THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學
Pao Yue-kong Library
包玉剛圖書館

Copyright Undertaking

This thesis is protected by copyright, with all rights reserved.

By reading and using the thesis, the reader understands and agrees to the following terms:

1. The reader will abide by the rules and legal ordinances governing copyright regarding the use of the thesis.
2. The reader will use the thesis for the purpose of research or private study only and not for distribution or further reproduction or any other purpose.
3. The reader agrees to indemnify and hold the University harmless from and against any loss, damage, cost, liability or expenses arising from copyright infringement or unauthorized usage.

IMPORTANT

If you have reasons to believe that any materials in this thesis are deemed not suitable to be distributed in this form, or a copyright owner having difficulty with the material being included in our database, please contact lbsys@polyu.edu.hk providing details. The Library will look into your claim and consider taking remedial action upon receipt of the written requests.

Pao Yue-kong Library, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

http://www.lib.polyu.edu.hk

DEVELOPING AN EFFECTIVE MANAGEMENT FRAMEWORK FOR ENHANCING PARTNERING PERFORMANCE OF TRANSMISSION SUBSTATION PROJECTS (TSP) IN THE HONG KONG POWER INDUSTRY

CHAN TSZ KIN

Ph.D

The Hong Kong Polytechnic University

2016

The Hong Kong Polytechnic University

Department of Building and Real Estate

Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects (TSP) in the Hong Kong Power Industry

Chan Tsz Kin

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

December 2015

Certificate of Originality

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgment has been made in the text.

Chan Tsz Kin

University Number: 0890

Abstract

This research studies the application of strategic partnering in the context of the power industry in Hong Kong. The tightening requirements on time, budget, quality and environmental aspects, as well as the closer public scrutiny make the operating regime for utilities in Hong Kong more challenging than ever before. In addition, the vague project scope of substation projects and increasing customer expectations make collaboration and commitment from projects stakeholders more important. In view of this, one of the power utility companies (the Utility Company) in Hong Kong opted to implement partnering approach for managing a serious of Transmission Substation Projects (TSP) since 2005 for a 5-year timeframe. It was the first trial for the Utility Company to adopt partnering approach for managing TSP. Thus, the Utility Company intended to review the applicability of partnering in the utility context and capture the lesson learnt for future reference. This research was triggered accordingly.

This research was conducted under a Teaching Company Scheme between the Utility Company and The Hong Kong Polytechnic University (Chan et al. 2011), which facilitated the adoption of action research approach. The author of this thesis was involved in managing the implementation of partnering approach in the capacity of Deputy Contract Responsible Officer. The author also acted as the in-house facilitator of the partnering review workshops.

This research aimed at developing an effective management framework for enhancing partnering performance for utility business in the Hong Kong power industry and the corresponding six specific research objectives were : (1) Understand the concept and application of partnering, (2) Review why and how the Utility Company implemented partnering, (3) Examine the applicability of partnering in the

Hong Kong power utility business, (4) Identify the essential partnering tools for nurturing partnering spirit in the Hong Kong power utility business, (5) Develop a set of reliable and objective Key Performance Indicator (KPI) for measuring partnering performance and (6) Determine and prioritize the success factors for implementing partnering in the Hong Kong power utility. The research objectives were achieved through employing a combination of research methods including literature review, case study, questionnaire survey and structured interview. Specifically, Delphi survey method and Analytical Hierarchy Process were adopted for developing a set of KPIs for measuring partnering performance and prioritization success factors for implementing partnering in utility business respectively.

The findings of this research contributed to the knowledge enhancement in the area of partnering research. First, a conceptual model of partnering was developed based on the Intergroup Contact Theory, outlining the facilitating conditions: (1) Equal Status, (2) Cooperative Interaction, (3) Common Goal, (4) Authority Support, and (5) Friendship, and the mediating processes: (1) Understanding Each Other, (2) Reduction of Anxiety and (3) Enhancing Empathy, required for making partnering a success. Second, the applicability of partnering in the power utility sector in Hong Kong was examined, illustrating that partnering could create values in both project and personal levels. Third, the essential partnering tools required for nurturing partnering spirits were identified, which included: (1) Regular Meetings at senior and middle management levels, (2) Partnering Workshops, (3) Issue Resolution Mechanism, (4) Shared Risk Mechanism, and (5) 3-layers Governance Structure. Fourth, a set of objective and reliable KPIs with quantitative indicators and corresponding measurement range specific to the power utility context was developed. The KPIs with

weighting identified were: (1) Long-term Business Relationships with weighting of 0.152, (2) Top Management Commitment with weighting of 0.146, (3) Cost Performance with weighting of 0.140, (4) Time Performance with weighting of 0.121, (5) Safety Performance with weighting of 0.121, (6) Harmonious working relationships with weighting of 0.114, (7) Stakeholder's Satisfaction with weighting of 0.108, and (8) Innovation and Improvement with weighting of 0.098. The corresponding measurement ranges for each KPIs against the five common performance level, from “Poor”, “Average”, ”Good”, “Very Good” to “Excellent” were also determined. Fifth, the success factors for partnering implementation were identified and prioritized, which were : (1) “Commitment to Partnering” with relative importance of 0.39, (2) “Realizing Partnering Spirit” with relative importance of 0.21, (3) “Fair Commercial Framework” with relative importance of 0.16, (4) “Collaborative Working Environment” with relative importance of 0.13 and (5) “Stakeholder Involvement” with relative importance of 0.12.

Synthesizing the research findings, an effective management framework for partnering implementation was developed, which consists of four key elements: (1) Guiding Principle, (2) Commercial Arrangement, (3) Management Structure, and (4) Implementation Process. The framework provided an empirical guideline for partnering practitioner’s reference in the power utility sector on how to implement partnering effectively in practice.

List of Publication

Refereed Conference Paper (Published and Accepted)

1. Chan, K. T. K., Chan, A. P. C., and Yeung, J. F. Y. (2011). "Enhancing University-Industry collaboration via teaching company scheme: A case study on research partnerships in Hong Kong." In: *36th Annual Conference for Australian University Building Educators*, Bond University, Gold Coast

2. Chan, K. T. K., Chan, A. P. C., and Yeung, J. F. Y. (2015). "An Effective Partnering Implementation Framework for Managing Engineering Projects" In: *3rd International Conference on Science, Innovation and Management*, Sydney, Australia

Refereed Journal Paper (Published)

1. Chan, K. T. K., Chan, A. P. C., and Yeung, J. F. Y. (2015). "An Effective Partnering Implementation Framework for Managing Engineering Projects" *International Journal of Mechanical And Production Engineering,* 3 (11), 75- 80 (Impact Factor: 3.05)

Refereed Journal Paper (Under Revision)

1. Chan, K.T. K, Chan, A.P.C., and Yeung, J.F.Y. (2015) "Understanding partnering from theory to practice: a case study on utility business in Hong Kong". *International Journal of Project Management*, Manuscript No. JPMA-D-15-00642 (The referees have recommended that the paper be considered for publication as long as certain improvements are made.)

Refereed Journal Papers (Pending Submission)

1. Chan, K. T.K., Chan, A.P.C. and Yeung J.F.Y. (2016) "Prioritizing Key Success Factors for Strategic Partnering: A Case on Utility Business in Hong Kong" Manuscript submitted to Project Management Journal.

2. Chan, K. T.K., Chan, A.P.C. and Yeung J.F.Y. (2016) "Applicability of Strategic Partnering in Utility Business in Hong Kong" Manuscript to be submitted to *International Journal of Project Management*.

3. Chan, K. T.K., Chan, A.P.C. and Yeung J.F.Y. (2016) "Measuring Strategic Partnering Performance in Utility Business Context in Hong Kong" Manuscript to be submitted to *Journal of Management in Engineering, ASCE.*

Acknowledgments

Completion of this thesis marks a great milestone in my life and means a lot to me. It not only realizes my vision of contributing to the society but also lets me experience a fruitful seven-year research journey, which enhanced my research skills for knowledge creation for the betterment of the society. Conducting research is a challenging but rewarding process, especially in a part-time basis. It requires self-discipline, commitment and passion. Support from stakeholders is also crucial. Thus, I would like to express my appreciation to the following stakeholders, their support to me has contributed to the success of this research.

First of all, I have to express my gratitude to Mr. Kenny Tse, RIP, who introduced my Chief Supervisor, Prof. Albert Chan, to me in 2008. I also appreciated the guidance, support and advices from Prof. Albert Chan and my Co-Supervisor, Dr. John Yeung throughout the research journey.

My appreciation also goes to my family members. Firstly, I have to thank for my grandparents' and parents' encouragement and support to me in my life. Secondly, I have to express my deep gratitude to my wife, Ms. Ada Lei, who has taken over my role of taking care of my beloved four-year-old daughter, Ms Olivia Chan, especially in the weekends and holidays in the past four years, to release me for the research. Ada's support, understanding and motivation throughout the whole research process are one of the success factors of this research. I am particularly grateful to know that my dedication to research works has inspired Olivia, who shows interest in pursuing a PhD when she grows up.

In the workplace, I would like to express my gratitude to Mr. Howard Ng, Mr. S.M. Ho, Mr. S.K. Ho, Mr. K.K. Leung, who supported the establishment of this Teaching

Company Scheme. I would also like to offer my special thanks to Mr. Henry Chan, Mr. CK Lam, Mr. Albert Hsu and Mr. Sunny Ho for sharing their valuable partnering experiences with me. The support from the colleagues and contractors who have participated in the surveys, focus group discussions and interviews of this research is also appreciated.

Last but not least, I would like to acknowledge all the engineering professionals who have contributed to providing a reliable electricity supply in Hong Kong, providing a comfortable environment to facilitate my research works regardless of the time of day or night and the weather conditions.

Table of Contents

CHAPTER 1. INTRODUCTION 1

1.1. INTRODUCTION 1

1.2. RESEARCH DRIVES 1

1.3. RESEARCH AIM AND OBJECTIVES 2

1.4. RESEARCH SCOPE 4

1.5. RESEARCH ORIGINALITY 5

1.6. RESEARCH SIGNIFICANCE 6

1.7. STRUCTURE OF THE THESIS 7

1.8. CHAPTER SUMMARY 9

CHAPTER 2. RESEARCH PARADIGM AND METHODOLOGY 10

2.1. INTRODUCTION 10

2.2. ONTOLOGICAL AND EPISTEMOLOGICAL ASSUMPTIONS 10

2.3. RESEARCH APPROACHES 13

2.4. INTRODUCTION OF RESEARCH METHODS 16

2.5. APPLICATION OF RESEARCH METHODS 20

2.6. RESEARCH PROCESS 38

2.7. CHAPTER SUMMARY 39

CHAPTER 3. BACKGROUND OF PARTNERING 41

3.1. INTRODUCTION 41

3.2. BACKGROUND OF PARTNERING 41

3.3. DEFINITION OF PARTNERING 42

3.4. TYPES OF PARTNERING 45

3.5. PARTNERING ELEMENTS AND TOOLS 46

3.6. BENEFITS OF PARTNERING 50

3.7. PARTNERING MODEL 52

3.8. UNDERLYING PRINCIPLE OF PARTNERING 61

3.9. CHAPTER SUMMARY 69

CHAPTER 4. IMPLEMENTATION ISSUES OF PARTNERING 70

4.1. INTRODUCTION 70

4.2. PARTNERING PROCESS 70

4.3. PARTNERING PERFORMANCE MEASUREMENT 71

4.4. CRITICAL SUCCESS FACTORS FOR PARTNERING IMPLEMENTATION 78

4.5. CHALLENGES OF IMPLEMENTING PARTNERING 79

4.6. DEVELOPMENT TREND OF PARTNERING 81

4.7. CHAPTER SUMMARY 82

CHAPTER 5. BACKGROUND OF THE UTILITY COMPANY 84

5.1. INTRODUCTION 84

5.2. BUSINESS NATURE OF THE UTILITY COMPANY 84

5.3. NATURE AND PROCESS OF TRANSMISSION SUBSTATION PROJECTS 85

5.4. DRIVERS FOR ADOPTING PARTNERING APPROACH 87

5.5. THE PARTNERING ARRANGEMENT 88

5.6. PARTNERING TOOLS ADOPTED 90

5.7. CHAPTER SUMMARY 97

CHAPTER 6. APPLICABILITY OF PARTNERING IN THE POWER UTILITY CONTEXT 99

6.1. INTRODUCTION 99

6.2. PARTICIPANT PROFILE AND RESPONSE RATE 99

6.3. PARTNERING PROJECT PERFORMANCE 100

6.4. BENEFIT OF PARTNERING 102

6.5. DIFFICULTIES OF PARTNERING 106

6.6. VALUES OF PARTNERING 110

6.7. CHAPTER SUMMARY 113

CHAPTER 7. THE ESSENTIAL PARTNERING TOOLS FOR NURTURING PARTNERING SPIRIT 114

7.1. INTRODUCTION 114

7.2. SURVEY RESULT 114

7.3. DATA ANALYSIS 115

7.4. DISCUSSION OF SURVEY RESULT 117

7.5. CHAPTER SUMMARY 120

CHAPTER 8. PARTNERING PERFORMANCE MEASUREMENT 122

8.1. INTRODUCTION 122

8.2. PANEL MEMBER SELECTION 122

8.3. PARTICIPANT PROFILE AND RESPONSE RATE 123

8.4. STAGE 1: FORMULATION OF CONCEPTUAL FRAMEWORK OF KPIS 124

8.5. STAGE 1: FOUR ROUNDS OF DELPHI SURVEY 127

8.6. STAGE 2: SURVEY FOR EXPLORING POTENTIAL QUANTITATIVE INDICATORS 134

8.7. STAGE 2: 2 ROUNDS OF DELPHI SURVEY FOR QUANTITATIVE INDICATORS 143

8.8. STAGE 2: DETERMINATION OF MEASUREMENT RANGE OF EACH QI 148

8.9. DISCUSSION OF THE RESULTS 152

8.10. CHAPTER SUMMARY 154

CHAPTER 9. KEY SUCCESS FACTORS OF PARTNERING 157

9.1. INTRODUCTION 157

9.2. STAGE 1 SURVEY 157

9.3. STAGE 2: ANALYTIC HIERARCHY PROCESS (AHP): 164

9.4. RESULTS AND ANALYSIS 166

9.5. DISCUSSION OF THE RESULT 174

9.6. MANAGERIAL IMPLICATIONS OF THE RESULT 178

9.7. CHAPTER SUMMARY 180

CHAPTER 10. THE MANAGEMENT FRAMEWORK FOR PARTNERING IMPLEMENTATION 183

10.1. INTRODUCTION 183

10.2. PROPOSED FRAMEWORK 183

10.3. VALIDATION OF THE PROPOSED MANAGEMENT FRAMEWORK 192

10.4. FINAL MANAGEMENT FRAMEWORK 195

10.5. CHAPTER SUMMARY 199

CHAPTER 11. CONCLUSION AND RECOMMENDATION 201

11.1. INTRODUCTION 201

11.2. REVIEW OF RESEARCH OBJECTIVES 201

11.3. CONTRIBUTIONS OF THE RESEARCH 206

11.4. LIMITATION OF THE RESEARCH 210

11.5. RECOMMENDATION 211

11.6. CHAPTER SUMMARY 213

APPENDICES 214

REFERENCE 262

List of Figure

FIGURE 1-1. HIERARCHICAL RELATIONSHIPS OF RESEARCH AIM AND OBJECTIVES 4

FIGURE 2-1. THE INTERRELATIONSHIP BETWEEN VARIOUS RESEARCH ELEMENTS ADAPTED FROM GRIX (2004) 11

FIGURE 2-2. CALCULATION OF MEASUREMENT RANGE OF THE FIVE PERFORMANCE LEVELS 33

FIGURE 2-3. THE TWO-STAGE APPROACH ADOPTED FOR DETERMINING AND PRIORITIZING PARTNERING SUCCESS FACTORS 34

FIGURE 2-4. THE CONCEPTUAL FRAMEWORK OF PARTNERING SUCCESS FACTORS 37

FIGURE 3-1. THE PARTNERING PROCESS MODEL ADOPTED FROM CRANE ET AL. (1997) 53

FIGURE 3-2. THE THREE-STAGE PARTNERING MODEL ADOPTED FROM CHENG AND LI (2002) 53

FIGURE 3-3. THE PARTNERING MINDSET. ADOPTED FROM LENDRUM (1998) ... 55

FIGURE 3-4. THE PARTNERING CONTINUUM (ADOPTED FROM THOMPSON AND SANDERS (1998) 55

FIGURE 3-5. THE BROOME AND MARGETT'S SPECTRUM OF PARTNERING (ADOPTED FROM BROOME (2002) 56

FIGURE 3-6. THE PARTNERING MODEL AND ITS EFFECT ON PROJECT PERFORMANCE ADAPTED FROM ANVUUR AND KUMARASWAMY (2007) 57

FIGURE 3-7. THE CONCEPTUAL FRAMEWORK OF PARTNERING ADAPTED FROM BEACH ET AL. (2005) 58

FIGURE 3-8. THE VIRTUAL ORGANIZATION MODEL OF PARTNERING ADAPTED FROM CROWLEY AND KARIM (1995) 59

FIGURE 3-9. THE CONCEPTUAL PARTNERING MODEL EMBRACING VARIOUS CAUSAL ELEMENTS ADOPTED FROM TANG ET AL. (2006) 60

FIGURE 3-10. THE FACILITATING CONDITIONS AND MEDIATING PROCESS FOR OPTIMAL INTERGROUP CONTACT. SOURCE: AUTHOR'S OWN INTERPRETATION. 63

FIGURE 3-11. THE CONCEPTUAL MODEL OF PARTNERING ADOPTED AND EXPENDED FROM ANVUUR AND KUMARASWAMY (2007) 68

FIGURE 4-1. THE BEST PRACTICE FRAMEWORK OF PROJECT PARTNERING ADOPTED FROM CHAN ET AL. (2006) 71

FIGURE 4-2. THE OGSM MODEL ADOPTED FROM CRANE ET AL. (1999) 75

FIGURE 5-1. NATURE OF TRANSMISSION SUBSTATION PROJECTS (TSP) 86

FIGURE 5-2. THE TYPICAL PROCESS OF TRANSMISSION SUBSTATIONS PROJECTS ADOPTED FROM CHAN AND WOO (2001) 87

FIGURE 5-3. OVERVIEW OF THE CONTRACTUAL AND PARTNERING ARRANGEMENT ADAPTED AND EXPENDED FROM FORD ET AL. (2006) 89

FIGURE 5-4. MEMBERSHIP, STRUCTURE AND ROLES OF THE 3-LAYER MANAGEMENT HIERARCHY ADAPTED FROM FORD ET AL. (2006) 93

FIGURE 5-5. THE PERFORMANCE-BASED INCENTIVE SCHEME. ADAPTED FROM CHAN ET AL. (2008) 97

FIGURE 6-1. THE ORGANIZATIONAL AND POSITIONAL DEMOGRAPHY OF THE PARTICIPANTS 99

FIGURE 8-1. THE ORGANIZATIONAL AND POSITIONAL DEMOGRAPHY OF THE PARTICIPANTS 123

FIGURE 8-2. THE CONCEPTUAL FRAMEWORK OF KPIS FOR PARTNERING PROJECTS. ADOPTED FROM YEUNG ET AL. (2007B) 125

FIGURE 9-1. THE 3-LEVEL HIERARCHY MODEL 163

FIGURE 10-1. THE PROPOSED MANAGEMENT FRAMEWORK BASED ON THE RESEARCH FINDINGS 184

FIGURE 10-2. THE ENRICHED 3-LAYER MANAGEMENT STRUCTURE FOR EFFECTIVE PARTNERING IMPLEMENTATION ADOPTED FROM FORD ET AL. (2006) 187

FIGURE 10-3. THE PROPOSED STRUCTURED PARTNERING PROCESS. ADAPTED AND EXPANDED FROM THE LATHAM REPORT (1994) 190

FIGURE 10-4. CONCEPT OF INCENTIVE SCHEME ADOPTED FROM CHAN ET AL. (2015) 196

FIGURE 10-5. THE FINAL 3-LAYER MANAGEMENT STRUCTURE FOR EFFECTIVE PARTNERING IMPLEMENTATION ADOPTED FROM FORD ET AL. (2006) 198

FIGURE 10-6. THE FINAL STRUCTURED PARTNERING PROCESS. ADAPTED AND EXPANDED FROM THE LATHAM REPORT (1994) 198

FIGURE 10-7. THE FINALIZED EFFECTIVE MANAGEMENT FRAMEWORK FOR PARTNERING IMPLEMENTATION 200

List of Table

TABLE 2-1. COMPARISON OF QUANTITATIVE AND QUALITATIVE RESEARCH METHODS EXTRACTED FROM GRIX (2004) 14

TABLE 2-2. CRITERIA FOR ESTABLISHING TRUSTWORTHINESS OF RESEARCH ADAPTED FROM RAFTERY ET AL. (1997) 15

TABLE 2-3. RESEARCH METHODS EMPLOYED FOR THIS RESEARCH 21

TABLE 2-4. STRUCTURE OF LITERATURE REVIEW ON PARTNERING 25

TABLE 2-5. STRUCTURE OF THE CASE STUDY ON THE UTILITY COMPANY 26

TABLE 2-6. SPECIFIC OBJECTIVES AND METHODS EMPLOYED FOR OBJECTIVE 3 26

TABLE 2-7. THE POTENTIAL BENEFITS AND DIFFICULTIES OF PARTNERING 27

TABLE 2-8. METHODS EMPLOYED FOR OBJECTIVE 5 30

TABLE 3-1. THE COMMON PARTNERING ELEMENTS 48

TABLE 3-2. THE COMMON PARTNERING TOOLS 49

TABLE 4-1. COMPARISONS ON THE THREE PERFORMANCE MEASUREMENT FRAMEWORKS ADOPTED FROM YANG ET AL. (2010) 73

TABLE 4-2. THE FUNCTIONAL CRITICAL SUCCESS FACTORS ADOPTED FROM CHENG AND LI (2002) 79

TABLE 4-3. THE BARRIERS OF IMPLEMENTING PARTNERING ADAPTED FROM NG ET AL. (2002) 81

TABLE 6-1. PERFORMANCE OF PARTNERING PROJECTS 101

TABLE 6-2. SURVEY RESULT ON THE PERCEIVED BENEFITS OF PARTNERING .. 102

TABLE 6-3. SURVEY RESULT OF THE PERCEIVED DIFFICULTIES OF IMPLEMENTING PARTNERING 106

TABLE 6-4. CLIENT'S COMMENTS ON THE VALUE OF IMPLEMENTING PARTNERING 111

TABLE 6-5. CONTRACTOR'S COMMENTS ON THE VALUE OF IMPLEMENTING PARTNERING 111

TABLE 7-1. THE PARTNERING TOOLS ADOPTED AND THE PARTNERING ATTRIBUTES 114

TABLE 7-2. SURVEY RESULT ON EFFECTIVENESS OF PARTNERING TOOLS..... 116

TABLE 8-1. SUMMARY OF LITERATURE REVIEW ON KPIS FOR PARTNERING PROJECTS 126

TABLE 8-2. ROUND 1 SURVEY RESULT 128

TABLE 8-3. ROUND 2 SURVEY RESULT 130

TABLE 8-4. ROUND 3 SURVEY RESULT 131

TABLE 8-5. ROUND 4 SURVEY RESULT 133

TABLE 8-6. PROPOSED QUANTITATIVE INDICATORS FOR LONG-TERM BUSINESS RELATIONSHIPS 135

TABLE 8-7. PROPOSED QUANTITATIVE INDICATORS FOR TOP MANAGEMENT COMMITMENT 136

TABLE 8-8. PROPOSED QUANTITATIVE INDICATORS FOR COST PERFORMANCE 137

TABLE 8-9. PROPOSED QUANTITATIVE INDICATORS FOR TIME PERFORMANCE 138

TABLE 8-10. PROPOSED QUANTITATIVE INDICATORS FOR SAFETY PERFORMANCE..... 139

TABLE 8-11. PROPOSED QUANTITATIVE INDICATORS FOR HARMONIOUS WORKING RELATIONSHIPS 140

TABLE 8-12. PROPOSED QUANTITATIVE INDICATORS FOR STAKEHOLDER'S SATISFACTION 141

TABLE 8-13. PROPOSED QUANTITATIVE INDICATORS FOR INNOVATION AND IMPROVEMENT 142

TABLE 8-14. RESULT OF ROUND 1 DELPHI SURVEY ON THE QUANTITATIVE INDICATORS..... 146

TABLE 8-15. RESULT OF ROUND 2 DELPHI SURVEY ON THE QUANTITATIVE INDICATORS..... 147

TABLE 8-16. SURVEY RESULT ON THE MEAN VALUES AND MEASRUEMENT RANGE 150

TABLE 8-17. OVERALL RESULT OF THE KPIS, QI AND MEASUREMENT RANGE FOR THE UTILITY COMPANY 151

TABLE 8-18. COMPARSION OF KPIS..... 154

TABLE 9-1. THE SURVEY RESULTS ON THE 41 UNDERLYING SUCCESS FACTORS ADOPTED FROM (CHAN ET AL. 2004) 159

TABLE 9-2. THE SCALE OF IMPORTANCE FOR PAIRWISE COMPARISON ADAPTED FROM SAATY (1980) 164

TABLE 9-3. THE CONSISTENCY RATIO (CR) OF THE INDIVIDUAL INPUTS 167

TABLE 9-4. THE NORMALIZED MATRIX OF THE 5 MAIN SUCCESS FACTORS AT LEVEL 2 168

TABLE 9-5. THE NORMALIZED MATRIX OF THE SUB FACTORS UNDER THE CATEGORY OF "STAKEHOLDER INVOLVEMENT" 169

TABLE 9-6. THE NORMALIZED MATRIX OF THE SUB FACTORS UNDER THE CATEGORY OF "COMMITMENT TO PARTNERING" 170

TABLE 9-7. THE NORMALIZED MATRIX OF THE SUB FACTORS UNDER THE CATEGORY OF "REALIZING PARTNERING SPIRIT" 171

TABLE 9-8. THE NORMALIZED MATRIX OF THE SUB FACTORS UNDER THE CATEGORY OF "FAIR COMMERCIAL FRAMEWORK" 171

TABLE 9-9. THE NORMALIZED MATRIX OF THE SUB FACTORS UNDER THE CATEGORY OF "COLLABORATIVE WORKING ENVIRONMENT" 172

TABLE 9-10. THE LOCAL AND GLOBAL WEIGHTS OF ALL SUB FACTORS 174

Chapter 1. Introduction

1.1. Introduction

This chapter outlines the fundamental elements of this research including the drives, aim and objectives. Scope and significance of this research are also clarified and discussed. The Structure of this thesis is also introduced.

1.2. Research Drives

Partnering, being a member under the umbrella of Relational Contracting (Chan et al. 2009), had been evolving from its first development in the UK (Bennett and Jayes 1998) and US (Cowan et al. 1992) in the 1980s. It can be seen that partnering has drawn attentions from academia and the construction industry in the past decades in view of its claimed benefits of better time and cost control resulted by improving relationship and communication among project participants. (Abudayyeh 1994; Black et al. 2000; Chan et al. 2003a; Cowan et al. 1992; Gransberg et al. 1999; Li et al. 2001; Thompson and Sanders 1998).

In view of the potential benefits of partnering, the Utility Company has adopted partnering approach to manage its Transmission Substation Projects (TSP) as a trial. Without experience of implementing partnering, the Utility Company is interested to know:

1. Is partnering suitable for managing TSP in the power industry?
2. How partnering can be implemented effectively in the power utility context?

Considering that it was a trial implementation of partnering in the Utility Company, it would be practically valuable to systematically capture the experiences on partnering and develop an industry-specific partnering framework for practitioners' reference. In this regard, this research was then initiated in response to the above-mentioned research questions.

1.3. Research Aim and Objectives

Following the research questions, this research aims at developing a framework for implementing strategic partnering in the Hong Kong power industry. Such a framework is expected to provide guidelines and references to power utilities on how to implement partnering in an effective manner to enhance project performance. With the above-mentioned considerations, the research aim was set as:

Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry

---

As Cheng et al. (2000) suggested, proper contextual characteristics, critical performance measurement and appropriate management skills are the three critical building blocks of partnering success. The first building block, contextual characteristics of a partnering agreement are mainly associated with which partnering elements and tools employed. The second building block, performance measurement, is apparently important to management since a reliable and objective performance measurement can direct the participants to focus on particular areas to achieve the

partnering success effectively. The third building block, management skills, can be regarded as how partnering can be effectively implemented in practice. To develop a management framework for enhancing partnering performance, it is fundamentally important to clarify what partnering is and understand why and how the Utility Company adopts partnering. In additional, it is worthwhile to verify if partnering approach is applicable to the power utility concerned in this research. With the above considerations, the following specific research objectives are therefore derived for achieving the research aim:

1. Understand the concept and application of partnering;
2. Review why and how the Utility Company implemented partnering;
3. Examine the applicability of partnering in the Hong Kong power utility business;
4. Identify the essential partnering tools for nurturing partnering spirit in the Hong Kong power Utility business;
5. Develop a set of reliable and objective Key Performance Indicator (KPI) for measuring partnering performance;
6. Determine and prioritize the success factors for implementing partnering in the Hong Kong power utility.

The overall research aim and the objectives are presented in Figure 1-1.

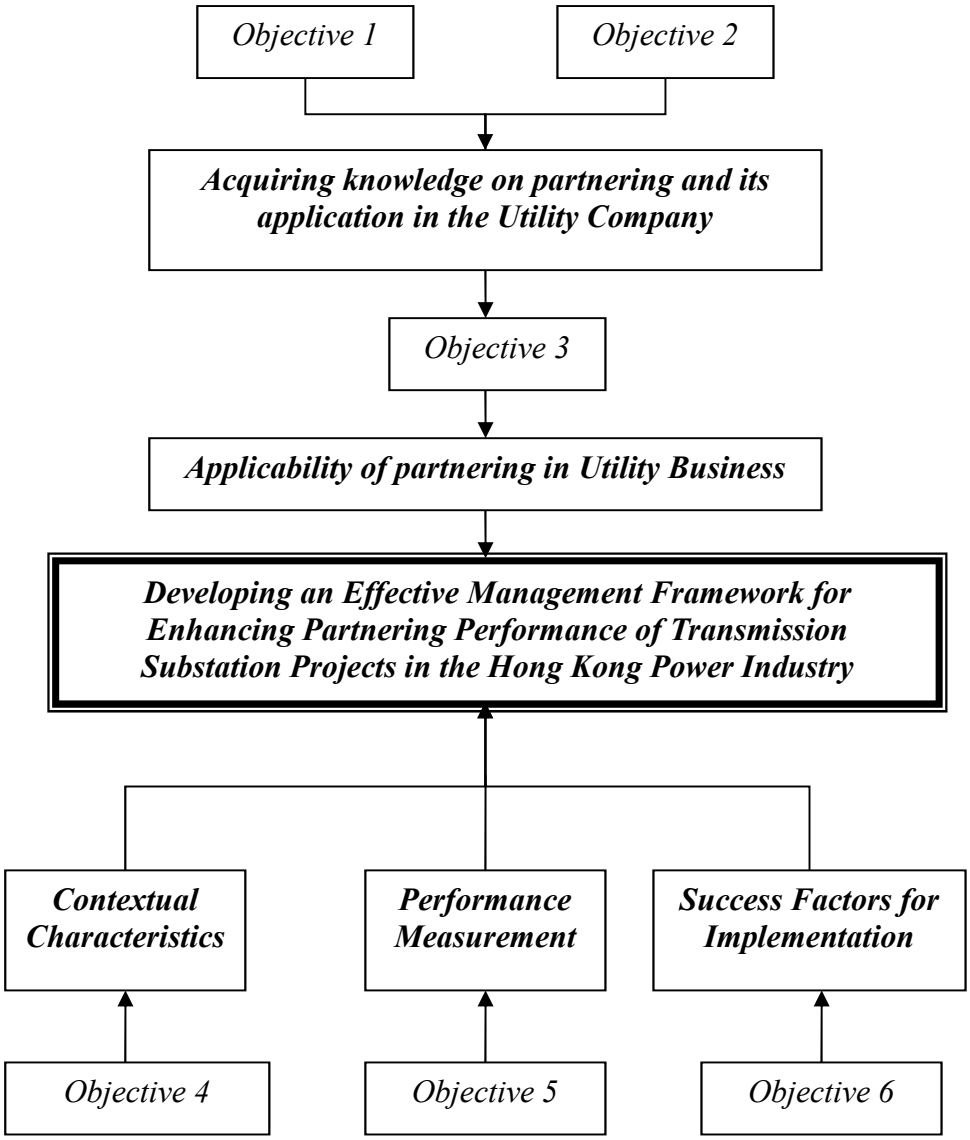


Figure 1-1. Hierarchical relationships of research aim and objectives

1.4. Research Scope

To facilitate the research process, the research scope was well defined at the beginning so that a clear focal point can be maintained throughout the course of this research. This research focuses on the partnering approach adopted on top of a

conventional contacting relationship for managing transmission substations project of a power utility in Hong Kong. The projects involved both civil services and electrical equipment supply. Details of the partnering arrangement in the Utility Company will be discussed in Chapter 5.

1.5. Research Originality

Most of the empirical partnering research focuses on partnering application in the construction industry or infrastructure sector. Reviewing prevailing literature indicates that most of the reported empirical case studies focus on the construction industry (Chan et al. 2003a; Larson 1997; Thompson and Sanders 1998), railway industry (Bayliss et al. 2004; Chan et al. 2008; Ng et al. 2004) and public infrastructure projects (Abudayyeh 1994; Cowan 1991; European Construction Institute 1997; Schmader 1994; Sparrow and Toong 2003; Warne 1994) . Only little, if not none, research effort has been put on the power industry regarding the application of partnering. Lacking empirical evidence of partnering from the power industry also puts a question mark on whether the claimed benefits of partnering reported in the construction industry can be realized in other industries, in which the operating regime and client's values may be different. This study expands the partnering research to an unexplored area, the power industry. This study specifically sheds light on the partnering application for managing Transmission Substation Projects (TSP), involving both electrical works and civil works, in the Hong Kong power industry context. The research deliverables provide original contributions to partnering research by supplementing the literature about the partnering application in the power industry, and this research also provides a practical guideline on how to effectively implement partnering in practice.

1.6. Research Significance

Based on an empirical case of partnering application in Hong Kong, the research deliverables can provide insights in both managerial and academic perspectives. The management framework can provide a reference for power utilities on how to effectively implement partnering, covering what partnering tools should be employed, how partnering performance should be measured and which success factors should be focused on during the partnering implementation process. In addition, the research can also capture and document the valuable experiences of implementing partnering in the Utility Company for future references. Essentially, the research deliverables can also foster the development of partnering culture in the Hong Kong construction industry to align the objectives stated in the Tang's report (Tang 2001), and to provide insights of partnering application in the power industry context to the world-wide research community.

From the academic point of view, the research results would be published to selected international journals and conferences to foster the development and application of partnering in the engineering or construction related industry by providing empirical evidences about partnering application in the Hong Kong power industry.

In addition, efficiency and productivity of the engineering and construction industry in the years ahead are of utmost importance, as United Nations (2015) estimated, the world population will reach 8.5 billion in 2030, representing an increase of 1.1 billion people in the span between 2015 and 2030. In response to the increasing population trend together with economic developments in different countries, the

infrastructure investment across the globe will increase accordingly. The Organization for Economic Co-operation and Development (OECD 2011) stated that the projected annual investment in the major countries from 2015 to 2030 is at level of USD 585 billion, mainly for infrastructure facilities development including airport, railway, ports, and oil and gas transport and distribution. The related aggregate investment in the period 2015-2030 reaches a level of USD 8,815 billion. All the upcoming development mentioned requires electricity supply and it can be seen that the performance of the power, engineering and construction industries as a whole would be critical in the years ahead considering the substantial amount of infrastructure investment around the globe.

1.7. Structure of the Thesis

This thesis is organized as follow:

Chapter 1 provides an introduction of this research. It covers the background of the research, research aim and objectives, research scope and research significance. It also outlines the research process and the thesis structure.

Chapter 2 outlines the research methodology of this research. The fundamental assumptions in the ontological and epistemological perspectives are discussed and that of the author adopted for this research is also clarified. Research methods adopted and the overall research process are also explained.

Chapter 3 reviews the background of partnering, including the partnering definitions, common partnering elements and tools and types of partnering. Benefits of partnering and various partnering models are also introduced. A significant contribution of this

chapter is the development of a conceptual model based on the Intergroup Contact Theory, explaining the operating principle of partnering in psychological perspective.

Chapter 4 focuses on reviewing issues related to implementation of partnering, covering partnering process, performance measurement and success factors and challenges of implementing partnering.

Chapter 5 introduces the business nature of the power utility company in Hong Kong and the characteristics of the associated Transmission Substation Project. The rationale of adopting partnering and how partnering was implemented in practice are also discussed.

Chapter 6 examines the applicability of partnering in the power industry context, employing document analysis, focus group and survey methods. The values, benefits and difficulties of implementing partnering are identified.

Chapter 7 evaluates the effectiveness of the partnering tools in nurturing partnering attributes advocated by the Utility Company by employing a survey method. A list of essential partnering tools is identified.

Chapter 8 applies the Delphi survey technique to develop a set of objective and reliable KPIs for measuring partnering performance in the utility context. A set of 8 KPIs with weighting is identified. The corresponding quantitative indicator and the associated measurement range for each of the 8 KPIs are also developed.

Chapter 9 identifies and prioritizes the success factors for implementing strategic partnering in the power industry context by means of adopting the Analytic Hierarchy Process. 5 Main Success Factors with relative importance are identified.

Chapter 10 synthesizes the research findings and presents an effective management framework for enhancing partnering performance of utility business in the power industry in Hong Kong.

Chapter 11 concludes the whole research. Achievement of research objectives is reviewed, followed by a highlight of knowledge gained through this research. Limitations and recommendations of potential future research areas are also provided to sustain knowledge development in the research about partnering.

1.8. Chapter Summary

This chapter outlined on the foundations of this research, starting from the research drive and research aim. 6 specific research objectives were subsequently introduced with a clarification on the research scope. The research significance was also stated followed by an introduction on the structure of this thesis.

Chapter 2. Research Paradigm and Methodology

2.1. Introduction

This chapter first discusses the philosophical foundation of research, ontological and epistemological assumptions, which underlie research methodology. The ontological and epistemological assumptions adopted for this research is also clarified. The second section focuses on the characteristics of quantitative and qualitative approaches. The research methodology and methods adopted in this research, including literature review, case study, interview, and survey, are then introduced.

