

## **Achieving Partnering Success through an Incentive Agreement: Lessons Learned from an Underground Railway Extension Project in Hong Kong**

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### **Abstract**

Over the years, it has been observed that partnering has been ineffectively implemented in the public sector of Hong Kong. Contributing factors to this lack of success are nature and large size of bureaucratic organizations and commercial pressure compromising the partnering attitude. The Mass Transit Railway Corporation Limited (MTRCL), one of the prominent pioneers in adopting project partnering in the infrastructure sector of Hong Kong since 1999, however, implemented the partnering principle with significant success. This paper, based on a recently completed research project funded by the Construction Industry Institute-Hong Kong (CII-HK) in late 2004 and a follow-up in-depth interview meeting with senior executives of MTRCL in early June 2005, analyzes the rationale behind the successful development of partnering culture in the infrastructure sector of Hong Kong through a case study – the Tseung Kwan O Railway Extension (TKE) Contract 654 - Platform Screen Doors. The project comprises the supply and installation of platform screen doors along the whole MTRCL's TKE with five stations. This project was analyzed by means of the project documentation and face-to-face interviews with the project representatives, comparisons with another five partnering case studies, and a follow-up in-depth interview meeting with another two senior executives of MTRCL. After the analysis, it was found that the implementation of partnering together with an Incentive Agreement (IA), a kind of Target Cost (TC) contracts, underpinned the partnering success of this project. Therefore, it is recommended that partnering together with TC contracts such as IA greatly assists in the achievement of construction excellence, and can provide a workable model for enhancing overall project performance in electrical and mechanical projects.

**CE Database subject headings:** Construction management; Hong Kong; Partnerships; Procurement; Incentives.

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## **Introduction**

The construction industry is a competitive and risky business. It is faced with problems such as poor co-operation, limited trust, and ineffective communication often resulting in an adversarial working relationship among all project stakeholders. This type of adversarial relationship is likely to lead to construction delays, difficulty in resolving claims, cost overruns, litigation, and a win-lose climate (Moore et al 1992). The Construction Industry Review Committee (CIRC 2001) in Hong Kong identified ten major problems besetting the local construction industry and one of them was that the industry is very fragmented and is beset with an adversarial culture.

To achieve a significant improvement in construction performance, CIRC advocates the necessity for the local construction industry to develop a new culture focusing on delivering better value to the customers on a continuous basis (CIRC 2001). Amongst other things, a wider adoption of the partnering approach was recommended as an innovative strategy to improve industry performance. The introduction of partnering, whereby parties work more closely in some form of partnership, has been widely accepted by both academics and practitioners as an effective management tool to improve time, cost, and quality and to reduce confrontation between parties, thus enabling an open and non-adversarial contracting environment (Cook and Hancher 1990; CII 1991; Abudayyeh 1994; CII 1996; Drexler and Larson 2000; Manley and Hampson 2000).

However, over the past decade, it has been observed that partnering has not reaped its full benefits in the public sector of Hong Kong. Two conspicuous reasons behind this assumption are the large size of the bureaucratic organisations and commercial pressure which together compromise the partnering attitude (Chan et al 2004a; 2004b). Although partnering in general was implemented less successfully in the public sector, the MTRCL, one of the outstanding pioneers in advocating project partnering in the infrastructure sector of Hong Kong since 1999, implemented the partnering principle with remarkable success. The achievements included (MTRC 2003a):

1. construction time to be 7% less than the original construction plan. This produced significant additional revenue;

2. cost to be over 40% less than the original budget, bringing increased profit to the shareholders due to less borrowed capital to finance the project;
3. a significantly improved claims culture with fewer and earlier resolution of claims than was found in previous MTRCL projects;
4. an early resolution of final accounts (60% of final accounts settled before project completion);
5. a high standard of quality demonstrated by lower rejection rates;
6. improved coordination among different parties;
7. considerable improvement in attitude and approach to site safety within individual contracts and across the project;
8. a more productive working environment; and
9. greater job satisfaction with far less time spent on pointless disputes.

To investigate and examine the effectiveness and performance of project partnering as applied in the local building and construction industry, the CII-HK (<http://www.ciihk.org.hk>) commissioned a research team to undertake an industry-driven research study to compare project partnering practices in Hong Kong (Chan et al 2004a). An industry-based research task force made up of prominent representatives who gained abundant hands-on experience in project partnering was established to oversee and monitor the progress of the research team. Six representative case studies from various sectors of construction were selected for in-depth investigation by the research task force. The aim is to compare project partnering practices in the public, private, and infrastructure sectors based on six partnering projects completed in Hong Kong between 1999 and 2002. The study commenced in March 2003 and was completed in December 2003. Since there are only 6 case studies and the sample size is small, the research findings are indicative in nature rather than conclusive. The study described in this paper is to analyze and evaluate the effect of IA on partnering performance based on a case study of railway extension project: Contract 654 – Platform Screen Doors, one of the six selected case study projects employing partnering in this research study.

## **Research Methodology**

This study used a combination of interviews, case study approach, computation of Key Performance Indicators (KPIs) and Partnering Performance Monitoring Matrix (PPMM) from

published reports for data collection. An extensive literature review on partnering was conducted using relevant books, journals, magazines, newsletters, conference proceedings, workshops, seminars, and other sources. The review exercise also included the development of a template with which to conduct the case study. The case study data were collected through face-to-face interviews. Two industrial practitioners, including a client representative and a main contractor representative with hands-on experience in the MTRCL TKE partnering project, were interviewed, and such interviews were fully documented. In addition, workshop reports, the details of IA, and the data used in compiling the KPIs were also gleaned from the client so as to analyze the project comprehensively. Three formal meetings between the research task force and the research team were held in order to substantiate and help improve the credibility of the research findings. The first meeting aimed at agreeing on the overall research framework for the investigation and establishing contact points for subsequent liaison with the relevant staff involved in the case study. The second meeting was to brief the research project task force on the research progress and any issues which had arisen. The last meeting was to discuss and verify the preliminary results and conclusions.

## **Background to the Adoption of Partnering for the MTRCL TKE Project**

The TKE project consists of 13 civil contracts, 4 building services contracts, and 17 E&M contracts. The civil contracts are mostly engineer's design, split geographically among stations, tunnels, and a depot. The building services contracts are all design and construct, again geographically split (i.e. stations and ancillary buildings, and a depot). The system-wide E&M contracts are all design and construct, split by discipline, each one covering the whole extent of TKE (MTRC 2003a).

Work on the TKE was managed for MTRCL by their Project Division. Construction commenced in late 1998, with opening to the public in the second half of 2002 since the senior management was convinced from the Airport Railway experience that adversarial working environments were materially detrimental to the efficient delivery of multi-discipline railway projects, the concept of partnering was initiated. This was followed by the setup of a senior management steering group to conduct research on partnering in the UK, Australia and Hong Kong (MTRC 2003b). The steering group's mission was to assess the benefits that

could be reaped from partnering and to identify how partnering might be introduced to the MTRCL Project Division's projects. The conclusions of the group were that the introduction of partnering would improve cost-effectiveness, give greater time certainty, and result in better communication, more cooperation, and quicker problem solving. In 1999, MTRCL decided to adopt partnering for its TKE project. The TKE contractors were invited to participate in a 'Partnering' initiative on a voluntary basis although the contract had been awarded on a 'traditional' basis. This was initially supported with varying degrees of enthusiasm by 10 civil contractors, notably with strong support from some leading contractors, and an external partnering facilitator organization (MTRC 2003b).

### **MTRCL TKE Contract 654 (Platform Screen Doors)**

MTRCL TKE Contract 654 is one of the 17 E&M contracts and comprised the supply and installation of platform screen doors along the whole MTRCL's TKE with five stations. The original contract sum at tender award was approximately HK\$131 million (approximately US\$16.8 million), with original contract duration of 1,393 calendar days. The key participants included the client and the main contractor. The project was procured by a Lump Sum Fixed Price Design-and-Build Contract together with IA. The mechanism of the IA is developed whereby from an agreed start date, all outstanding works are calculated with risk cost and a gain-share/pain-share arrangement is agreed with the main contractor. The client and the main contractor share any savings (gains) if the final account is less than the target. Should the final account exceed the target, they share the excess (pain) (MTRC 2003a).

### **Partnering Approach and Process**

Figure 1 shows the partnering approach and process of MTRCL TKE Contract 654 (Platform Screen Doors) in which there were a total of five partnering workshops. They included one inaugural workshop, one initial partnering workshop, three interim partnering workshops and one final partnering review. The inaugural workshop was mainly to introduce the concept of partnering to the senior management staff of each participating organization. The 1-day initial workshop was held at 17% of the post contract award period with 14 participants. It is of interest to note that unlike the United States where the first or inaugural partnering workshop is usually held after contract award but generally before any contract work is

initiated, the initial partnering workshop in this project was held after the contract work started. A major reason behind this approach is that partnering is still at a germinating stage of development in Hong Kong and its implementation is not so widespread when compared with the United States and the United Kingdom. Moreover, the traditional working relationship between client and contractor is not long-term and is largely on a project-by-project basis. Therefore, many clients may prefer introducing partnering at a later time after they have developed a higher level of mutual trust by working closely together with other parties at the beginning of a project. Four activities were undertaken, including (1) discussions of visions and common goals; (2) identification of waste and improvement areas; (3) an action plan; and (4) a participation game (Red and Blue Exercise), which included a problem resolution process and nomination of partnering champions.

**Please insert Figure 1 here.**

The partnering charter contained seven specific issues summarized as follows,

1. to ensure safety and reliability;
2. to complete a quality project in a financially viable and environmental friendly manner;
3. to be one of the best TKE contracts;
4. to build long term business relationships;
5. to have continuous improvement;
6. to build reputation;
7. to make a contribution to provision to the Hong Kong citizen of the world's best railway service.

The three interim workshops encompassed four activities:

1. improving performance;
2. discussing the dealing with issues;
3. discussing the identified waste and improvement areas;
4. participating in a team building game (Red and Blue Exercise).

The final review included interviews with senior management staff of each participating organization and a summary of their comments and lessons learned on partnering application.

## **Partnering Performance Monitoring Matrix (PPMM)**

Partnering champions were nominated from each of the key project stakeholders. Their charge was to coordinate and plot a PPMM to record feedback from all key project stakeholders on the partnering goals developed in the Partnering Charter on a monthly basis. The assessment of performance of each goal was done in the form of questionnaire responses on a 5-point Likert scale where 1 = very unsatisfactory and 5 = very satisfactory. There are a total of 10 partnering goals that were established in the Partnering Charter of this project. Figure 2 shows the top-3 goals in descending order: Item 1 - Trust, Item 4 – Relationship/Teamwork/Co-operation and Item 9 – Working Atmosphere and the bottom-3 goals in descending order: Item 7 - Safety, Item 10 – Problem Solving and Item 8 – Financial Objectives. It should be noted that the average scores for all items over the measurement period are very close, ranging from 3.72 to 4.23, which means that all items have a satisfactory performance. On the other hand, it is reflected that the trends of all items generally increase steadily over the life of the project, except for Item 8 – Financial Objectives which fluctuates to a certain degree over the whole period.

**Please insert Figure 2 here.**

## **Summary of the Interview Dialogues**

Partnering practice was investigated by the use of a structured interview method. Two rounds of face-to-face interviews were conducted. The interviewees included the client representative and the main contractor representative. They represented a cross-section of the senior management and project management staff. They had direct involvement in the partnering process and were able to provide an overall picture of the partnering practices in this case study project.

Twenty-two open-ended questions were used to explore why the partnering concept was adopted and to provide details of the partnering practice. Face-to-face interviews were launched either in the interviewees' offices or at the Hong Kong Polytechnic University. Each interview lasted for about one to two hours. The interview questions addressed: (1) perceived major benefits of partnering; (2) critical success factors for adopting partnering; (3)

relationships in partnering; (4) communication in partnering; (5) major difficulties in implementing partnering; and (6) partnering performances. The background information about the case study project was also solicited to gain a better understanding of the participants' decision on the partnering arrangement.