2.2. Ontological and epistemological assumptions

The ultimate aim of conducting research is to find out the truth or to understand the nature of reality in the world (Grix 2004). In this sense, what reality actually exits or believed to be existing in the world should first be clarified prior to conducting investigation. Clarifying ones' core assumptions to the world means understanding one's ontological and epistemological assumptions. Ontology and epistemology assumptions would guide the development of research objectives and the corresponding research methodology. Grix (2004) advocated that ontology and epistemology are the building blocks of a research and they affect the development of methodology, choice of research methods and source of data in turn as shown in Figure 2-1. In this sense, it is essential to clarify the core assumptions of a research for a clear, precise and logical presentation of works, prior to developing research methods. Grix (2004) also explained that the main reasons for such clarification are:

1. To understand the interrelationship of the key components of research (including methodology and methods);

2. To avoid confusion when discussing theoretical debates and approaches to social phenomena;

3. To be able to recognize others' and defend our own positions;

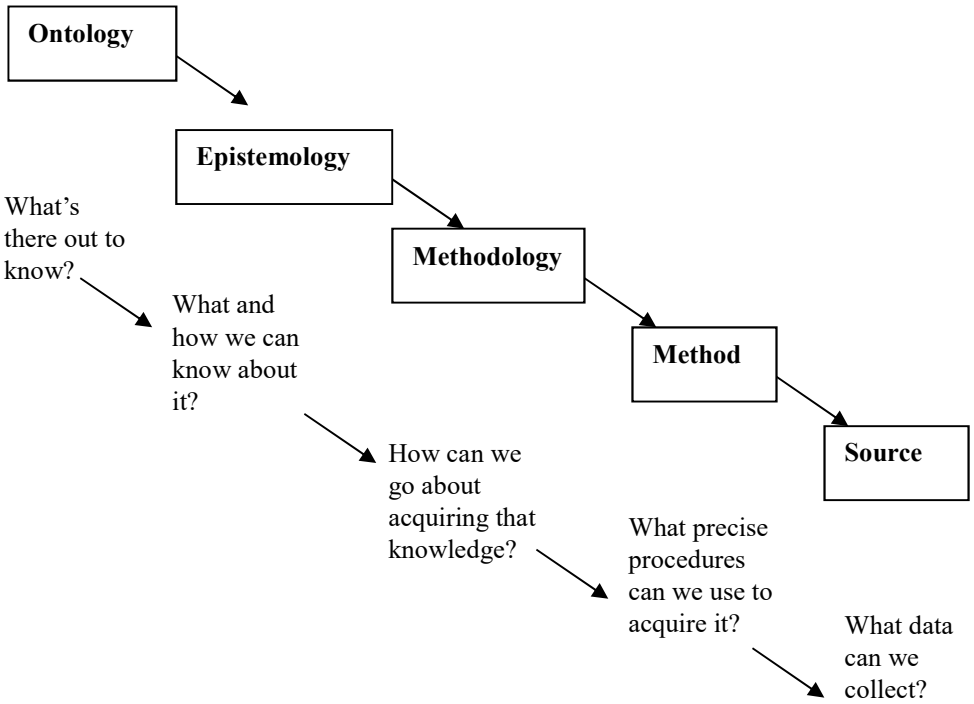


Figure 2-1. The Interrelationship between Various Research Elements Adapted from Grix (2004)

Balikie (2000) defined ontological assumptions as "…assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units make it up and how these units interact with each other. In short, ontological assumptions concern with what we believe constitutes social reality", in other words, it clarifies what reality exists in the world.

Balikie (2000) also defined epistemological assumptions as "the possible ways of gaining knowledge of social reality, whatever it is understood to be. In short, epistemology claims about how what is assumed to be can be known", in essence it clarifies the relationship between reality and the researchers, and the knowledge gathering processes.

The ontological standpoint adopted for this research is constructed reality or anti-foundationalism since it matches author's personal view to the world that reality does not exist independently but it is constructed by human. The epistemological standpoint adopted for this research is interpretivism since it matches author's personal view to the world that knowledge is subjective in nature, its existence is based on individual's interpretation.

Based on the declared ontological and epistemological standpoints of the author, the effective management framework for enhancing partnering performance does not independently exist in the world, instead, it depends on the interpretations of the stakeholders including the Utility Company, the related contractors and the author. Thus, the development of such a framework, comprising selection of partnering tools, performance measurement system and the critical success factors for implementing partnering approach in the power industry, should focus on identifying the interpretations of stakeholders. Based on these assumptions, research approach and methods for each objective are developed as discussed in the next sections.

2.3. Research Approaches

2.3.1. Quantitative approach

Quantitative research method, grounded on positivism, mainly focuses on numerical data and consists of three basic phases including identifying variables, operationalizing the variables and measuring them (Grix 2004). Common quantitative methods include questionnaire/survey, statistical analysis of collected data or content analysis. As it mainly deals with numerical data, various statistical techniques (e.g. regression analysis) are employed for analysis.

Grix (2004) asserted that the main criticisms of quantitative research method is its ignorance of social and cultural context in which the variables are being measured, and this characteristic lead to a limitation on its application in the social world, in which not every variable can be easily measured such as "trust" or "commitment".

2.3.2. Qualitative approach

Qualitative research method, based on interpretivism, on the other hand focuses on in-depth investigation of knowledge, but not focusing on numerical data. Common methods employed include interview, observation, documentary analyses or ethnographic study (Ragin 1994: 120). Main criticisms of qualitative methods include representativeness and generality based on limited examples, leading to a validity issues (Grix 2004).

2.3.3. Combining Quantitative and Qualitative Approaches

Johnson and Onwuegbuzie (2004) summarized difference of quantitative and qualitative research approaches as "traditional quantitative research is a focus on

deduction, confirmation, theory/hypothesis testing, explanation, prediction, standardized data collection, and statistical analysis. The major characteristics of traditional qualitative research are induction, discovery, exploration, theory/hypothesis generation, the researcher as the primary "instrument" of data collection, and qualitative analysis". Grix (2004), based on the comments from Mason (1998), Silverman (2000), Neuman (2000) and Danermark et al. (2002), summarized the characteristics of quantitative and qualitative methods as shown in Table 2-1.

Table 2-1. Comparison of quantitative and qualitative research methods Extracted from Grix (2004)

Quantitative methods	Qualitative methods
• Its epistemological orientation is rooted in the positivist tradition	• Its epistemological orientation is rooted on the Interpretivist tradition
• Interested in finding out numerical qualities of an event or case: how many? How much?	• Interested in the nature and essence of an event or person of a case. Concerning "what".
• Goal of investigation is explanation, prediction, control, description and hypothesis testing	• Goal of investigation is understanding, description, discovery and hypothesis generation
• Uses hard data (numbers)	• Uses soft data (words or image from documents or observations)
• Objective	• Subjective
• Usually tackles macro-issues, using large, random and representative samples	• Tends to analyses micro-issues, using small, non-random and non-representative samples
• Employs a deductive research strategy	• Employs and inductive research strategy
• Survey methodology	• Interview (in-depth case study)
• Research procedures are standard and replication is presumed	• Research procedures are particular and replication are rare
• Findings attempt to be comprehensive, holistic and generalizable	• Findings are seen to be precise, narrow and not generalizable

It can be seen that the two approaches are rooted at two extremes, quantitative approach is objective in nature and focuses on macro-issues, while qualitative approach

is subjective in nature and focuses on micro-issues. However, such differences are not necessarily leading to contradiction if the two approaches are properly combined for a particular research.

Raftery et al. (1997), based on works of Lincoln and Guba (1985), Csete and Albrecht (1994), defined the criteria of establishing trustworthiness of quantitative and qualitative approaches as shown in Table 2-2. It can be seen that the two approaches tend to establish its trustworthiness in different ways, but they concern the same set of overarching criteria including truth value, consistency, applicability and neutrality. This implies that quantitative and qualitative approaches are not contradictory to each other.

Table 2-2. Criteria for Establishing Trustworthiness of Research Adapted from Raftery et al. (1997)

Quantitative Approach	Overarching Criteria	Qualitative Approach
By Internal validity	**Truth value**	By Credulity
By Replicability	**Consistency**	By Dependability
By External validity	**Applicability**	By Transferability
By Objectivity	**Neutrality**	By Confirmability

Quantitative and qualitative approaches, although developed from different paradigms, can complement each other since they share similar fundamental research principles that aiming at getting a better understanding of the word (Csete and Albrecht 1994). In addition, the two approaches try to demonstrate the respective trustworthiness of the research findings by striving for truth value, consistency, applicability and neutrality of their methods employed. Johnson and Onwuegbuzie (2004) advocated that "researchers should collect multiple data using different strategies, approaches, and methods in such a way that the resulting mixture or combination is likely to result in complementary strengths and non-overlapping weaknesses" based on the "fundamental

principle of mixed research" (Johnson and Turner 2003).

Adoption of both qualitative and quantitative methods for a study is termed as "Triangulation". Denzin (1978) defined triangulation as "the combination of methodologies in the study of the same phenomenon". Such combination of methods can offer a greater confidence on the validity of results by cross-checking each other (Jick 1979). Combination of qualitative and quantitative methods have been adopted for researches about the construction industry for many years (Raftery et al. 1997). In fact, triangulation has been adopted for studying partnering (Chan et al. 2004; Yeung 2007) or contract strategy (Chan and Yu 2005) in the construction industry. Therefore, for the sake of achieving greater validity, triangulating approach was adopted for this research.

2.4. Introduction of Research Methods

Considering the research aim of "Developing a management framework for enhancing partnering performance of utility business in the Hong Kong power industry" and the adoption of triangulation approach as discussed in the previous section, a combination of methods was adopted in this research, including literature review, case study, interview and questionnaire survey. In fact, these methods are commonly adopted for research in the domain of construction management (Chow 2005). In addition, Delphi survey method was adopted for the development of a set of KPIs to measure partnering performance and Analytic Hierarchy Process (AHP) was employed for prioritizing the identified key successes factors for partnering implementation in the power industry. The research methods employed in this study are introduced in the following session.

2.4.1. Literature Review

Literature review refers to the knowledge or information collection for a certain research topic. Literature review can serve the purpose of gathering background knowledge of the topic concerned, consolidating all the output of previous studies related to the research (Chow 2005) , identifying the extent of current knowledge and the main issues of the topic concerned, which can also identify the knowledge gap and provide a rationale for the research being conducted (Fellows and Liu 2008).

2.4.2. Case Study

Case study allows in-depth investigation on specific issues within the scope of a research. Case study can also be conducted along with a combination of data collection methods like interviewing with the key personnel related to the study and documentary analysis (Fellows and Liu 2008).

2.4.3. Survey

Survey is regarded as the most common research method adopted for construction management studies, since a set of standardized data can be collected from the sample identified (Chow 2005). Commonly, surveys are administrated through questionnaires (Fellows and Liu 2008) by which statistical sampling can be obtained.

2.4.4. Interview and Focus Group

Interview is a process of gathering qualitative information. In the continuum of formality, it can be classified as structured interview, semi-structured interview and unstructured interview Structured interview is conducted along with pre-set questions (Yeung 2007), while unstructured interview is a conversation about a certain topic, in

which the respondents can talk about what they think are important under a certain topic (Bell 2005). Interview can also be conducted in group basis and it is commonly regarded as focus group, under which, the participants are allowed to interact to each other for reaching consensus on the topic concerned. Focus group can be conducted either in structured or unstructured basis. Focus group is effective for soliciting in-depth information about what the participants think about a certain issue and their rationale behind (Bell 2005).

2.4.5. Delphi method

Delphi method is a protocol that structures and facilitates group communication to achieve consensus among stakeholder on particular issue, through a series of iterations (Loo 2002). The Delphi method was invented by Kaplan for making policy at the RAND Corporation in the 1950s after the Second World War (Loo 2002), the original aim of the study was to 'obtain the most reliable consensus of opinion of a group of experts by a series of intensive questionnaires interspersed with controlled opinion feedback'(Linstone and Turoff 1975). It is conducted by rounds interspersed with group opinion and information feedback in the form of relevant statistical data. This mechanism makes the Delphi method has a self-validating nature. Chan et al. (2001) stated that Delphi method is a well-established method for mining the maximum amount of unbiased information from a group of experts. The Delphi method can also be characterized by three features : anonymity; iteration with controlled feedback; and statistical response (Dickey and Watts 1975). With these unique features, the Delphi method offers the following advantages:

- high independence since the survey results are individual based;

- no interpersonal conflicts and communication problem since the results keeps anonymous and there is no interaction between the experts;
- experts can amend their choices at later stage of the survey giving a more rigorous result.

Selection of panel member is critical to the success of the Delphi method (Chan et al. 2001) since the panel members must be able to provide in-depth opinions on the subject concerned. Proper selection of panel members can also overcome the concern of small panel size compared to the hundreds required for survey (Loo 2002).

2.4.6. Analytical Hierarchy Process

AHP is one of the Multiple Criteria Decision Making (MCDM) tools and was developed in early 1980 by Thomas L. Saaty (Saaty 1980). AHP has been widely adopted in various areas including engineering, education, management, political and social studies, manufacturing, environmental management, power and energy industry, transportation industry and construction industry, health and others. (Subramanian and Ramanathan 2012; Vaidya and Kumar 2006), for various objectives including planning, selecting a best alternative, resource allocation and resolving conflicts (Subramanian and Ramanathan 2012). AHP is an analytical technique and a subjective method by which a large sample size is not necessary for a valid result (Cheng and Li 2001), it focuses more on the degree of consistency of the data (Wong and Li 2008). In fact, some pervious researches adopting AHP only involved 6 (Chin et al. 2008) 8 (Lam and Zhao 1998) or 9 samples (Cheng and Li 2002).

This study adopted the widely cited five–step process of AHP set out by Saaty (1980), including:

1. Define the problem to be solved;
2. Decompose the problem into a chain of hierarchy;
3. Employ a pair-wise comparison;
4. Undertake the consistency test; and
5. Estimate relative weights of the components of each level.

2.5. Application of research methods

To achieve the research aim and the 6 specific research objectives, a combination of the introduced research methods were employed for this research. Table 2-3 shows a summary of the application of various research methods for each research objective. Details are discussed in turn in the next sections.

Table 2-3. Research methods employed for this research

Objectives	Approach/ Methods	Data to be collected
1. Understand the concept and application of partnering	Approach: Qualitative Method: Literature Review	Knowledge and background information about partnering
2. Review why and how the Utility Company implemented partnering	Approach: Qualitative Method: Case Study	Empirical evidences on why and how partnering was implemented in the Utility Company
3. Examine the applicability of partnering in the Hong Kong power utility	Approach: Triangulation Methods: Surveys, focus group and interview	Quantitative: hard figures of partnering project performance Qualitative: Comments from project participants towards various issues related to the adoption of partnering
4. Identify the essential partnering tools for nurturing partnering spirit in the Hong Kong power utility business	Approach: Quantitative Methods: Survey with statistical analysis	Views from the project participants on the effectiveness of partnering tools
5. Develop a reliable and objective partnering performance measurement system	Approach: Triangulation Methods: - Literature review - Delphi survey with statistical analysis	Quantitative: Views from project participants on the most significant KPIs and the corresponding quantitative indicators and range for objective performance measurement.
6. Determine and prioritize key success factors for implementing partnering in the Hong Kong power utility	Approach: Quantitative Methods: - Literature review for identifying potential success factors - Survey and Analytical Hierarchy Process (AHP) for prioritizing CSF	Comments from project participants towards critical success factors of implementing partnering concept in the Utility Company.
Overall Research Aim: **Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong power industry**	Synthesizing the findings of the 6 specific research objectives.	

2.5.1. Method adopted for Objective 1

Objective 1 was set to acquire background knowledge about partnering. Literature review was performed to achieve this objective. Prior to conducting the literature review, the following issues raised by Bell (2005) for an effective literature review strategy were clarified:

1. Language of the materials to be reviewed;
2. Time range of materials to be reviewed;
3. Location range of materials to be reviewed;
4. Discipline of materials to be reviewed;
5. Keywords adopted for literature search; and
6. Search engines adopted.

The starting point of the literature review was set to year 1989, which was the year that the first paper about partnering published in construction journal (Hong et al. 2012b). The literature in English from 1989 – 2012 published in journals in the engineering, management and construction related disciplines were reviewed. The territory of the papers was not limited so as to be comprehensive.

A list of literature was first identified from the search engine "Scopus" with key words "partnering", "strategic partnering" and "project partnering" in the search field of article title, abstract and keywords. The subject areas selected were "Engineering", "Energy", "Business Management and Accounting", "Economics, Econometrics and Finance", "Social Science" and "Decision Sciences". The search resulted 1,594 articles.

The source code adopted was as shown below:

TITLE-ABS-KEY("partnering" or "construction partnering" or"Strategic partnering" or "project partnering" or "collaborative project management") AND PUBYEAR > 1989 AND PUBYEAR < 2012 AND (LIMIT-TO(LANGUAGE,"English")) AND (LIMIT-TO(SRCTYPE,"j")) AND (LIMIT-TO(SUBJAREA,"ENGI") OR LIMIT-TO(SUBJAREA,"BUSI") OR LIMIT-TO(SUBJAREA,"SOCI") OR LIMIT-TO(SUBJAREA,"ECON") OR LIMIT-TO(SUBJAREA,"DECI") OR LIMIT-TO(SUBJAREA,"ENER"))

(Searched on 28 Nov 2012)

To reduce the number of articles to a manageable level, those internationally-refereed construction and project management related journals identified by Chau (1997), Li et al. (2000), Bygballe et al.(2010) and Hong et al.(2012b) were adopted as the second-round selection criteria. The journals identified were Journal of Management in Engineering (JME), Construction Management and Economics (CME), International Journal of Project Management (IJPM), Journal of Construction Engineering and Management (JCEM), Engineering, Construction and Architectural Management (ECAM) and Proceedings of the Institution of Civil Engineers-Civil Engineering (PICE-CE), Project Management Journal (PMJ), Building and Environment (BE), Proceedings of the Institution of Civil Engineers-Municipal Engineers (PICE-ME) and Automation in Construction(AIC). In additional, two more journals related to the power industry were also added into the list, which were IEEE Transactions on Engineering Management and IEEE Engineering Management Review, resulting 12 journals in total. The source code adopted for the second around search was as shown in the next page:

TITLE-ABS-KEY("partnering" or "Strategic partnering" or "project partnering") AND PUBYEAR > 1989 AND PUBYEAR < 2012 AND (LIMIT-TO(LANGUAGE,"English")) AND (LIMIT-TO(SRCTYPE,"j")) AND (LIMIT-TO(SUBJAREA,"ENGI") OR LIMIT-TO(SUBJAREA,"BUSI") OR LIMIT-TO(SUBJAREA,"SOCI") OR LIMIT-TO(SUBJAREA,"ECON") OR LIMIT-TO(SUBJAREA,"DECI") OR LIMIT-TO(SUBJAREA,"ENER")) AND (LIMIT-TO(EXACTSRCTITLE,"Journal of Management in Engineering") OR LIMIT-TO(EXACTSRCTITLE,"Construction Management and Economics") OR LIMIT-TO(EXACTSRCTITLE,"International Journal of Project Management") OR LIMIT-TO(EXACTSRCTITLE,"Journal of Construction Engineering and Management") OR LIMIT-TO(EXACTSRCTITLE,"Engineering Construction and Architectural Management") OR LIMIT-TO(EXACTSRCTITLE,"Proceedings of the Institution of Civil Engineers Municipal Engineer") OR LIMIT-TO(EXACTSRCTITLE,"IEEE Engineering Management Review") OR LIMIT-TO(EXACTSRCTITLE,"IEEE Transactions on Engineering Management") OR LIMIT-TO(EXACTSRCTITLE,"Building and Environment") OR LIMIT-TO(EXACTSRCTITLE,"Proceedings of the Institution of Civil Engineers Civil Engineering") OR LIMIT-TO(EXACTSRCTITLE,"Automation in Construction"))

(Searched on 28 Nov 2012)

There were 183 articles identified from Scopus. During the second stage search, it was found that PMJ was not included in Scopus so that the related paper were searched separately, using the same set of key words and 7 more papers were identified, resulting 190 papers, which formed the basic source of literature for this research. The identified papers were then classified and reviewed according to their relevancy to the specific research objectives. More papers were identified by citation search and cross referencing in the course of the research during the period 2012 – 2015, specific to each research objectives.

To achieve Objective 1, literature review was conducted under two main headings, namely, “Background of Partnering” and “Implementation Issues of Partnering”. The sub headings of the above-mentioned headings are presented in Table 2-4.

Table 2-4. Structure of Literature review on partnering

Main Heading	Sub Headings
Background of Partnering	• Definition of Partnering • Types of Partnering • Partnering Elements and Tools • Benefits of Partnering • Partnering Models • Underlying Principle of Partnering
Implementation Issues of Partnering	• Partnering Process • Partnering Performance Measurement • Success Factors for Partnering Implementation • Challenges of Implementing Partnering

2.5.2. Method adopted for Objective 2

Objective 2 "Review why and how the Utility Company implemented partnering" focused on understanding the rationale of adopting partnering in the Utility Company. To achieve Objective 2, a case study was employed to review the related internal documents and work processes of the Utility Company with the following specific objectives:

- To provide a detailed description of the business nature and the operating regime of the utility company;
- To understand on the nature and process of the Transmission Substation Projects (TSP), which were managed under the partnering approach;
- To explain the drivers for adopting partnering approach for the TSP;
- To provide a detailed account of the partnering arrangement adopted, in both contractual and management perspective; and
- To identify the specific partnering tools adopted

The structure of the review on the Utility Company is shown in Table 2-5.

Table 2-5. Structure of the case study on the Utility Company

Main Heading	Sub Headings
Background of the Utility Company	• Business Nature of the Utility Company • Nature and Process of Transmission Substation Project • Drivers for adopting Partnering Approach • Partnering Arrangement • Partnering Tools Adopted

2.5.3. Methods adopted for Objective 3

To achieve Objective 3 "Examine the applicability of partnering in the Hong Kong power utility", a combination of research methods, including focus group and survey were employed to verify if the partnering spirit can enhance partnering performance. In particular, the perceived values and benefits of implementing partnering were also identified. For the purpose of continuous improvement, the perceived difficulties of implementing partnering were identified as well. Empirical project figures were also collected to support the findings. The Specific Objectives and the corresponding research method are stated in Table 2-6.

Table 2-6. Specific Objectives and Methods employed for Objective 3

Specific Objectives (SO)	Method Employed
SO 1: To verify if the partnering spirit can enhance project performance	Analysis of empirical project data
SO 2: To identify the perceived benefits and difficulties of partnering	Survey
SO 3: To identify the perceived values of partnering	Focus group

To verify if the partnering spirit can enhance project performance, the empirical project data was collected, which included the performance of partnering projects in the safety, cost, time and environment perspectives.

To identify the perceived benefits and difficulties of implementing partnering, a survey was conducted. Due to the relevance to the context of Hong Kong construction industry, the potential partnering benefits proposed by Chan et al. (2003a) and the difficulties of partnering implementation proposed be Chan et al. (2003b) were adopted to form the basis for the survey with modification and some rephrasing on the wordings according to the situation in the Utility Company. Finally, 22 potential partnering benefits and 31 difficulties of implementing partnering were identified as shown in Table 2-7.

Table 2-7. The potential benefits and difficulties of partnering

The potential benefits of partnering Adopted from Chan et al. (2003a)	**The difficulties of implementing partnering Adopted from Chan et al. (2003b)**
1. Development of long term business relationship	1. Parties had little experience with the partnering approach
2. Improved safety performance	2. Concept of partnering was not fully understood by participants
3. Faster construction time	3. Key subcontractors had not been included in the process
4. More responsive to the short-noticed emergency or changing project requirements	4. Parties did not have proper training on partnering approach
5. Reduction in dispute / conflict	5. Uneven levels of commitment were found among project participants
6. Improved relationship amongst project participants	6. Parties were faced with commercial pressure that compromised the partnering attitude
7. Improved conflict resolution strategies	7. Parties failed to build a true relationship of trust
8. Better productivity	8. Many problems with plans and specifications from design consultants were found during the construction stage
9. Reduction in monetary claims	9. Issues and problems were allowed to slide and escalate
10. Increased opportunity for innovation and value engineering	10. Continuous improvement was difficult to maintain

The potential benefits of partnering Adopted from Chan et al. (2003a)	**The difficulties of implementing partnering Adopted from Chan et al. (2003b)**
11. Achieving continuous improvements	11. Conflicts arose from misalignment of personal goals with project goals
12. Sharing project risks more equitably	12. Continuity of open and honest communication was not achieved
13. Joint satisfaction amongst project participants achieved	13. The up-front time commitment for partnering was too demanding
14. Reduction of engineering rework	14. Parties failed to understand how the partnering relationship would provide a competitive advantage
15. Knowledge sharing between stakeholders	15. It was extremely costly and inefficient to align all organizations with every partnering undertaking
16. Reduction of paperwork	16. Dealing with large bureaucratic organizations impeded the effectiveness of partnering
17. Reduction of administrative cost due to elimination of defensive behaviour	17. Organizations were reluctant to change to an integrating culture
18. End user satisfaction	18. Parties were conditioned to the adversarial environment and were not comfortable with the perceived risk in trusting
19. Better design quality	19. Risks or rewards were not shared fairly
20. Reduction in variations	20. It was difficult to obtain and maintain organizational commitment
21. Attaining cost saving	21. Fair profit motive was not fully understood/supported by project participants
22. Better workmanship	22. Some participants did not accept partnering as a long-term way of doing business
	23. Participants were conditioned in a win-lose environment
	24. The owner and slave concept was alive in project
	25. Top management just gave lip service to the partnering approach
	26. The partnering relationship created a strong dependency on other partners
	27. The parties failed to share information
	28. Unfamiliarity or misunderstanding of partnering concepts by the senior management
	29. Parties were over reliant on legal protection, advantages, and loopholes in the contract
	30. Parties refrained from establishing closer relationship to one another to avoid possible allegations of corruption
	31. Design consultants and other consultants had not been included in the process

The project stakeholders were requested to rate the significance of partnering on achieving the potential benefits in the 5-point Likert scale (from 1 = Not Significant to 5 = Extremely Significant). Similarly, the project stakeholders were requested to rate

the significance of the difficulties according to their experience in the five-point Likert scale (1 = Not Significant, 5=Extremely Significant).

The 'Mean Score' method suggested by Chan et al. (2006), who identified the benefits, difficulties and critical successful factors of partnering in the Hong Kong construction industry by the method, was adopted for the questionnaires. The mean score (MS) was calculated by the following formula:

$$MS = \frac{\sum (f \times S)}{N}$$

where f is the frequency of response to each rating (1-5)
S is the rating given to the factor concerned
N is the total number of response received for the factor.

Considering the subjective nature of values of partnering, a focus group discussion was conducted with the participants to identify the perceived values of partnering in the individual and the company level. The identified project performance figures were presented to the focus group participants to provide them an overview of the partnering projects. The participants were then allowed to discuss and come up with a list of values which they can get from the partnering arrangement.

2.5.4. Method adopted for Objective 4

To achieve Objective 4 "Identify the essential partnering tools for nurturing partnering spirit in the Hong Kong power utility", a survey was adopted to evaluate the

effectiveness of partnering tools in nurturing partnering spirit. To operationalize the survey, the attributes of partnering spirit advocated by the Utility Company and the corresponding partnering tools adopted were first identified through a case study on the partnering application in the Utility Company (Objective 2).

To evaluate the effectiveness of the partnering tools, the project stakeholders were requested to rate the perceived effectiveness of the 10 partnering tools on nurturing each partnering attributes in the 5-point Likert scale (from 1 = Not Significant to 5 = Extremely Significant). The survey was conducted along with the one for Objective 3.

2.5.5. Methods adopted for Objective 5

To achieve Objective 5 "Develop a set of reliable and objective Key Performance Indicator (KPI) for measuring partnering performance", a combination of literature review, Delphi Survey and questionnaire survey method was adopted as shown in Table 2-8.

Table 2-8. Methods employed for Objective 5

Stage	Step	Method
1	1. Identification of potential KPIs	Literature Review
	2. Selection of KPIs for measuring the partnering performance	2 rounds of Delphi survey with statistical analysis
	3. Determination of KPIs weighting	2 rounds for Delphi survey with statistical analysis
2	4. Exploring quantitative indicators for each KPIs	Questionnaire Survey
	5. Selection of quantitative indicator for each KPIs	2 rounds of Delphi Survey with statistical analysis
	6. Determination of measurement range for each identified quantitative indicator	Survey and statistical analysis

2.5.6. Stage 1: Literature review and 4 rounds of Delphi survey

There were two stages in the KPI development process. In stage 1, literature review was conducted to form a conceptual framework of partnering -specific KPIs. Subsequently, 2 rounds of Delphi survey were conducted. In the first round, the participants were asked to select minimum of 5 and maximum of 10 KPIs from the identified potential KPIs, they can also suggest other KPIs in the survey, if deemed necessary. The first round aimed to gather all the potential KPIs and preliminarily rank up the KPIs.

In the second round, the participants were asked to reconsider their choices with reference to the overall result of first round and their respective inputs. This mechanism can let the participants validate their inputs. Those KPIs selected by 50% or more participants were selected for further analysis.

In the third round, the participants were requested to rate the selected KPIs in 5-point Likert scale (from 1 = least important to 5 = most important), while in the fourth round, the participants were asked to reconsider their rating with reference to the overall result of third round and their respective rating on each KPIs. Upon completion of the fourth round, the weighting of each KPIs was computed by the formula suggested by Yeung et al. (2007):

$$\text{Weighting of each KPI} = \frac{\text{Mean rating of individual KPI}}{\text{Sum of the mean rating of all the selected KPIs}}$$

2.5.7. Stage 2: Questionnaire and 2 rounds of Delphi survey

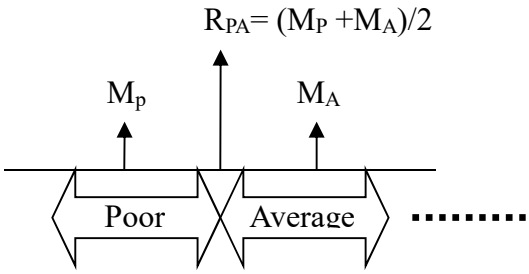
In stage 2, a questionnaire survey was conducted aiming to explore the potential quantitative indicators of each selected KPI. The participants were requested to suggest potential indicators for measuring each KPI. The suggested indicators were then consolidated for the first round of Delphi survey, in which the participants were requested to rate the consolidated indicators according to the following criteria (Yeung et al. 2008):

1. Importance of the indicator in measuring the KPI;
2. Measurability of the indicator;
3. Obtainability of the indicator.

Each criterion carried the same weighting, and the final mean rating of each indicator was the average of the corresponding three mean ratings of the three criteria. The participants were requested to rate each indicator according to the three criteria and the indicator with highest final mean rating was selected for the respective KPIs.

To operationalize the identified KPIs, the final step focused on determining the measurement range for each indicator against the five common performance levels adopted by practitioners including “Poor”, “Average”, “Good”, “Very good” and “Excellent”. The approach of computing a measurement range had been adopted by Chow and Ng (2007) and Yeung et al.(2008). This research adopted similar arrangement for computing the measurement range. The participants were requested to provide a figure against each performance level for each indicator. As illustrated in

Figure 2-2, the measurement range demarcation (R_{PA}) was the average of the mean values of the two adjacent performance levels.



M_p = Mean values of the figures for "Poor" Performance
M_A = Mean values of the figures for "Average" Performance
R_{PA} = Range demarcation between "Poor" and "Average" performance

Figure 2-2. Calculation of measurement range of the five performance levels

2.5.8. Selection criteria of panel members

Selection of panel members is critical to the success of the Delphi method (Chan et al. 2001) since the panel members must be able to provide in-depth opinions on how partnering performance should be measured by a set of KPIs based upon their experiences. Proper selection of panel members can also overcome the concern of small panel size compared to the hundreds required for survey (Loo 2002).

In this connection, a purposive approach (Chan et al. 2001) was adopted for selecting panel members. Only those participants with three years or more experiences of managing partnering projects in the Utility Company and the contractor company were invited to join the Delphi surveys.

2.5.9. Method adopted for Objective6

To achieve Objective 6 "Determine and prioritize the success factors for implementing partnering in the Hong Kong power utility", a 2-stage approach consisting of a questionnaire survey and an Analytic Hierarchy Process (AHP) was adopted as shown in Figure 2-3.

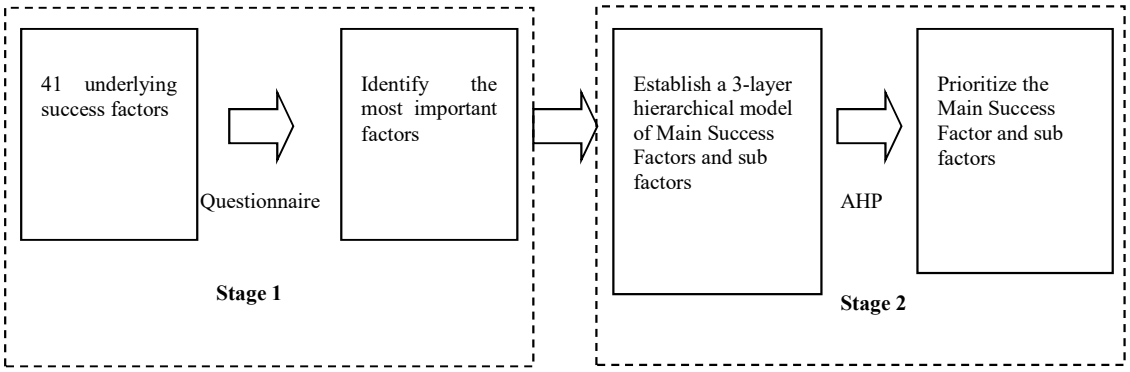


Figure 2-3. The two-stage approach adopted for determining and prioritizing partnering success factors

2.5.10. Stage 1: Identifying the most important factors

The stage 1 survey aimed to identify the most important underlying factors for the subsequent AHP. The 41 underlying partnering success factors identified by Chan et al. (2004) were adopted. The reason of adopting the factors was due to their relevance to the Hong Kong context. The underlying factors were based on the inputs from professionals in Hong Kong, including senior and site management staff from client, consultant and contractor organizations, with hands-on experiences in partnering projects. To confirm the appropriateness of adopting the factors, the 41 factors were cross checked with a list of success factors suggested by the participants in a partnering workshop conducted beforehand facilitated by the author of this thesis. It was found

that the list covered all the factors suggested by the participants, despite of some wordings. Thus, the list of 41 factors was adopted with minor revision of the wordings to the context.

The survey was aimed to identify the most significant underlying factors for further analysis. The participants were requested to rate the 41 underlying factors in a typical 5-point Likert scale from 1 (the least important) to 5 (the most important). The survey was conducted through email. To explore other possible underlying factors, the participants were requested to add other success factor, which was not covered by the list of underlying factors. However, no participants suggested addition factors, implying that the underlying factors were comprehensive. The average rating of each factor was calculated by the formula:

$$\text{Average rating of the underlying factor} = \sum R_i/N \quad (i=1,2,\ldots n)$$

where R is the rating of each underlying factors from each participants and
N is the total number of participant.

As this research aimed to identify the most important partnering success factors and their corresponding relative importance to draw practitioners focus during the course of implementation, stringent criteria was adopted for selecting the most critical success factors. Following the arrangement adopted by Cheng and Li (2002) and Chen & Chen (2007), only those underlying success factors with average rating of 4.0 or above were selected as the critical factors for further analysis.

2.5.11. Stage 2: Forming a Hierarchy Model for AHP

The first step in stage two was structuring the issue concerned into a hierarchy. For the purpose of this research, a three-level hierarchy model was formulated, which consisted of three levels: objective, categories and sub-categories (Talib and Rahman 2015). For this study, Level 1 of the hierarchy was the single element stating the overall goal, and Level 2 contained the Main Success Factors important to achieving the goal, while individual sub factors, required to achieve the corresponding Main Success Factors were included in Level 3. Similar approach was adopted by Cheng and Li (2002) and Salmeron and Herrero (2005) for prioritizing critical successful factors.

The identified underlying success factors were all put into the Level 3 of the hierarchy model and categorized according to its nature endowed. In addition, they were put under the same Main Success Factor in Level 2, and Main Success Factors would be determined by synthesizing the meaning of its corresponding sub-factors.

To ensure the proposed grouping of the sub factors and naming of the Main Success Factors were appropriate, another survey would be conducted to rate the appropriateness of the proposed grouping and the naming of the Main Success Factors in 5-point Likert scale (with 1 = Not appropriate at all, 5 = Very appropriate). Average rating of the proposed grouping and the naming of the Main Success Factors would be calculated to judge the appropriateness of the hierarchy for further AHP survey as per the procedure introduced in the previous section. The conceptual framework for Objective 6 is graphically shown in Figure 2-4.

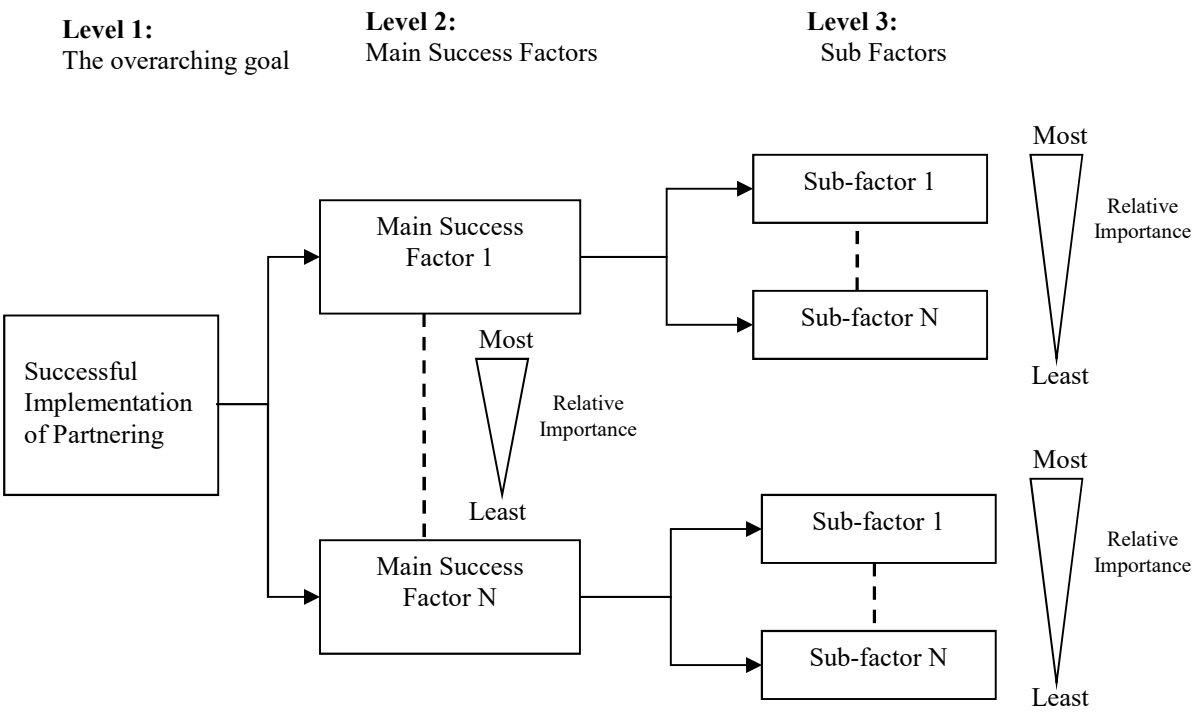


Figure 2-4. The conceptual framework of Partnering Success Factors

2.5.12. Method adopted for the research aim

To achieve the research aim "Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry" The research outputs from Objective 1 to 6 was consolidated to form a skeleton of the management framework covering three key aspects including commercial arrangement, management structure and implementation process.

To validate the management framework, structured interview was conducted with the senior management, who have direct involvement on the partnering projects in the management or/and contractual perspective, in the Utility Company and the contractor company. The aim of the structured interview was to solicit insights on the key aspects for successful partnering implementation in the senior management perspective. The senior management invited for the structured interview from the Utility Company

included business group director, chief procurement officer and deputy directors, while that from the contractor company was the general managers. The final management framework was formulated after taking the insights from senior management into account.

2.6. Research Process

To achieve the research aim and the 6 research objectives, this research went through three main stages, including theory formation stage; data collection stage and the analysis stage. Objective 1 and Objective 2 were achieved in the theory formation stage, in which essential knowledge about partnering was acquired, while the partnering application in the Utility Company was analyzed and documented. Achieving Objective 1 and Objective 2 laid the theoretical and empirical foundations for this research.

Literature review was conducted to acquire the essential knowledge on fundamentals of partnering, its implementation issues and the operating principles of partnering (Objective 1). A case study was also conducted on the Utility Company to clarify the project nature and understand how and why partnering was implemented in the power industry context (Objective 2). Upon completion of these foundation works, research aim and objectives were developed. A partnering review workshop was conducted with the project stakeholders of the Utility Company as a pilot study to verify the appropriateness of research objectives. The findings supported the proposed research aims and objectives.

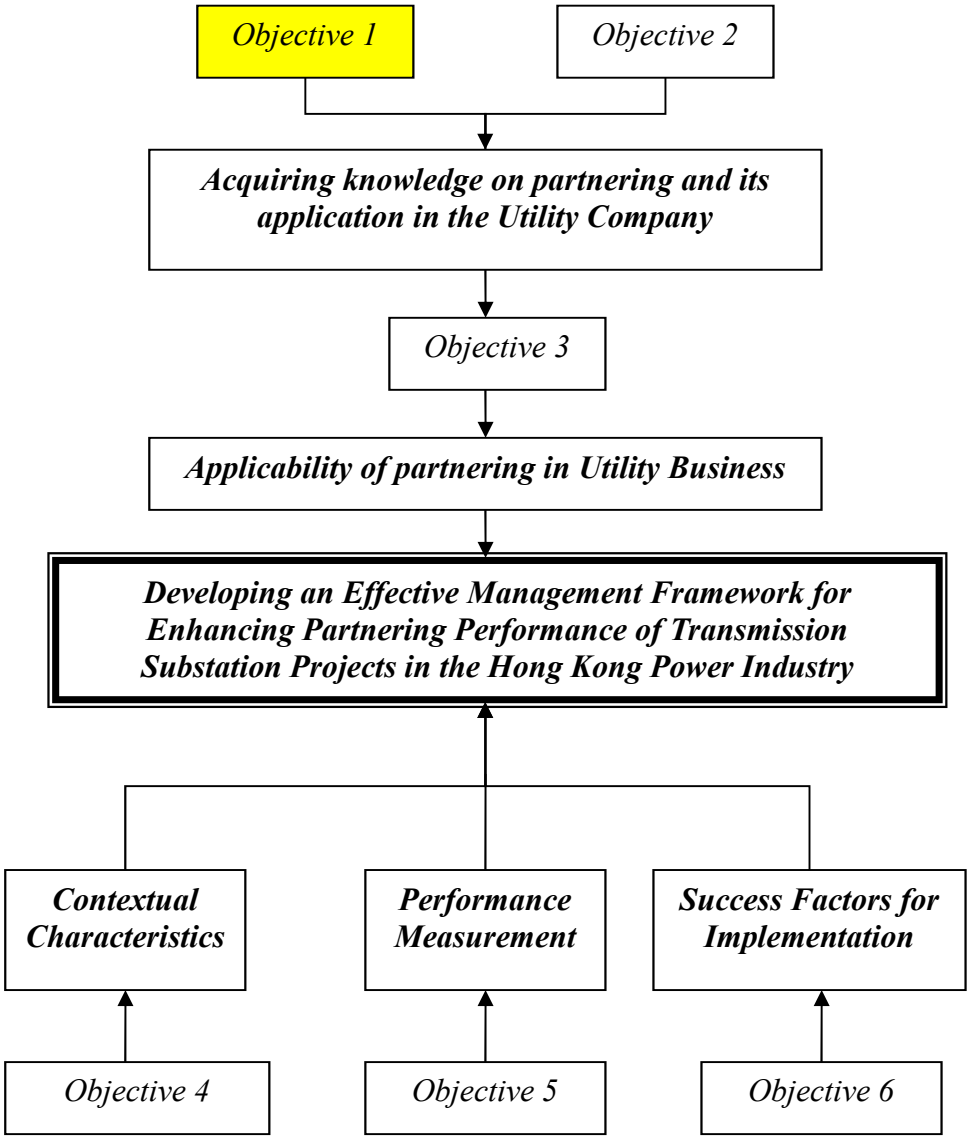
In the data collection stage, relevant qualitative and quantitative data was collected. A group of target participants involved in managing the partnering projects in the Utility Company was first identified, ranging from top management to frontline across the

Utility Company and the contractor company. Survey, focus group and structured interview were adopted to collect quantitative and qualitative data from the target participants for the subsequent analysis. The partnering projects information was also collected through document analysis in this stage.

In the analysis stage, statistical analysis and content analysis were adopted for analyzing the data collected from survey, focus group and interview for examining the applicability of strategic partnering and identifying the essential partnering tools in the power industry (Objective 3 and 4). Delphi survey technique with statistical analysis was adopted for developing a reliable and objective partnering performance measurement system (Objective 5). Analytic Hierarchy Process was adopted for prioritizing the identified partnering success factors (Objective 6). Finally, all the research findings for Objective 1 to 6 were synthesized for developing an effective management framework for enhancing partnering performance of utility business in the Hong Kong power industry (Research aim), which was validated by conducting structured interviews with the senior management from both Utility Company and the related contractor company.

2.7. Chapter summary

The research paradigm, in terms of ontological and epistemological assumptions adopted for this research, was clarified. Characteristics of quantitative and qualitative approaches were discussed and it was stated that triangulation was adopted for this research for achieving higher validity. The various research methods adopted for this research and the overall research process were also explained.


Objective 1
Objective 2
Acquiring knowledge on partnering and its application in the Utility Company
Objective 3
Applicability of partnering in Utility Business
Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry
Contextual Characteristics
Performance Measurement
Success Factors for Implementation
Objective 4
Objective 5
Objective 6

Chapter 3. Background of Partnering

3.1. Introduction

This chapter presents a structured way to understand partnering. It starts from clarifying the partnering definition, a clear definition of partnering is the cornerstone for application and development of partnering as it can facilitate a coherent codification among both the practitioners and researchers. With a common understanding on what partnering is, the next step is to look at the common partnering elements and tools, which are required for implementing partnering. The benefits of partnering are also discussed, followed by the introduction of various partnering models. Finally, the underlying principle explaining how and why partnering can enhance project performance in a psychological perspective is discussed.

3.2. Background of partnering

The nature of the engineering and construction industries has long been characterized as project-based and fragmented (Fellows and Liu 2012; Venselaar et al. 2015), which leads to various problems, like lack of mutual trust, effective communication and cooperation. These problems eventually result in adversarial relationship among the project stakeholders and poor project performance (Chan et al. 2010). Partnering was strategically introduced to the construction industry in the 1990s to mitigate the confrontational culture and improvement project performance (CII 1991) by means of promoting a more integrated and relational approach, instead of the conventional transactional approach (Walker and Jacobsson 2014). Since its first development in the construction industry in the UK (Bennett and Jayes 1998) and the US (Cowan et al. 1992), partnering has drawn attention from researchers in the last two

decades (Jacobsson and Roth 2014). However, as Mollaoglu et al. (2015) asserted, partnering has been underutilized in the industry although it has been introduced for more than 2 decades. One of the possible reasons was that partnering still remains a vague concept, from its definition to how it should be implemented (Jacobsson and Wilson 2014), hindering the application and diffusion of partnering in the engineering and the construction industries.

3.3. Definition of partnering

The early and the widely cited definition of partnering in the literature are those of the Construction Industry Institute (CII) (1991) from the USA and the Construction Industry Broad (CIB) (1997) from the UK. CII (1991, p. iv) defined partnering as:

"[a] long term commitment between two or more organizations for the purposes of achieving specific business objectives by maximizing the effectiveness of each participant resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based on trust, dedication to common goals, and an understanding of each other's individual expectations and values".

The definition from CII essentially states the purposes and prerequisites of partnering. CIB (1997, p. 1) offered another view on partnering, and defined partnering as a structured management approach aiming to facilitate team work across contractual parties:

"Partnering is a structured management approach to facilitate team working across contractual boundaries. Its fundamental components are formalized mutual objectives,

agreed problem resolution methods, and an active search for continuous measurable improvements…….. it should not be confused with other good project management practices, or with long standing relationships, negotiated contracts, or preferred supplier relationships, all of which lack the structure and objective measures that must support a partnering relationship."

CIB (1997) provided more insights about partnering by stating the differentiating elements of partnering against other project management practice, and including the key components of partnering. Although it depicts partnering as a structured management approach, but it still fails to describe how partnering exists in practice.

Apart from CII and CIB, various authors have also attempted to define partnering. Bennett and Jayes (1995) defined partnering as a management approach used by two or more organizations to achieve specific business objectives by maximizing the effectiveness of each participant's resources. Likewise, Chan et al. (2003a) defined partnering as a process establishing good working relationship. Bresnen and Marshal (2000b) asserted that partnering should be conceptualized as a management strategy, which cultivates cooperative contracting relationship with appropriate tools. More recently, Eriksson (2010, p.907) defined partnering as "a cooperative governance form facilitated through various cooperative procurement procedures".

Some scholars attempt to clarify the relationship between partnering and contract. Cheung et al. (2003) asserted that "partnering is not a contract but an attempt to establish non-adversarial working relationships among project participants through mutual commitment and open communication". Tang et al. (2006) suggested that partnering is cooperative philosophy added on top of the traditional contracting

relationship between client and contact.

Some authors defined partnering in a more systematic way, Nystrom (2005) advocated that there is no a single definition for a multifaceted concept like partnering, in contrast, it is a family of definition which share the same core components with different optional components. Nystrom adopted the German philosopher Ludwig Wittgenstein's family-resemblance concept to define partnering and developed a "partnering sunflower". The core components in the centre of the flower are trust and mutual understanding, while the optional components in the petal of the flower are partner selection, openness, incentives, teambuilding, conflict resolution, facilitator and structured meeting. Yeung (2007) offered more insights on the components of partnering by advancing Nystrom's (2005) work and developed a more detailed "Partnering Sunflower", which divided the core components with hard elements (Partnering Charter and Non-real Gain/Pain Share) and soft elements (Trust and Long-term Commitment). The optional partnering components are also specified as Continuous improvement, Equity, Agreed Problem Resolution Methods, Common Goals and Objectives, Communication and Cooperation, Facilitated Workshop, Win-win Philosophy. This type of definition clearly shows the essential components of partnering and provides insights on the core and optional components constituting partnering.

Although there is no unified definition of partnering in the prevailing literature, there is a consensus on the key elements of partnering such as common goal, mutual trust and joint problem resolution (Hong et al. 2012a; Naoum 2003; Nystrom 2005; Yeung et al. 2007b) among the numerous definitions of partnering. Referring to the numerous definitions of partnering, it can be concluded that partnering can be generally

viewed as a management approach to facilitate team works across contracting parties (CII 1991) to establish common goals and mutual trust among the contracting parties, a mechanism for problem resolution, and a benchmarking process for continuous improvement (Naoum 2003) along a structured process (Bayramoglu (2000). In addition, Naoum (2003) and Eriksson (2010) advocated that it is more appropriate to understand partnering as an approach rather than a philosophy and so the definition of partnering from CIB (1997) is adopted for this thesis unless specified.

3.4. Types of Partnering

Partnering is commonly classified as either project partnering or strategic partnering. Project partnering refers to "a means of transforming contractual relationship into a cohesive project team with a common set of goals and clear procedures for resolving disputes in a timely and effective manner" (Beach et al. 2005), the established working relationship is short-term and lasts for a single project only. While strategic partnering refers to, in contrast, "a long-term co-operation between two or more organizations committed to achieving specific business objectives by maximizing the effectiveness of each participant's resources" (Beach et al. 2005) the established working relationship is long-term and lasts for more than one project. In general, project partnering refers to adopting partnering approach for a single project, while the strategic partnering refers to applying partnering approach for a series of projects with a longer term contracting relationship (Meng 2012).

3.5. Partnering Elements and Tools

To have a thoughtful understanding on partnering, partnering elements and tools are differentiated in this study. Partnering elements in this paper refer to those characteristics or components that are required or emphasized under partnering arrangement as compared with the conventional contracting approach, while partnering tools refer to those management mechanisms or special arrangements that are adopted in the course of implementing partnering.

Table 3-1 shows an overview of the common partnering elements with its frequency of occurrence shown. The top-3 common partnering elements are (1) Trust; (2) Mutual Objective/Understanding; (3) Continuous Evaluation/Improvement of Performance respectively. Partnering essentially focuses on creating a trust-based environment, in which contracting parties can be benefited by contributing to the project goal (Tang et al. 2006). In addition, through the process of developing mutual objective, the project participants can appreciate each other's constraints and understand more the overall project goal (Kadefors 2004). Continuous Evaluation/Improvement of Performance is important to ensure that the objectives of partnering can be implemented as expected and allowing capturing lessons learned for longer term improvement (Beach et al. 2005). Other common partnering elements include Equity, Management Commitment/Support, Good Communication/Openness, Long-Term Commitment, and Early Involvement of Key Project Stakeholders.

Various partnering tools are applied in practice in the course of partnering implementation. Bygballe et al. (2010) asserted that there is a tendency in the prevailing literature emphasizing the application of formal partnering tools. Table 3-2 shows the

common partnering tools identified from the literature are (1) Shared Risk/Economic Incentives; (2) Conflict Resolution Processes; and (3) Partnering workshop. Other common partnering tools include Regular Review Meeting, Partnering Charter and Facilitator.

Table 3-1. The Common Partnering Elements

Partnering Elements	CII (1991)	Baden-Hellard (1995)	Bennett and Jayes (1995)	Lenard et al. (1996)	Barlow (1997)	Black et al.(2000)	Cheng et al. (2000)	Kumaraswamy and Matthews (2000)	Scott (2001)	Ng et al. (2002)	Naoum (2003)	Packham et al.(2003)	Kadefors (2004)	Nystrom (2005)	Chan et al. (2006)	Yeung et al.(2007a)	Lahdenperä (2012)	Jacobsson and Roth (2014)	Venselaar et al. (2015)	Mollaoglu et al.(2015)	Frequency
Trust	X	X		X	X	X	X	X	X	X	X	X		X		X	X	X			15
Mutual objectives/understanding	X	X	X	X	X			X		X	X	X	X	X		X		X			13
Continuous evaluation /improvement of performance		X	X	X		X		X		X			X		X	X	X				10
Equity	X	X	X	X				X	X	X						X					8
Good communication /Openness				X		X	X		X	X				X		X		X			7
(Long-term) Commitment	X		X				X	X		X						X	X				7
Management commitment/support		X	X	X		X	X		X												6
Early involvement of key project stakeholders				X					X	X					X					X	5
Innovation				X			X		X												3
Partner selection														X				X	X		3
Mutual rewards and benefits	X								X												2
Education, training and preparation										X										X	2
Learning culture/exchange of knowledge				X																X	2
Investment	X																				1
Cooperation								X													1
Win-Win Philosophy																X					1

Note: The previous studies are ranked from left to right in an increasing order of year of publication followed by the alphabetical order of the author

Table 3-2. The Common Partnering Tools

Partnering Tools	CII(1991)	Bennett and Jayes (1995)	Lenard et al.(1996)	Barlow et al. (1997)	Cheng et al. (2000)	Kumaraswamy and Matthew(2000)	Ng et al (2002)	Naoum (2003)	Packham et al.(2003)	Kadefors (2004)	Nystrom (2005)	Chan et al.(2006)	Lu and Yan (2007)	Yeung et al.(2007a)	Erikson (2010)	Lahdenperä(2012)	Jacobsson and Roth (2014)	Venselaar et al. (2015)	Mollaoglu et al.(2015)	Frequency
Conflict/ Problem resolution processes		X	X		X	X	X		X	X		X		X	X	X	X		X	14
Shared risk/ Economic Incentives	X	X		X		X	X	X	X	X	X	X		X			X		X	13
Partnering workshop			X	X	X		X			X	X	X	X	X	X			X	X	11
Regular review meeting				X	X					X	X			X			X			6
Partnering charter					X					X		X	X			X		X	X	7
Facilitator								X					X	X			X	X	X	6
Social functions				X	X												X			3
Newsletter				X	X															2
Objective and subjective performance measurement										X								X		2
Integrated team						X														1
Partnering champion													X							1
Team Building															X					1
Partnering questionnaire															X				X	2
Collaborative contractual cause																			X	1

Note: The previous studies are ranked from left to right in an increasing order of year of publication followed by the alphabetical order of the author

3.6. Benefits of Partnering

Benefits of partnering have been reported in the early studies. Abudayyeh (1994) studied the partnering case of The California Department of Transportation (Caltran) and pointed out that partnering can bring various benefits including reduced cost in litigation and claims, improved productivity, improved cost and schedule control, lower risk of cost overrun and delays and increased financial success.

Similarly, the United States Army Corps of Engineers (Weston and Gibson 1993) studied 16 partnered and 39 non-partnered projects, and concluded that partnering has great effect on the claims issues, which matches the primary objective of employing partnering in government agency - reducing claims or reducing litigation.

In addition, Warne (1994) studied the partnering case of Arizona Department of Transportation (ADOT) and revealed that ADOT achieved benefits in the areas of claims, construction time, construction administration, value engineering, budget reduction, and indirect benefits. Schmader (1994) investigated the benefits from partnering at the Naval Facilities Engineering Command (NAVFAC) and concluded that partnering has significant impact on litigation, value engineering and schedule adherence.

Partnering is not only beneficial to the government bodies. Private sectors can also get benefits from partnering. Larson (1995) produced a representative report by investigating 280 construction projects in Canada and United States with surveying among members of Project Management Institute. Research results show that

partnering has impact on both hard and soft sides of project management. Specifically, partnering elements like problem solving and provision of continuous improvement intent can contribute to improvement of cost control and meeting schedule. In general, partnering activities can be positively related to satisfying customer needs, avoiding expensive litigation and overall results. Larson (1995) also asserts that structured partnering approach can yield more superior results than informal partnering, especially in terms of cost control, achieving technical performance, meeting customers' requirement and overall project results. This implies that structured partnering approach is more promising than informal partnering regarding effectiveness of improving project results.

Another country-wide study on benefits of partnering was carried out by the Construction Industry Institute Australia; 32 construction projects in Australia were investigated in 1996 (Lenard et al. 1996). The study concluded that partnering can reduce claims, disputes, schedule deferral and reworking. Apart from that, partnering can also improve safety and profit margin, and foster innovation.

Chan et al. (2003a) conducted a survey in Hong Kong with representatives from client, consultant and contractor organizations. The study concluded that the ranking of perceived benefits of partnering are generally aligned. The most significant benefits from partnering rated by clients is faster construction time while the consultant and contractor rated improved relationship among project participants as the most significant benefit. Both groups rated improved communication among project participants is the most significant benefit from partnering.

A recent study by Wang et al. (2015) on the hydropower projects in China indicated that partnering can optimize design process and facilitate project planning and execution, and resolving disputes. Essentially, these benefits can ultimately lead to better project schedule, cost, quality, safety, health and environment performance. Likewis, Challender et al. (2014) concluded that partnering can enhance cost certainty, shorten project duration, improve quality and project management, based on the study on the construction projects in the UK.

The above studies signposted that partnering is beneficial to the clients, consultant and contractor for various types of projects implemented in different counties.

3.7. Partnering model

The concept of partnering has been implemented in the construction industry in the past two decades, various partnering models or conceptual frameworks have been developed for demonstrating the concept and supporting the development of partnering. Studying these partnering models can deepen the understanding on partnering. The partnering models and conceptual frameworks identified in the literature will be presented in this section.

Crane et al. (1997) developed a partnering process model consisting of 5 stages, that organizations should follow for a successful implementation of partnering. The five stages include owner internal alignment, partner selection, alliance alignment, project alignment and work process alignment. The objectives of each stage are shown in Figure 3-1.

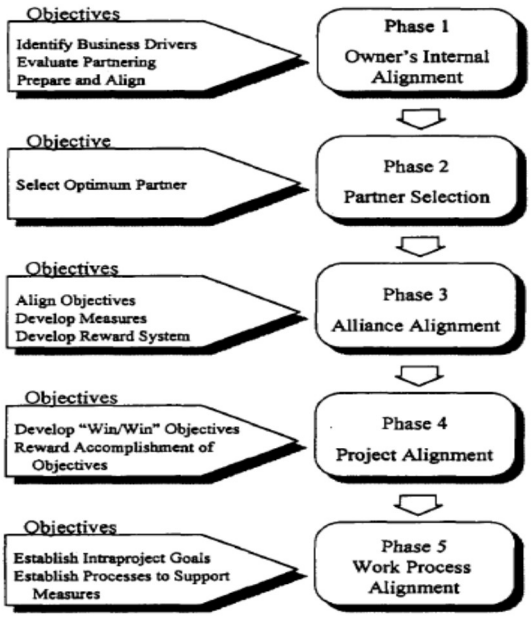


Figure 3-1. The partnering process model adopted from Crane et al. (1997)

Similarly, Cheng and Li (2002) proposed a three-stage partnering process model, which comprises formation stage, implementation stage and partnering completion/reactivation stage respectively. There are various critical success factors for each stage as shown in Figure 3-2. The loop represents strategic partnering in which partnering relationship is reactivated upon completion of a particular project.

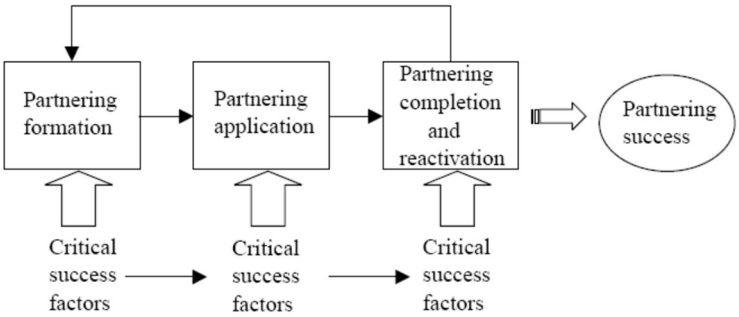


Figure 3-2. The three-stage partnering model adopted from Cheng and Li (2002)

The development of the three-stage model was based on two premises. First, partnering process is an organization change process consisting of three stages, namely, unfreezing, transformation and refreezing stages. Secondly, the partnering process should share similar key stages of strategic alliance due to their similar nature, including creation, implementation and evaluation.

The partnering formation stage focuses on goal alignment and unfreezing of stakeholders mind for accepting the concept of partnering. In the partnering application stage, focus is on executing the informal partnering relationship to achieve the agreed goals while in the partnering completion/reactivation, stakeholders may focus on performance measurement for continuous improvement if it is a strategic partnering, otherwise the stakeholders may not be interested in performance measurement.

Some researchers view partnering as a matter of degree. Lendrum (1998) developed a model describing the various types of inter-organizational relationship which project participants may experience. The model classifies the relationship as Vendor, Supplier and Partner along with increasing degree of various aspects such as complexity or competitive advantage as shown in Figure 3-3. According to Lendrum's model, partnering relationship embraces all attributes of the relationship class of Supplier but there are unique elements such as trust and commitment which are facilitated by the 12 motivators including adding values, improving communication and gaining commitment.

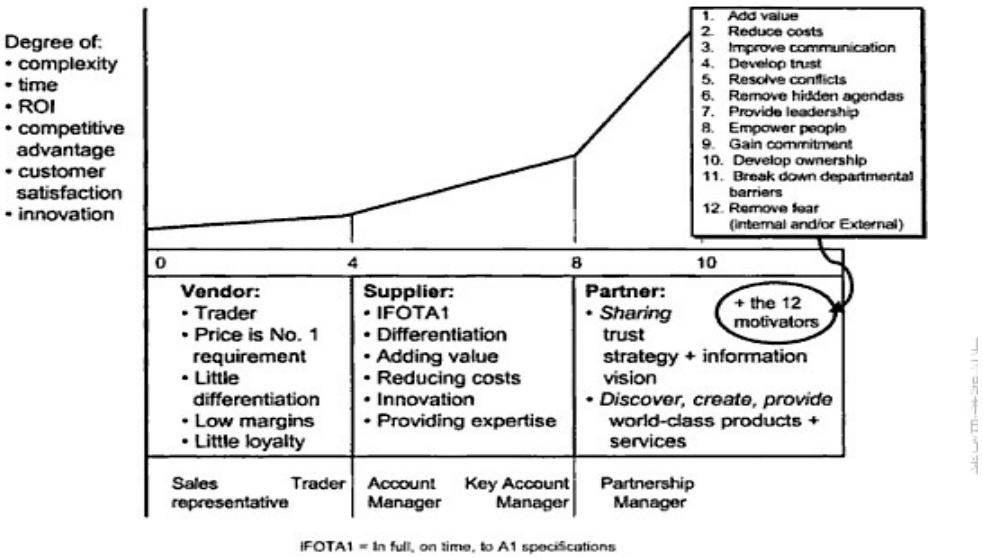


Figure 3-3. The partnering mindset. Adopted from Lendrum (1998)

In the same way, Thompson and Sanders (1998) developed a model of Partnering Continuum to describe partnering by various classes of relationship, which include competition, cooperation, collaboration and coalescence as shown in Figure 3-4. The model depicts the degree of objective alignment of various types of inter-organizational relationship and suggests that the higher degree of objective alignment, the higher potential benefits can be obtained from the established relationship.

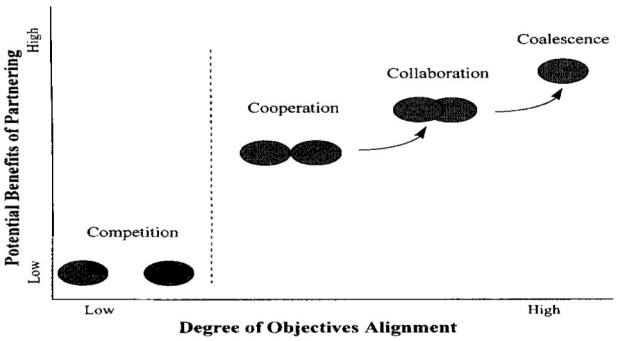


Figure 3-4. The Partnering Continuum. Adopted from Thompson and Sanders (1998)

Apart from viewing partnering in terms of classes of inter-firm relationship, Broome (2002) views partnering as a spectrum of management approaches with various characteristics as shown in Figure 3-5. The model describes a journey of a company which may experience from a traditional contracting approach to a joint venture approach. Partnering is spread over along the journey in between the extremes. According to the model, partnering exists in various formats depending on different factors including company's situation, business drivers, cultural issues, attitude to risk.

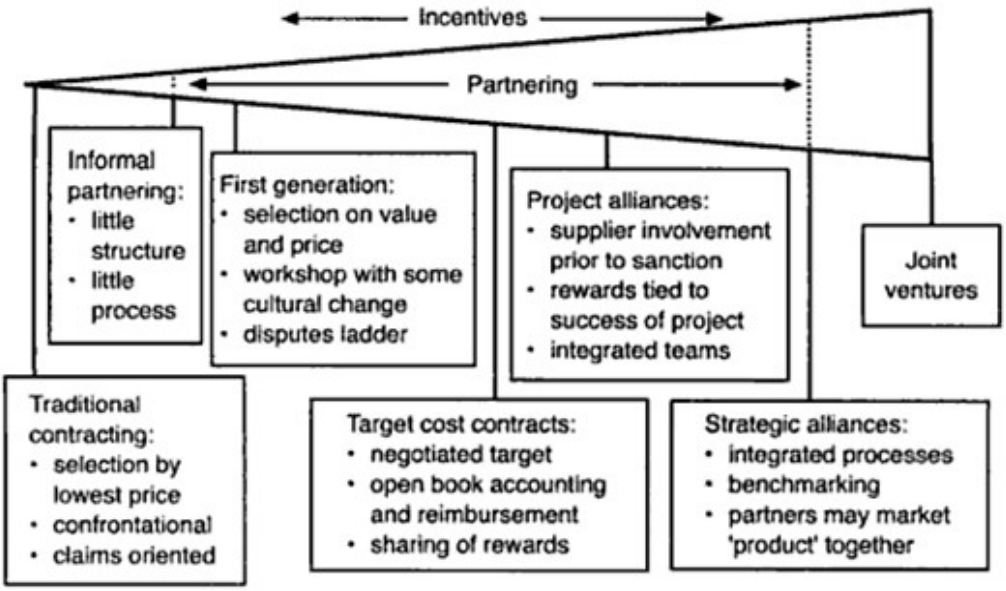


Figure 3-5 The Broome and Margett's spectrum of partnering. Adopted from Broome (2002)

Partnering has also been viewed as structured process. Based on the contact theory by Allport (1954), Anvuur and Kumaraswamy (2007) view that partnering is a process which can create an environment to build up essential factors, termed as process benefits (Albanese 1994), for optimal workgroup relationship in construction industry,

the factors include: equal status or respects; common goal; inter-group cooperative interaction; and authority support.

Anvuur and Kumaraswamy (2007) advocate that partnering process, with elements such as partnering workshop, team incentive and well defined issue resolution procedures, can generate these process benefits. These process benefits in turn facilitate the achievement of content benefits such as innovation and improved cost, quality and schedule performance. Figure 3-6 shows the model.

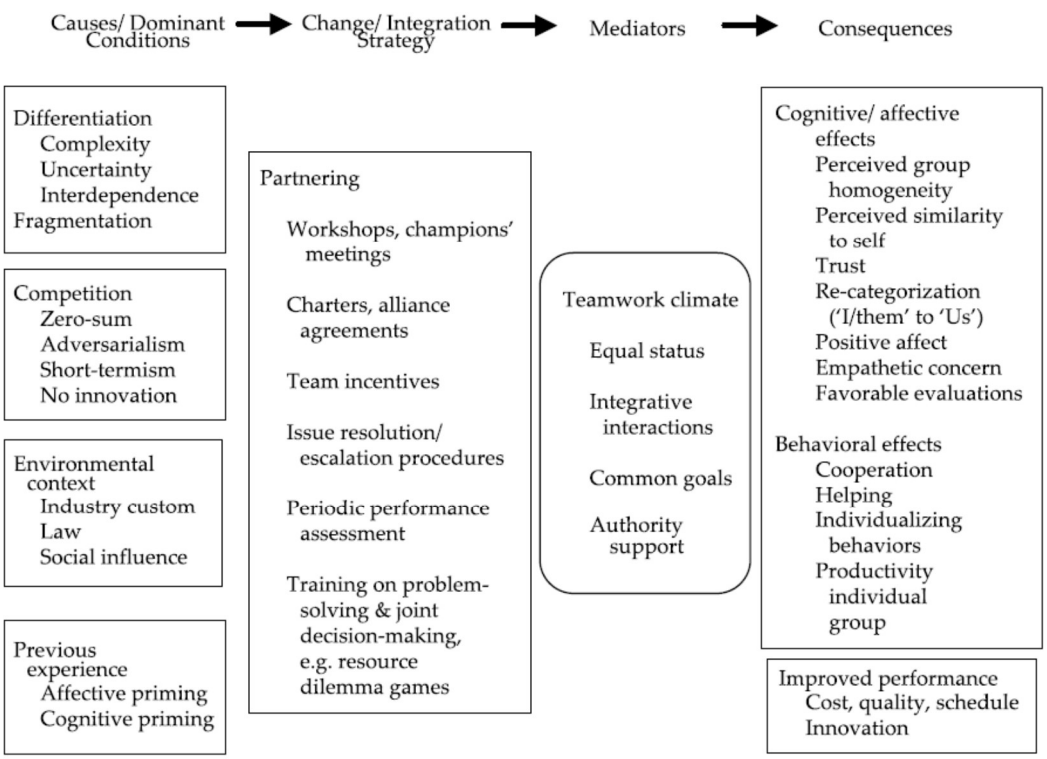


Figure 3-6 Partnering model and its effect on project performance. Adopted from Anvuur and Kumaraswamy (2007)

Similarly, Beach et al. (2005) develop a partnering model showing three main elements including commitment, process and tool are the key pillars supporting a partnering relationship, and this relationship has a mutual effect on the stakeholders' culture. With all these preceding elements, benefits of partnering can be induced.

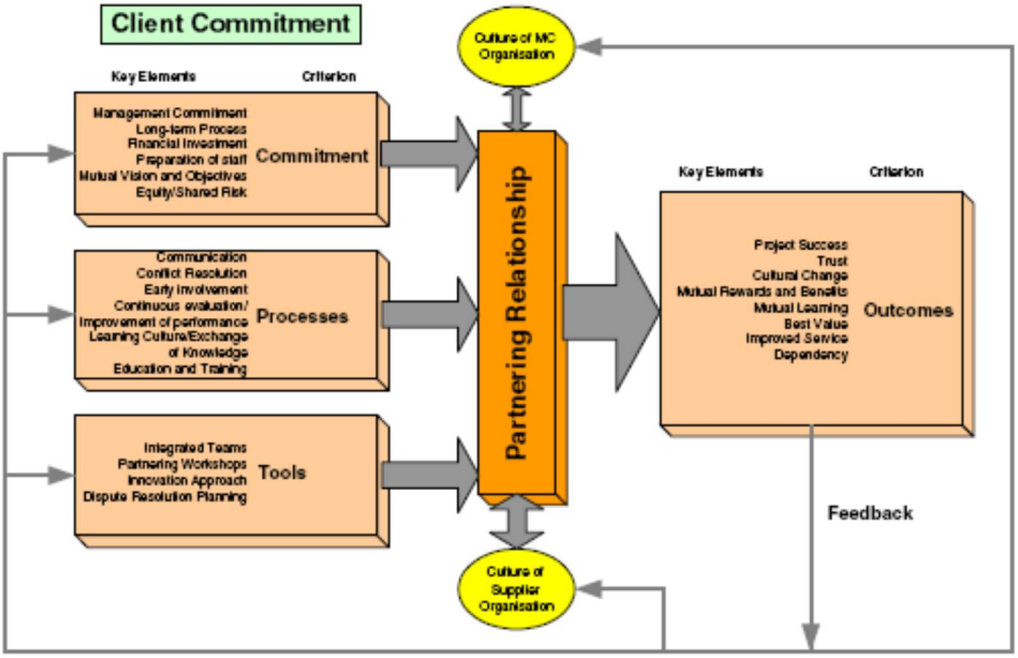


Figure 3-7 The conceptual framework of partnering. Adapted from Beach et al. (2005)

Crowley and Karim (1995), on the other hand, define partnering as a virtual organization linking up clients, designer and contractor, with aims of achieving project goals by effective issues resolution, decision making and increased organizational competence by adopting a cooperative strategy to modify traditional boundaries between contracting parties. Figure 3-8 demonstrates the concept.

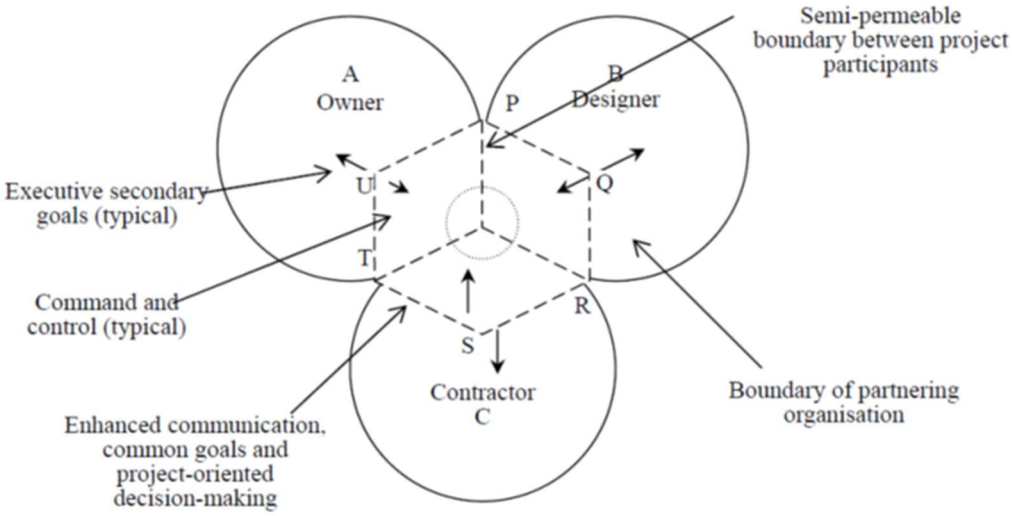


Figure 3-8 The virtual organization model of partnering. Adapted from Crowley and Karim (1995)

With more experiences on partnering due to increased adoption in the industry, researchers started to develop partnering model showing the causal relationship of various partnering elements.

Tang et al. (2006) develop a conceptual partnering model based on the identified critical successful factors of partnering. The model depicts the causal relationship between various factors and how these factors can lead to the ultimate goal of increasing opportunity of project success. Figure 3-9 shows the model.

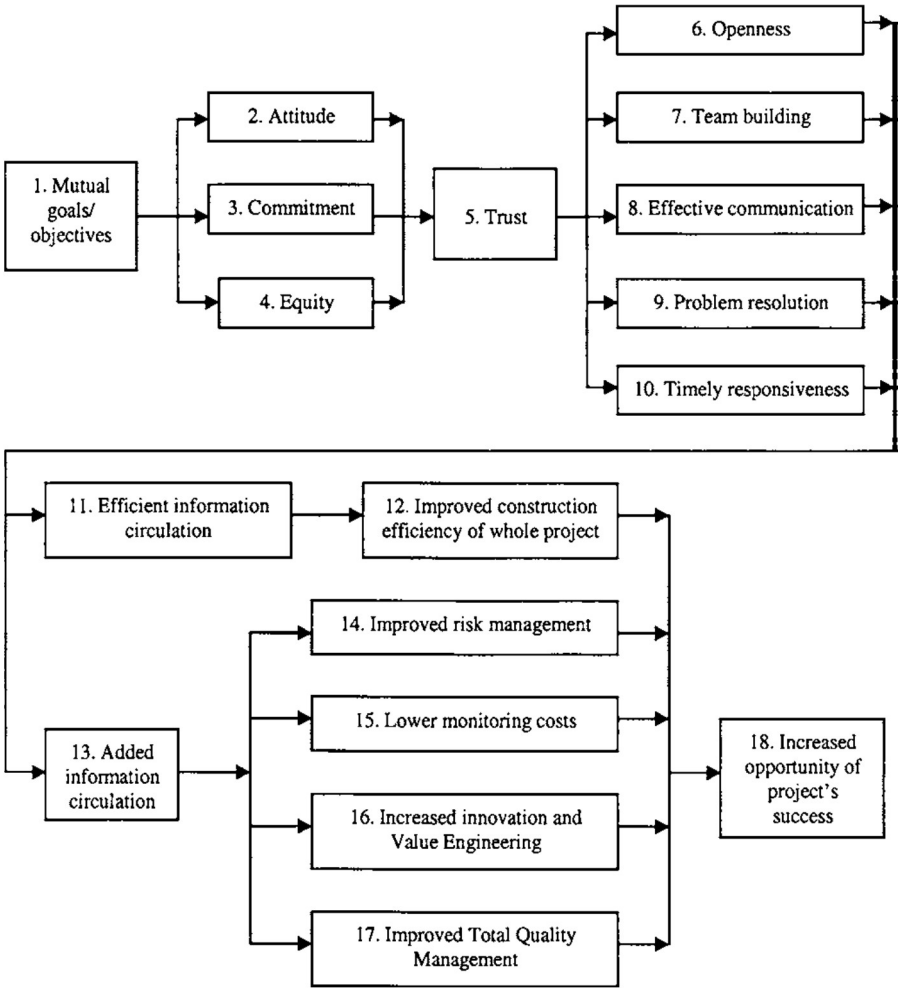


Figure 3-9 The conceptual partnering model embracing various causal elements. Adopted from Tang et al. (2006)

As discussed above, it can be seen that various partnering models have been formulated in the literature, like the partnering process models (Cheng and Li 2002; Crane et al. 1997); partnering continuum models (Broome 2002; Lendrum 1998; Thompson and Sanders 1998); and conceptual partnering framework (Anvuur and Kumaraswamy 2007; Beach et al. 2005). These models offer more insights on about the concept of partnering and portray the key concept of partnering.