### **Perceived Major Benefits of Adopting Partnering**

Five major partnering benefits were identified from the interviewees. These were: (1) savings in time and cost; (2) improvement in construction quality; (3) better working relationship; (4) establishment of common goals and mutual trust; and (5) development of an easier and smoother decision-making process.

### **Critical Success Factors for Adopting Partnering**

The interviewees shared a common view on the major critical success factors for adopting partnering. These included (1) support from both the client and the main contractor; and (2) commitment to the partnering spirit.

### **Relationships in Partnering**

All parties agreed that the working relationship between the client and the main contractor was good. The client described the working relationship as 'excellent' and stated that informal communication was enhanced and the closer relationship with the main contractor prevented confusion. Mutual trust and collaborative working relationship were demonstrated in the project cycle. The main contractor stated that he had a harmonious and collaborative working relationship with other parties. For example, MTRCL held the training session in Japan for the convenience of the Japanese engineering team of the main contractor.

### **Communication in Partnering**

All parties agreed that efficiency of communication for projects using the partnering management system was higher. The client viewed that partnering representatives were supported by both their superiors and subordinates so the implementation of partnering



became much more effective. The establishment of mutual trust also made communication more efficient. The main contractor stated that under the partnering arrangement, the client and the other contractors became more accessible; thus the communication was speedier.

### **Major Difficulties in Implementing Partnering**

The client stated that it had no problem working with the main contractor, but the interfacing parties were quite troublesome because this was a multi-disciplinary project which consisted of a host of various trade contractors separately engaged by the client, e.g. on E&M works, signaling and civil works. The main contractor complained that some problems arose from other interfacing parties. For instance, the civil engineering team failed to complete its task on time which delayed the work of the contract. The main contractor also commented that the client might face difficulties in educating all the contractors about the partnering concept and approach. The contractors might not have any incentives to commit to partnering because there were no obvious financial benefits. As for the subcontractors, they might face some difficulties in managing their time because they were not always available for partnering meetings for better co-ordination with the main contractor, even though they were willing to do so.

### **Key Performance Indicators (KPIs)**

Chan & Chan (2004) developed a framework to measure the success of construction projects in which a set of KPIs were measured both objectively and subjectively. The objective KPIs used in this study include (1) Construction Time; (2) Time Variation; (3) Construction Cost; (4) Injury (Accident) Rate; and (5) Number of Environmental Complaints received.

Table 1 shows the KPIs for the MTRCL TKE Contract 654 (Platform Screen Doors). It is noted that the time variation was ahead of schedule by 4.95% and the construction cost was within budget. The injury (accident) rate of this project was 57.60/1000, which was much lower than the industry average of 85.2/1000 based on the statistics released by the Labor Department in 2002. These KPIs provided evidence that this was a successful partnering project.

**Please insert Table 1 here.**

## **Comparisons of MTRCL TKE Contract 654 (Platform Screen Doors) with Five Partnering Case Studies**

In order to investigate the major reasons for the success of MTRCL TKE Contract 654, an analysis was made through comparisons with 5 other partnering case studies (two from the private sector, two from the public sector, and one from the infrastructure sector (also from MTRCL) conducted in this research study. The first comparison is on the KPIs. The second comparison is on the time frame and problem resolution process amongst five structured partnering projects. The third comparison is on the relative ranking of the mean scores for the major benefits of partnering, major difficulties, and overall partnering performances based on the responses on the quantitative survey questionnaires.

### **Comparisons of Key Performance Indicators (KPIs)**

**Please insert Table 2 here.**

The time variations for the two infrastructure projects are  $-5.62\%$  and  $-4.95\%$  respectively, which show that these projects were ahead of schedule by  $5.29\%$  on average. As to the private sector, one project was on schedule and another was ahead of schedule by  $0.63\%$  whilst for the public sector, the two projects were both on schedule. It is clear that the time performance for the two infrastructure projects is better than the private and public sector projects.

Comparing the incident rate, the mean score for the two infrastructure projects was higher than for the building projects, at  $44.07/1,000$  whilst the mean scores for the private and public sectors were very close, at  $14.9/1,000$  and  $15/1,000$  respectively. However, all these incident rates were much lower than the industry average of  $85.2/1000$  based on the statistics released by the Labor Department in 2002.

## **Comparisons of Time Frame**

**Please insert Table 3 here.**

The timing of the initial partnering workshops for Chater House, Kai Tak Estate Redevelopment Phase II and MTRCL Contract 601 (Hang Hau Station & Tunnels) were very close, ranging from 3% to 6% post contract award period, with the workshop for Tuen Mun Area 4C being arranged a little bit later at 9%, and MTRCL Contract 654 (Platform Screen Doors) at the latest, 17%. The timing of the interim workshops for Chater House and the two public sector projects were close, ranging from 40% to 48%. However, there were a number of interim workshops for the two infrastructure sector projects, with 15%, 38%, 54%, 66%, and 82% for MTRCL Contract 601 (Hang Hau Station & Tunnels), and 43%, 54%, and 73% for MTRCL Contract 654 (Platform Screen Doors). The timing of the final workshops for Chater House and Tuen Mun Area 4C were close, with 111% and 101% respectively while the timing of final review workshops for the two infrastructure projects was 90% and 98% respectively.

For both MTRCL Contract 601 and Contract 654, the final reviews were carried out by the partnering consultant. Instead of doing it through a wrap-up workshop, a number of interviews and discussions had been arranged to solicit views from project participants and to capture lessons learned. The partnering consultant had consolidated their findings in a report to MTRCL which was later published as the 'The Tseung Kwan O Extension Success Story' in 2003.

## **Comparisons of Problem Resolution Process**

Since the same facilitator was engaged for the Chater House and the two public sector projects (i.e. Tuen Mun Area 4C and Kai Tak Estate Redevelopment Phase II), their problem resolution processes were by and large identical. The workshop emphasized how the lack of communication was itself a major potential obstacle whilst open communication was a primary strategic weapon in countering problems. It was also stressed that the lowest possible management and supervision levels should be empowered to resolve issues thereby avoiding delays and unnecessary response time. The issue escalation ladder sets out the

levels and corresponding personnel under which any problematic issue can be referred. The elevation of an issue is an undesirable phenomenon casting doubts on whether the partnering process is efficient and commitment to the charter is real.

The general rule agreed upon by the workshop was that the partners at each level should attempt to reach agreement on an issue twice before passing it to the next level for resolution. Each level should handle any particular problem within a two-day period. In particular, four principles for issue resolution were established, which included: (1) communicate the issues immediately to the parties concerned; (2) resolve at the lowest possible level; (3) define severity and level of urgency; and (4) resolve within an agreed timescale. The process for issue resolution can be summarized as follows:

- (a) On identification of an issue, communicate it to the parties concerned as quickly as possible;
- (b) Define the issue and define a timescale for resolution;
- (c) Agree on the spot, if possible;
- (d) If not able to agree, refer to the next level with appropriate analysis and suggestions;
- (e) If not able to agree, repeat Step (d) until resolution is achieved;
- (f) Record outcome;
- (g) If the issue remains unresolved for eight weeks or more, it has to be escalated to the highest level.

As for MTRCL Contract 601 (Hang Hau Station & Tunnels) and Contract 654 (Platform Screen Doors), the problem resolution process was similar to Chater House and the two public sector projects, including: (1) understand the problems (the basic concern of the counterpart); (2) know the level of responsibility/authority; (3) time scale for solving the problems; (4) from default to elevation; and (5) agree corrective actions.

### **Comparisons of Rankings of Partnering Attributes**

The twenty-one interviewees were requested to complete a questionnaire for evaluating significant partnering attributes. A five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was used to calculate the mean scores for the benefits, difficulties, and overall partnering performances. The mean scores were then used to determine the relative rankings. The results of the comparisons are as follows.

## **Major Benefits of Partnering**

Ten major reported benefits of partnering were identified from the literature as shown in Table 4. In the questionnaire survey, respondents were requested to evaluate the benefits of partnering in the project with which they had been involved.

**Please insert Table 4 here.**

The top-3 perceived major benefits are: 'improved relationship amongst the project participants'; 'improved communication amongst the project participants'; 'better productivity was achieved'; and 'reduction in dispute'.

The infrastructure sector gives the highest mean score for six of the partnering benefits. The private sector gives the highest mean score for four of the partnering benefits. The public sector shares two highest mean scores with the private sector.

The infrastructure projects manage to realize most partnering benefits because of the systematic approach of implementing partnering and the method-related nature of civil and E&M installation works, which entail a lot of discussion and co-ordination amongst the interfacing project participants (Chan et al, 2004b). Communication between parties is essential in reaching mutually agreed methods of construction and installation. Partnering can be implemented to the fullest possible extent by conducting more interim review workshops at all levels organized by external and in-house trained facilitators.

In contrast, the public sector has the fewest items with high mean scores because it is less flexible in nature and has more stringent procedures to follow in case of any deviations from the contract arrangement.

The benefits of partnering are less pronounced for the building works because of the more standard construction methods and technology used in practice compared with the infrastructure works.

## **Major Difficulties in Implementing Partnering**

Ten major difficulties were elicited from the literature and formed one part of the questionnaire to examine the perceptions of project participants towards major difficulties in partnering (Table 5). Respondents were requested to evaluate the major difficulties according to a five-point Likert scale.

**Please insert Table 5 here.**

The top three major difficulties were ‘Dealing with large bureaucratic organizations impeding the effectiveness of partnering’; ‘Uneven levels of commitment amongst the project participants’; and ‘Parties were faced with commercial pressure which compromised the partnering attitude’.

The public sector had the highest mean scores in nine identified difficulties. The public sector is less flexible in nature and has more stringent procedures to follow whenever variations occur. This indicates that emphasis on public accountability may reduce flexibility to some extent and it will hinder the successful implementation of partnering concepts in these projects (Chan et al, 2006).

The infrastructure sector rated almost half of the identified difficulties lower than 3. This means that some of the common difficulties of implementing partnering are not a concern in the infrastructure sector.

The private sector indicated that ‘Uneven levels of commitment were found amongst the project participants’ was the main difficulty that they had encountered.

## **Partnering Performance**

Five indicators were identified from the literature to measure partnering performance (Table 6). Respondents were requested to give their perceptions on the performance indicators according to a five-point Likert scale.

**Please insert Table 6 here.**

The infrastructure sector achieved the best overall project performance with the least dispute magnitude. This can be attributed to the systematic approach of implementing partnering, and method-related nature of civil and E&M installation works, which entail a lot of discussion and co-ordination amongst the interfacing project participants. Partnering can help in facilitating such multiple communications and mitigating dispute occurrence and magnitude due to improved communication channels (Chan et al, 2006).

The public sector did well in mitigating the scope of rework but the private sector outperformed the other two sectors in 'Quality performance' and 'Professional image establishment'. Quality assurance has been widely accepted as an essential element in establishing a professional image among counterparts especially in the highly competitive private sector. Partnering is also instrumental in shaping a professional image among counterparts by achieving quality and prestigious construction.

### **MTRCL's Incentivisation Agreement (IA)**

Based on (1) the high scores in all the items of the PPMM; (2) the positive comments revealed by the interviews with the client and the main contractor representatives related to the adoption of project partnering; (3) the good KPIs results; and (4) comparisons with the other five partnering case studies, it can be concluded that the MTRCL TKE Contract 654 (Platform Screen Doors) is an outstanding example of success that can be brought about by implementing a partnering scheme. An in-depth analysis of its success (also same for MTRCL Contract 601 – Hang Hau Station and Tunnels) over the other four private and public sector projects is revealed by studying the MTRCL TKE's unique and innovative method in the implementation of IA. It is of particular interest to note that the MTRCL TKE Contract 654 (Platform Screen Doors) was a traditional lump sum contract only payable on certified valuation as a reimbursement for employer's risks. Originally, there was no comprehensive financial incentive scheme for contractors to identify and bring up new and innovative ways of cost saving not included in the contract provision (MTRC 2003a). The IA was an innovative and evolutionary measure initiated by MTRCL because it first addressed soft (relationship management) issues, followed by commercial considerations (MTRC

2003a). It first obtained internal buy-in and understanding through a series of structured workshops, followed by external understanding and commitment. Partnering then formally commenced with independently facilitated workshops on individual contracts, involving MTRCL's staff, its contractors and consultants. These workshops developed a sound understanding of common goals and aspirations, which were then set out in the partnering charters.