3.8. Underlying Principle of Partnering

A common approach for implementing partnering is to apply various collaborative tools. However, as Suprapto et al. (2015) stated that attention has put on the application of formal partnering tools, while the underlying principles in social dimension, which facilitating project participants across various organizations can perform as a team, has been underplayed. This leads to a situation of failing to develop collaborative culture among the project team as expected, even various partnering tools have been applied. This makes practitioners unclear on how to operationalize partnering in practice (Hartmann and Bresnen 2011). That means, apart from the formal tools, focus should be put on the daily practices and the importance of changing the mindset of the project participants (Jacobsson and Roth 2014). Suprapto et al. (2015) concluded that team building process and people aspects are more influential than application of collaborative tools, though each has a role to play, on the project performance. This implies that the key to make partnering a success is to understand the social psychological dimension of partnering so as to understand the overarching objectives of advocating various partnering elements and adopting various partnering tools. Thus, based on the recent advances in the Intergroup Contact Theory (Pettigrew et al. 2011) in the field of social psychology and the conceptual model by Anvuur and Kumaraswamy (2007), this research attempts to develop a conceptual model showing how partnering can improve project performance.

3.8.1. The Intergroup Contact Theory

Intergroup Contact Theory, also known as contact hypothesis, was originally developed by Allport (1954) in the field of social psychology for studying races and ethnicities, but recent empirical tests show that it holds equally well for other context. The Intergroup Contact Theory received extensive research effort and guided the research in the area of intergroup contact for the past five decades (Pettigrew et al. 2011), and has been applied widely for studying the inter-group relationship in the racial, ethnic and religious related aspects (Luo et al. 2015). The theory states the facilitating conditions under which the intergroup prejudice or conflict can be reduced during the face-to-face interaction between the members of different groups. The facilitating conditions include (1) Equal status within the group; (2) Common goal; (3) Management/authority support and (4) cooperative interaction (Allport 1954; Pettigrew 1998).

3.8.2. Recent Advancements on the Intergroup Contact Theory

Given the wide application in various areas, the Intergroup Contact Theory has been kept evolving in the recent years. Based on the majority of studies in the field of social psychology. On top of the four facilitating conditions, Pettigrew (2008) further proposed intergroup friendship as the fifth facilitating conditions required for the optimal intergroup contact, based on the rationale that the process of developing friendship encourages self-disclosure among the members in the repeated contacts, and facilitates mutual understanding. This was echoed by Bohmert and DeMaris (2015) that

positive contact effect can be resulted by increasing perceptions and feelings of similarity though the process of developing friendship.

Apart from the addition of the fifth facilitating conditions, another recent advancement on the Intergroup Contact Theory is that having facilitating conditions alone does not necessarily lead to positive contact effects. In fact, certain mediating processes are actually required to effectuate the positive contact effects. In a study on how intergroup contact can reduce intergroup prejudice, Pettigrew and Tropp (2008) asserted that understanding each other, reduction of anxiety, and generating empathy are the three major mediating processes required for positive intergroup contact together with the facilitating conditions. The recent advancements on the Intergroup Contact Theory are summarized as shown in Figure 3-10.

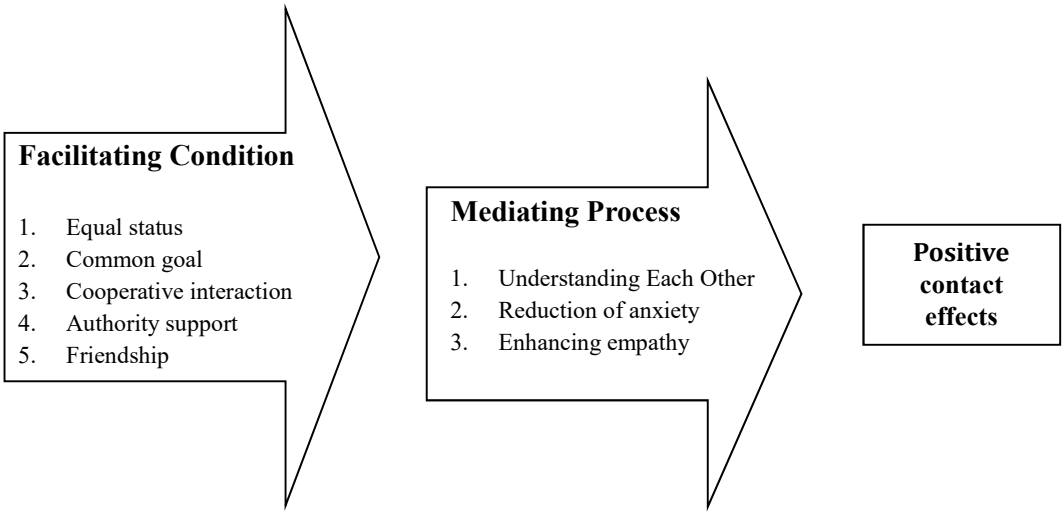


Figure 3-10. The Facilitating Conditions and Mediating Process for Optimal Intergroup Contact. Source: Author's own interpretation.

3.8.3. The Three Mediating Processes for Optimal Intergroup Contact

To have a more insightful understanding on how partnering can lead to optimal intergroup contact, the three medicating processes are discussed below.

3.8.4. Understanding Each Other

Understanding more about each other, or learning about the out group, is a critical process for improving intergroup relations (Pettigrew 1998) since it can help reduce prejudice and improve intergroup relations (Dovidio et al. 2003). With deeper personal understanding to each other, the group members can treat each other in a more personalized way, which facilitates building a new association to each other and undermines any established stereotype. It can increase recognition of injustice to each other by enhancing intercultural understanding. In addition, through the process of knowing about others, the group members can identify the similarity and virtually deny the difference among different groups of members (Pettigrew and Tropp 2008).

3.8.5. Reduction of Intergroup Anxiety

Intergroup anxiety refers to the feelings of threat and uncertainty that people experience during intergroup interaction (Pettigrew and Tropp 2006). The presence of anxiety in intergroup contact can lead to various negative effects such as adverse reactions to other group members, hindering intergroup communication, and leading to intergroup mistrust, fear and anger (Dovidio et al. 2003). Miller (2002) asserted that higher level of familiarity among the group members can foster individuating information of others regardless of their social categories. This personalized

communication with higher familiarity can reduce anxiety and discomfort among the group members. It can also promote interpersonal trust and disconfirm those negative stereotypes of other, if any.

3.8.6. Enhancing Empathy

Affective factors like empathy or perspective taking are critical to reducing bias (Pettigrew and Tropp 2008). Dovidio et al. (2003) explained that empathy can drive people to feel more positively about each other, and influence people to behave into more supportive way, no matter how they perceive each other. Interaction with friendship facilitates one to take the perspective of others and care about their respective concerns (Pettigrew and Tropp 2008). More importantly, friendship can also enable self-disclosure, which is a key mediator of positive contact effect (Pettigrew et al. 2011) and enhance communication quality. Enhancing empathy is a self-expansion process (Aron and McLaughlin-Volpe 2001), under which people would outspread the sense of self to embrace others and take others' perspectives. Walker and Lloyd-Walker (2015) also highlighted the importance of perspective taking to partnering success.

Among the three mediating processes, Enhancing empathy and Reduction of Intergroup Anxiety are relatively more important. Pettigrew and Tropp (2008) suggested that initial anxiety must be first reduced through positive intergroup contact, after which the group members can increase empathy towards each other for an effective prejudice reduction.

3.8.7. Enriched Conceptual partnering model

The conceptual partnering model proposed by Anvuur and Kumaraswamy (2007) portrayed an overview on partnering, which states the dominant conditions of the construction industry as the driver for adoption of partnering. The implementation partnering would then result teamwork climate, which is characterized as equal status, integrative interaction, common goals and authority support. The teamwork climate acts as a mediator and leads to ultimate consequence of improved relationship and project performance. The model generally follows an input-mediator-outcome framework. To have more insights on how partnering can lead to the desired cogitative, behavioral and project performance improvement benefits in practice, this paper attempts to enrich the "mediator" of model.

Based on the model developed by Anvuur and Kumaraswamy (2007; 2015)and foregoing discussion on the Intergroup Contact Theory, a conceptual partnering model is developed as shown in Figure 2, which explained how partnering can lead to improved project performance in social and psychological perspective. Essentially, partnering can create the five facilitating conditions for optimal contact, and facilitate the project participants to go through the mediating processes, in which the project team members can learn more about one another, reduce anxiety from the interaction and enhance empathy towards one another through repeated interaction in the course of partnering implementation.

The facilitating conditions together with the mediating process lead to positive cognitive and behavior effects including cooperation, trust, helping each other,

perceived group homogeneity, re-categorization among the team and perspective taking. These behavioral characteristics can lead to improved team and project performance.

Partnering plays another important role of advocating various effective project management measures, as demonstrated by the common partnering elements discussed. Meng (2012) stated that project management measures including encouraging collaboration among project stakeholders, fostering open and effective communication, realizing fair risk allocation, conducting regular performance review and measures, and facilitating an effective problem solving, can significantly reduce the chance of occurrences of poor project performance in terms of time delays, cost overrun and quality defects. Among all positive cognitive and behavioral effects, cooperation and trust are considered as the most influential to improvement in both relationship and project performance (Phua and Rowlinson 2004; Suprapto et al. 2015). Wong et al. (2008) suggested that trust is the most essential behavioral factor in managing relationship in construction, and Meng (2012) affirmed that the relationship among the project stakeholders in the construction industry greatly affects the project performance, especially in the cost aspect.

It can be concluded that implementation of partnering, as an input, results positive cognitive and behavior effects, and implementation of effective project management measures. The interaction of these two partnering outcomes, as a mediator, would then lead to improvements in project performance in terms of cost, quality, safety and innovation, as the outcome, as shown in Figure 3-11.

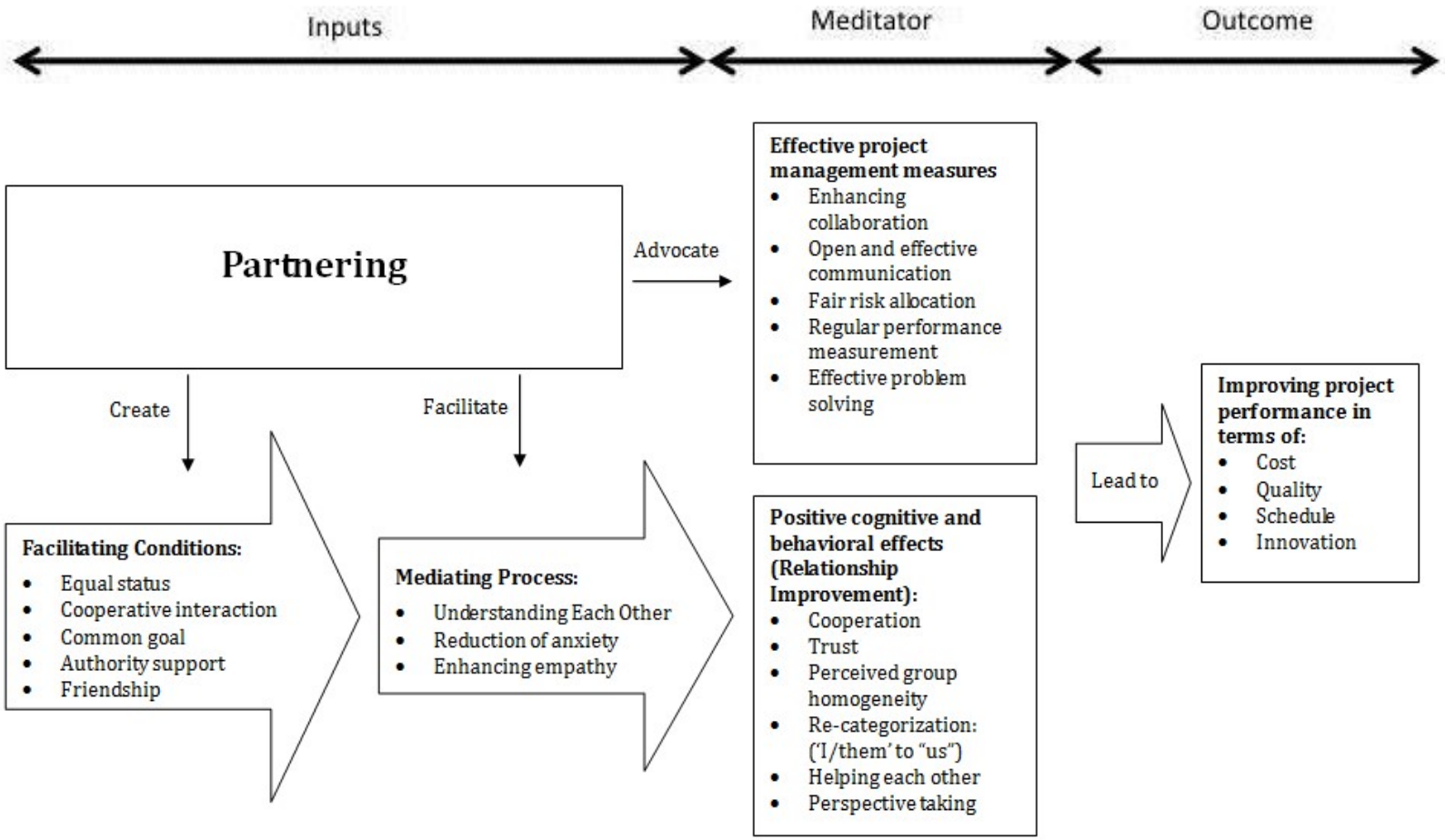


Figure 3-11. The Conceptual Model of Partnering. Adopted and expended from Anvuur and Kumaraswamy (2007)

3.9. Chapter Summary

This chapter discussed the fundamentals about partnering. Various definitions of partnering available from the literature were introduced. It was clarified that the definition of partnering from CIB (1997) was adopted for this research. Types and benefits of partnering were also covered. The significant contribution of this chapter was the development of a conceptual model explaining, in a psychological perspective, that partnering enhances project performance by implementation of effective project management measures, such as regular performance measurement and fair risk allocation, and improved cognitive and behavioral effects, which was resulted by creating five facilitating conditions, including (1) equal status, (2) cooperative interaction, (3) common goal, (4) authority support, and (5) friendship, facilitating three mediating processes, including (1) understanding each other, (2) reduction of anxiety and (3) enhancing empathy along the partnering process.

Chapter 4. Implementation Issues of Partnering

4.1. Introduction

Having reviewed the background of partnering, this chapter sheds light on the implementation issues of partnering. Firstly, the common partnering process and partnering performance measurement are introduced. The critical success factors for partnering are discussed, followed by the challenges of implementing partnering.

4.2. Partnering Process

Chan et al. (2006) conducted an industry-wide investigation in Hong Kong to develop a framework of project partnering practice based on six case studies from public, private and infrastructure sectors. The generalized project partnering practice, aligning with the recommendation of Sir Michael Latham's report, is shown in Figure 4-1. The framework indicates that workshops with various purposes are organized throughout the project. In the early stage of each project, initial workshop is organized, aiming at establishing a cooperative project environment for stakeholders. Issues such as common goals among project stakeholders, critical success factors of partnering and problem resolution process are explained and discussed. Interim workshop is organized in the midway of each project to review partnering issues, including performance measurement, effectiveness of issue resolutions or improvement areas. Upon completion of project, overall review is conducted in a final workshop. Typically, an external facilitator is employed to guide the stakeholders throughout the process.

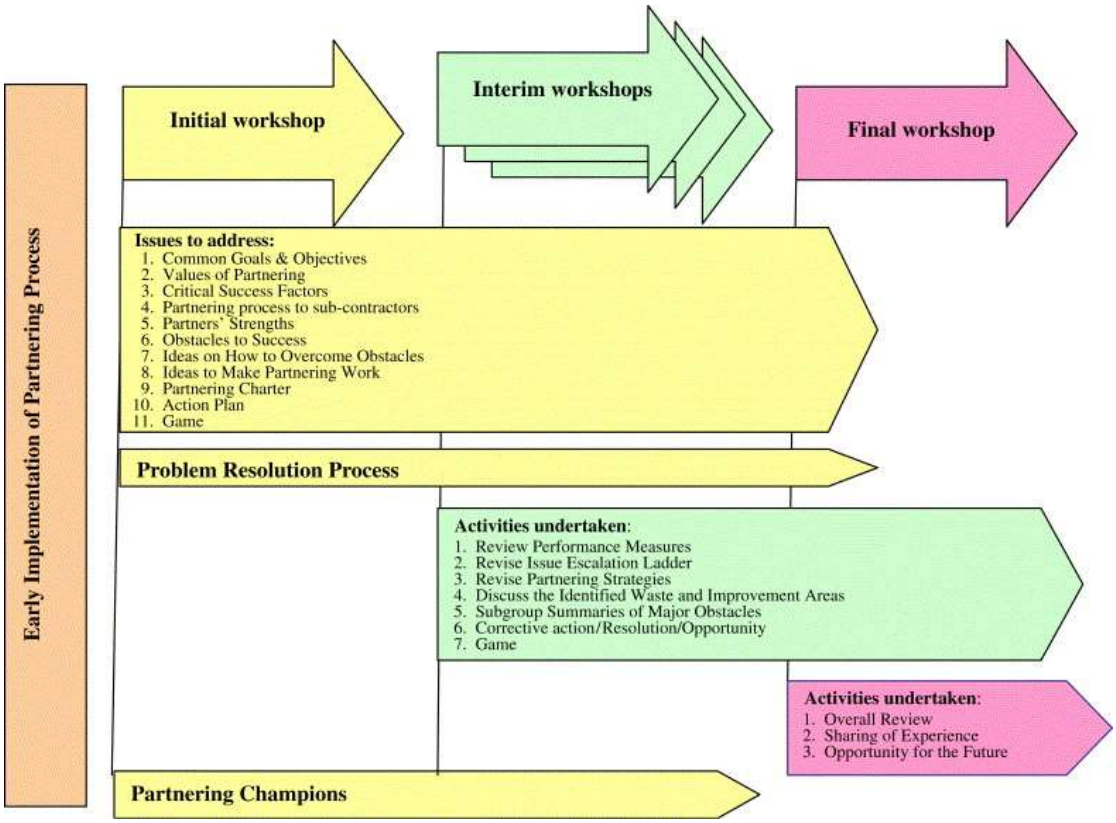


Figure 4-1. The best practice framework of project partnering. Adopted from Chan et al. (2006)

4.3. Partnering Performance measurement

4.3.1. Frameworks for measuring performance in construction industry

Conducting a review on the development of performance measurement in the construction industry, Yang et al. (2010) concluded that performance measurement in the construction industry has been extended from the traditional project level in terms of time, cost and quality to the organizational level and even stakeholder level, Performance indicators covers other areas such as business performance, environment and customer satisfaction (Yu et al. 2007). While the three common measurement frameworks adopted in the construction industry are European Foundation for Quality

Management (EFQM) excellence model, Balanced Score Card (BSC) and Key Performance Indicators (KPIs). The frameworks will be briefly introduced below.

The EFQM excellence model was developed in late 1980s, which focuses on measuring two areas, result area and enabler's area, the former concerns achieved results and the latter concern the management of the organization (Westerveld 2003). EFQM excellence model is commonly adopted for measuring performance organizational level and stakeholder level.

BSC was developed by Kaplan and Norton (1992) in early 1990s, which consists of a set of leading and lagging indicators to measure performance at four perspective, including financial, customers, innovation and improvement, and internal process (Punniyamoorthy and Murali 2008).

KPIs model was developed in the Construction Best Practice Program (CBPP) in the late 1990s (Lin and Shen 2007) for measuring performance at both the project and organization levels in the construction industry (KPI Working Group 2000), KPIs model can also measure performance at the stakeholder level apart from at the project and organization level (Dainty et al. 2003).

The three performance measurement frameworks have their own merits and limits, there is no single framework fits all situation as explained by Neely (1999). A comparison of the three frameworks is presented in Table 4-1. Choosing a proper measurement framework should be contextual and should refer to the nature and objectives of the measurement.

Model	Comparison	Application
EFQM excellence model	**Main advantages** Offering an integrated measurement model concerning result areas (lagging indicators) and organization areas (leading indicators) (Lin and Shen 2007). **Main criticisms** Vague and underrated in the areas of improvement, innovation and supplier partnership strategies (Bassioni et al. 2004). Inflexible to adopt changes, lack of application experience with the model (Watson and Seng 2001).	Organizational level and project level
BSC model	**Main advantages** Offering a balanced measurement between economic and operating performance, financial and customer outcomes, short and long term objectives of an organization.(Luu et al. 2008). Evaluating congruence between the performance of an organization and its strategic goals. Focusing the organization's efforts on a relatively small number of measures leading to relatively low cost (Kagioglou et al. 2001). **Main criticisms** Ignoring the suppliers and human perspectives in the measurement. Difficult and time consuming to established a comprehensive BSC in a large organization (Luu et al. 2008). Other perspectives such as competition, employee, and other project-specific perspectives like supplier for construction haven't been considered (Schneiderman 1999).	Organization level
KPIs model	**Main advantages** Being a tool facilitating benchmarking both at strategic and at operational level such as rectifying defects and meeting client's expectations (KPI Working Group 2000). **Main criticisms** Some KPIs defined are practically difficult to be measured in terms of collecting related project information (Chan and Chan 2004). Lack of a holistic viewpoint on the relationship between the different indictors and none of the indicators deals with the innovation and learning perspective (Kagioglou et al. 2001).	Project, organization and stakeholder level

Table 4-1. Comparisons on the three performance measurement frameworks adopted from Yang et al. (2010)

4.3.2. Measuring partnering performance

Referring to the definition of partnering by the Construction Industry Institute (CII) (1991), the introduction of partnering concept to construction projects aims to establish a cooperative working environment by which stakeholders can focus on efficiency and cost effectiveness leading to a better project performance with increased opportunity for innovation and continuous improvement. Thus, measuring the performance of partnering projects should not only measure those traditional project "hard" aspects like cost, schedule, quality or safety, since these "hard" measures can tell little or nothing about the working environment (Crane et al. 1999), and they are unable to provide a clear picture of the partnering performance (Cheung et al, 2003). As such, Crane et al. (1999) developed an "Objective, Goals, Strategy and Measure" (OGSM) models (Figure 4-2) for selecting proper measures for partnering performance measurement with consideration on project objectives, goals and strategy. In this sense, measuring performance of partnering is different to measuring that of the conventional projects, in which only those common "hard" indicators and other organization specific measures are included. For measuring partnering performance, some 'soft' indicators should be applied to measure those relational elements, such as trust, communication, problem solving and goal alignment.

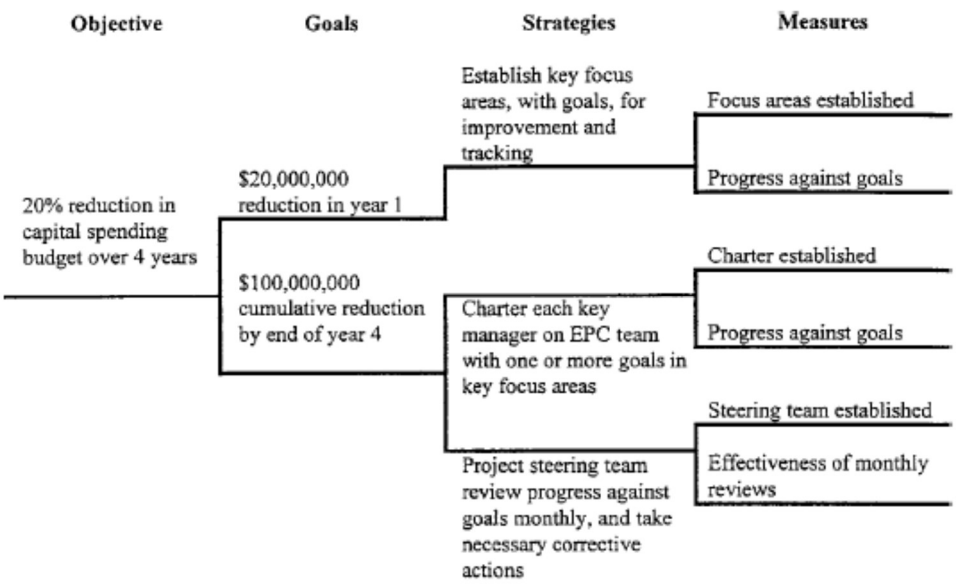


Figure 4-2. The OGSM model. Adopted from Crane et al. (1999)

Measuring partnering performance can be seen as a project level measurement with consideration on relational elements. In addition, the performance of stakeholders should also be measured under the heading of collaborative working environment. As shown in Table 4-1, the EFQM excellence model and BSC model are not suitable as they lacks of considering either supplier partnership aspects or human perspectives. In addition, they have not been applied to measure performance at stakeholder level. As such KPIs model are commonly adopted for measuring partnering performance (Crane et al., 1999; Cheung et al., 2003; Bayliss et al., 2004; Chan et al., 2004 and 2006).

4.3.3. Key Performance Indicators (KPIs)

Cox et al. (2003) defined KPIs as compilations of data measures used to evaluate the performance of an operation. KPIs are tools for management to assess staff's performance on a specific task and the process usually involves comparing actual and

the expected performance in terms of efficiency, effectiveness and quality in terms of product and workmanship.

The KPI Working Group (2000) pointed out that the purpose of KPIs is to enable measurement of project and organizational performance throughout the construction industry, Collin (2002) advocated that the process of developing KPIs involved the consideration of the following factors:

- KPIs are general indicators of performance that focus on critical aspects of outputs or outcomes.
- Only a limited, manageable number of KPIs is maintainable for regular use. Having too many (and too complex) KPIs can be time- and resource-consuming.
- The systematic use of KPIs is essential as the value of KPIs is almost completely derived from their consistent use over a number of projects.
- Data collection must be made as simple as possible.
- A large sample size is required to reduce the impact of project specific variables. Therefore, KPIs should be designed to use on every building project.
- For performance measurement to be effective, the measures or indicators must be accepted, understood and owned across the organization.
- KPIs will need to evolve and it is likely that a set of KPIs will be subject to change and refinement.
- Graphic displays of KPIs need to be simple in design, easy to update and accessible.

4.3.4. Common Partnering Measurement Systems

Cheung et al. (2003) developed a Partnering Temperature Index (PTI) to measure the performance of partnering. The PTI comprises of five "hard" measures (time, cost, quality, safety, and environment) and 3 "soft" measures (communication, contract relations, and claim and issue resolution). Project participants can rate the individual measures (in 5-point Likert Scale) according to their judgements. The PTI can offer an overview of partnering performance against a set of predefined measures. However, this method is subject to the personal judgement of the marks contributors, and so reliability and objectivity are not guaranteed. Furthermore, which measures or indicators should be adopted is not universal, as the measurement should be referred to the organisational goals to be achieved by partnering (Crane et al. 1999). In this sense, partnering performance measurement should be contextual in nature.

Yeung et al. (2007b) developed a more objective and reliable Partnering Performance Index (PPI) for assessing partnering performance of construction projects in Hong Kong based on previous related studies (Bayliss et al. 2004; Chan et al. 2006; Chan 2004; Chan et al. 2001; Cheng et al. 2000; Cheung et al. 2003c; Crane et al. 1999), results of surveys and interview with selected experts with practical partnering experiences in the Hong Kong construction industry. The PPI comprises of seven Key Performance Indicators (KPIs) including time performance, cost performance, top management commitment, quality performance, trust and respect, effective communication, innovation and improvement.

4.4. Critical Success Factors for Partnering Implementation

The potential benefits from partnering should not be taken for granted. The claimed benefits of partnering can only be realized by adequate inputs to the management system. Various studies have been conducted to identify the critical success factors of implementing partnering. Based on the previous research (Black et al. 2000; Cowan et al. 1992) on partnering, Tang et al. (2006) summarized the critical successful factors of implementing partnering, which include mutual objectives, commitment, equity, trust, attitude, openness, effective communication, teambuilding, problem resolution, timely responsiveness and incentive.

Chan et al. (2004) conducted an empirical survey in Hong Kong and identified 5 significant success factors for implementing partnering from 41 underlying factors. The 5 significant success factors included establishment and communication of conflict resolution strategy, willingness to share resources among project participants, a clear definition of responsibilities, a commitment to win-win attitude and regular monitoring of partnering process.

Cheng and Li (2002) identified critical success factors for partnering. They suggested that there are some common critical success factors for the process and there are also some stage-specific (functional) critical success factors. The common critical success factors for partnering include top management support, mutual trust, open communication and effective co-ordination. The specific critical success factors for the partnering formation, partnering application and partnering completion/reactivation stage are listed respectively in Table 4-2.

Table 4-2. The functional critical success factors adopted from Cheng and Li (2002)

Stages	Critical Success Factors
Partnering Formation	Team building, facilitator and partnering agreement.
Partnering application	Adequate resources, partnering goals achievement and joint problem solving
Partnering completion/reactivation	Long-term commitment, continuous improvement, learning climate and partnering experience

Likewise, Wang et al. (2015) categorized the critical success factors of partnering into attitudinal factors and open communication factors respectively. Attitudinal factors refer to mutual goals/ attitude, commitment, equity and trust, while open communication factors refer to team building, openness, effective communication, problem resolution and timely responsiveness.

The above-mentioned success factors should be considered before and during implementation of partnering for increasing the chance of achieving partnering success and maximizing its potential benefits.

4.5. Challenges of Implementing Partnering

Partnering can bring mutual benefits to contracting parties but implementing partnering is not problem-free. Chan et al. (2003b) identified nine main barriers of implementing partnering in Hong Kong. The main hurdles impeding partnering success include misunderstanding of partnering concept, relationship problems, culture barrier, uneven commitment, communication problems, lacks of continuous improvement,

inefficient problem solving, insufficient efforts to keep partnering going and discreditable relationship. Mollaoglu et al. (2015) conducted a study, focusing on the Architecture, Engineering, and Construction Industry in US, and categorized the 25 identified barriers of implementing partnering into three main clusters, namely cultural, project team, and organizational barriers. The overall top 3 barriers were "Resistance from project team members", "Lack of trust among partnering participants" and "Lack of partnering training programs and workshops early on in the project".

Glagola and Sheedy (2002) conducted an empirical study on public partnering projects in US to determine the goals of adopting partnering and the corresponding barriers preventing attaining the defined goals. The top three goals of adopting partnering identified were 'Develop working relationships", "Dispute Resolution" and "Claims Avoidance", while the most significant barriers were top management commitment, ego/personality indifference, low-bid mentality, working level commitment, lack of common goals, lack of understanding the principles and past adversarial experiences. A recent study by Challender et al. (2014) in UK identified cooperation, fairness and information sharing as the barriers of successful partnering implementation.

Ng et al. (2002) conducted an empirical study on barriers of implementing partnering in the public sector of Australia and 15 barriers have been identified, which can be further categorized as "all stakeholders specific", "client specific", "contractors specific" and "project specific" barriers. The corresponding barriers are listed in Table 4-3.

Table 4-3. The barriers of implementing partnering adapted from Ng et al. (2002)

Categories	Specific Barriers to Partnering Implementation
All stakeholders specific	• Lack of continuous open and honest communication • Stakeholders not developing a "win–win" attitude • Stake holders are not committed to the partnering arrangement • Lack of intimacy in the partnering relationship • Issues are allowed to slide and escalate • Some partners are unwilling to compromise
Client specific	• Lack of empowerment in the client's controlling bodies • Dealing with large bureaucratic organizations • Controlling body's lack of technical knowledge
Contractors specific	• Commercial pressures compromising the partnering attitude • Lack of training and guidance in the project partnering arrangement
Project specific	• Use of a competitive tendering arrangement inhibits flexibility • Problems with drawings and specifications • Key subcontractors not included in the partnering process • Partnering is not suitable for a particular project

4.6. Development Trend of Partnering

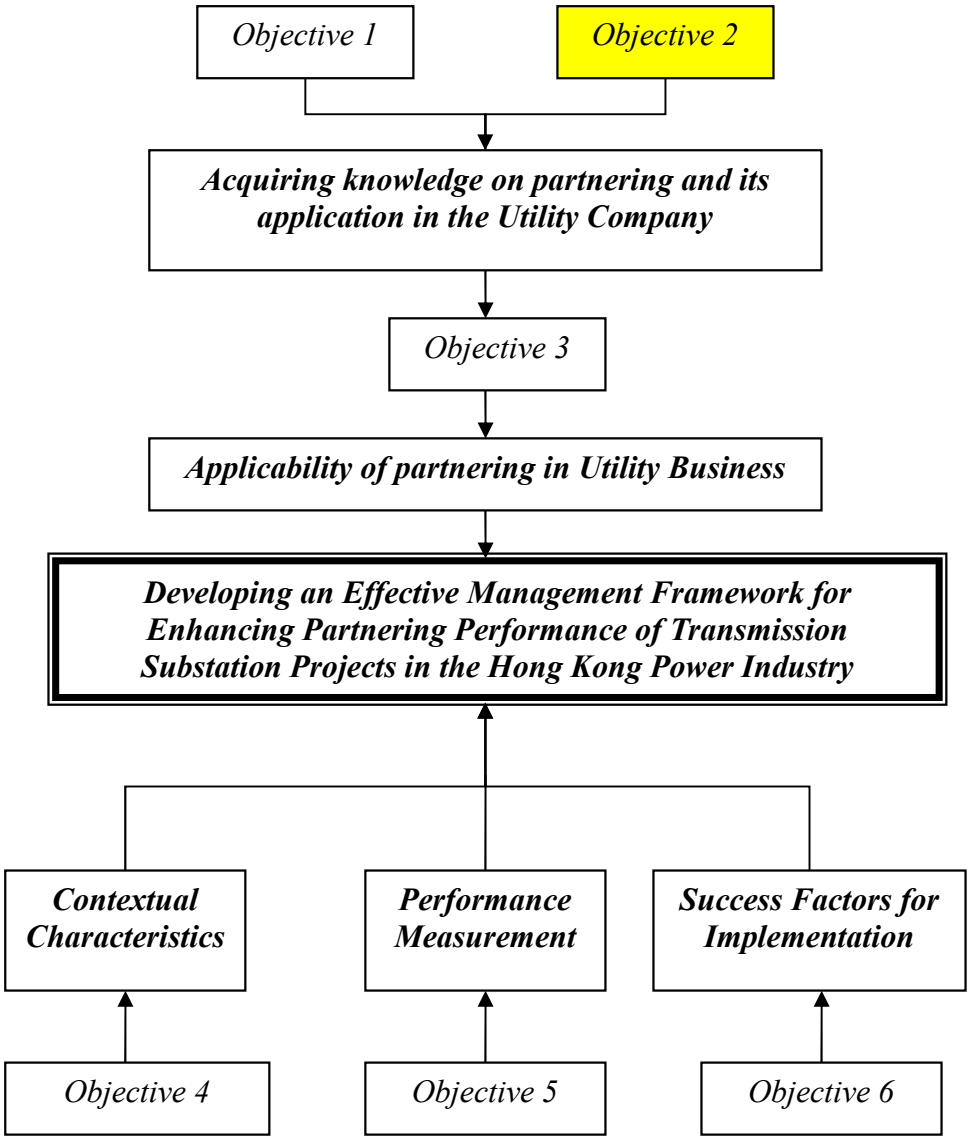
Partnering has been implemented commonly in practice as a collaborative principle applied on top of traditional contractual framework. With the reported potential benefits from partnering, the implementation of partnering is evolving and there is a trend of formalizing the partnering principles into the contract. In fact, various partnering contacts has been kept evolving in the last decade (Mollaoglu et al. 2015). Adoption of partnering contact can foster collaborative behavior, promote joint optimization and discourage opportunistic behavior between the contracting parties (Tvarnø 2015). One of the commonly adopted partnering contacts is the New

Engineering Contract Version 3 (NEC3) (ICE 2013). Partnering Contacts, like NEC3 not only prompt partnering principles but also advocate proactive project management practice, including fair risk allocation, transparent cost monitoring, proactive dispute management (Wright and Fergusson 2009). In view of these, contractual partnering has been receiving growing applications in industry.

In fact, some governments, like those in UK, Denmark (Tvarnø 2015) and Hong Kong (Chan, Hu, Ma and Shan 2015) have endorsed and promoting application of contractual partnering, it is expected that contractual partnering would probably become the major trend of partnering development in the years ahead.

4.7. Chapter Summary

This chapter discussed implementation issues of partnering, including the process involved for implementing partnering, the critical success factors and the key challenges of implementation partnering in practice. This chapter, together with the background of partnering discussed in Chapter 3 and the case of strategic partnering application in the Utility Company in Chapter 5 laid down a foundation for the subsequent research tasks.


Objective 1
Objective 2
Acquiring knowledge on partnering and its application in the Utility Company
Objective 3
Applicability of partnering in Utility Business
Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry
Contextual Characteristics
Performance Measurement
Success Factors for Implementation
Objective 4
Objective 5
Objective 6

Chapter 5. Background of the Utility Company

5.1. Introduction

This chapter provides an overview of the Power Utility Company. The business nature of the Utility Company is first introduced. Nature and process of the Transmission Substation Projects (TSP), studied in this research, are also discussed, followed by the rationale of adopted partnering and how partnering was implemented in the utility context.

5.2. Business Nature of the Utility Company

The Power Utility Company (the Utility Company) operates a vertically integrated electricity business in Hong Kong, covering the electricity generation, transmission, distribution and retail businesses. This research focuses on the transmission business of the Utility Company employing strategic partnering approach. To meet the local electricity demand growth (2-3% per annual) and to maintain the high power supply reliability (99.999%), The Utility Company continuously invests on extending and upgrading its transmission and distribution network. Around 60% of the Utility Company's annual capital expenditure goes to extending and upgrading its transmission and distribution network to maintain the supply reliability and to meet the demand growth. It can be seen that a huge amount of capital expenditure will be invested in the transmission and distribution network in response to the new residential and major infrastructure developments in the city, and so an effective approach for managing

transmission and distribution network projects is definite curial to the Utility Company's success.

5.3. Nature and Process of Transmission Substation Projects

Projects for the transmission network can be broadly classified as substation related and cable/overhead line related projects. The former is termed as Transmission Substations Projects (TSP), which is the focus of this study. There are two types of TSP in the Utility Company, the first one is green-field projects which aim for meeting the growth of electricity demand due to new town development or infrastructure by building new substations, while the second one is brown-field projects which aim for maintaining the high supply reliability and operational safety by replacing aged electrical equipment such as transformers or switchgears.

Typically, a TSP involves electrical equipment supply and civil works. For electrical equipment supply, it can be further classified as primary and secondary equipment. Primary equipment refers to switchgear and transformers while secondary equipment refers to protection, control and communication devices. For civil works, it involves civil design, as per requirements of primary electrical equipment, and construction of substation. As shown in Figure 5-1, the TSP can be regarded as a mixture of electrical equipment turnkey projects and construction projects.