Eighteen months after introducing partnering, MTRCL developed innovative incentivized commercial arrangements on several contracts, with final accounts agreed, Target Costs (TC) set against risk schedules (Target Cost means the budget amount for the Shared Risk Element), and gain share/pain share systems introduced, whereby MTRCL and the contractors agreed to share savings or cost overruns. These agreements changed traditionally tendered contracts into incentivized TC arrangements, with a creative approach to risk management. The agreements also proved to be highly successful, with significant savings against the targets. Every TC arrangement ended in a gain share situation (MTRC 2002). Such a major change in MTRCL's contracting approach and strategy gave the contractors a clear incentive to reduce costs and identify savings with benefits for themselves and MTRCL. This entailed a change in MTRCL's attitude and approach towards project risk management. MTRCL was mindful of the need to align the interests of all parties and to gain an understanding and acceptance that all problems, such as claims and variations, were shared problems. It was also understood that the contractors needed to receive a form of gain share or some commercial benefits from their support of partnering (MTRC 2003a). Essentially, MTRCL's strategy was to overlay a non-contractual partnering approach onto their traditional competitively tendered contracts on a voluntary participation basis jointly funded by the main contractor and MTRCL as in this infrastructure project (Platform Screen Doors). MTRCL also identified three categories of risks, including (1) what the Corporation was to take; (2) what the contractor was to take; and (3) what was unresolved and classified as 'shared risks'.

IA, being similar to TC Contracting in principle, was developed between the main contractor and MTRCL whereby from an agreed start date, all outstanding works were calculated with a cost for risk and a real 'gain share – pain share' arrangement mutually agreed between them. The IA sorts out the risks exposure of the parties and those remaining risks are shared



between the client and the main contractor. The Shared Risk Element can be thought of as a 'bucket' to catch all future issues not included in the Contractor's Risk or Employer's Risk (Shared Risk Element means any works and other matters which are not included within the Contractor's Risk Element or the Employer's Risk Element.) The budget agreed for the Shared Risk Element represents the monies available to be expended. In the event that the actual expended amount is less than the budget amount, the under-expenditure is then shared equally between the Employer and the Contractor. Similarly, if the actual expended amount exceeds the target cost, the over-expenditure is then shared between the Employer and the Contractor on a graduated scale. An upper bound has been placed on the Contractors liability to such over expenditure, which limits the benefit that he will receive if the anticipated out turn TC is achieved (MTRC 2002).

A TC is established for dealing with those shared risks and a pain share/gain share formula is agreed upon whereby under-spending or over-spending is shared between them (Cheung et al 2002). Thus, MTRCL and the main contractor would share savings (gain) if the final account turned out to be less than the target. Should the final account exceed the target, they would share the excess (pain). This is a unique approach that shifted from a fixed price approach to a TC approach based on joint determination and agreement between the contractor and the client on the allocation of shared risks. The agreement arose from partnering initiatives that encouraged the main contractor and MTRCL to manage all works jointly and share any consequent benefits and losses. Site staff had the opportunity to report enhanced profits from achieving gain share savings, an action which proved to be a very powerful motivator (MTRC 2003b). Figure 3 illustrates the underlying principles of a typical incentive scheme arrangement adopted by MTRCL on the TKE railway contracts.

**Please insert Figure 3 here.**

MTRCL, as the client, had a potential benefit through the contractor's efforts to minimize the impact of the claims, reduce costs arising from variations and to ensure a more accurate and early control of the final project costs (MTRC 2003a). The shared risks were managed by Site Control Group (SCG). The Group provided a regular forum for the Engineer's senior site staff and the contractor's representative to examine technical and financial issues and make decisions. Its main functions included (1) reviewing the necessity of design changes;

(2) determining the most efficient method of implementation; and (3) deciding on any necessary delay recovery measures and consequently confirming risk allocation of agreed changes and actions in accordance with the terms of the IA. Through the SCG, both parties were able to build a more collaborative working relationship and a sense of joint ownership of all major issues. The success of the SCG contributed directly to the achievement of common goals and mutual interests agreed by the parties in the partnering charter (MTRC 2003a).

### **MTRCL's Recommendations for Performance Improvement**

As MTRCL becomes familiar with the principles of partnering, it is looking to embrace more and more aspects of the concept. The question with respect to future projects is not so much whether or not partnering should be introduced, but in what format and to what extent (Bayliss 2002). Partnering has already been introduced in the 34 TKE Contracts, starting first with the soft (relationship) issues. Infrastructure sector projects are able to realize most partnering benefits because of the systematic approach adopted in the implementation of partnering, and the method-related nature of civil and E&M installation works. This entails much discussion and co-ordination amongst the interfacing project participants. Communication between parties is essential in reaching mutually agreed methods of construction and installation. Partnering can be applied to the fullest possible extent by launching more interim review workshops at all levels organized by external and in-house trained facilitators. In addition, the following three initiatives have been proposed by MTRCL to improve the overall project performance for future projects:

1. Reviewing the contract conditions to reflect partnering principles;
2. Changing the criteria for contractor selection, moving away from price alone to a combination of price and technical/management approach criteria; and
3. Introducing TC contracts.

Bayliss (2002) advocated that MTRCL and the rest of the local construction industry need to address the wider implications of partnering concepts, beyond the construction contracts. Adequate consideration should be given to involving more parts of the supply chain in the partnering process. When partnering becomes mature, consideration also needs to be placed on the concept of strategic alliances so that the quality and effectiveness of the construction

industry will be further enhanced. It is worthy of note that the recent successful partnering implementation of both the MTRC Contract C4420 (Tsim Sha Tsui Station Modification Works) and the MTRC Contract C5201 (Tung Chung Cable Car Project) have firstly been adopted with the TC Contracts.

## **Conclusion**

This paper through the medium of the Mass Transit Railway Corporation Limited (MTRCL) and with reference to the infrastructure sector of Hong Kong and comparisons with another five partnering case studies has provided valuable insights into how the partnering culture can be successfully developed through the implementation of Incentive Agreement (IA). Both quantitative and qualitative findings derived from different sources converged to demonstrate outstanding partnering performance achieved in the MTRCL Tseung Kwan O Extension (TKE) Contract 654 (Platform Screen Doors). The underlying basis for this outstanding performance was due to the client's initiative to introduce a novel IA. IA, being similar to Target Cost (TC) contracting in principle, facilitated a mutually agreed upon 'gain share/pain share' arrangement between the client and the main contractor. Consequently, the three core partnering elements, mutual trust, common goals, and commitment, were easily achieved under such a mechanism. The implementation of IA underpinned the partnering success on the MTRCL TKE Contract 654 – Platform Screen Doors. Therefore, it is recommended that partnering together with TC contracts such as IA be adopted across a wider spectrum of the construction industry to reap sustainable benefits and achieve construction excellence. Other case study projects introducing partnering concepts in both public and private sectors will be reported in subsequent journal publications.

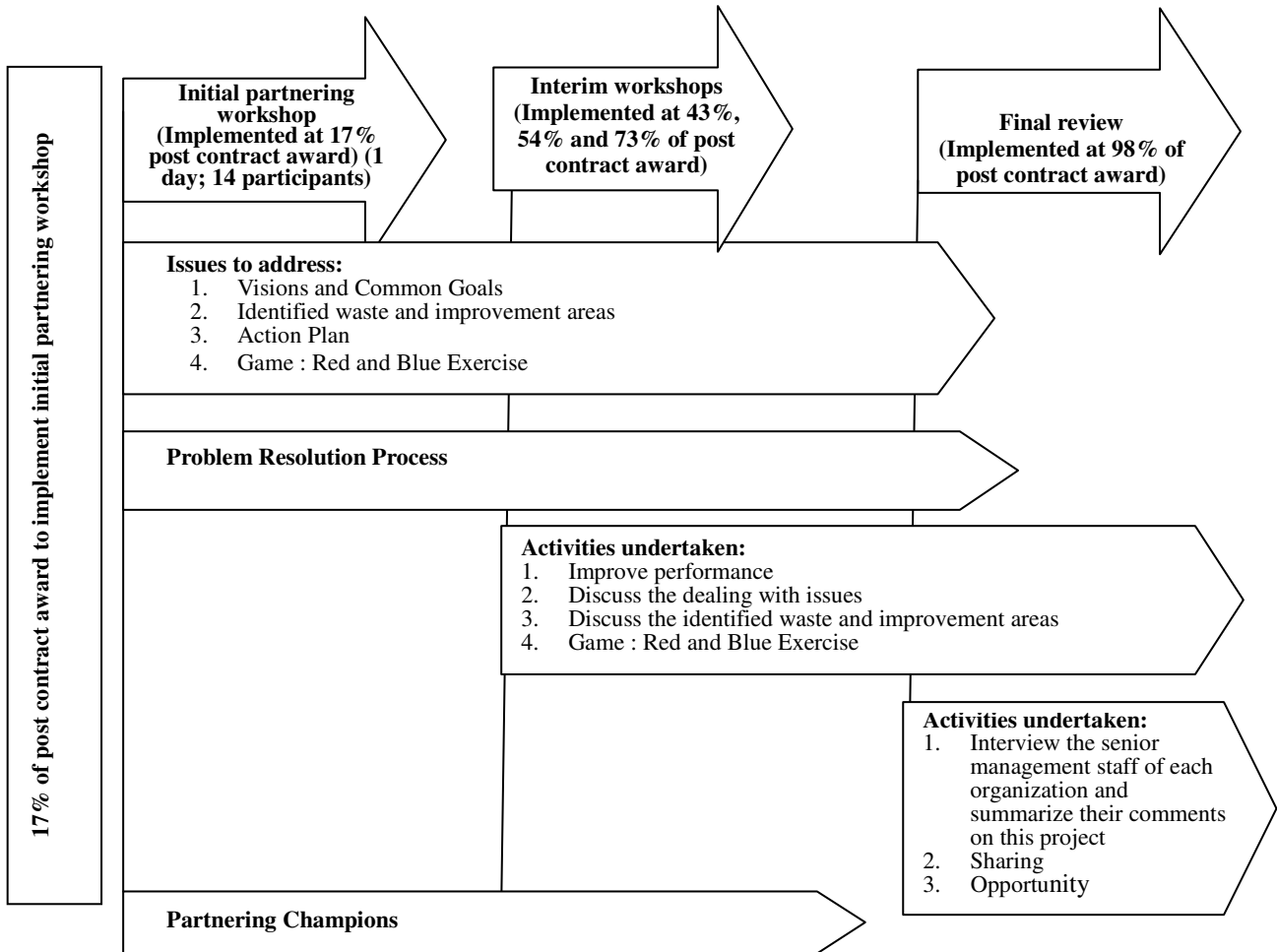
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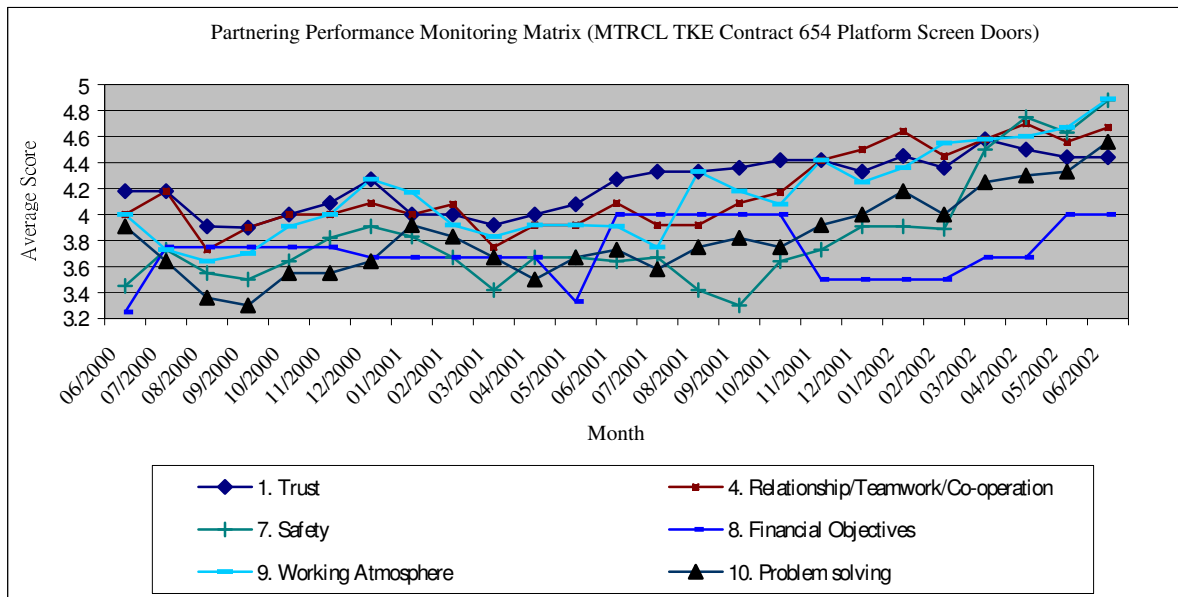
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**Figure 1.** The partnering approach and process of Mass Transit Railway Corporation Limited (MTRCL) Tseung Kwan O Railway Extension (TKE) Contract 654 (Platform Screen Doors) [Adapted from the Latham's (1994) Report] (Source: Chan et al 2004b, permission has been obtained for both print and online use from the Construction Industry Institute, Hong Kong)