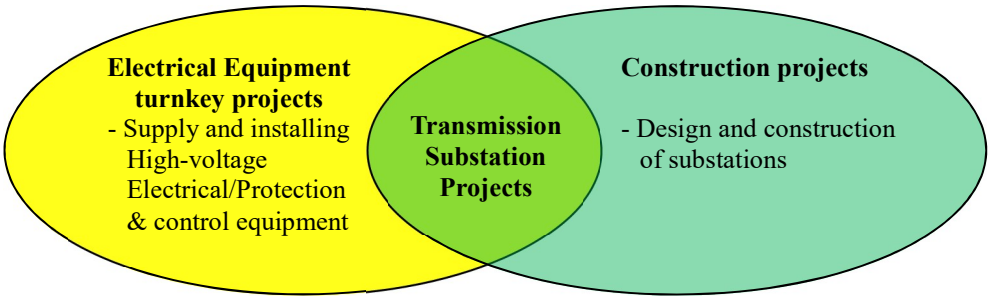


Figure 5-1. Nature of Transmission Substation Projects (TSP)

Generally, all the transmission substation projects in CLP would go through the following stages and the corresponding sequence is shown in Figure 5-2.

1. Feasibility study
2. Land reservation (for new substations)
3. Project start up stage
4. Design stage
5. Procurement and manufacturing stage
6. Construction and commissioning stage
7. Hand over stages

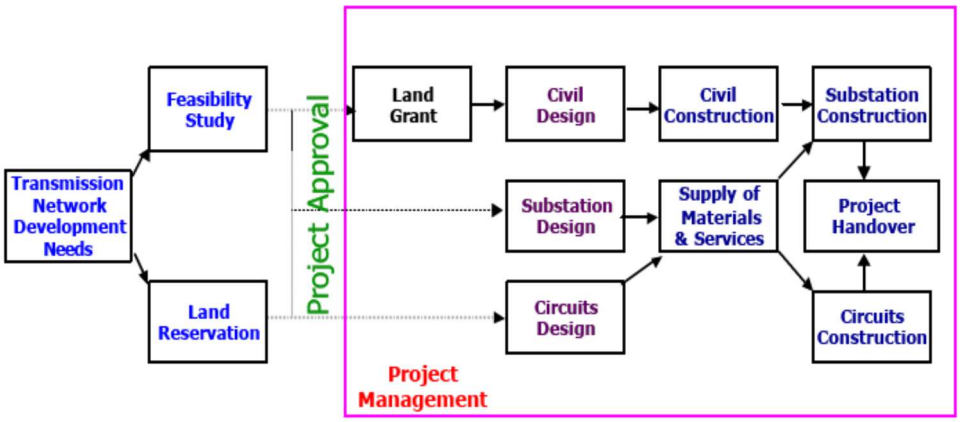


Figure 5-2. The typical process of transmission substations projects adopted from Chan and Woo (2001)

5.4. Drivers for adopting Partnering Approach

A typical TSP requires wide range of expertise including, substation civil design, high-voltage electrical equipment design (with consideration on installation, operation and maintenance) and high-voltage equipment protection and control design. Apparently, no single party in the market can manage such a power-system specific project (Lo et al. 2004). The traditional turnkey approach is not effective for managing these high-risk projects, since under which the contractor is responsible for design, construction and coordination related activities, and more importantly, the contractor also need to bear all the risks throughout the projects. This leads to the occurrence of a high risk premium charged by the contractors and disputes when some unpredicted events such as unforeseeable underground condition, which have not been specified in the project scope. To facilitate an effective cost and risk management, the Utility Company implemented strategic partnering approach for managing new transmission

substation projects since 2005. Building a new transmission substation involves pilling, foundation and superstructure works, the expertise from civil contractor becomes critical, as such a tri-partite model was developed which allows better utilization of expertise from both Electrical Solution Provider (ESP) and Civil Solution Provider (CSP) as shown in Figure 5-3.

5.5. The Partnering Arrangement

The Utility Company adopted partnering approach for 9 Transmission Substation Projects (TSPs) for a 5-year timeframe. Conventional form of contact was adopted. The projects involved both civil and electrical main contractors forming a tri-partite partnering relationship. Conventional Design and Build contract was adopted for the civil aspect. The respective civil main contractor needed to manage the Designer, Consultant, Architect and Electrical & Mechanical consultants. For the electrical aspect, the substation projects involved design and construction of high voltage electrical equipment, like transformer and switchgear. The respective electrical main contractor, needed to manage the other equipment suppliers and erection works, as well as working with the civil main contractor in developing detailed civil design to match with the major electrical equipment under the tri-partite partnering arrangement.

Although there was no contractual relationship between the electrical and civil main contactors, they were encouraged to work with each other to attain project success through closer collaboration under the partnering approach. Their collective effort would be reflected in the performance-based incentive scheme. The overall contractual

and partnering arrangement is shown in Figure 5-3.

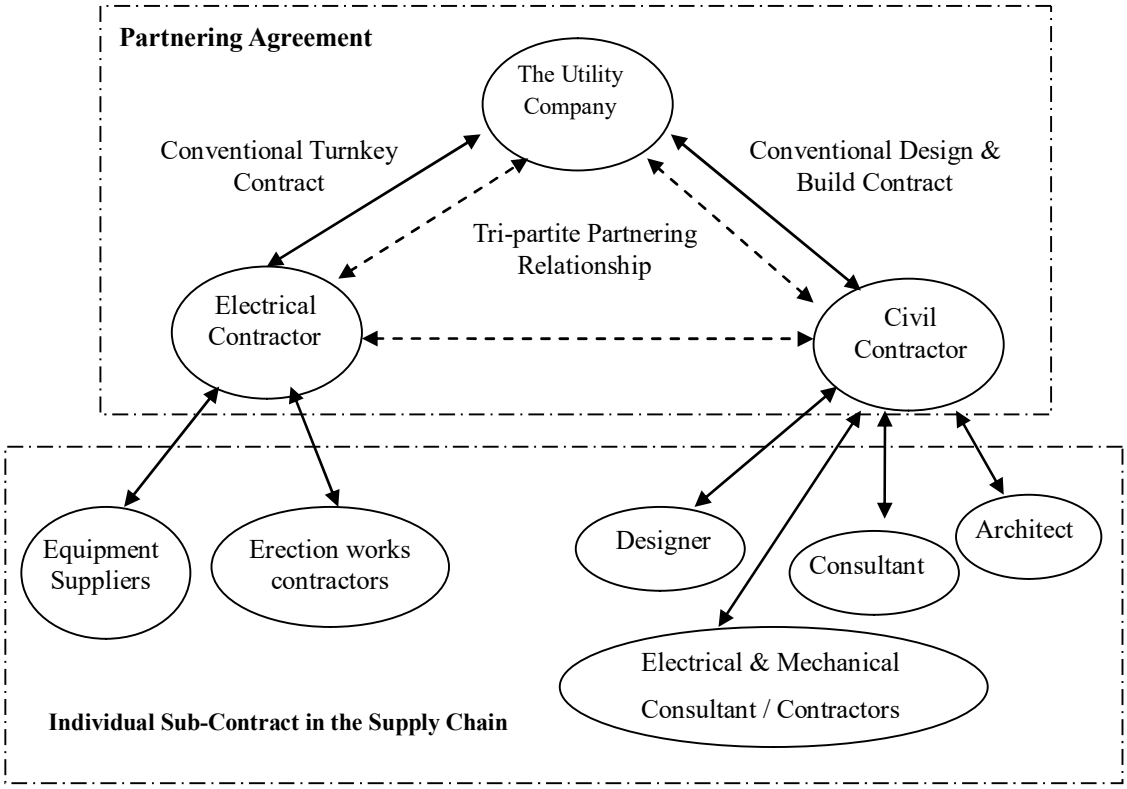


Figure 5-3. Overview of the Contractual and Partnering Arrangement. Adopted and expended from Ford et al. (2006)

There are two salient points worth noting in the contractual arrangement. First, aiming to better tap in contractor's expertise in early design stage, in contrast to the traditional arrangement in the construction industry, the main civil contractor took a leading role throughout the contract period, and he was responsible for managing and coordinating with the designer, consultants, architect and other subcontractors. Likewise, the electrical main contractor was responsible for managing and coordinating the electrical suppliers and the sub-contractors.

Another salient point is the separation of design and construction works. Both the electrical and civil contractors were paid for a fixed amount of design fee at the beginning of each project. Upon completion of the design stage, each contractor was requested to submit a refined construction cost proposal to the Utility Company for consideration, and the agreed construction costs would then form the basis for the performance-based incentive scheme.

5.6. Partnering Tools Adopted

To nurture partnering spirit, various partnering tools have been adopted including Partnering Charter, Partnering Workshops, 3-layer Management Hierarchy, Issue Resolution Mechanism, Joint Performance Measurement, Shared Risk Mechanism and Performance-based Incentive Scheme. These partnering tools will be discussed in the following section.

5.6.1. Partnering Charter

The partnering charter essentially captured the partnering spirit that The Utility Company would like to nurture through applying the partnering tools. The partnering spirit was largely represented by 5 components: (1) Mutual Objective, (2) Honesty/Openness with Integrity, (3) Effective Communication/Understanding partners' needs, (4) Collaborative/Win-win Attitude, (5) Mutual Trust and Respect Ford et al. (2006). The partnering charter also included some specific project objectives like "completing the project in the shortest time while minimizing impacts on operational flexibility", and some guiding principle like "Talk before you write – be open" to drive

the stakeholders to focus on project performance and to reinforce partnering spirit.

A signing ceremony has been arranged for the stakeholders, to sign on the partnering charter to signify their commitment on project objectives and the guiding principle of partnering. Both the senior and middle management and the key frontline staff of the Utility Company, the electrical and civil main contractors have singed on the partnering charter to signify their commitment.

5.6.2. Partnering Workshops

To nurture partnering spirit among the project stakeholders, The Utility Company has engaged an external facilitator to conduct series of partnering workshops, which serves the purpose of educating the stakeholders about partnering during the initial stage, and identifying problems and opportunities for value creations in later stages. In the first series of partnering workshop, the facilitator led the project stakeholders to develop common project objectives and the guiding principles of the partnering arrangement, aiming to foster collaboration and reinforced mutual trust among the project stakeholders. Partnering spirit was also well defined and explained to the project stakeholders during the first workshop. Both key persons from the designers, contractors and the subcontractors were invited to join the workshops. Apart from the management, frontlines were also invited to join the workshops, aiming to nurture partnering spirit in both horizontal and vertical dimension across the organizations concerned.

In the later stage when there were projects being implemented, the workshops

acted as a platform for both parties to exchange views on the problem encountered and to review the partnering performance in a friendly and open manner with the aid of various games, by which the project participants were allowed to interact and to understand each other's concern and constraints in a casual way. The Utility Company took the completion of a project as a milestone to conduct review workshops, in which the benefits and difficulties of implementing partnering, effectiveness of issue resolution process and project performance in terms of cost, time, safety and quality would be discussed among the project stakeholders. In addition, opportunity for continuous improvement in both partnering implementation and project specific perspective would be identified.

5.6.3. Three-Layer Management Hierarchy

To facilitate effective communications and holistic project stakeholder engagement, a 3-layer management hierarchy was adopted. The top layer is the Project Leadership Team (PLT), which consisted of senior management from both The Utility Company and the main contractors. PLT was mainly responsible for setting the direction and guidelines for the project team, maintaining and developing inter-firm relationship, and exploring business opportunities. PLT meeting was arranged in a half-yearly basis. Each party would be the host of the PLT meeting in turn, which usually included a visit to the hosting company, social functions and performance review meeting.

The second layer is the Project Management Team (PMT), which consisted of

middle management from both parties, including project managers and senior engineers, who focus on resolving project issues and implementing follow-up actions derived from the PLT meeting. PMT meeting is arranged monthly.

The third layer is the Wider Integrated Project Team (WIPT), which consisted of the frontline engineers from both parties. WIPT was responsible for daily operation of the projects. Any unresolved issue arising from the WIPT level was escalated to the PMT. Figure 4 shows the overall arrangement of the Three-Layer Management Hierarchy.

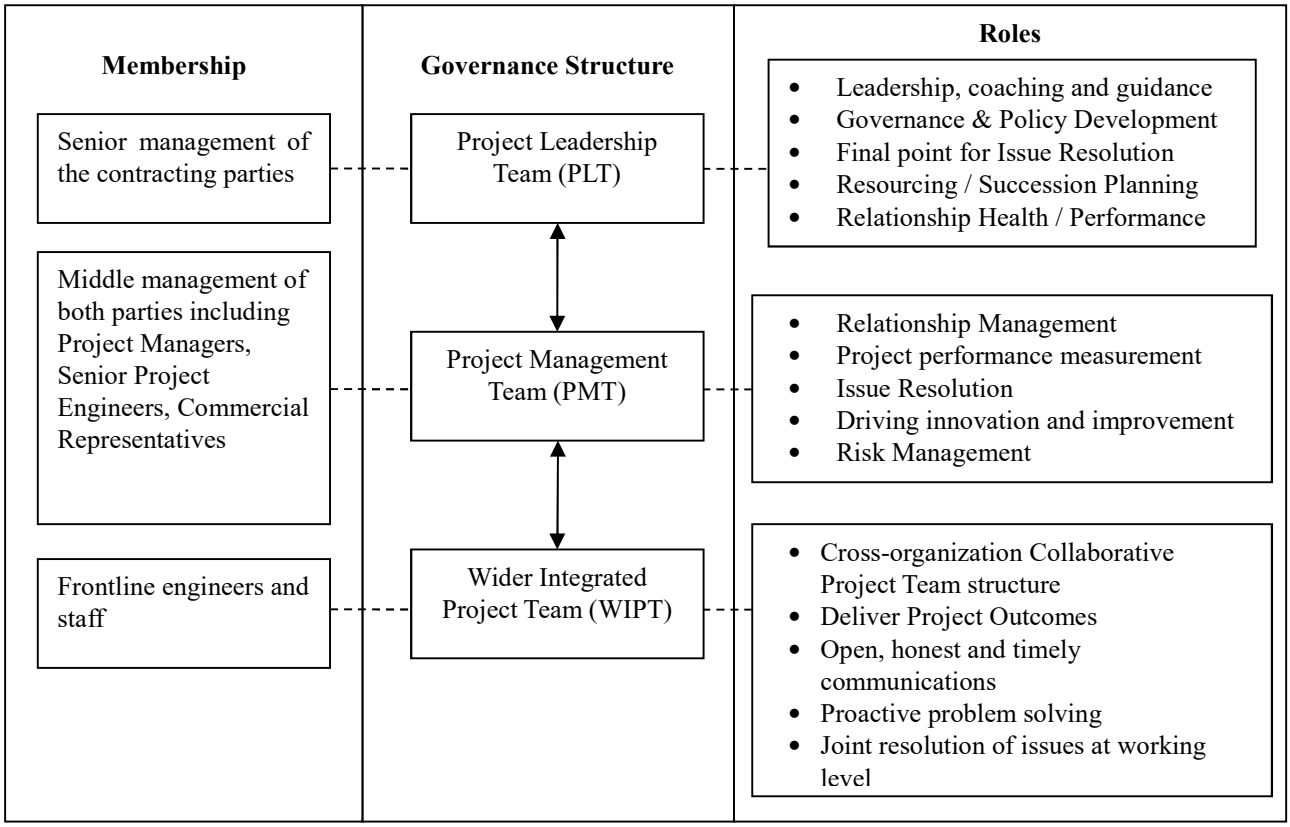


Figure 5-4. Membership, Structure and Roles of the 3-layer Management Hierarchy. Adopted from Ford et al. (2006)

5.6.4. Issue Resolution Mechanism

To avoid unnecessary delay in resolving issue, an Issue Resolution Mechanism was established. If any project related issue cannot be solved at the frontline level, the responsible staff of either party can put the issue in the issue register. During the regular PMT meeting, the middle management would discuss and resolve the registered issue. In case the issue cannot be resolved at the PMT level, it is further escalated to the PLT level for senior management discussion. According to the Utility Company's experiences, most of the issues could be resolved in the WIPT and PMT level.

5.6.5. Joint Performance Measurement

Two sets of performance measures were adopted to gauge the contractor performance and the individual project performance. The contractor performance measurement aimed to gauge the overall performance of the contractor in the contract period, covering 5 aspects including Safety, Health and Environmental, Project Management, Design Work, Quality of Work, and Customer Orientation. The individual project performance measurement focused on the performance at project level with specific pre-agreed targets, covering 5 aspects including Quality, Schedule, Safety, Environment, and Community. The individual project performance also formed the basis of calculating the incentive payment. Both of the measurements were conducted monthly and the performance scores were agreed by both parties in the regular PMT meetings.

5.6.6. Shared Risk Mechanism

To facilitate realizing cost performance improvement by collaboration, a Shared Risk Mechanism was adopted. In the tendering stage, the contractors were required to clearly define and distribute the quantified project risk between themselves and the Utility Company, notably, as Contractor Risk and Client Risk according to the project scope. In addition, those risks required joint effort to mitigate were defined as Shared Risk. A reduction target on the quantified Shared Risk value was also mutually agreed by both parties, for example 90% of the identified Shared Risk value.

Essentially, the Shared Risk Mechanism allowed the contractor to divide the tender price into two components. The first one was a non-transparent component containing the necessary costs, overhead and profit of the contractor, which were managed by the contractor in a normal manner. The second one was a transparent quantified Shared Risk component, which would be jointly managed by both parties with an objective of lowering the risk profile, minimizing risk expenditure such that the unspent Shared Risk cost would be shared upon project completion. The sum of these two components formed the tender price of each project.

The examples of the Shared Risk items for the civil contractor were “Unexpected permanent foundation works” and “Late change from the client”, while that for the electrical contractor were “Equipment re-work after delivery” and “Deviation from the standard design” .During the cause of the project, both parties were entitled to claim the Share Risk items as per the quantified value and subject to mutual agreement. At the final project accounting stage, sum of Shared Risk items claimed would be

compared with the target, and the corresponding difference would be shared as gain or pain in accordance to the performance.

5.6.7. Performance-based Incentive Scheme (Gain/Pain Sharing)

Incentive scheme is regarded as an important measure to motivate collaboration and reinforce mutual trust (Bresnen and Marshall 2000a) and common goals (Kadefors 2004) between the clients and contractors. Specifically, the Gain/Pain Sharing could actualize the spirit of mutual accountability and win-win attitude. As a pilot, the Incentive Scheme adopted by the Utility Company was based on the Shared Risk Mechanism instead of the overall final project cost.

As per the result of final accounting of each project, the deviation from the mutually agreed target of the Shared Risk values would be shared between The Utility Company and the contractors in accordance to the contractor's final performance score. In case of Gain Sharing, the sharing ratio is determined by the final performance score of the contactors, the higher performance score of the contractor, the higher ratio on sharing the gain, for example, if the contractor performance score was 85, the sharing ratio between the contractors to the Utility Company would be 85%:15%. The ratio varies linearly according to the performance score. Similarly, in case of Pain Sharing, the over expense against the target is shared and the ratio depends on the contractor performance, the higher performance score of the contractor, the lower ratio on sharing of over expense. However, the Pain Sharing is capped at the sum of the tendered project cost plus the predefined Shared Risk cost, meaning that the overspent portion exceeded

the cap would be solely responsible by the contractors. The arrangement is graphically shown in Figure 5-5.

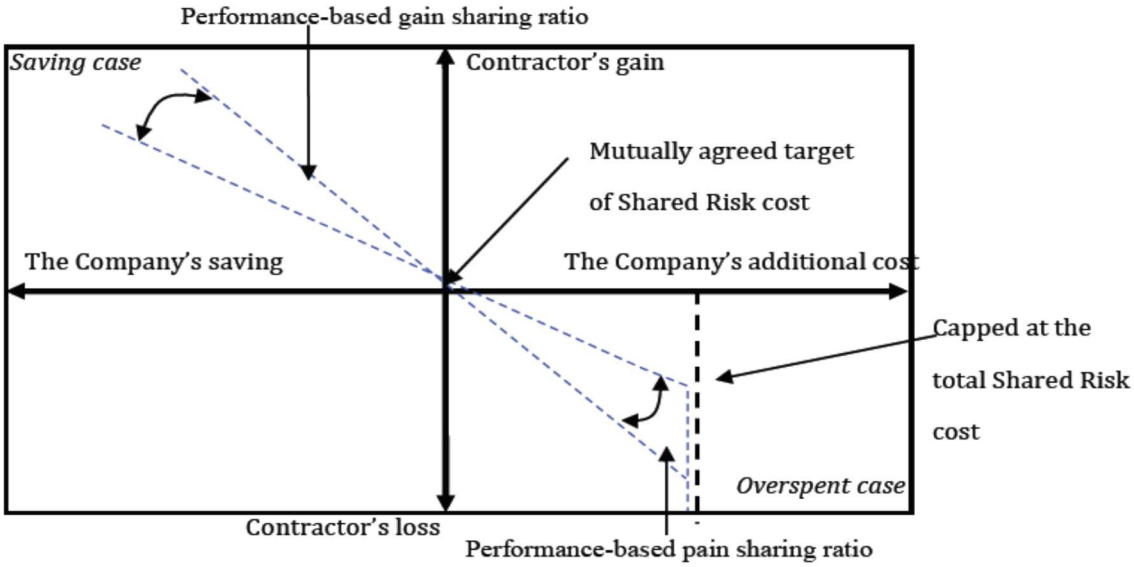
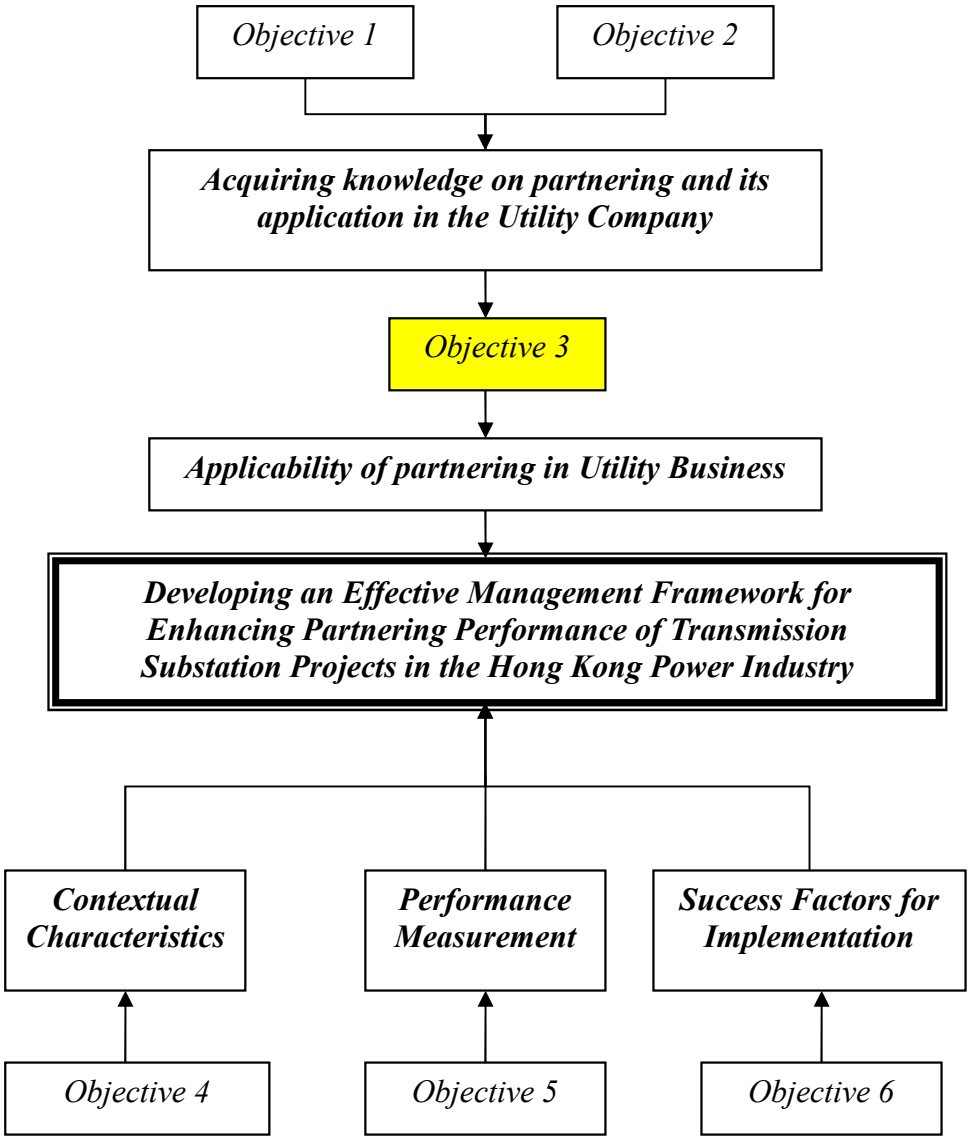


Figure 5-5. The Performance-based Incentive Scheme. Adopted from Chan et al. (2008)

5.7. Chapter Summary

This chapter introduced the background of the power utility in Hong Kong. In particular the operating regime and the challenging business environment of the power utility, and the rationale of employing partnering for managing the Transmission Substation Projects (TSP) were discussed. 10 partnering tools employed by the Utility Company were also introduced, including Partnering Charter, Partnering Workshops, 3-layer Management Structure, Regular meeting at senior, middle and front line levels, Issue Resolution Mechanism, Joint Performance Measurement, Shared Risk Mechanism, and Performance-based Incentive Scheme.


Objective 1
Objective 2
Acquiring knowledge on partnering and its application in the Utility Company
Objective 3
Applicability of partnering in Utility Business
Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry
Contextual Characteristics
Performance Measurement
Success Factors for Implementation
Objective 4
Objective 5
Objective 6

Chapter 6. Applicability of Partnering in the Power Utility Context

6.1. Introduction

This chapter aims to assess the applicability of the partnering in the power utility context. The empirical project performance data is first discussed, outlining the partnering project performance, followed by the survey and the focus group results regarding benefits, difficulties and values of partnering.

6.2. Participant profile and response rate

The project stakeholders from the Utility Company and the contractors company, who had managed one or more partnering projects (Transmission Substation Project) in the Utility Company, were invited to participate in the survey and the focus group. There were 28 participants identified. The corresponding organizational and positional demography is shown in Figure 6-1. Since the research was taken under a Teaching Company Scheme (Chan et al. 2011), the researcher was the employee of the Utility Company, facilitating a response rate of 100% for the survey.

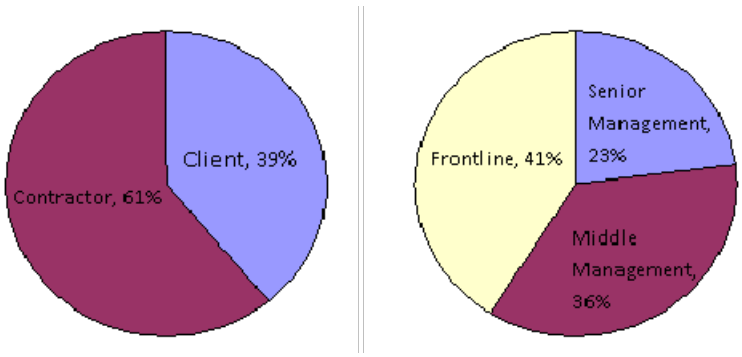


Figure 6-1. The organizational and positional demography of the participants

6.3. Partnering project performance

The project performance data of five completed Transmission Substation Projects (TSP) was retrieved from the Utility Company. The five TSP were similar in scope, involving civil foundation and superstructure works, as well as electrical equipment installation. The value of the five projects was similar, at the level of HKD 10 million each. The collected data covered the project performance in the safety, cost, schedule and environment perspectives. The Utility Company has adopted a measurement system for all its contactors, named Contactor Performance Management System (CPMS), under which the internal users would provide a monthly subjective assessment on the contactor concerned in five aspects including Safety, Health and Environment, Field Quality, Design Quality, Project Management and Customer Orientation. The score ranged from 0 – 100. To assess the contractor's general performance under partnering approach, the related contractor performance management score was also obtained for analysis.

In the safety perspective, the contractor has obtained 20 safety awards under the partnering contract period in various industry competitions in Hong Kong. This level of performance exceeded other similar contactor managed in the traditional approach.

In the cost perspective, a significant amount of cost saving, HKD 23.6 million was obtained through various cost saving initiatives implemented in the civil design and construction. Under the Share Pain/Share Gain mechanism, a HKD 2.8 million Share Gain to the client was achieved through the effective joint management of the identified Share Risk at the outset of the contract commencement.

In terms of schedule, all the five projects were completed and handed over on time, one of the salient point in this area was the partial access arrangement, which allowed concurrent civil and electrical works on site. The partial access arrangement could facilitate fast tracking of the project works. This arrangement could be difficult to achieve under traditional project management approach due to liability concern between different contactors. The contactor also performed well in the environmental aspect, three environmental related awards were obtained within the contract period.

The score of the Contactor Performance Management System (CPMS) over the contacting period was found to be continuously uplifting throughout the contracting period, from the level of 78 at the beginning stage to the 87 at the end of the contract, with an average score of 85.3 out of 100, which was considered at the high side as compared with CPMS score of the previous contract for Transmission Substation Project, which was not managed under partnering approach.

Table 6-1. Performance of partnering projects

Areas	Performance
Safety	Attained 20 Safety awards
Cost saving	All projects were completed within budget and the five projects and attainted HKD 23.6 million savings
Share Gain	HKD2.8 million resulted from effective risk management
Schedule	All projects were completed and handed over on time Partial access to fast track the progress
Environment	Obtained 3 environment related Awards: • Water-wise label (Class of Excellence) • Energy-wise label (Class of Good) • HK BEAM (Gold Award)
CPMS	Average score: 85.3 over the contracting period

6.4. Benefit of partnering

6.4.1. Survey results

The participants were requested to rate the perceived benefits of partnering based on their experiences on handling partnering projects in the Utility Company, in the five-point Likert scale (1 = Not Significant, 5 = Extremely Significant). The survey result is shown in Table 6-2.

Table 6-2. Survey result on the perceived benefits of partnering

	Benefits of partnering	Overall		Client		Contractor	
		Mean	Rank	Mean	Rank	Mean	Rank
1.	Development of long term business relationship	4.07	1	3.91	3	4.12	2
2.	Improved safety performance	4.00	2	4.00	1	4.18	1
3.	Faster construction time	3.96	3	3.82	4	4.06	5
4.	More responsive to the short-noticed emergency or changing project requirements	3.96	3	3.7	6	4.06	5
5.	Reduction in dispute / conflict	3.96	3	4.00	1	4.00	9
6.	Improved relationship amongst project participants	3.96	3	3.82	4	3.94	10
7.	Improved conflict resolution strategies	3.93	7	3.64	7	4.12	2
8.	Better productivity	3.89	8	3.55	9	3.82	15
9.	Reduction in monetary claims	3.75	9	3.64	7	4.12	2
10.	Increased opportunity for innovation and value engineering	3.75	9	3.27	17	3.76	18
11.	Achieving continuous improvements	3.75	9	3.27	17	3.65	20
12.	Sharing project risks more equitably	3.71	12	3.55	9	4.06	5
13.	Joint satisfaction amongst project participants achieved	3.71	12	3.45	12	3.88	13
14.	Reduction of engineering rework	3.70	14	3.4	14	3.88	14
15.	Knowledge sharing between stakeholders	3.68	14	3.27	17	3.94	10
16.	Reduction of paperwork	3.63	16	3.3	16	3.82	15

Benefits of partnering	Overall		Client		Contractor	
	Mean	Rank	Mean	Rank	Mean	Rank
17. Reduction of administrative cost due to elimination of defensive behaviour	3.61	17	3.55	9	4.06	5
18. End user satisfaction	3.61	17	3.36	15	3.94	10
19. Better design quality	3.57	19	3.00	22	3.53	22
20. Reduction in variations	3.54	20	3.45	12	3.82	15
21. Attaining cost saving	3.46	21	3.09	21	3.71	19
22. Better workmanship	3.39	22	3.18	20	3.59	21
Number (n)	28		11		17	
Kendall's Coefficient of Concordance (W)	0.189		0.224		0.193	
Level of significance	0.000		0.000		0.000	

6.4.2. Data Analysis

Kendall's coefficient of concordance (W) was adopted to measure the agreement of the survey reply within the individual client and contractor group. Attaining the level of significance of 0.05 represents a certain degree of agreement within the group. The higher agreement, the closer to the value of one. In contrast, the less agreement, the closer to the value of zero. Using standard SPSS package software, the Kendall's coefficient of concordance (W) for the ranking of benefits on partnering for the client and contractor group were found to be 0.224 and 0.193 respectively, while that for the whole group was 0.189, meaning that the null hypothesis that the participants' rating with a certain group are unrelated to each other was rejected at a 0.0001 significant level. Essentially, it is confirmed that there was certain agreement within each group of participants.

The Spearman rank correlation coefficient (r_s) was adopted to check the agreement between two groups of participants. If the Spearman rank correlation coefficient (r_s) is significant at the 0.05 level, it confirms that there is substantial agreement among the

participants between the two groups. The correlation coefficient (r_s) calculated by SPSS on the ranking of the benefits of partnering were 0.912 between the client and contractor group. Thus, the null hypothesis that there is no significant disagreement between the client and contractor groups has to be accepted. It can be concluded that there was a substantial agreement on the rankings of client and contractors at a 99% confidence level.

6.4.3. Discussion on survey result

As asserted by Chan et al. (2003a), the ranking procedure for the perceived benefits of partnering is a subjective assessment and attention should be put on the factors among the highest and lowest ranking, rather than on the absolute values of the mean score of each factors.

As confirmed by the analysis of the survey result, there is significant agreement on the ranking of the perceived benefits of partnering between the client and contractor group. Considering the overall ranking as indicted in Table 6-2, the top 3 benefits were "Development of long term business relationship", "Improved safety performance", "Faster construction time", "More responsive to the short-noticed emergency or changing project requirements", "Reduction in dispute / conflict" and "Improved relationship amongst project participants", which generally aligned with the findings reported by Chan et al. (2003a).

It was interesting to note that both the client group and the contractor group rated "Improved safety performance" as the most significant benefit. This result was well supported by the high safety performance with numerous safety awards obtained by the project participants under the partnering arrangement as shown in Table 6-1. This also reflected the Utility Company's effort and attention on promoting construction safety. Similarly, "Development of long term business relationship" was also rated as a significant benefit (third and second for the client and contractor group respectively), this benefits proved that the partnering process could nurture business relationship. Both the groups agreed that the partnering approach can facilitate a better time control since "Faster construction time" was ranked as fourth and fifth by the client and contractor group respectively.

However, some disparities on the ranking between the client and contractor group were observed. The client group ranked "Reduction in dispute / conflict" as one of the most significant benefits while the contractor group ranked it as ninth. This difference indicated that the perception on effectiveness of issue resolution mechanism under the partnering approach. Similar discrepancy was found in the ranking of "Improved relationship amongst project participants", the client group ranked it as fourth while the contractor group ranked it as tenth. Relatively, the perceived significance of the relationship improvement was lower in the contractor group. This difference might be due to the different expectation between the client and contractor groups on relationship improvement under the partnering approach.

6.5. Difficulties of partnering

6.5.1. Survey results

The participants were requested to rate the perceived difficulties of implementing partnering based on their experiences on handling partnering projects in the Utility Company, in the five-point Likert scale (1 = Not Significant, 5 = Extremely Significant). The survey result is shown in Table 6-3.

Table 6-3. Survey result of the perceived difficulties of implementing partnering

Difficulties of implementing partnering	Overall		Client		Contractor	
	Mean	Rank	Mean	Rank	Mean	Rank
1. Key subcontractors had not been included in the process	2.86	1	3.50	1	2.85	1
2. Parties did not have proper training on partnering approach	2.86	1	3.50	1	2.54	5
3. Parties had little experience with the partnering approach	2.86	1	2.88	8	2.5	7
4. Concept of partnering was not fully understood by participants	2.86	1	3.38	3	2.46	8
5. Uneven levels of commitment were found among project participants	2.77	5	3.38	3	2.43	11
6. Parties were faced with commercial pressure that compromised the partnering attitude	2.76	6	3.25	5	2.46	8
7. Parties failed to build a true relationship of trust	2.59	7	3.13	6	2.29	18
8. Many problems with plans and specifications from design consultants were found during the construction stage	2.57	8	2.50	13	2.62	3
9. Issues and problems were allowed to slide and escalate	2.52	9	2.88	8	2.31	15
10. Continuous improvement was difficult to maintain	2.5	10	2.25	19	2.64	2
11. Conflicts arose from misalignment of personal goals with project goals	2.5	10	2.88	8	2.29	18
12. Continuity of open and honest communication was not achieved	2.5	10	3.00	7	2.21	24

Difficulties of implementing partnering	Overall		Client		Contractor	
	Mean	Rank	Mean	Rank	Mean	Rank
13. The up-front time commitment for partnering was too demanding	2.43	13	2.13	21	2.62	3
14. Parties failed to understand how the partnering relationship would provide a competitive advantage	2.41	14	2.75	11	2.21	24
15. Parties refrained from establishing closer relationship to one another to avoid possible allegations of corruption	2.38	15	2.38	16	2.38	12
16. It was extremely costly and inefficient to align all organizations with every partnering undertaking	2.33	16	2.00	24	2.54	5
17. Dealing with large bureaucratic organizations impeded the effectiveness of partnering	2.33	16	2.38	16	2.31	15
18. Organizations were reluctant to change to an integrating culture	2.32	18	2.38	16	2.29	18
19. Parties were conditioned to the adversarial environment and were not comfortable with the perceived risk in trusting	2.29	19	2.00	24	2.46	8
20. Risks or rewards were not shared fairly	2.29	19	2.13	21	2.38	12
21. It was difficult to obtain and maintain organizational commitment	2.29	19	2.50	13	2.15	26
22. Fair profit motive was not fully understood/supported by project participants	2.23	22	2.00	24	2.36	14
23. Some participants did not accept partnering as a long-term way of doing business	2.23	22	2.63	12	2.00	29
24. Participants were conditioned in a win-lose environment	2.19	24	2.13	21	2.23	21
25. The owner and slave concept was alive in project	2.14	25	1.88	29	2.31	15
26. Top management just gave lip service to the partnering approach	2.14	25	2.00	24	2.23	21
27. The partnering relationship created a strong dependency on other partners	2.14	25	2.25	19	2.08	28
28. Design consultants and other consultants had not been included in the process	2.14	25	2.50	13	1.93	31
29. The parties failed to share information	2.05	29	1.75	30	2.23	21
30. Unfamiliarity or misunderstanding of partnering concepts by the senior management	2.00	30	2.00	24	2.00	30
31. Parties were over reliant on legal protection, advantages, and loopholes in the contract	1.9	31	1.50	31	2.15	26
Number (n)	28		11		17	
Kendall's Coefficient of Concordance (W)	0.177		0.218		0.197	
Level of significance	0.000		0.000		0.000	

6.5.2. Data Analysis

Kendall's coefficient of concordance (W) was adopted to measure the agreement of the survey reply within the individual client and contractor group. Attaining the level of significance of 0.05 represents a certain degree of agreement within the group. Using standard SPSS package software, the Kendall's coefficient of concordance (W) for the ranking of difficulties of partnering for the client group, contractor group and the overall result were found to be 0.218, 0.197 and 0.177 respectively, meaning that the null hypothesis that the participants' rating with a certain group are unrelated to each other was rejected at a 0.0001 significant level. Essentially, it is confirmed that there was certain agreement within each group of participants.