**Figure 2.** Partnering Performance Monitoring Matrix (Mass Transit Railway Corporation Limited (MTRCL) Tseung Kwan O Railway Extension (TKE) Contract 654 Platform Screen Doors) (Source: Chan et al 2004b, permission has been obtained for both print and online use from the Elsevier)

\* Top-3 items: (1) Trust (4) Relationship/Teamwork/Co-operation (9) Working Atmosphere  
 Bottom-3 items: (7) Safety (10) Problem Solving (8) Financial Objectives  
 \* Items were rated on a 5-point Likert scale with 1 = Very Unsatisfactory and 5 = Very Satisfactory

**Table 1.** Key Performance Indicators (KPIs) for Mass Transit Railway Corporation Limited (MTRCL) Tseung Kwan O Railway Extension (TKE) Contract 654 (Platform Screen Doors) (Source: Chan et al 2004b, permission has been obtained for both print and online use from the Construction Industry Institute, Hong Kong)

| KPIs  | MTRCL TKE Contract 654   |
|---|--|
| 1. Actual Construction Duration                                 | 1,324 calendar days  |
| 2. Time Variation   | -4.95% (i.e. completion at 69 calendar days ahead of schedule) |
| 3. Construction Cost  | Within budget  |
| 4. Injury (Accident) Rate                                       | 57.60/1000 employees   |
| 5. Number of Complaints Received Caused by Environmental Issues | 0  |

**Table 2.** Comparisons of Key Performance Indicators (KPIs) amongst the Six Partnering Projects (Source: Chan et al 2004b, permission has been obtained for print and online use from the Elsevier)

| KPIs   | Private Sector           |                          | Public Sector            |                                       | Infrastructure Sector                           |  |
|--|--------------------------|--------------------------|--------------------------|---------------------------------------|---|--|
|  | Chater House             | 1063 King's Rd           | Tuen Mun Area 4C         | Kai Tak Estate Redevelopment Phase II | MTRCL Contract 601 (Hang Hau Station & Tunnels) | MTRCL Contract 654 (Platform Screen Doors) |
| 1. Actual Construction Time  | 635 calendar days        | 636 calendar days        | 835 working days         | 702 calendar days                     | 1176 calendar days                              | 1324 calendar days                         |
| 2. Speed of Construction   | 84.72m <sup>2</sup> /day | 42.92m <sup>2</sup> /day | 85.15m <sup>2</sup> /day | 73.85m <sup>2</sup> /day              | N/A   | N/A  |
| 3. Time Variation  | -0.63%                   | 0%                       | 0%                       | 0%                                    | -5.62%  | -4.95%                                     |
| 4. Construction Cost   | Within budget            | Within budget            | Within budget            | Within budget                         | Within budget                                   | Within budget                              |
| 5. Incident (Accident) Rate  | 17/1000                  | 12.8/1000                | 2/1000                   | 28/1000                               | 30.54/1000                                      | 57.60/1000                                 |
| 6. No. of complaints received being caused by Environmental Issues | Nil                      | Nil                      | 2                        | Nil                                   | 26  | 0  |

**Table 3.** Time Frame of Partnering Workshops for the Five Structured Partnering Projects (Source: Chan et al 2004b, permission has been obtained for both print and online use from the Construction Industry Institute, Hong Kong)

|                                       | Initial workshop                  | Interim Workshop(s)               |     |     |     | Final Workshop                     |                                    |
|---------------------------------------|-----------------------------------|-----------------------------------|-----|-----|-----|------------------------------------|------------------------------------|
| Chater House                          | 4% of post contract period        | 40% of post contract award period |     |     |     | 111% of post contract award period |                                    |
| Tuen Mun Area 4C                      | 9% of post contract award period  | 44% of post contract award period |     |     |     | 101% of post contract award period |                                    |
| Kai Tak Estate Redevelopment Phase II | 3% of post contract award period  | 48% of post contract award period |     |     |     | Unknown                            |                                    |
| MTRCL Contract 601                    | 6% of post contract award period  | 15%                               | 38% | 54% | 66% | 82%                                | *90% of post contract award period |
| MTRCL Contract 654                    | 17% of post contract award period | 43%                               |     | 54% | 73% |                                    | *98% of post contract award period |