The Spearman rank correlation coefficient (r_s) was adopted to check the agreement between two groups of participants. The correlation coefficient (r_s) calculated by SPSS on the ranking of the benefits of partnering were 0.545 between the client and contractor group. Thus, the null hypothesis that there is no significant disagreement between the client and contractor groups has to be accepted. It can be concluded that there was a substantial agreement on the rankings of client and contractors at a 99% confidence level.

6.5.3. Discussion on survey result

In the overall perspective, the top four difficulties were "Key subcontractors had not been included in the process", "Parties had little experience with the partnering approach", "Concept of partnering was not fully understood by participants" and

"Parties did not have proper training on partnering approach", they all shared the same rating of 2.86. Despite the first one which was related to subcontractor involvement, the rest of the top four difficulties were related to the lack of experiences or understanding of partnering. Lacking of understanding on partnering concept could hinder the development of harmonious working relationship and team-work spirit among the project team, such situation may result in slipping back to the traditional adversarial working relationship, and proper training about partnering should be provided. However, the training about partnering provided to the project participants seemed to be insufficient as implied by the top rated difficulty "Parties did not have proper training on partnering approach".

Both the client group and the contractor group consistently rated "Key subcontractors had not been included in the process" as the top difficulty encountered. This essentially pointed the significance of involving all the key players across the supply chain into the partnering process. On the other hand, "Parties were over reliant on legal protection, advantages, and loopholes in the contract" was rated as the least significant difficulty and it implied that the participants perceived that each party was acting with equity and trust, with relatively little reference to the contact terms.

There were some disparities observed in the ranking between the client and contractor group. "It was extremely costly and inefficient to align all organizations with every partnering undertaking" got the most discrepancy on its ranking, the client group ranked it as twenty fourth while the contractors ranked it as the fifth. This major discrepancy might be attributed to the difference on resources dedicated to

implementing partnering. Conventionally, contractors might focus completing the project works as early as possible and then allocated resources to another project. Thus, contractor would find it difficult and inefficient to commit on implementing partnering, whose effect and the relationship building required certain period of time to take effect. This point was supported by the ranking difference on "The up-front time commitment for partnering was too demanding", whose ranking from the client and contractor group were twenty first and third respectively.

Similarly, "Continuity of open and honest communication was not achieved" was ranked as the seventh by the client group while the contractor group ranked it as the 24th. One possible cause for this difference was the conflict on agreeing final solution for some new project requirement raised during construction stage. In particular, the contractor might think that it was time consuming to get an agreement on final solution for new requirement requested by the Utility Company, who hadn't specified the expected budget for the new requirement due to internal procurement guideline but the contractor was requested to propose a solution and the associated cost higher than expected. Finally, it took rounds to get an agreement.

6.6. Values of partnering

To get qualitative comments from participants towards the values and overall performance of partnering, a focus group was arranged for the 28 identified participants. The participants were divided into three groups with both project stakeholders from the Utility Company and the contractor company. They were requested to provide comments regarding the values at project level and personal level as well as the overall

performance of the implemented partnering approach according to their hands-on experiences. They were allowed to discuss among the group mates for 15 minutes and presented the result afterwards. Their comments were then consolidated and classified into client group and contractor group as shown in Table 6-4 and Table 6-5.

Table 6-4. Client's comments on the value of implementing partnering

At project level	At personal level
● Better time control ● Better communication ● Enhanced relationship ● Attain higher Safety, Health, Environment and Quality standard ● Better upfront risk management	● Equity and freedom on exchanging ideas ● More cohesive working environment ● Encouraged to take initiatives

Table 6-5. Contractor's comments on the value of implementing partnering

At project level	At personal level
● More resources can be allocated from the mother company with the proven outstanding project outcomes ● Promote safety and environmental protection culture ● Healthy cash flow ● Better understanding on end-user requirements ● Better time control	● Sense of satisfaction ● More appreciations from mother company ● More personal achievement

6.6.1. Focus group result – values of partnering

The values of partnering in project level stated by participants from the Utility Company included "Better time control", "Better communication", "Enhanced relationship", "Attain higher Safety, Health, Environment and Quality standard" and "Better upfront risk management". The values "Better time control" and "Attain higher Safety, Health, Environment and Quality standard" aligned with the project data shown in Table 6-1. The value of "Better upfront risk management" might be attributed to the implemented Shared Risk Mechanism and the other two values "Better communication" and "Enhanced relationship".

The contractor group echoed that "Better time control" was the value gained through partnering. Other values named by the contractor group included "Promote safety and environmental protection culture", "Better understanding on end-user requirements" and "Healthy cash flow", and these values gained also led to another value of "More resources can be allocated from the mother company with the proven outstanding project outcomes"

In the personal level, the participants from the Utility Company named three values, including "Equity and freedom on exchanging ideas", "More cohesive working environment" and "Encouraged to take initiatives" while the contractor group though that "Sense of satisfaction", "More appreciations from mother company" and "More personal achievement" were the values gained under partnering approach.

6.7. Chapter Summary

This chapter assessed the applicability of partnering in the Utility Company by identifying the perceived benefits and values of partnering. The corresponding perceived difficulties were also identified. The top three perceived benefits identified were "Development of long term business relationship" (4.07), "Improved safety performance" (4.00) , "Faster construction time" (3.96), "More responsive to the short-noticed emergency or changing project requirements" (3.96), "Reduction in dispute / conflict" (3.96) and "Improved relationship amongst project participants" (3.96). The empirical project data showed that partnering projects performed well in various aspects including safety (attained 20 awards), cost (HKD 23.6 million savings and HKD 2.8 million share gain to the Utility Company), schedule (all projects were completed on time), environment (obtained 3 awards) and contract performance score (higher average score than non-partnering project). The empirical project data supported that partnering is beneficial to the Utility Company.

The difficulties encountered by the participants were also identified for facilitating successful partnering implementation in the future. The major difficulties identified included "Key subcontractors had not been included in the process" (2.86), "Parties had little experience with the partnering approach" (2.86), "Concept of partnering was not fully understood by participants" (2.86) and "Parties did not have proper training on partnering approach" (2.86). These areas should be addressed in the outset of implementing partnering.

Chapter 7. The Essential Partnering Tools for Nurturing Partnering Spirit

7.1. Introduction

After assessing the applicability of partnering in the Utility Company, this Chapter aims at identifying the essential partnering tools for nurturing partnering spirit. Specifically, the partnering attributes advocated and the corresponding partnering tools adopted by the Utility Company were identified, as shown in Table 7-1, for participants to rate the effectiveness of the partnering tools in nurturing each partnering attribute.

Table 7-1. The partnering tools adopted and the partnering attributes

Partnering tools	Partnering attributes
1. Shared Risk Mechanism 2. Performance-based Incentive Scheme 3. 3-layers Governance Structure 4. Regular PLT Meetings 5. Regular PMT Meetings 6. Regular WIPT Meetings 7. Issue Resolution Mechanism 8. Partnering Charter 9. Joint Performance Measurement 10. Partnering Workshops	1. Mutual Objectives 2. Honesty /Openness/ Integrity 3. Effective communication / Understanding partner's needs 4. Collaboration-oriented / Win-Win Attitude 5. Mutual Trust

7.2. Survey result

The participants were requested to rate the effectiveness of the 10 identified partnering tools on nurturing each of the partnering attributes based on their experiences on handling partnering projects in the Utility Company, in the five-point Likert scale (1 = Not effective, 5 = Extremely effective). The survey result is shown in Table 7-2.

7.3. Data analysis

Kendall's coefficient of concordance (W) was adopted to measure the agreement of the survey reply within the individual client and contractor group. Attaining the level of significance of 0.05 represents a certain degree of agreement within the group. Using standard SPSS package software, the Kendall's coefficient of concordance (W) for the ranking of effectiveness of the partnering tools of the client and contractor group for each partnering attributes were shown in Table 7-2. All the computed Ws were significant at the level of 0.000, meaning that the null hypothesis that the participants' ratings within a certain group are unrelated to each other was rejected. Essentially, it is confirmed that there was certain agreement within each group of participants.

The Spearman rank correlation coefficient (rs) was adopted to check the agreement between two groups of participants. The correlation coefficient (rs) calculated by SPSS on the ranking of the effectiveness of partnering tools on each partnering attitude between the client and contractor group were shown in Table 7-2. They were all found to be significant at level of 0.01. Thus, the null hypothesis that there is no significant disagreement between the client and contractor groups has to be accepted. It can be concluded that there was a substantial agreement on the rankings of client and contractors at a 99% confidence level.

Table 7-2. Survey result on effectiveness of partnering tools

Partnering Attribute / Partnering Tools	Developing mutual objectives			Developing honesty and openness			Developing effective communication/ mutual understanding			Developing collaborative / Win-Win attitude			Developing mutual Trust			Overall Average	Client Overall Average	Contractor Overall Average
	Overall	Client	Contractor	Overall	Client	Contractor	Overall	Client	Contractor	Overall	Client	Contractor	Overall	Client	Contractor			
Shared Risk Mechanism	3.92	3.78	4.00	3.60	3.11	3.88	3.72	3.56	3.81	3.73	3.56	3.82	3.80	3.44	4.00	**3.75**	3.49	3.90
Performance-based Incentive Scheme	3.60	3.44	3.69	3.36	3.11	3.50	3.64	3.44	3.75	3.58	3.56	3.59	3.44	3.00	3.69	**3.52**	3.31	3.64
3-layers Governance Structure	3.64	3.89	3.50	3.64	3.78	3.56	3.88	4.11	3.75	3.80	3.78	3.81	3.73	3.89	3.65	**3.74**	3.89	3.65
Regular PLT Meetings	3.83	3.89	3.80	3.96	3.89	4.00	3.88	3.89	3.87	3.83	3.78	3.87	3.92	4.00	3.88	**3.88**	3.89	3.88
Regular PMT Meetings	3.88	3.78	3.93	3.75	3.56	3.87	3.92	4.00	3.87	3.96	3.89	4.00	3.88	4.00	3.80	**3.88**	3.85	3.89
Regular WIPT Meetings	3.42	3.22	3.53	3.58	3.33	3.73	3.68	3.44	3.81	3.50	3.33	3.60	3.42	3.44	3.40	**3.52**	3.35	3.61
Issue Resolution Mechanism	3.88	4.00	3.81	3.88	4.00	3.81	3.60	3.78	3.50	3.81	4.11	3.65	3.80	3.67	3.88	**3.79**	3.91	3.73
Partnering Charter	3.28	2.78	3.56	3.36	2.67	3.75	3.44	2.89	3.75	3.32	2.67	3.69	3.35	2.44	3.82	**3.35**	2.69	3.71
Joint Performance Measurement	3.44	3.44	3.44	3.48	3.33	3.56	3.56	3.44	3.63	3.48	3.22	3.63	3.46	3.00	3.71	**3.48**	3.29	3.59
Partnering Workshops	3.79	3.75	3.81	3.75	3.63	3.81	3.75	3.75	3.75	3.83	3.63	3.94	3.88	3.63	4.00	**3.80**	3.68	3.86
W	0.254	0.244	0.248	0.263	0.254	0.267	0.233	0.238	0.249	0.256	0.254	0.276	0.254	0.244	0.248			
r_s		0.955			0.972			0.969			0.975			0.959				

Note:
Number (n) Overall = 28, Client = 11, Contractor = 17
W : Kendall's Coefficient of Concordance *H*0 : participants' ratings are unrelated to each other within each group
r_s : Spearman rank correlation coefficient

7.4. Discussion of survey result

Those partnering tools, rated as top 3 in nurturing each of the 5 partnering spirits, were Regular PLT (Project Leadership Team) Meetings, Regular PMT (Project Management Team) Meetings, Partnering Workshops, Issue Resolution Mechanism, Shared Risk Mechanism and 3-layers Governance Structure. These tools were considered as the essential partnering tools for nurturing partnering spirit in general, as highlighted in Table 7-2.

Specifically, Regular PMT Meetings was considered as the most essential partnering tools, it was rated as the top 3 most effective tool for nurturing all the 5 partnering attributes. In particular, it was rated as the most effective tool for "Developing effective communication/ mutual understanding" and "Developing collaborative / Win-Win attitude". The PMT consists of middle management from both parties, including project managers and senior engineers, who focus on resolving project issues and implementing follow-up actions derived from the Project Leadership Team. Apart from monitoring the partnering and project performance, the Project Management Team also acted as a role model demonstrating and promoting partnering spirit for the frontline as well as the internal stakeholders of the respective organizations. Essentially, this result implied that interaction at the middle management level is critical to developing partnering spirit.

Sharing the same overall rating with the Regular PMT rating, the Regular PLT was also considered as the most essential partnering tool, which was rated as the most effective tool in “Developing honesty and openness” and “Developing mutual Trust”. Project Leadership Team, consisting of the senior management of both the contracting parties, played a leadership role throughout the course of the partnering implementation. Project Leadership Team was mainly responsible for providing necessary resources and guidelines for the project team, maintaining and developing inter-firm relationship, and exploring business opportunities. It also serves as the final point for issues resolution. This result suggested that the guidance and the business atmosphere set up by the senior management are important to nurturing partnering spirit.

Being rated as the second effective partnering tool in the overall perspective, Partnering Workshops were rated as the top 3 effective tool for “Developing honesty and openness”, “Developing collaborative / Win-Win attitude” and “ Developing mutual trust”. Partnering workshops can facilitate the project stakeholders to understand the partnering principles and understand each other and build up friendship among the project participants. This characteristic makes partnering different to the traditional project management approach. The middle or top management should also join the workshop as role models of exercising partnering attitudes. An interim partnering workshop should be held in the midway of the

project, focusing on reviewing the partnering performance, correcting feedback from the participants regarding partnering implementation and identifying improvement areas. A final workshop should be held upon the completion of a project for an overall review and capturing the lesson learnt for continuous purpose.

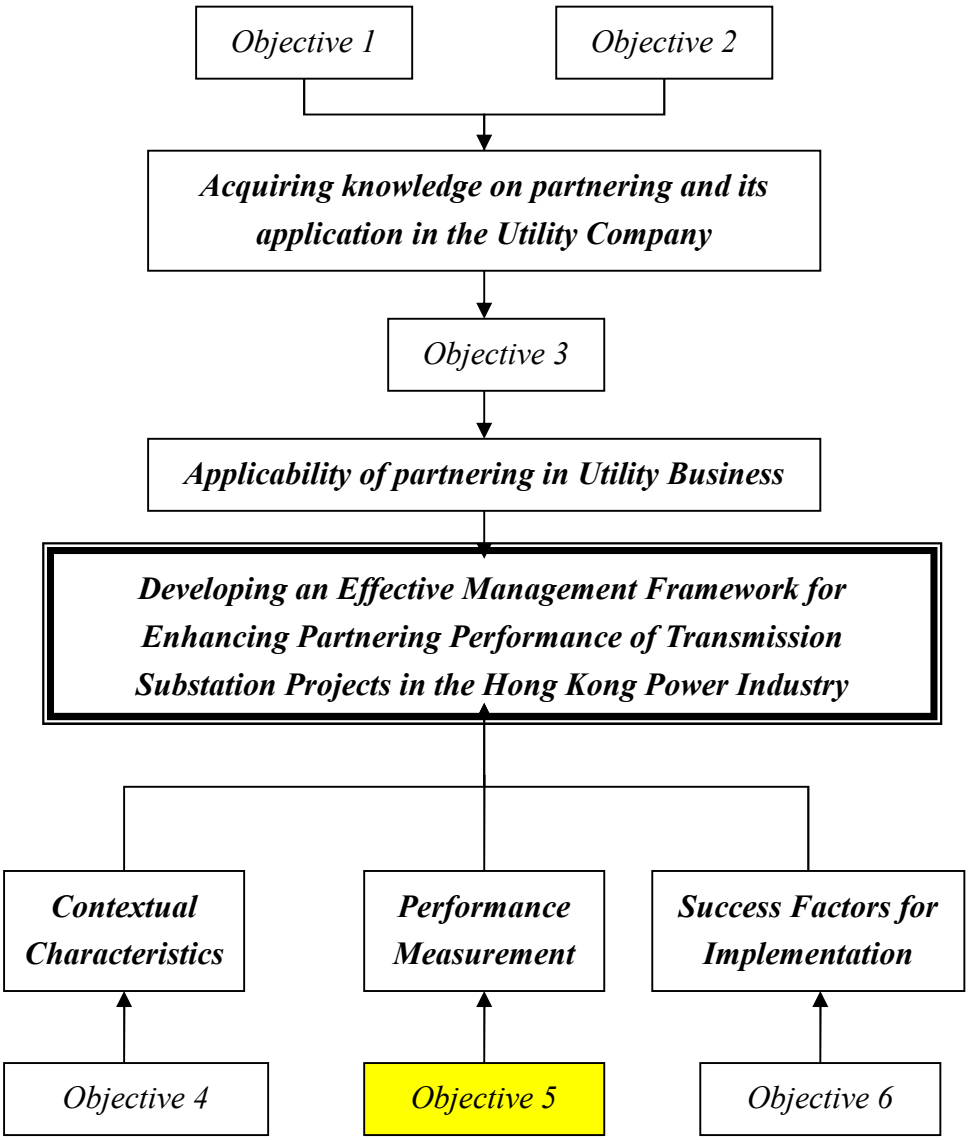
Issue Resolution Mechanism was rated as the third effective partnering tool in the overall perspective. It was also rated as the top 3 effective tool for "Developing mutual objectives", "Developing honesty and openness" and "Developing collaborative / Win-Win attitude". This result indicated that resolving issue effectively can avoid prolonged conflict and negative interaction among the participants, and on the other hand, can facilitate development of partnering attitude.

The 3-layers Governance Structure was rated as the top 3 effective tool for "Developing effective communication/ mutual understanding", this revealed that communication should be structurally maintained at each level along the organization hierarchy, by which the specific concerns regarding project and partnering issues at each level can be effectively addressed. The Shared Risk Mechanism was rated as the most effective tool for "Developing mutual objectives". This result implied that a fair and agreed risk allocation is critical to setting a partnering friendly business environment for developing partnering attribute as it

can demonstrate, especially to the contractor that partnering is not a lip service and the project risks are properly allocated and shared in an agreed and open manner.

7.5. Chapter Summary

This chapter evaluated the effectiveness of the partnering tools adopted by the Utility Company. The essential partnering tools in nurturing partnering spirit included Regular PMT Meetings (3.88), Regular PLT Meetings (3.88), Partnering Workshops (3.8), Issue Resolution Mechanism (3.79), Shared Risk Mechanism (3.75) and the 3-layers Governance Structure (3.74). The effectiveness of the partnering tools in nurturing specific partnering attributes had also been evaluated. It was found that that Regular PMT Meetings was among the top 3 effective partnering tools for nurturing the five partnering attributes.


Objective 1
Objective 2
Acquiring knowledge on partnering and its application in the Utility Company
Objective 3
Applicability of partnering in Utility Business
Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry
Contextual Characteristics
Performance Measurement
Success Factors for Implementation
Objective 4
Objective 5
Objective 6

Chapter 8. Partnering Performance Measurement

8.1. Introduction

This chapter aims to develop a set of reliable and objective Key Performance Indicators (KPIs) for measuring partnering performance. A conceptual framework of common KPIs adopted for measuring partnering project is first presented, followed by the survey results of the selection of KPIs, determination of selected KPIs weighting, exploring and selection of quantitative indicators for each selected KPI and, finally, the determination of quantitative measurement range for each identified indicator.

8.2. Panel member selection

In order to get a holistic view on how to measure partnering performance, a purposive approach (Chan et al. 2001) is adopted for selecting panel members. Two groups of experts will be invited to join the Delphi survey. For the client perspective, those engineers or managers who have managed one or more partnering projects were invited; for the contractor perspective, those contractors including project managers, consultant and architect, who have managed the partnering projects, were invited.

8.3. Participant profile and response rate

Since the selection of panel members is critical to the success of the Delphi method (Chan et al. 2001), not all the project stakeholders from the Utility Company and the contractors company were invited to participate in the survey. Instead, only those who had three years of more experiences of managing partnering projects (Transmission Substation Project) in the Utility Company were invited to participate in the survey. Following this criteria, there were 12 participants identified. The corresponding organizational and positional demography is shown in

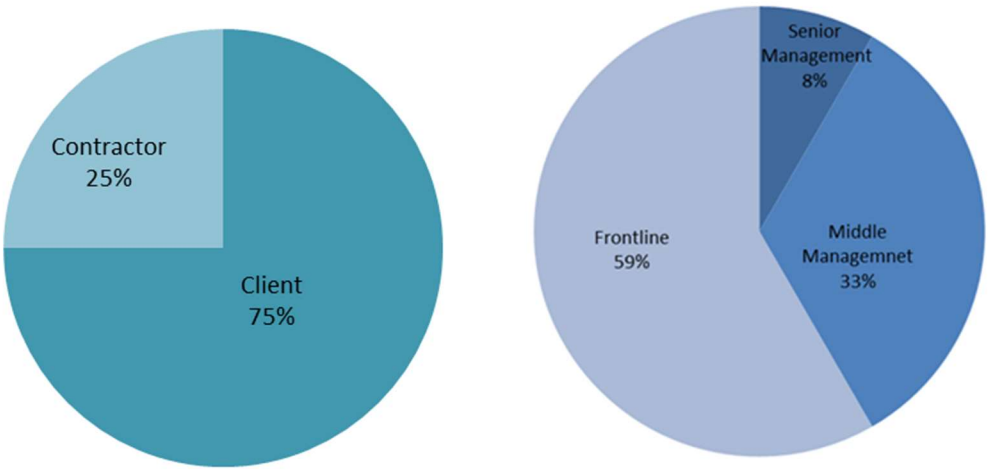


Figure 8-1. The organizational and positional demography of the participants

Since the research was taken under a Teaching Company Scheme (Chan et al. 2011), the Utility Company fully supported the research and researcher was the employee of the Utility Company, his personal network facilitated a response rate of 100% to the survey.

8.4. Stage 1: Formulation of Conceptual framework of KPIs

A list of common KPIs adopted for measuring partnering performance was formulated through reviewing the previous related studies (Bayliss et al. 2004; Chan et al. 2006; Chan 2004; Chan et al. 2001; Cheng et al. 2000; Cheung et al. 2003c; Crane et al. 1999; Yeung 2007). In order to develop a conceptual model of KPIs suiting the context of the Utility Company, those KPIs adopted by the Utility Company were also included in the list as shown in Table 8-1.

Since the KPIs only indicated the issue or area to be measured but not the actual measurement, the identified 26 KPIs were consolidated by grouping those KPIs with similar meanings. “Client’s satisfaction”, “Customer’s satisfaction” and “Job satisfaction” were grouped into “Stakeholder Satisfaction”. “Scope of rework” was combined with “Quality performance”, and “Pollution occurrence” was combined with “Environmental performance”. “Litigation occurrence and magnitude”, “Dispute occurrence and magnitude” and “Claim occurrence and magnitude” were grouped into “Dispute occurrence”. “Trust and

Respect" was grouped into 'Harmonious working relationships". "Productivity" was grouped into "Efficiency". Finally, a list of 16 KPIs was consolidated. The KPIs were further grouped into four categories: result-oriented objective measures; result-oriented subjective measures; relationship-oriented objective measures and relationship-oriented subjective measures as shown in Figure 8-2.

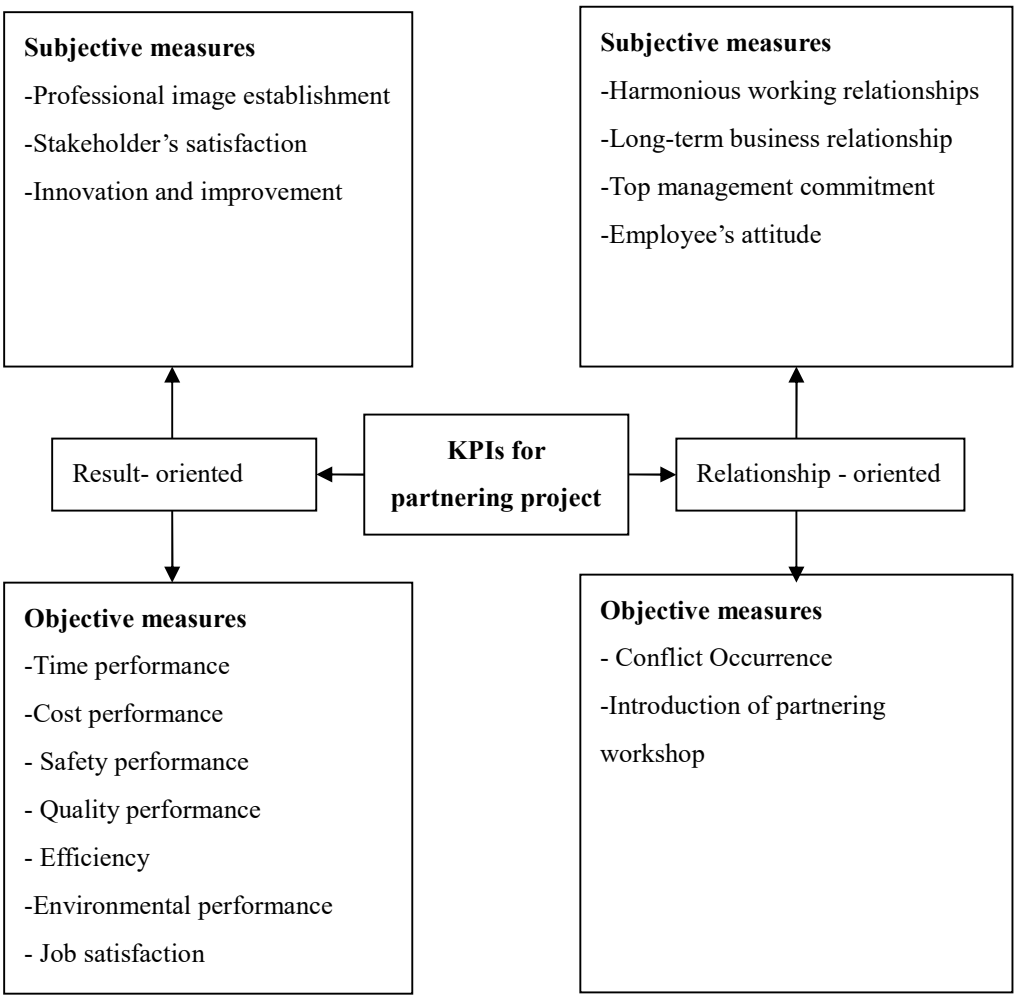


Figure 8-2. The conceptual framework of KPIs for partnering projects. Adopted from Yeung et al. (2007b)

Table 8-1. Summary of literature review on KPIs for partnering projects

KPIs for partnering projects	(Crane et al. 1999)	(Cheng et al. 2000)	(Chan et al. 2001)	(Zhao 2002)	(Cheung et al. 2003c)	(Bayliss et al. 2004)	(Chan et al. 2006; 2004)	(Yeung et al. 2007b)	(Yeung et al. 2009)	Adopted in the Utility Company
1. Construction time/Time variation/ Programme	✓		✓	✓	✓	✓	✓	✓	✓	✓
2. Cost/Budget	✓		✓	✓	✓	✓	✓	✓	✓	✓
3. Quality	✓		✓		✓	✓	✓	✓	✓	✓
4. Claims occurrence/magnitude			✓		✓	✓	✓			
5. Effective communication	✓			✓	✓	✓		✓	✓	
6. Accident/Incidence rate/Safety	✓				✓	✓	✓		✓	✓
7. Environmental complains				✓	✓	✓	✓			✓
8. Trust and respect	✓			✓	✓			✓	✓	
9. Harmonious working relationship		✓	✓							
10. Litigation occurrence/magnitude	✓						✓			
11. Dispute occurrence/magnitude			✓				✓			
12. Customer/stakeholders satisfaction		✓		✓					✓	✓
13. Profit and financial objectives				✓						
14. Scope of rework	✓									
15. Productivity				✓						
16. Innovation and improvement				✓				✓	✓	✓
17. Environmental incidence occurrence							✓			✓
18. Professional/positive image establishment							✓			✓
19. Employee's attitude				✓						
20. Top management commitment								✓		
21. Client's satisfaction								✓		
22. Job satisfaction								✓		
23. Introduction of partnering workshop								✓		
24. Long-term business relationship								✓		
25. Reduction of paper work								✓		
26. Knowledge sharing with stakeholders										✓
KPI identified	8	2	6	10	8	7	10	12	8	10

8.5. Stage 1: Four rounds of Delphi Survey

8.5.1. Round 1 of the Delphi Survey

8.5.2. Format

The participants were asked to select 5 to 10 KPIs from the list of 16 KPIs, which they believed were important for measuring the success of partnering projects in the Utility Company. They were also encouraged to suggest suitable KPIs if deemed necessary. The survey was sent to the participants via email. All the responses were received in 1 week time.

8.5.3. Result

The result of the round 1 survey is listed in Table 8-2. Following the criteria adopted by Chan et al. (2001) and Yeung et al (2007b), only those KPIs selected by 50% or more participants would be selected for further analysis. There were 11 KPIs with 50% or more participants selected, which included (1) Top management commitment, (2) Long-term business relationships, (3) Time performance, (4) Cost performance, (5) Innovation and improvement, (6) Harmonious working relationships, (7) Stakeholder's satisfaction, (8) Efficiency, (9) Safety performance, (10) Employee's attitude and (11) Quality performance. There were two KPIs suggested by the participants, including (1) Risk Management and (2) Award recognition. The overall result is shown in Table 8-2.

Table 8-2. Round 1 survey result

KPIs	% of participants selected in round 1
Top management commitment	79%
Long-term business relationships	79%
Time performance	71%
Cost performance	71%
Innovation and improvement	71%
Harmonious working relationships	64%
Stakeholder's satisfaction	64%
Efficiency	57%
Safety performance	57%
Employee's attitude	50%
Quality performance	50%
Conflict Occurrence	36%
Environmental performance	36%
Job satisfaction	14%
Introduction of partnering workshop	14%
Professional image establishment	0%
Risk Management	
Referring to the effort on identification of project risk, assisting risk owners and action owners to monitor, implement and review risk mitigation measures on a monthly basis	Newly Proposed by the participants
Award Recognition	
Referring to the recognized award or certificate obtained by the project team, e.g. Quality Building Award, Safety Award, Considerate Site Award	Newly Proposed by the participants

8.5.4. Round 2 of the Delphi Survey

8.5.5. Format

Similar to round 1, the participants were asked to reconsider the selection of 5 to 10 KPIs from the list of 18 KPIs. The overall result in round 1 and the individual participant's choice in round 1 were presented in the survey for participants' reference. The survey was sent to the participants via email. All the responses were received in 1 week time.

8.5.6. Result

The result of round 2 Delphi Survey is shown in Table 8-3. Number of eligible KPIs was reduced from 11 in round 1 to 8 in round 2. Those KPIs dropped out in round 2 included (1) Efficiency, (2) Employees' attitude and (3) Quality performance. The 8 KPIs, with 50% or more participants selected, were: (1) Top management commitment, (2) Long-term business relationships, (3) Time performance, (4) Cost performance, (5) Innovation and improvement, (6) Harmonious working relationships, (7) Safety performance and (8) Stakeholder's satisfaction.

Table 8-3. Round 2 survey result

KPIs	% of participants selected in round 2
Top management commitment	93%
Long-term business relationships	86%
Time performance	79%
Cost performance	79%
Innovation and improvement	79%
Harmonious working relationships	71%
Safety performance	71%
Stakeholder's satisfaction	50%
Efficiency	36%
Quality performance	36%
Award Obtained by the team	36%
Conflict Occurrence	29%
Risk Management	29%
Employee's attitude	21%
Job satisfaction	14%
Environmental performance	7%
Introduction of partnering workshop	7%
Professional image establishment	0%

8.5.7. Round 3 of the Delphi Survey

8.5.8. Format

In round 3, the participants were requested to rate the importance of the 8 selected KPIs on measuring success of partnering projects in the Utility Company in the 5-point Likert Scale (1 = least important, 2 = slightly important, 3 = important, 4 = very important, 5 = most

important). The survey was sent to the participants via email. All the responses were received in 2 weeks' time.

8.5.9. Result

The result of round 3 Delphi Survey is shown in Table 8-4. Ratings of the 8 KPIs were, in descending order, Top management commitment (4.67), Long-term business relationships (4.67), Cost Performance (4.27), Time Performance (3.87), Safety performance (3.80), Harmonious working relationships (3.60), Stakeholder's satisfaction (3.40) and Innovation and improvement (3.13).

Table 8-4. Round 3 survey result

KPI	**Round 3** Average Score
Top management commitment	4.67
Long-term business relationships	4.67
Cost performance	4.27
Time performance	3.87
Safety performance	3.80
Harmonious working relationships	3.60
Stakeholder's satisfaction	3.40
Innovation and improvement	3.13

8.5.10. Round 4 of the Delphi Survey

8.5.11. Format

Similar to round 3, the participants were asked to reconsider the rating of the importance of the 8 selected KPIs on measuring success of partnering projects in the Utility Company in the 5-point Likert Scale. The average rating of each KPI and the individual participant's rating in round 3 were presented in the round 4 survey for participants' reference. The survey was sent to the participants via email. All the responses were received in 1 week time.

8.5.12. Result

The result of round 4 Delphi Survey is shown in Table 8-5. Ratings of 4 KPIs were changed as compared with that in round 3. The ratings of the 8 KPIs, in descending order, were Long-term business relationships (4.80), Top management commitment (4.60), Cost Performance (4.40), Time Performance (3.80), Safety performance (3.80), Harmonious working relationships (3.60), Stakeholder's satisfaction (3.40) and Innovation and improvement (3.13). The weighting of each KPIs were also calculated based on the following formula:

$$\text{Weighting of each KPI} = \frac{\text{Mean rating of individual KPI}}{\text{Sum of the mean rating of all the selected KPIs}}$$

The weightings of the 8 KPIs are shown in Table 8-5. After obtaining the weightings of each KPIs, a Partnering Project Performance Index specific to the Utility Company was formulated as shown below:

Partnering Project Performance Index *= 0.152 x Long-term business relationships + 0.146 x Top management commitment + 0.14 x Cost performance + 0.121 x Time performance + 0.121 x Safety performance + 0.114 x Harmonious working relationships + 0.108 x Stakeholder's satisfaction + 0.098 x Innovation and improvement*

Table 8-5. Round 4 survey result

KPI	Round 4 Average Score	Weighting
Long-term business relationships	4.80	15.2%
Top management commitment	4.60	14.6%
Cost performance	4.40	14.0%
Time performance	3.80	12.1%
Safety performance	3.80	12.1%
Harmonious working relationships	3.60	11.4%
Stakeholder's satisfaction	3.40	10.8%
Innovation and improvement	3.13	9.8%

8.6. Stage 2: Survey for exploring potential quantitative indicators

8.6.1. Format

After identifying the weighting of each KPIs, the participants were requested to propose quantitative indicators which they believe are suitable to measure the corresponding KPIs. The participants were requested to suggest one to three quantitative indicators for measuring each KPI. The survey was sent to the participants via email and all the response were received in 2 weeks' time.

8.6.2. Result

8.6.3. Quantitative Indicators for Long-term Business Relationships

6 quantitative indicators QI were suggested by the participants to measure Long-term business relationship as shown in Table 8-6. The QIs "Number of team building events", "Number of joint function arranged in a year" and "Number of participation to each other's event", shared with similar meanings, were combined and rephrased as "Number of joint events organized in a year". The remaining 3 QIs were kept unchanged and there were 4 QIs identified.

Table 8-6. Proposed Quantitative Indicators for Long-term business relationships

KPI 1: Long-term business relationships	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Subjective assessment on SHEQ, support, delivery, cost/commercial and maturity in a 1-10 scale	QI1. Subjective assessment on SHEQ performance, support, delivery, cost/commercial and maturity in a 1-10 scale
QI2. Number of claims per active project	QI2. Number of claims per active project
QI3. Number of projects the contractor has worked with the clients	QI3. Number of projects the contractor has worked with the clients
QI4. Number of team building events QI5. Number of joint function arranged in a year QI6. Number of participation to each other's event	QI4. Number of joint events organized in a year
Note: - QI4,QI5 and QI6 were combined due to their similar meaning - "SHEQ" means Safety, Health, Environment and Quality	

8.6.4. Quantitative Indicators for Top Management Commitment

5 quantitative indicators (QI) were suggested by the participants to measure Top Management Commitment. The QI "Contractor senior management conducts management audits for each active project in a year" was rephrased to "Number of management audits conducted by the senior management for each active project in a year". The QIs "Participation rate of senior management attending joint management meeting/forum" and "Number of meetings held amongst top management of both companies" were combined due

to their similar meanings. The remaining 2 QIs were kept unchanged and there were 4 QIs identified as shown in Table 8-7.

Table 8-7. Proposed Quantitative Indicators for Top Management Commitment

KPI 2: Top Management Commitment	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Subjective assessment say on a 1-10 scale	QI1. Subjective assessment say on a 1-10 scale
QI2. Contractor senior management conducts management audits for each active project in a year	QI2. Number of management audits conducted by the senior management for each active project in a year
QI3. Financial resources spent on partnering development expressed as a percentage of total project cost	QI3. Financial resources spent on partnering development expressed as a percentage of total project cost
QI4. Participation rate of senior management attending joint management meeting/forum QI5. Number of meetings held amongst top management of both companies	QI4. Top management participation rate of attending joint management meetings/events
Note: - QI2 was reparsed - QI4 and QI5 were combined due to their similar meaning	

8.6.5. Quantitative Indicators for Cost Performance

With the similar approach adopted, the 8 quantitative indicators (QI) suggested by the participants to measure Cost Performance were consolidated to 4 QIs finally as shown in Table 8-8.

Table 8-8. Proposed Quantitative Indicators for Cost Performance

KPI 3: Cost Performance	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Cost variation expressed as a % to the Target Cost QI2. Variation against contract price QI3. Magnitude of VO as compared to previous similar items	QI1. Cost variation expressed as a % to the Target Cost
QI4. Number of value engineering proposal generated per project QI5. Total saving generated through value engineering	QI2. Cost saving generated per project through value engineering
QI6. Number of disputes/claims per each project QI7. Accumulative number of claims submitted	QI3. Accumulated no of claims raised per each project
QI8. Reduction in overhead and project administration costs	QI4. Reduction in overhead and project administration costs
Note: - QI1, QI2 and QI3 were combined due to their similar meaning - QI4 and QI5 were combined due to their similar meaning - QI6 and QI7 were combined due to their similar meaning	

8.6.6. Quantitative Indicators for Time Performance

With the similar approach adopted, the 5 quantitative indicators (QI) suggested by the participants to measure Time Performance were consolidated to 3 QIs finally as shown in Table 8-9.

Table 8-9. Proposed Quantitative Indicators for Time Performance

KPI 4: Time Performance	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Time variation expressed as a percentage to the Target Project Duration QI2. Delay of work completion QI3. Request of Extension of Time	QI1. Time variation expressed as a percentage to the Target Project Duration
QI4. Agreed work completion time is shorter than the market norm	QI2. Agreed work completion time is shorter than the market norm
QI5. Number of predefined project milestones achieved in a year	QI3. Number of predefined project milestones achieved in a year
Note: - QI1, QI2 and QI3 were combined due to their similar meaning	

8.6.7. Quantitative Indicators for Safety Performance

With the similar approach adopted, the 6 quantitative indicators (QI) suggested by the participants to measure Safety Performance were consolidated to 4 QIs finally as shown in Table 8-10.

Table 8-10. Proposed Quantitative Indicators for Safety Performance

KPI 5: Safety Performance	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Leading indicators e.g. no. of training, BBSO and safety audit conducted	QI1. Number of safety related activity conducted e.g. training, BBSO or safety audit
QI2. Lagging indicators e.g. no. of Non Compliance (NC) case QI3. Performance in terms of incident indicators e.g. Disabling Injury (DI) incident QI4. Number of reported SHE related incident	QI2. Number of reported SHE related incident e.g. DIIR, NC Case
	QI3. Number of safety related awards received
QI5. Number of safety related awards received QI6. Performance rated by independent safety auditor	QI4. Performance rated by independent safety auditor
Note: - QI1was rephrased - QI2, QI3 and QI4 were combined due to their similar meaning - "BBSO" means Behavioral Based Safety Observation, which is a safety improvement initiatives implemented in the Utility Company	

8.6.8. Quantitative Indicators for Harmonious Working Relationships

With the similar approach adopted, the 8 quantitative indicators (QI) suggested by the participants to measure Harmonious Working Relationships were consolidated to 4 QIs finally as shown in Table 8-11.

Table 8-11. Proposed Quantitative Indicators for Harmonious Working Relationships

KPI 6: Harmonious Working Relationships	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Subjective assessment on a 1-10 scale QI2. Scores by project participants in monthly partnering survey	QI1. Subjective assessment on a 1-10 scale
QI3. No of non-business related events organized for the work team QI4. No of sharing in know-how QI5. No of sharing on industry/technology trends	QI2. No of non-project related events organized for the work team
QI6. Percentage change on the amount of formal correspondence issued from both parties as compared to that of pervious year	QI3. Percentage change on the amount of formal correspondence issued from both parties as compared to that of pervious year
QI7. Time required to resolve a dispute QI8. Effective use of dispute escalation mechanism e.g. how quick in resolving issues	QI4. Time required to resolve a dispute
Note: - QI1 and QI2 were combined due to their similar meaning - QI3, QI4 and QI5 were combined due to their similar meaning - QI7 and QI8 were combined due to their similar meaning	

8.6.9. Quantitative Indicators for Stakeholder's Satisfaction

With the similar approach adopted, the 7 quantitative indicators (QI) suggested by the participants to measure Stakeholder's Satisfaction were consolidated to 4 QIs finally as shown in Table 8-12.

Table 8-12. Proposed Quantitative Indicators for Stakeholder's Satisfaction

KPI 7: Stakeholder's Satisfaction	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Subjective assessment say on a 1-10 scale QI2. Customer feedback	QI1. Subjective assessment say on a 1-10 scale
QI3. No of complaints from project stakeholders QI4. No of appreciation from project stakeholders QI5. Average number of non-conformance reports generated per month	QI2. Number of complaint/appreciation from project stakeholders
QI6. Number of initiatives with cost saving to partnering companies	QI3. Number of initiatives with cost saving
QI7. Reduction of defects as compared with other similar projects	QI4. Reduction of defects as compared with other similar projects
Note: - QI1 and QI2 were combined due to their similar meaning - QI3, QI4 and QI5 were combined due to their similar meaning	

8.6.10. Quantitative Indicators for Innovation and Improvement

The 4 quantitative indicators (QI) suggested by the participants to measure Innovation and Improvement were adopted as shown in Table 8-13.

Table 8-13. Proposed Quantitative Indicators for Innovation and Improvement

KPI 8: Innovation and Improvement	
Proposed Quantitative Indicators (QI)	**Consolidated Quantitative Indicators (QI)**
QI1. Saving / benefits as derived from the innovations implemented expressed in the % of the total value of the project	QI1. Saving / benefits as derived from the innovations implemented expressed in the % of the total value of the project
QI2. Number of cost saving proposal	QI2. Number of cost saving proposal
QI3. Number of implemented SHEQ related initiatives	QI3. Number of implemented SHEQ related initiatives
QI4. Number of sharing session conducted	QI4. Number of joint-company sharing event
Note: - QI4 was rephrased - "SHEQ" means Safety, Health, Environment and Quality	

8.7. Stage 2: 2 rounds of Delphi Survey for quantitative indicators

8.7.1. Round 1 of Delphi Survey

8.7.2. Format

With the potential quantitative indicators (QI) identified for each KPIs, the next step was to evaluate the appropriateness of the QIs. To achieve this, each participant was requested to evaluate each QI in three dimensions, namely, importance, measurability and obtainability. The survey was conducted via email with an explanation of the survey objective provided. All the replies were received in 1 week time.

8.7.3. Result

The mean ratings of the quantitative indicators for each KPI against the dimension of importance, measurability and obtainability were computed. As shown in Table 8-14, the QIs with highest overall rating were: (1) "Number of projects the contractor has worked with the clients" (for Long-term Business Relationship) with overall rating of 4.56; (2) Top management participation rate of attending joint management meetings/events (for Top Management Commitment) with overall rating of 4.33; (3) "Cost variation expressed as a percentage to the Target Cost" (for Cost Performance) with overall rating of 4.11; (4) "Time variation expressed as a percentage to the Target Project Duration" (for Time Performance)

with overall rating of 4.10; (5) "Number of safety related activity conducted eg. training, BBSO or safety audit" (for Safety Performance) with overall rating of 4.36; (6) " Time required to resolve a dispute" (for Harmonious Working Relationships) with overall rating of 3.64; (7) "Number of cost saving initiatives" (for Stakeholders Satisfaction) with overall rating of 4.02: and (8) "Number of joint-company sharing event" (for Innovation and Improvement) with overall rating of 4.10.

8.7.4. Round 2 of Delphi Survey

8.7.5. Format

The mean ratings and the individual participant's rating round 1 were presented in the survey in round 2 for participants' reference and the participants were asked to reconsider the rating of the quantitative indicators of each KPIs in the 5-point Likert Scale based on the information provided. The round 2 survey was sent to each participant via email. All the replies were received in 1 week time.

8.7.6. Result

Most of the participants had adjusted their ratings in round 2. The highest ratings of QIs of 4 KPIs have changed as compared with that in round 1. The QI with highest rating for Cost Performance was changed from "Cost variation expressed as a percentage to the Target

Cost" to "Accumulated number of claims raised per each project" with mean rating of 4.25. The QI with highest rating for Time Performance was changed from "Time variation expressed as a percentage to the Target Project Duration" to "Number of predefined project milestones achieved in a year" with mean rating of 4.22. The QI with highest rating for Safety Performance was changed from "Number of safety related activity conducted eg. training, BBSO or safety audit" to "Number of reported SHE related incident e.g. DI or NC Case" with mean rating of 4.43. The QI with highest rating for Innovation and Improvement was changed from "Number of joint-company sharing event" to "Number of implemented SHEQ related initiatives" with mean rating of 4.23. The QI with the highest rating of the remaining 4 KPIs remained unchanged. The overall result of round 2 is shown in Table 8-15.

Table 8-14. Result of round 1 Delphi Survey on the quantitative indicators

Quantitative Indicators for Long-term Business Relationships	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment on the criteria – SHEQ, support, delivery, cost/commercial and maturity in a 1-10 scale	4.1	3.8	3.8	3.89
2. No. of disputes/claims per active project	3.8	4.2	4.2	4.06
3. No. of projects the contractor has worked with the clients	4.0	4.8	4.9	4.56
4. No. of joint events organised in a year	3.2	4.5	4.5	4.07
Quantitative Indicators for Top management Commitment	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment in a 1-10 scale	4.1	3.6	3.5	3.72
2. No. of management audits conducted by the senior management for each active project in a year	3.5	4.0	4.0	3.82
3. Financial resources spent on partnering development expressed as a percentage of total project cost	3.5	3.7	3.7	3.65
4. Top management participation rate of attending joint management meetings/events	4.2	4.3	4.5	4.33
Quantitative Indicators for Cost Performance	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Cost variation expressed as a % to the Target Cost	4.1	4.2	4.1	4.11
2. Cost saving generated per project through value engineering	4.4	3.7	3.5	3.84
3. Accumulated no of claims raised per each project	3.7	4.2	4.0	3.97
4. Reduction in overhead and project administration costs	3.4	3.1	3.3	3.24
Quantitative Indicators for Time Performance	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Time variation expressed as a % to the Target Project Duration	4.2	4.2	4.0	4.10
2. Agreed work completion time is shorter than the market norm	3.8	3.5	3.3	3.53
3. No. of predefined project milestones achieved in a year	3.9	4.2	4.1	4.08
Quantitative Indicators for Safety Performance	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. No. of safety related activity conducted eg. training, BBSO or safety audit	4.2	4.4	4.5	4.36
2. No. of reported SHE related incident e.g. DIIR, NC Case	4.5	4.3	4.3	4.35
3. Number of safety related awards received	3.8	4.3	4.2	4.11
4. Performance rated by independent safety auditor	4.0	4.2	4.1	4.08
Quantitative Indicators for Harmonious Working Relationship	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment in a 1-10 scale	4.1	3.2	3.4	3.56
2. No. of non-project related events organized for the work team	3.2	3.8	3.9	3.64
3. Percentage change on the amount of formal correspondence issued from both parties as compared to that of pervious year	2.9	3.6	3.5	3.36
4. Time required to resolve a dispute	4.0	3.5	3.5	3.64
Quantitative Indicators for Stakeholder Satisfaction	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment on a 1-10 scale	4.0	3.7	3.7	3.81
2. No. of complaint/appreciation from project stakeholders	3.8	4.1	4.1	3.98
3. No. of initiatives with cost saving	4.1	4.1	3.9	4.02
4. Reduction of no. of defects as compared with other similar projects	4.0	3.5	3.5	3.66
Quantitative Indicators for Innovation and Improvement	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Saving / benefits as derived from the innovations implemented expressed in the % of the total value of the project	4.1	3.9	3.6	3.88
2. No. of Value Engineering proposal	3.8	4.1	3.9	3.94
3. No. of implemented SHEQ related initiatives	3.8	4.2	4.2	4.09
4. No. of joint-company sharing event	3.7	4.2	4.4	4.10

Table 8-15. Result of round 2 Delphi Survey on the quantitative indicators

Quantitative Indicators for Long-term Business Relationships	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment on the criteria – SHEQ, support, delivery, cost/commercial and maturity in a 1-10 scale	4.2	4.0	4.0	4.08
2. No. of disputes/claims per active project	3.8	4.2	4.5	4.18
3. No. of projects the contractor has worked with the clients	3.9	4.7	4.8	4.48
4. No. of joint events organised in a year	3.2	4.5	4.4	4.02
Quantitative Indicators for Top management Commitment	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment in a 1-10 scale	4.2	3.7	3.5	3.82
2. No. of management audits conducted by the senior management for each active project in a year	3.5	4.0	4.2	3.91
3. Financial resources spent on partnering development expressed as a percentage of total project cost	3.6	3.9	4.0	3.85
4. Top management participation rate of attending joint management meetings/events	4.2	4.3	4.5	4.36
Quantitative Indicators for Cost Performance	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Cost variation expressed as a % to the Target Cost	4.2	4.2	4.3	4.22
2. Cost saving generated per project through value engineering	4.3	3.8	3.8	3.99
3. Accumulated no of claims raised per each project	3.9	4.5	4.4	4.25
4. Reduction in overhead and project administration costs	3.5	3.5	3.8	3.58
Quantitative Indicators for Time Performance	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Time variation expressed as a % to the Target Project Duration	4.2	4.2	4.1	4.16
2. Agreed work completion time is shorter than the market norm	3.9	3.6	3.6	3.72
3. No. of predefined project milestones achieved in a year	4.0	4.3	4.4	4.22
Quantitative Indicators for Safety Performance	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. No. of safety related activity conducted eg. training, BBSO or safety audit	4.2	4.5	4.5	4.38
2. No. of reported SHE related incident e.g. DIIR, NC Case	4.5	4.4	4.5	4.43
3. Number of safety related awards received	3.9	4.5	4.6	4.34
4. Performance rated by independent safety auditor	4.0	4.3	4.4	4.22
Quantitative Indicators for Harmonious Working Relationship	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment in a 1-10 scale	4.2	3.6	3.7	3.83
2. No. of non-project related events organized for the work team	3.4	3.8	4.1	3.77
3. Percentage change on the amount of formal correspondence issued from both parties as compared to that of pervious year	3.2	3.8	4.0	3.67
4. Time required to resolve a dispute	4.1	3.6	3.7	3.81
Quantitative Indicators for Stakeholder Satisfaction	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Subjective assessment on a 1-10 scale	4.1	3.8	3.8	3.89
2. No. of complaint/appreciation from project stakeholders	3.8	4.1	4.2	4.03
3. No. of initiatives with cost saving	4.2	4.2	4.3	4.22
4. Reduction of no. of defects as compared with other similar projects	4.1	3.9	3.9	3.97
Quantitative Indicators for Innovation and Improvement	**Importance**	**Measurability**	**Obtainability**	**Overall**
1. Saving / benefits as derived from the innovations implemented expressed in the % of the total value of the project	4.2	4.0	3.8	4.02
2. No. of Value Engineering proposal	3.9	4.2	4.3	4.14
3. No. of implemented SHEQ related initiatives	3.9	4.2	4.5	4.23
4. No. of joint-company sharing event	3.7	4.2	4.5	4.13

8.8. Stage 2: Determination of measurement range of each QI

After selecting a quantitative indicator, the next step was to operationalize the set of KPIs by determining the measurement range of each Quantitative Indicator (QI) against the commonly used performance level: Poor, Average, Good, Very Good and Excellent. To achieve this, a survey was conducted with the participants' to find out their expectation on the QIs against the 5 performance levels for determining the measurement range for each QIs.

8.8.1. Format

Each selected QI was listed against the 5 performance levels, and the participants were request to input a figure for each performance level, from Poor, Average, Good, Very Good to Excellent, for each QI. The survey was sent to the participants via email. All the replies were received in two weeks' time. Enquiries were received from some participants regarding the content of the survey. To make sure that the participants understand the aim of the survey, a follow-up phone call was made to each participant to explain how to complete the survey.

8.8.2. Result

The mean values of the 5 performance levels of each QI were first computed. The demarcation values between each of the performance level were also computed as shown in Table 8-16. As explained in section 2.5.7, the demarcation values are the average of the mean values of every two

adjacent performance levels. For example, the mean values of "Poor" and "Average" for QI "Number of projects the contractor has worked with the clients" were 2.3 and 4.9, so the demarcation value between "Poor" and "Average" was 3.6, the average of 2.3 and 4.9. Measurement range of the performance levels could then be determined with after all the demarcation values calculated. Same approach was applied for each QI. The overall result of the KPIs with weighting and the corresponding QI and measurement range are shown in Table 8- 17.

Table 8-16. Survey result on the mean values and measruement range

Indicator		Poor	Average	Good	Very Good	Excellent
Number of projects the contractor has worked with the clients	Mean value	2.3	4.9	7.1	9.4	11.6
	Demarcation value	3.6	6.0	8.3	10.5	
Top management participation rate of attending joint management meetings/events	Mean value	12.1	33.6	54.3	72.9	83.6
	Demarcation value	22.9	43.9	63.6	78.2	
Accumulated no of claims raised per each project	Mean value	6.4	5.0	3.3	1.9	0.3
	Demarcation value	6	4	2.6	1.1	
Number of predefined project milestones (civil works) achieved per each project	Mean value	5.0	3.7	2.3	1.1	0.0
	Demarcation value	4.4	3.0	1.7	0.6	
Number of reported SHE related incident e.g. DI or NC Case	Mean value	2.3	3.7	4.7	5.9	7.0
	Demarcation value	3.0	4.2	5.3	6.4	
Subjective assessment in a 1-10 scale	Mean value	3.0	5.1	6.6	8.0	9.4
	Demarcation value	4.1	5.9	7.3	8.7	
Number of initiatives implemented with cost saving	Mean value	0.0	3.6	5.3	6..7	8.1
	Demarcation value	1.8	4.4	6.0	7.4	
Number of implemented SHEQ related initiatives	Mean value	1.8	4.0	6.0	8.2	9.7
	Demarcation value	2.9	5.0	7.1	8.9	

Note: The demarcation value is the average of the mean values of two adjacent performance levels.

Table 8-17. Overall result of the KPIs, QI and Measurement Range for the Utility Company

Identified KPIs for measuring Partnering Projects	Weighting	Indicator	Poor	Average	Good	Very Good	Excellent
Long-term business relationships	15.2%	Number of projects the contractor has worked with the clients	<3.6	3.6 -6.0	6.0 – 8.3	8.3 – 10.5	>10.5
Top management commitment	14.6%	Top management participation rate of attending joint management meetings/events	<22.9	23 – 43.9	44-63.6	63.7-78.2	>78.2
Cost performance	14.0%	Accumulated no of claims raised per each project	>6	6 – 4	4 – 2.6	2.6 – 1.1	<1.1
Safety performance	12.1%	Number of reported SHE related incident e.g. DI, NC Case	>4.4	4.4-3.0	3.0-1.7	1.7-0.6	<0.6
Time performance	12.1%	Number of predefined project milestones (civil works) achieved per each project	<3.0	3.0 -4.2	4.2 - 5.3	5.3- 6.4	>6.4
Harmonious working relationships	11.4%	Subjective assessment in a 1-10 scale	<4.1	4.1-5.9	5.9-7.3	7.3-8.7	>8.7
Stakeholder's satisfaction	10.8%	Number of initiatives implemented with cost saving	<1.8	1.8-4.4	4.4-6.0	6.0-7.4	>7.4
Innovation and improvement	9.8%	Number of implemented SHEQ related initiatives	<2.9	2.9-5.0	5.0-7.1	7.1-8.9	>8.9

8.9. Discussion of the results

Referring to the classification of Figure 8-2, the result indicated that both result-oriented and relationship-oriented KPIs should be adopted for measuring partnering performance in the Utility Company. Specifically, both subjective (Stakeholder Satisfaction and Innovation and Improvement) and objective (Time Performance, Cost Performance and Safety Performance) measurements were selected for result-oriented aspect, while only subjective (Top Management Commitment, Harmonious Working Relationships and Long-term Business Relationships) measurement was selected for relationship-oriented aspect of partnering performance. The possible reason was the subjective nature of relationship, which makes it hard to be measured objectively.

Comparing the 8 identified KPIs from this research with that of similar research by Yeung et al (2007) for the construction industry in Hong Kong, who have identified 7 KPIs are shown in Table 8-18. It could be seen that 4 out of 8 KPIs identified by this research are the same as that for the construction industry, including Time Performance, Cost Performance, Top Management Commitment and Innovation and Improvement, reflecting that they are the core aspects for partnering projects no matter in the construction industry in general or in the Utility sector.

It was interesting to note that the common KPI for project management, Quality Performance, was not selected for measuring partnering success. This reflected that the quality performance was not a main concern by the participants. One possible reason was due to the fact that the contractor under the partnering contract had worked with the Utility Company for several years and so the contractor could clearly understand and meet the specific requirements of the Utility Company. However, the expected continuous improvement in the quality performance had been reflected in the QI "Number of implemented SHEQ related initiatives" under Innovation and Improvement. Safety Performance was one of the four different KPIs. This reflected that the Utility Company concerned more on the safety performance than the construction industry in general. The remaining three different KPIs were Stakeholder Satisfaction, Harmonious Working Relationships and Long-term Business Relationships, which reflected the expectation from the participants on the partnering projects.

Considering half of the 8 KPIs selected for measuring partnering project in the Utility Company were different to that for the construction industry as shown in Table 8-18, it could be seen that there was no an universal of standard set of KPIs measuring partnering performance in various industry. Instead, partnering performance measurement should be context dependent with some KPIs specific to the sector or industry concerned.

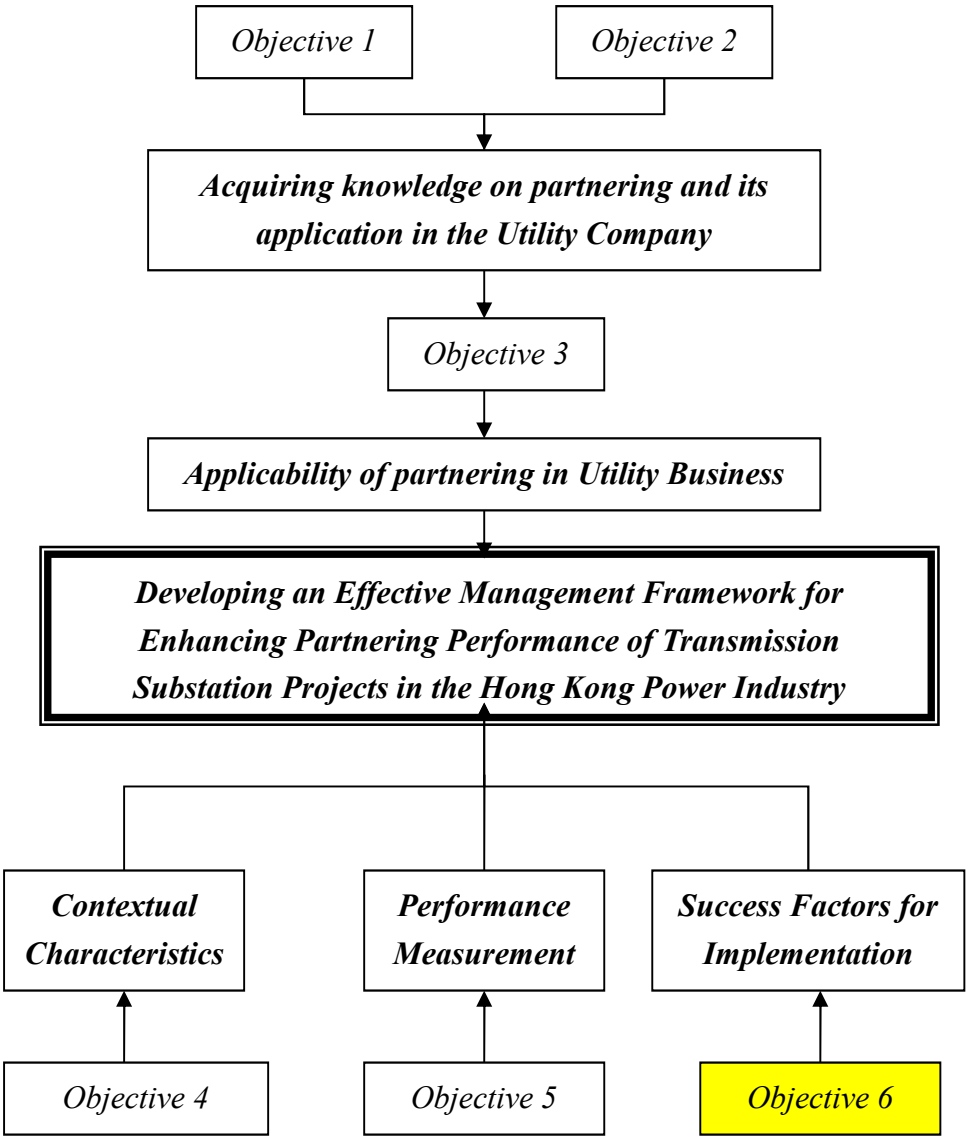
Table 8-18. Comparsion of KPIs

KPIs for the construction industry by Yeung et al. (2007)	KPIs for the Utility Company
Similar KPIs	
Time Performance	Time Performance
Cost Performance	Cost Performance
Top Management Commitment	Top Management Commitment
Innovation and Improvement	Innovation and Improvement
Non-similar/other additional KPIs	
Trust and Respect	Safety Performance
Quality Performance	Stakeholder Satisfaction
Effective Communication	Harmonious Working Relationships
	Long-term Business Relationships

8.10. Chapter Summary

This chapter has successful identified 8 KPIs for measuring partnering performance in the Utility Company context through employing the Delphi survey method. The 8 KPIs identified include: (1) Long-term Business Relationships with weighting of 15.2 %; (2) Top Management Commitment with weighting of with weighting of 14.6 %; (3) Cost Performance with weighting of 14.0%; (4) Safety Performance with weighting of 12.1 %; (5) Time Performance with weighting of 12.1%; (6) Harmonious Working Relationships with weighting of 11.4%; (7) Stakeholder Satisfaction with weighting of 10.8% and (8) Innovation and Improvement with weighting of 9.8%. The corresponding quantitative

indicators and the measurement range against the 5 performance levels from “Poor” to “Excellent” have also been identified. The result of this chapter essentially provides a clear guideline on how to effectively achieve partnering success. The development process of the KPIs, involving the stakeholders from both the client and contractor companies, essentially realized partnering spirit and facilitated each party to understand each other’s concerns.


Objective 1
Objective 2
Acquiring knowledge on partnering and its application in the Utility Company
Objective 3
Applicability of partnering in Utility Business
Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry
Contextual Characteristics
Performance Measurement
Success Factors for Implementation
Objective 4
Objective 5
Objective 6

Chapter 9. Key Success Factors of Partnering

9.1. Introduction

This Chapter intends to explore and prioritize a set of partnering success factors specific to the Utility Company for providing empirical insights for practitioners' reference. To identify and prioritize the partnering success factors, a 2-stage approach consisting of a survey and an Analytic Hierarchy Process (AHP) was adopted.

9.2. Stage 1 Survey

The stage 1 survey aimed to identify the most important underlying factors for the subsequent AHP. The 41 underlying partnering success factors identified by Chan et al. (2004) were adopted. The reason of adopting the list was the relevance to the Hong Kong context. The underlying factors were based on the inputs from professionals in Hong Kong, including senior and site management staff from client, consultant and contractor organizations, with hands-on experiences in partnering projects. To confirm the appropriateness of adopting the factors, the 41 factors were cross checked with a list of success factors suggested by the participants in a partnering workshop conducted beforehand facilitated by the author. It was found that the list covered all the factors suggested by the participants, despite of some wordings. Thus, the list of 41 factors was adopted with minor revision of the wordings to the context.

The survey was aimed to identify the most significant underlying factors for further analysis. The participants were requested to rate the 41 underlying factors in a typical 5-point Likert scale from 1 (the least important) and to 5 (the most important). The survey was conducted through email. To explore other possible underlying factors, the participants were requested to add other success factors, which were not covered by the list of underlying factors. However, no participants suggested addition factors, implying that the underlying factors were comprehensive. The survey result is showed in Table 9-1. The average rating of each factor was calculated by the formula:

Average rating of the underlying factor an element = $\sum Ri/N \quad (i=1,2, \ldots n)$

Where R is the rating of each underlying factors from each participants and N is the total number of participant.

As this study aimed to identify the most important partnering success factors and their corresponding relative importance, following the arrangement adopted by Cheng and Li (2002) and Chen & Chen (2007), only those underlying success factors with average rating of 4.0 or above were selected as the critical factors for further analysis. This arrangement encountered marginal cases, the average rating of some factors was 3.96, but this study aimed at identifying the most important underlying factors for AHP, the stringent criteria was kept and so only those underlying factors with average rating of 4.0 were selected. It was in line with the comment from Chan et al. (2003a) that the focus of ranking exercise

should be on the most important factors on the list but not the absolute ranking values, which were based on a subjective assessment.

Table 9-1. The Survey Results on the 41 Underlying Success Factors Adopted from (Chan et al. 2004)

Underlying Success Factors	Average Rating
The end-user had a great deal of involvement in the project through the partnering arrangement.	4.3
Major subcontractors and manufacturers were involved in the partnering process.	4.26
The architect/designer was involved in the early design stage.	4.23
The participants were willing to provide a long-term commitment to the process.	4.19
Mutual goals were established amongst the project participants.	4.19
Real commitments were made and kept.	4.19
Adequate commitment was received from top to bottom of all stakeholder organizations.	4.15
Each party relied on the others to cooperate in the partnering project.	4.12
Each party trusted that its partner's decisions would be beneficial to its business.	4.07
Each party felt that it got a fair deal from its partners.	4.04
Everyone understood the need for a shared vision and common mission for the partnering relationship.	4
All parties took appropriate risk commensurate with their rewards.	4
Each party was willing to share resource with other partners.	4
All parties broke from the win-lose mind-set to a win-win attitude.	4
All parties were committed to improving communication within the team.	3.96
Every party was willing to exchange ideas and visions.	3.96
Clear expectations were communicated in the project.	3.96
All parties encouraged the open airing of problems and differences of opinion.	3.96
Open exchange and consideration of ideas were promoted during the partnering process.	3.96
There were no weak links in the team members.	3.93
All parties sought new ways to lower costs and differentiate themselves to gain competitive advantage.	3.93
All parties were willing to eliminate waste and barriers to improvement.	3.89
All parties were willing to improve processes and reduce duplication.	3.89
Control and resolution mechanism was developed to deal with problems.	3.88
An effective conflict resolution strategy was established.	3.85
Issues were resolved in a timely and responsive manner.	3.85

Underlying Success Factors	Average Rating
Parties agreed to evaluate the team performance as well as the partnering process on a regular basis.	3.85
A method to reward the successful completion of the partnering objectives was developed.	3.81
All levels of management supported the partnering process.	3.81
Top management consistently and publicly endorsed the principles of partnering.	3.81
Owner was properly represented in the project.	3.81
A team leader or champion was appointed to ensure that partnering principles did not slip out of focus.	3.81
During the partnering process, the parties developed aligned relationships to support objectives.	3.78
Partners responded in a non-defensive manner during the argument.	3.7
Responsibility and accountability were accepted by all team members.	3.69
Partners knew and were able to explain to others the mission of the organization.	3.69
Partners understood which decisions could be made alone and which decisions needed to involve others.	3.69
Roles and responsibilities were well defined in the partnering process.	3.67
Measurable goals determining individual responsibilities were developed in the partnering process.	3.65
Partnering was started at the design stage.	3.58
Partnering facilitator was engaged throughout the partnering process.	3.5

9.2.1. Forming a Hierarchy Model

One of the key steps of AHP is to structure the issue concerned into a hierarchy, for the purpose of the current study, a three level hierarchy model was formulated. A typical hierarchical structure should be of at least three levels: objective, categories and sub-categories (Talib and Rahman 2015). For this study, Level 1 of the hierarchy was the single element stating the overall goal, and Level 2 contained the Main Success Factors important to achieving the goal, while individual sub factors, required to achieve the corresponding

Main Success Factors were included in Level 3. Similar approach was adopted by Cheng and Li (2002) and Salmeron and Herrero (2005) for prioritizing critical successful factors.

The 14 identified underlying success factors were all put into the Level 3 of the hierarchy model and categorized according to its nature endowed, for example, those underlying success factors related to involvement of end user, major subcontractors and architect/designer were grouped together. In addition, they were put under the same Main Success Factor in Level 2. The author determined the name of the associated Main Success Factors by synthesizing the meaning of its sub-factors, like "Stakeholder Involvement" for the sub-factors just mentioned.

Finally, the 14 sub-factors were categorized into 5 Main Success Factors, including "Stakeholder Involvement", "Commitment to Partnering", "Realizing Partnering Spirit", "Fair Commercial Framework" and "Collaborative Working Environment". The corresponding sub-factors and the overall hierarchy are shown in Figure 9-1.

9.2.2. Validating the Hierarchy Model

To ensure the proposed grouping of the sub factors and naming of the 5 Main Success Factors were appropriate, another survey was conducted through email in which the participants were requested to rate the appropriateness of the proposed grouping and the

naming of the Main Success Factors in 5-point Likert scale (with 1 = Not appropriate at all, 5 = Very appropriate). Average rating of the proposed grouping and the naming of the Main Success Factors were 4.34 and 4.13 respectively. The result indicated the proposed hierarchy was considered appropriate by the participants and could be adopted for further AHP survey.

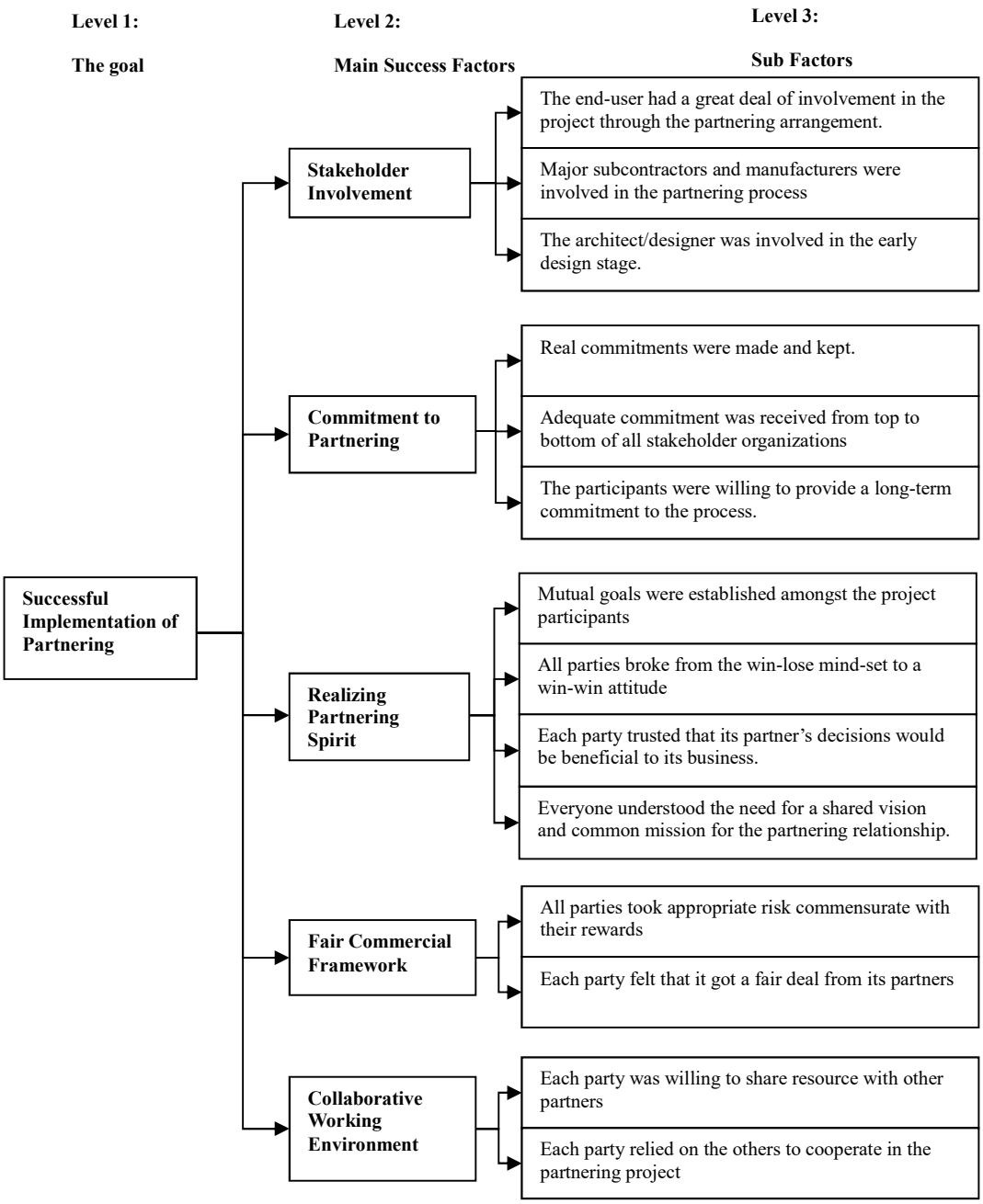


Figure 9-1. The 3-level Hierarchy Model

9.3. Stage 2: Analytic Hierarchy Process (AHP):

9.3.1. Pairwise Comparison

The scale of importance for pairwise comparison was defined in Table 9-2, which essentially follows the traditional 1- 9 judgment scale for AHP suggested by Saaty (1980).

Table 9-2. The Scale of Importance for Pairwise Comparison Adapted from Saaty (1980)

Intensity of Importance	Definition
1	Equal importance both element
3	Weak importance one element over another
5	Essential or strong importance one element over another
7	Demonstrated importance one element over another
9	Absolute importance one element over another
2, 4, 6, 8	Intermediate values between two adjacent judgments

The AHP survey in stage 2 was conducted through email, each participant received the survey with detailed explanations provided. A follow-up phone call was made to each participant to explain and to clarify the aim of AHP as well as the arrangement the pairwise comparison.

All the factors at the same level were compared to each other in a pairwise manner considering its respective importance to the factor at adjacent upper level. This process ultimately resulted in a matrix capturing the weightings of the factors from the pairwise comparison at the same level. The inputs from the participants were consolidated by the geometric mean approach suggested by Saaty (1994).

9.3.2. Determining the Relative Weighting of the Factors

The relative weighting of the factors in Level 2 and Level 3 of the Hierarchy were calculated following the steps suggested by Crowe et al. (1998):

1. Normalizing the matrix such that the sum of each column is equal to 1.0 by dividing each column by the sum of that column.
2. Calculating the "row sum" by adding the elements in each row of the normalized matrix.
3. Determining the relative weightings of the factors by dividing each element of the "row sum" by the number of the elements in the row. The resultant relative weighting is also termed as priority vector.

9.3.3. Consistence Test

With the relative weightings of the factors determined, the next step was to undertake a consistency test to verify the consistency of the inputs by calculating the Consistency Ratio (CR). According to Saaty (1994), the limit of CR values for different matrices sizes were: 0.05 for a 3-by-3 matrix; 0.08 for a 4-by-4 matrix; and 0.1 for larger matrices. If the CR of the matrices was below the limit, the inputs were recommended for further analysis.

9.4. Results and Analysis

To ensure the research rigor, consistency of the inputs from the 15 research participants has been examined following the steps of consistency tests depicted above. Only those inputs with Consistency Ratio (CR) equal or lower than the specified values by Saaty (1987) were adopted for further analysis. Similar method was adopted by Cheng and Li (2002). The research participants were numbered from 1 to 15, while the 6 matrices involved in the hierarchy were numbered from 1 to 6 with their size specified. The corresponding consistencies of the inputs by the individual participants are shown in Table 9-3. Those accepted inputs are bolded for easy reference. The remaining inputs were neglected due to its inconsistence.

Table 9-3. The Consistency Ratio (CR) of the Individual Inputs

Participant	Matrix 1 (5 by 5) CR limit: 0.1	Matrix 2 (3 by 3) CR limit: 0.05	Matrix 3 (3 by 3) CR limit: 0.05	Matrix 4 (4 by 4) CR limit: 0.08	Matrix 5 (2 by 2) CR limit: 0.00	Matrix 6 (2 by 2) CR limit: 0.00
1	**0.04**	0.19	0.12	**0.06**	**0**	**0**
2	0.31	0.26	0.27	0.43	**0**	**0**
3	0.12	0.27	0.97	0.1	**0**	**0**
4	0.12	0.12	0.49	0.13	**0**	**0**
5	**0.09**	**0.01**	0.32	0.17	**0**	**0**
6	0.13	**0**	0.12	0.12	**0**	**0**
7	0.37	3.83	0.41	1.18	**0**	**0**
8	**0**	0.77	**0**	0.3	**0**	**0**
9	**0.06**	**0**	0.26	**0.06**	**0**	**0**
10	0.14	**0**	**0**	0.25	**0**	**0**
11	**0.04**	**0**	**0**	**0.08**	**0**	**0**
12	**0.09**	**0**	**0.02**	**0.06**	**0**	**0**
13	0.3	**0**	**0.02**	0.12	**0**	**0**
14	**0.09**	**0.05**	**0**	**0.02**	**0**	**0**
15	0.52	0.12	0.19	0.13	**0**	**0**
No. of valid input	7	8	6	5	15	15

Notes: The CR limits of the matrices are referred to the values suggested by Saaty (1980)

9.4.1. Ranking of the Main Success Factors of Level 2

The normalized matrix of the 5 Main Success Factors at level 2 is shown in Table 9-4.The relative weighting of each Main Success Factor was calculated by dividing the "row sum" of each Main Success Factor of the normalized matrix by the number of the elements in the corresponding row (Crowe et al. 1998). In this way, the sum of the calculated relative weighting would be equal to 1 and those Main Success Factors with higher value of the relative weighting can be interpreted as more important with respect to

achieving the goal in level 1. For example, the relative weighting of "Stakeholder Involvement" (SI) was calculated by dividing the "row sum" by 5 and it resulted 0.12 as shown in Table 9-4.