\* Final partnering review instead of Final Workshop



**Table 4.** Ranking for the Perceived Major Benefits of Partnering Projects among the Private, Public and Infrastructure Sector in the Six Cited Projects (Source: Chan et al 2004b, permission has been obtained for print and online use from the Elsevier)

| <b>Benefits of Partnering</b>   | <b>Overall Mean</b> | <b>Private Sector</b> | <b>Public Sector</b> | <b>Infrastructure Sector</b> |
|---|---------------------|-----------------------|----------------------|------------------------------|
| Improved relationship amongst the project participants                          | 4.143               | 4.000                 | 4.000                | 4.583                        |
| Improved communication amongst the project participants                         | 4.048               | 3.875                 | 4.125                | 4.167                        |
| Better productivity was achieved  | 4.048               | 4.250                 | 3.875                | 4.000                        |
| Reduction in litigation   | 4.048               | 4.375                 | 4.375                | 3.917                        |
| Improved conflicts resolution strategies  | 4.000               | 4.000                 | 3.875                | 4.167                        |
| Reduction in dispute  | 3.952               | 4.000                 | 3.625                | 4.417                        |
| A win-win attitude was established amongst the project participants             | 3.810               | 3.875                 | 3.500                | 4.250                        |
| A long-term trust relationship was achieved                                     | 3.810               | 4.000                 | 3.750                | 3.667                        |
| More responsive to the short-term emergency, changing project or business needs | 3.714               | 3.750                 | 3.750                | 3.500                        |
| Improved corporate culture amongst the project participants                     | 3.714               | 3.375                 | 3.750                | 4.167                        |

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

**Table 5.** Ranking for the Major Difficulties of Partnering Projects among the Private, Public and Infrastructure Sector in the Six Cited Projects (Source: Chan et al 2004b, permission has been obtained for print and online use from the Elsevier)

| <b>Major difficulties in implementing partnering</b>                                  | <b>Overall Mean</b> | <b>Private Sector</b> | <b>Public Sector</b> | <b>Infrastructure Sector</b> |
|---|---------------------|-----------------------|----------------------|------------------------------|
| Dealing with large bureaucratic organisations impeded the effectiveness of partnering | 3.762               | 3.750                 | 4.125                | 3.167                        |
| Uneven levels of commitment were found amongst the project participants               | 3.762               | 4.000                 | 3.750                | 3.417                        |
| Parties were faced with commercial pressure which compromised the partnering attitude | 3.714               | 3.250                 | 4.125                | 3.833                        |
| The parties had little experience with the partnering approach                        | 3.667               | 3.375                 | 3.875                | 3.500                        |
| Risks or rewards were not shared directly   | 3.429               | 3.125                 | 3.750                | 3.333                        |
| The concept of partnering was not fully understood of the participants                | 3.429               | 3.500                 | 3.750                | 2.750                        |
| Conflicts arose from misalignment of personal goals with project goals                | 3.429               | 3.375                 | 3.500                | 3.250                        |
| Parties did not have proper training on partnering approach                           | 3.191               | 2.875                 | 3.750                | 2.750                        |
| Participants were conditioned in a win-lose environment                               | 3.095               | 2.875                 | 3.500                | 2.750                        |
| The partnering relationship created a strong dependency on other partners             | 3.095               | 3.250                 | NA                   | NA                           |

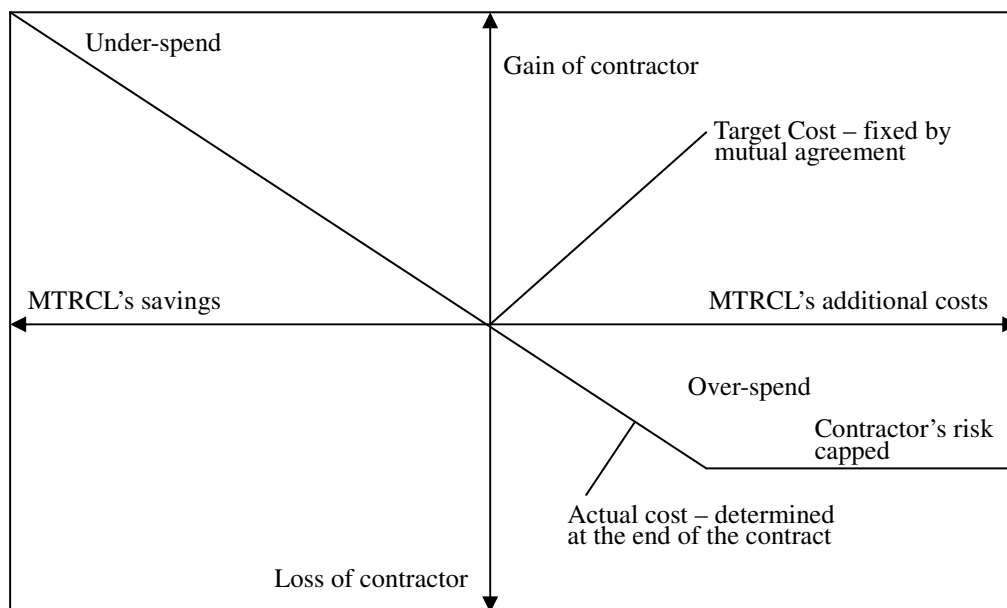
\* Items were rated on a 5-point Likert scale with 1 = Strongly Disagree and 5 = Strongly Agree

**Table 6.** Ranking for the Partnering Performances among the Private, Public and Infrastructure Sector in the Six Cited Projects (Source: Chan et al 2004b, permission has been obtained for print and online use from the Construction Industry Institute, Hong Kong)

| Performance Indicators           | Overall Mean | Private Sector | Public Sector | Infrastructure Sector |
|----------------------------------|--------------|----------------|---------------|-----------------------|
| Overall performance              | 4.29         | 4.50           | 3.88          | 4.59                  |
| Professional image establishment | 4.05         | 4.50           | 3.75          | 3.84                  |
| Quality performance              | 3.95         | 4.00           | 4.00          | 3.84                  |
| Scope of rework                  | 3.29         | 3.25           | 3.50          | 2.84                  |
| Dispute magnitude                | 3.29         | 3.38           | 3.13          | 3.42                  |

\* Items were rated on a 5-point Likert scale with 1 = Far below average and 5 = Well above average

\*\* Ratings of Scope of Rework and Dispute Magnitude are reversed for easy reference.



**Figure 3.** Typical Incentive Gain-share/Pain-share Arrangement (Adapted from Bayliss 2002)