"Commitment to Partnering"(CP) was rated as the most important with weighting of 0.39, followed by the factor "Realizing Partnering Spirit"(RPS) and "Fair Commercial Framework" (FCF) whose rating are 0.21 and 0.16 respectively. Rating of the factors "Collaborative Working Environment" (CWE) and "Stakeholder Involvement" (SI) were 0.13 and 0.12 respectively. It was worth noting that the first two Main Success Factors CP and RPS accounted for 60% of the overall importance.

Table 9-4. The Normalized Matrix of the 5 Main Success Factors at Level 2

	SI	CP	RPS	FCF	CWE	Relative Weighting
SI	0.12	0.14	0.16	0.08	0.08	0.12
CP	0.34	0.40	0.49	0.39	0.32	0.39
RPS	0.14	0.15	0.19	0.29	0.29	0.21
FCF	0.21	0.15	0.09	0.14	0.18	0.16
CWE	0.19	0.16	0.08	0.09	0.12	0.13
CR limit = 0.1				Calculated CR = o.o4		Sum = 1.0

Stakeholder Involvement = SI
Commitment to Partnering = CP
Realizing Partnering Spirit = RPS
Fair Commercial Framework = FCF
Collaborative working environment = CWE

9.4.2. Ranking of Sub Factors at Level 3

9.4.3. Relative Weighting of the Sub Factors under "Stakeholder Involvement"

The normalized matrix of the 3 Sub Factors under "Stakeholder Involvement" is shown in Table 9-5. The factor related to End User Involvement (EUI) is rated as the most important with weighting 0.53, which apparently dominates the other two factors. The weightings of factors related to Sub Contractor Involvement (SCI) and Architect/Designer Involvement (ADI) are 0.24 and 0.23 respectively

Table 9-5. The Normalized Matrix of the Sub Factors under the Category of "Stakeholder Involvement"

	EUI	SCI	ADI	Relative Weighting
EUI	0.53	0.55	0.52	0.53
SCI	0.23	0.24	0.25	0.24
ADI	0.23	0.21	0.23	0.23
CR limit = 0.05		Calculated CR = 0.0		Sum = 1.0

The end-user had a great deal of involvement in the project through the partnering arrangement.	=	EUI
Major subcontractors and manufacturers were involved in the partnering process	=	SCI
The architect/designer was involved in the early design stage	=	ADI

9.4.4. Relative Weighting of the Sub Factors under "Commitment to Partnering"

The normalized matrix of the 3 Sub Factors under "Commitment to Partnering" is shown in Table 9-6. The factor related to Real Commitment Made (RCM) is rated as the most important with weighting of 0.54, which apparently dominates the other two factors.

The weightings of factors related to Adequate Commitment from Top to Bottom (CTB) and Willingness to long term commitment (WLC) are 0.24 and 0.22 respectively.

Table 9-6. The Normalized Matrix of the Sub Factors under the Category of "Commitment to Partnering"

	RCM	CTB	WLC	Relative Weighting
RCM	0.25	0.28	0.19	0.24
CTB	0.48	0.54	0.61	0.54
WLC	0.26	0.18	0.20	0.22
CR limit = 0.05		Calculated CR = 0.02		Sum = 1.0

Real commitments were made and kept = RCM
Adequate commitment was received from top to bottom of all stakeholder organizations = CTB
The participants were willing to provide a long-term commitment to the process. = WLC

9.4.5. Relative Weighting of the Sub Factors under "Realizing Partnering Spirit"

The normalized matrix of the 4 Sub Factors under "Realizing Partnering Spirit" is shown in Table 9-7. The factor related to Mutual Goal (MG) is rated as the most important factor with respect to "Realizing Partnering Spirit" with weighting of 0.33. The weightings of factors related to "Win-win Attitude" (WW) and "Mutual Trust" (MT) are 0.24 and 0.22 respectively. The perceived least important factor in this group is the one related to the understanding of the need for a shared vision and common mission, which is weighted of 0.17.

Table 9-7. The Normalized Matrix of the Sub Factors under the Category of "Realizing Partnering Spirit"

	MG	WW	MT	SV	Relative Weighting
MG	0.33	0.34	0.38	0.25	0.33
WW	0.24	0.25	0.26	0.24	0.24
MT	0.21	0.23	0.24	0.34	0.26
SV	0.23	0.18	0.12	0.17	0.17
CR limit = 0.08		Calculated CR = 0.02			Sum = 1.0

Mutual goals were established amongst the project participants = MG
All parties broke from the win-lose mind-set to a win-win attitude = WW
Each party trusted that its partner's decisions would be beneficial to its business = MT
Everyone understood the need for a shared vision and common mission for the partnering relationship = SV

9.4.6. Relative Weighting of the Sub Factors under the Category of "Fair Commercial Framework"

As shown in Table 9-8, the Sub Factors related to Appropriate Risk Against Reward (AR) is considered more important to the factor related to Fair Deal (FD) with respect to "Fair Commercial Framework", their weightings are 0.63 and 0.37 respectively.

Table 9-8. The Normalized Matrix of the Sub Factors under the Category of "Fair Commercial Framework"

	AR	FD	Relative Weighting
AR	0.63	0.63	0.63
FD	0.37	0.37	0.37
CR limit = 0.00		Calculated CR = 0.0	Sum = 1.0

All parties took appropriate risk matching with their reward = AR
Each party felt that it got a fair deal from its partners = FD

9.4.7. Relative Weighting of the CSF under the Category of "Collaborative Working Environment"

As shown in Table 9-9, the CSF related to Willingness to Share Resources (SR) is considered more important to the CSF related to Reliance on Each Other to Cooperate (RC) with respect to "Collaborative Working Environment", their weightings are 0.72 and 0.28 respectively.

Table 9-9. The Normalized Matrix of the Sub Factors under the Category of "Collaborative Working Environment"

	SR	RC	Relative Weighting
SR	0.72	0.72	0.72
RC	0.28	0.28	0.28
CR limit = 0.00		Calculated CR = 0.0	Sum = 1.0

Each party was willing to share resource with other partners = SR
Each party relied on the others to cooperate in the partnering project = RC

9.4.8. Overall Local and Global Weightings

Table 9-10 shows the local weightings and global weightings of all the Sub Factors. The local weighting of the each CSF indicates its relative importance among other Sub Factors with respect to the corresponding Main Success Factor. While the global weighting of each CSF refers to the relative importance of it among all the 14 Sub Factors with respect to the overall goal "Successful Implementation of Partnering in Utility Business in Hong Kong" as stated in the level 1 of the 3-level hierarchy model.

The global weightings of individual Sub Factors are calculated by multiplying the local weightings of each CSF with the weighting of its corresponding Main Success Factor. With all the 14 key factors considered, the most important one was "Adequate Commitment was received from Top to Bottom of All Stakeholder organizations" (0.210), whose relative importance is one time higher than the rating of the 4 following Sub Factors, "All Parties took Appropriate Risk Matching with their Reward" (0.098), "Real Commitments were Made and Kept." (0.094), "Each Party was Willing to Share Resource with Other Partners" (0.092) and "The Participants were Willing to Provide a Long-term Commitment to the Process" (0.083). These top five Sub Factors represent over 50% of importance of all the 14 Sub Factors. It is worth noting that all the three Sub Factors under the Main Success Factor "Commitment to Partnering" were included in the top five Sub Factors. It implies that those commitment-related factors are more instrumental in ensuring the success of partnering.

Table 9-10. The Local and Global Weights of all Sub Factors

Main Success Factor	Weighting	Ranking	CSF	Local weighting	Local Ranking	Global Weighting	Global Ranking
Commitment to Partnering	0.39	1	Real commitments were made and kept.	0.24	2	0.094	3
			Adequate commitment was received from top to bottom of all stakeholder organizations	0.54	1	0.210	1
			The participants were willing to provide a long-term commitment to the process.	0.22	3	0.083	5
Realizing partnering spirit	0.21	2	Mutual goals were established amongst the project participants	0.33	1	0.069	6
			All parties broke from the win-lose mind-set to a win-win attitude	0.24	3	0.052	10
			Each party trusted that its partner's decisions would be beneficial to its business.	0.26	2	0.055	9
			Everyone understood the need for a shared vision and common mission for the partnering relationship.	0.17	4	0.037	11
Fair Commercial Framework	0.16	3	All parties took appropriate risk matching with their reward	0.63	1	0.098	2
			Each party felt that it got a fair deal from its partners	0.37	2	0.057	8
Collaborative working environment	0.13	4	Each party was willing to share resource with other partners	0.72	1	0.092	4
			Each party relied on the others to cooperate in the partnering project	0.28	2	0.035	12
Stakeholder Involvement	0.12	5	The end-user had a great deal of involvement in the project through the partnering arrangement.	0.53	1	0.063	7
			Major subcontractors and manufacturers were involved in the partnering process	0.24	2	0.029	14
			The architect/designer was involved in the early design stage.	0.22	3	0.027	13

9.5. Discussion of the result

The potential benefits of partnering should not be taken for granted. The claimed benefits of partnering can only be realized by adequate inputs to the management system. Cooke-Davies (2002) defined success factors as "those inputs to the management system

that lead directly or indirectly to the success of the project or business". Following this advocacy, success factors of partnering refers to those essential inputs to the management system that may lead directly or indirectly to the success of the partnering projects.

The previous studies on identifying success factors portrayed an overview of focal areas when implementing partnering. However, in the typical project or business environment, resources in terms of budget, manpower and time, are always limited. Organizations may not be able to address all the success factors at once (Chin et al. 2008). A clear understanding on the most influential factors, which makes partnering a success, is critical and it can also facilitate practitioners to exercise an optimal resource allocation when implementing partnering.

As shown in Table 9-10, "Commitment to Partnering" and "Realizing Partnering Spirit" were rated as the first and the second important Main Success Factors, with weighting of 0.39 and 0.21 respectively. These two factors alone accounted for 60% of the overall importance among the five identified Main Success Factors. It implied that actualization of partnering spirit in practice is the prerequisite to a successful partnering implementation apart from implementing key elements of partnering. Commitment to partnering is fundamental to partnering success (CII 1991). Chan et al.(2003b) summarized the literature and stated that uneven commitment was one of the common problems of partnering. Every

stakeholder must be committed to changing the adversarial mindset rooted in the industry due to the conventional competitive tendering approach, in which relational perspective was neglected (Doloi 2013), otherwise partnering would become lip services, making the partnering no difference to the conventional approach (Bayliss et al. 2004) and the stakeholders would stick to myopic thinking instead of moving towards collaborative thinking. Thus, realizing partnering spirit such as establishing mutual goal, nurturing win-win attitude, developing trust and shared vision are essential to partnering success.

"Fair Commercial Framework" was rated as the third Main Success Factor with weighting of 0.16. Transferring project risks to the contractors through contract terms, regardless the appropriateness of the risk allocation, is common in the industry (Zaghloul and Hartman 2003), and such an improper or unfair risk allocation may lead to conflicts or litigation (Peckiene et al. 2013). In this sense, a fair risk-sharing mechanism along with an incentive scheme (Chan et al. 2008) should be implemented which can encourage cooperation and foster win-win attitude among the contracting parties (Love et al. 2011), as well as nurturing development of mutual trust (Wong and Cheung 2004). Essentially, the risks undertaken by the contractors should be reasonably compensated, such that the project stakeholders, especially the contractor, can perceive equality.

The fourth Main Success Factor was “Collaborative Working Environment”, whose weighting is 0.13. This factor entails two aspects including resource sharing and mutual reliance. Resources are scared in the competitive business environment, and it is rare that contracting parties can share resources, both tangible and intangible resources like experiences, ideas or information, which hinders the potential of realizing synergy and identifying innovative problem solving. In fact, complementary resources sharing can actually increase competitiveness and constructability (Chen and Chen 2007) leading to project success. Allowing resource sharing among the contracting parties can essentially signify the departure from the adversarial working atmosphere, which in turn nurtures partnering spirit. On the other hand, mutual reliance is also considered important as it can facilitate development of mutual trust and sense of cooperation among project team members.

The fifth Main Success Factor was “Stakeholder Involvement”, whose weighting is 0.12. In a typical construction project, many stakeholders are involved, including client, main contractor, designer/architect and sub-contractors. Essentially, all the project stakeholders should get involved in the partnering arrangement, such that the partnering culture can be penetrated along the supply chain. Among all the major stakeholders, the involvement of end users and sub-contractors were considered more important than the

designer/architect, especially for those highly specific projects like those in the utility sector, which has specific and unique requirements. Thus involving the end users, who know what to build, and sub-contractors, who know how to build, are critical to reducing conflicts and meeting client's requirements. In the organization hierarchy perspective, top management, middle management and the front line staff should also be engaged throughout the partnering process. With key stakeholders involved, partnering can achieve the notion of reducing conflicts and fostering innovations for better project performance.

The 5 Main Success Factors are the cornerstones for successful implementation of strategic partnering in the utility business context. It should be stressed that the 5 Main Success Factors were consolidated from the 14 out of 41 sub factors, the rest of the sub factors have not been taken into account in the study. Thus, the 5 Main Success Factors should be interpreted as the prerequisite for partnering success, highlighting the most important areas that should be addressed with a higher priority when resources available are limited, while the rest of the sub factors should also be considered whenever it is practicable.

9.6. Managerial Implications of the result

The findings of this study provide some insights for senior management or procurement mangers, who are implementing or planning to implement partnering.

Partnering can enhance project performance but implementing partnering comes with a cost. Thus, how to make partnering works in practice are of utmost importance, otherwise partnering would not enhance project performance as expected and it could be regarded as a waste of resources. Two implications were derived from the findings of this study.

The first implication related to project stakeholder engagement before or at the early stage of implementing partnering. Not every project stakeholders is familiarized with partnering principles or has a partnering experience. More importantly, given their involvement in the industry under the conventional contracting approach, equipping the project stakeholders with sufficient knowledge understanding, and buy-in on the partnering principles are the prerequisites for implementing partnering. In fact, lacking of common understanding of partnering concept is one of the barriers of successful partnering implementation (Aarseth et al. 2012; Chan et al. 2003b). Thus, trainings or facilitated partnering workshops should be arranged. In addition, middle management, like project managers or function managers, of client and contractor organizations are the key stakeholders to be engaged. Since they are the linkage between the top management and the frontline, and apart from top management, they are the role models for the frontline, demonstrating and realizing the partnering principles in the daily interaction. How the middle management acts under a partnering arrangement is influential to the development

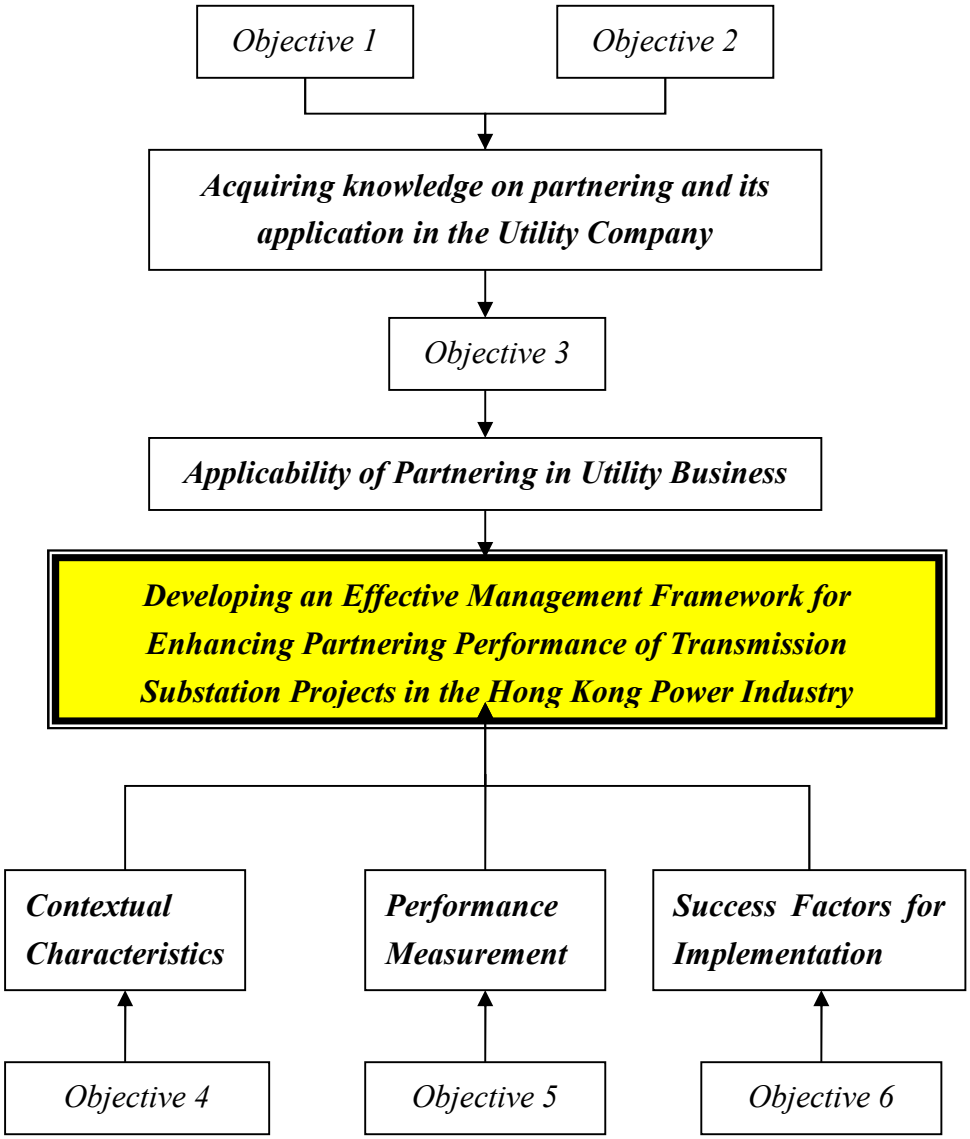
of partnering culture, which can in turn drive the frontline moving towards collaborative mindsets. Thus, a holistic stakeholder engagement plan should be derived beforehand in order to get all the stakeholders from top management to frontline familiarized and committed to the implementation of partnering.

The second implication is related to establishment of a fair commercial environment. Partnering fosters win-win attitude and advocates equity and collaboration among the contracting parties. However, under the conventional contracting approach, project risks normally are unevenly allocated and it apparently contradicts to the partnering principles. Procurement managers are advised to implement risk sharing mechanism (Chan et al. 2015) and performance-based incentive scheme (Chan et al. 2008) to establishment a partnering friendly business environment, under which the collective effort on cost saving, quality improvement or project performance enhancement by the contacting parties can be properly recognized and rewarded. It can essentially make sense of partnering to the contacting parties.

9.7. Chapter Summary

The previous studies on identifying success factors portrayed an overview of focal areas when implementing partnering. However, in the typical project or business environment, resources in terms of budget, manpower and time, are always limited.

Organizations may not be able to address all the success factors at once (Chin et al. 2008). A clear understanding on the most influential factors making partnering a success is critical and it can facilitate practitioners to exercise an optimal resource allocation when implementing partnering. As such this chapter identified a set of Main Success Factors of implementing partnering in the utility business in Hong Kong, employing a two-stage approach. In the first stage, 14 underlying factors were extracted from 41 factors through a survey to the practitioners with hands-on partnering experiences from both client and contractor organizations in the utility sector. The 14 underlying factors were then grouped into 5 Main Success Factors according to their nature. In the second stage, Analytic Hierarchy Process (AHP) technique was adopted to prioritize the 5 Main Success Factors, and the relative importance of the 5 Main Success Factors were, 0.39 for "Commitment to Partnering", 0.21 for "Realizing Partnering Spirit", 0.16 for "Stakeholder Involvement", 0.13 for "Fair Commercial Framework" and 0.12 for "Collaborative Working Environment". This set of Main Success Factors with relative importance can facilitate a more strategic resource allocation and draw management attention to certain areas during the course of implementing partnering.


Objective 1
Objective 2
Acquiring knowledge on partnering and its application in the Utility Company
Objective 3
Applicability of Partnering in Utility Business
Developing an Effective Management Framework for Enhancing Partnering Performance of Transmission Substation Projects in the Hong Kong Power Industry
Contextual Characteristics
Performance Measurement
Success Factors for Implementation
Objective 4
Objective 5
Objective 6

Chapter 10. The Management Framework for Partnering Implementation

10.1.Introduction

This chapter aims to synthesize the key findings from previous chapters for formulating an effective management framework for implementing partnering in the utility context. The refined framework after validating by the related senior management is presented.

10.2.Proposed framework

The findings in the previous chapters, including the partnering operating principles (Chapter 3); the major difficulties encountered in the course of implementing partnering in the Utility Company (Chapter 6); the essential partnering tools in nurturing partnering spirit (Chapter 7); the KPIs for measuring partnering performance (Chapter 8) and the success factors for implementing partnering (Chapter 9) can be synthesized and categorized into three key elements, namely Commercial Arrangement, Management Structure, and Implementation Process, which constitute a management framework for enhancing partnering performance in the utility context as shown in Figure 10-1.

Success factors (Chapter 9)

- "Commitment to Partnering"
- "Realizing Partnering Spirit",
- "Stakeholder Involvement"
- "Fair Commercial Framework"
- "Collaborative Working Environment"

Essential partnering tools (Chapter 7)

- Regular Project Management Team (PMT) Meetings,
- Regular Project Leadership Team (PLT) Meetings,
- Partnering Workshops,
- Issue Resolution Mechanism,
- Shared Risk Mechanism
- 3-layers Governance Structure

KPIs for measuring partnering performance (Chapter 8)

- Time Performance
- Cost Performance
- Top Management Commitment
- Innovation and Improvement
- Safety Performance
- Stakeholder Satisfaction
- Harmonious Working Relationships
- Long-term Business Relationships

Major Difficulties (Chapter 6)

- "Key subcontractors had not been included in the process",
- "Parties had little experience with the partnering approach"
- "Concept of partnering was not fully understood by participants"
- "Parties did not have proper training on partnering approach".

Foundations for partnering operation (Chapter 3)

- Facilitating conditions: (1) equal status, (2) cooperative interaction, (3) common goal, (4) authority support, and (5) friendship,
- Mediating processes: (1) understanding each other, (2) reduction of anxiety and (3) enhancing empathy
- Implementation of effective project management measures such as regular performance measurement and fair risk allocation

Research findings

Synthesize

Effective Management Framework for Enhancing Partnering Performance

Guiding Principle	Commercial Arrangement	Management Structure	Implementation Process

Figure 10-1. The Proposed management framework based on the research findings

10.2.1. Guiding Principle

The guiding principle of the management framework was derived from the partnering operating principle as explained in Chapter 3 and the success factors identified in Chapter 9. Essentially, implementation of partnering needs to create an environment which can fulfill the five facilitating conditions: (1) equal status, (2) cooperative interaction, (3) common goal, (4) authority support, and (5) friendship, and the mediating processes: (1) understanding each other, (2) reduction of anxiety and (3) enhancing empathy. The facilitating conditions and the mediating process can lead to positive cognitive effect on relationship improvement, which can result project performance improvement with the aid implementing effective project management measures, like regular performance measurement and far risk allocation. Throughout the partnering implementation process, there were five factors needed to be considered: (1) "Commitment to Partnering", (2) "Realizing Partnering Spirit", (3) "Stakeholder Involvement", (4) "Fair Commercial Framework" and (5) "Collaborative Working Environment".

10.2.2. Commercial Arrangement

Specifically, the commercial arrangement of the framework was derived based on the findings of Chapter 7 and Chapter 9. "Fair commercial framework" was identified as one of the success factors for implementing partnering in the Utility Company. It reflected the

criticality of a fair business environment for the contracting parties under a partnering agreement, which advocates equal status and fairness (Anvuur and Kumaraswamy 2007). On the other hand, Shared Risk Mechanism was one of the effective partnering tools for partnering spirit, developing mutual objectives in particular as discussed in section 7.4. This also echoed with suggestion from Cheung et al. (2009) that risk-sharing is one of the cooperative drivers for construction contract. Thus, in the commercial perspective, Risk Sharing Mechanism is included in the framework.

10.2.3. Management Structure

In Chapter 3, it stated that cooperative interaction is one of the required facilitating conditions, while "understanding each other" is one of the required mediating processes for positive contact behavior. In Chapter 7, the 3-layers Governance Structure and the regular meetings at the senior management and middle management level were found to be the partnering tools effective in nurturing partnering spirit. In addition, "Realizing Partnering Spirit", "Stakeholder Involvement" and "Collaborative Working Environment" were three of the success factors for implementing partnering. Based on the above finding, it was proposed to adopt the 3-layers Governance Structure for managing the partnering arrangement in the Utility Company. However, as identified in Chapter 6 that "Key subcontractors had not been included in the process" was one of the top difficulties of

implementing partnering encountered in the Utility Company. Thus, related sub-contractors should be involved as stated in the enriched 3-layers Governance structure with corresponding roles indicated as shown in Figure 10-2.

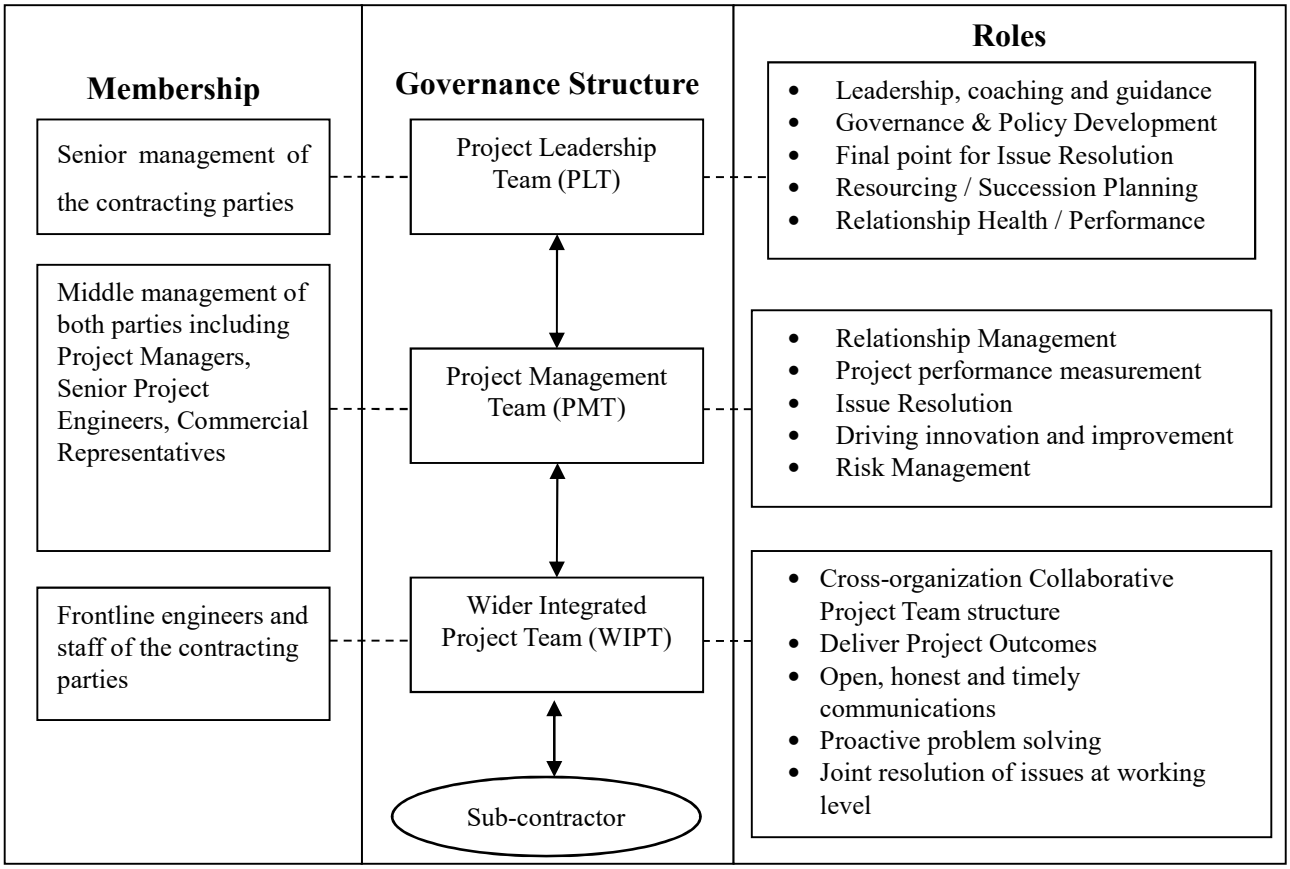


Figure 10-2. The enriched 3-layer management structure for effective partnering implementation. Adopted from Ford et al. (2006)

The research findings suggested that a 3-layer governance structure with a well-defined role for each layer is critical to developing an effective communication and mutual understanding among the contracting parties. The top layer is the Project Leadership Team (PLT), consisting of the senior management of both the contracting parties. The team plays

a leadership role throughout the course of the partnering implementation. PLT is mainly responsible for providing necessary resources and guidelines for the project team, maintaining and developing inter-firm relationship, and exploring business opportunities. It also serves as the final point for issues resolution.

The middle layer is the Project Management Team (PMT), which consists of middle management from both parties, including project managers and senior engineers, who focus on resolving project issues and implementing follow-up actions derived from the Project Leadership Team. Apart from monitoring the partnering and project performance, the Project Management Team also acted as a role model demonstrating and promoting partnering spirit for the frontline as well as the internal stakeholders of the respective organisations.

The bottom layer is the frontline staff from both parties and it is termed as Wider Integrated Project Team (WIPT), who is responsible for daily operation of the projects. The frontline should act in a "partnering" way guided by the Project Leadership Team and the Project Management Team. The members should be guided to adopt a proactive and collaborative attitude in identifying and resolving project issues. Any unresolved issue arising from the Wider Integrated Project Team should be escalated to upper level for a timely settlement.

10.2.4. Implementation Process

As stated in Chapter 3, implementation of effective project management measures including regular partnering performance measurement and fair risk allocation, together with the five facilitating conditions, development of friendship in particular and the three mediating processes are required for improving project performance. Considering three of the major difficulties of implementing partnering identified in Chapter 6, namely, "Parties had little experience with the partnering approach", "Concept of partnering was not fully understood by participants" and "Parties did not have proper training on partnering approach", it can be concluded that structural trainings/workshops about partnering are required for a successful partnering implementation. This echoed with the results of Chapter 7, which stated that partnering workshop is one of the essential partnering tools. In addition, "Commitment to Partnering" among the participants was identified as one of the success factors for partnering implementation as stated in Chapter 9. Based on the research findings, a structured partnering implementation process was proposed as shown in Figure 10-3.

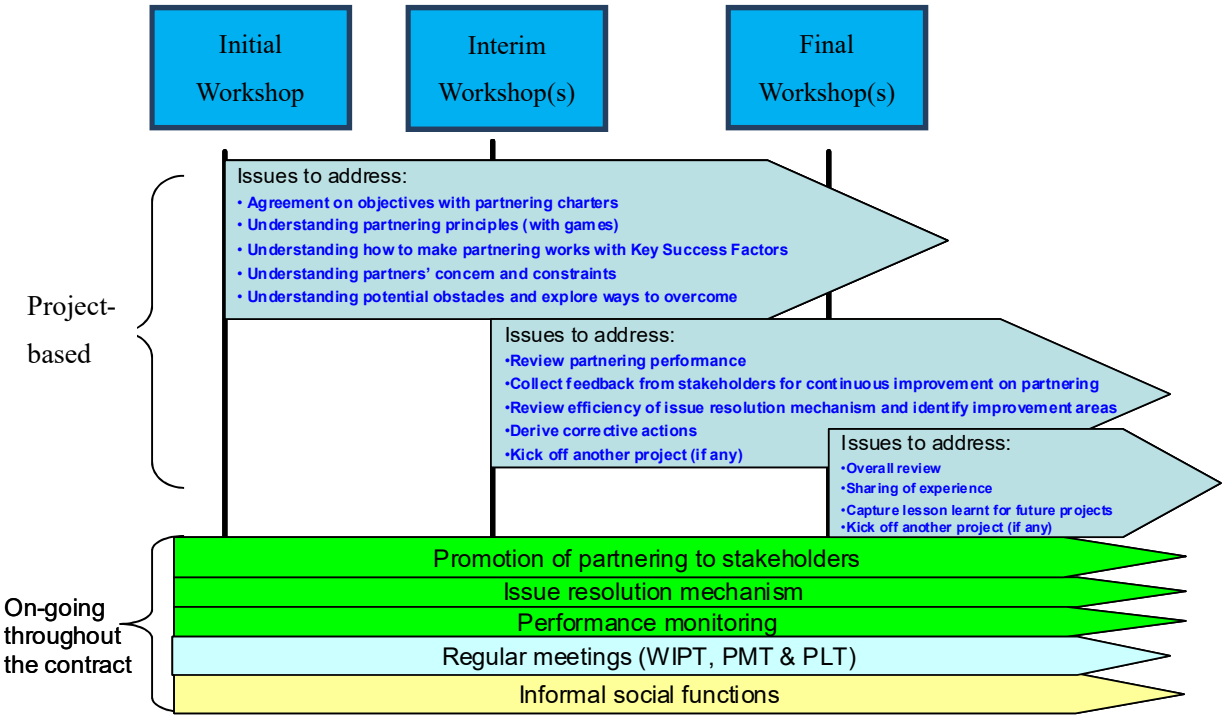


Figure 10-3. The proposed structured partnering process. Adopted and expanded from the Latham Report (1994)

There are two main categories of process, namely, project-based and on-going process. The project-based process refers to the arrangement of facilitated partnering workshops within the cycle of each project. The initial workshop should be held at the very beginning and it aims to "set the scene" and make sure all the project stakeholders understand the partnering principles which requires a change of mentality. The middle or top management should also join the workshop as role models of exercising partnering attitudes. An interim partnering workshop should be held in the mid way of the project concerned, focusing on reviewing the partnering performance, correcting feedback from the participants regarding

partnering implementation and identifying improvement areas. A final workshop should be held upon the completion of a project for an overall review and capturing the lesson learnt for the future projects. Both interim workshop and final workshop can also serve as initial workshop of another project, if deemed appropriate.

Despite of the project-based workshops, some on-going processes are required throughout the whole contacting period. Firstly, promotion of partnering to the project stakeholders is required to enhance their understanding on partnering concept and principles. Secondly, the partnering performance needs to be regularly monitored for deriving timely corrective actions or promoting those well-done aspects to the project stakeholders. The eight KPIs identified in Chapter 8 can serve this purpose. Thirdly, the issue resolution mechanism should be well maintained for resolving conflicts or problem at a timely manner. To enhance communication and build up relationship among the project stakeholders across different levels, regular meetings and social functions should be held consistently within the contracting period at each layer of the governance structure. Such arrangements with formal and causal interactions allow the stakeholders from various organisations to development mutual understanding at the personal level, facilitating the stakeholders to take each other's perspective, which is considered a key element to the success of partnering (Walker and Lloyd-Walker, 2014). More importantly, regular

meetings and social functions can facilitate development of friendship among the project participants, which is the fifth facilitating condition required for successful partnering implementation as discussed in section 4.8.2.

10.3. Validation of the proposed management framework

To validate the appropriateness of the proposed management framework, a series of structured interview was conducted with the senior management. The senior management invited for the structured interview from the Utility Company included Business Group Director, Chief Procurement Officer and Deputy Directors, while the senior management from the contractor company was the General Managers. All the interviewees had direct involvement in managing the partnering projects. There were 10 participants joined the interview, with 8 participants from the Utility Company and 2 from the contractor company.

10.3.1. Structured Interview

During the structured interviews, the proposed framework was presented to each interviewee at the beginning of the interview and the following questions related to the management framework were then discussed.

1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects?
2. What do you expect the proposed management framework can achieve?

3. What other element(s) should be included in the management framework for a better performance? And why you say so?
4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance?

10.3.2. Responses of the structured interview

10.3.3. Responses to Q1

In general, the proposed management framework was rated as effective for managing partnering. The interviewees commented that the industry-specific management framework can facilitate the development of mutual trust and win-win attitude, as well as encourage collaboration and communications among the participants in the course of partnering implementation. It also stated that the proposed management framework is a sound management framework covering the managerial, relational, practical/ implementation, and financial aspects of the partnering implementation.

10.3.4. Responses to Q2

The interviewees consistently expected that the proposed management framework with a well-defined partnering process can basically create a partnering friendly project environment, and a platform, which can nurture partnering mentality / culture among the stakeholders, facilitate relationship building and implement the partnering process systematically. More importantly, some interviewees appreciated that the framework can

assist management to focus on the most essential aspects in the course of partnering implementation such that the limited resources can be effectively utilized to achieve partnering success.

10.3.5. Responses to Q3

Consolidating the responses from the interviewees, the proposed management framework should be enriched in two perspectives. Firstly, performance-based incentive scheme should be included in the Commercial Arrangement model of the framework, since incentive scheme can facilitate the development of common goal and win-win attitude. It can also realize a "pay for performance" principle, under which better performance can be driven. Essentially, mutual benefits could be resulted, reinforcing the partnering relationship.

Secondly, the concept of Partnering Champion, a dedicated process owner, driving and monitoring the whole partnering process should be included in the implementation model of the framework. The Partnering Champion can ensure the partnering implementation process on the right track and reinforce the partnering culture by promoting the benefits gained from partnering to the stakeholders.

10.3.6. Responses to Q4

All the interviewees mentioned that the specific KPIs with indicators and measurement range developed can measure partnering performance in the reliable and objective way. The KPIs can measure both project and relational aspects under the partnering arrangement, it can also help monitor the areas of concerns critical to the partnering implementation and facilitate regular assessment on the relational performance for continuous improvement purposes.

10.4. Final management framework

Based on the results of the structured interview, the Commercial Arrangement and the implementation Process elements of the management framework were refined.

10.4.1. Refined Commercial Arrangement

Performance-based Incentive Scheme was included in the Commercial Arrangement of the framework. As Huang and Jie (2009) stated that a typical incentive scheme consists risk-rewarded and gain/pain share formula, which specify how the risk is allocated and how the cost saving or overrun is shared among the contracting parties. In a study of the compensation model for Public-Private Partnering projects in Australia, Love et al. (2011) pointed out that there is a close relationship between the behaviour of project participants

and incentive scheme. In this regard, incentives can act as a vehicle fostering win-win result by creating motivations for each party to act cooperatively towards a common goal set out by incentives. Incentives have been adopted for motivating not only cost, time or quality performance, it can also be applied for other aspects such as safety or impact on environment (Naoum 2003). Figure 10-4 demonstrates the concept of incentive scheme. Thus, after refinement, the Commercial Arrangement of the framework consists of Performance-based Incentive Scheme and Shared Risk Mechanism.

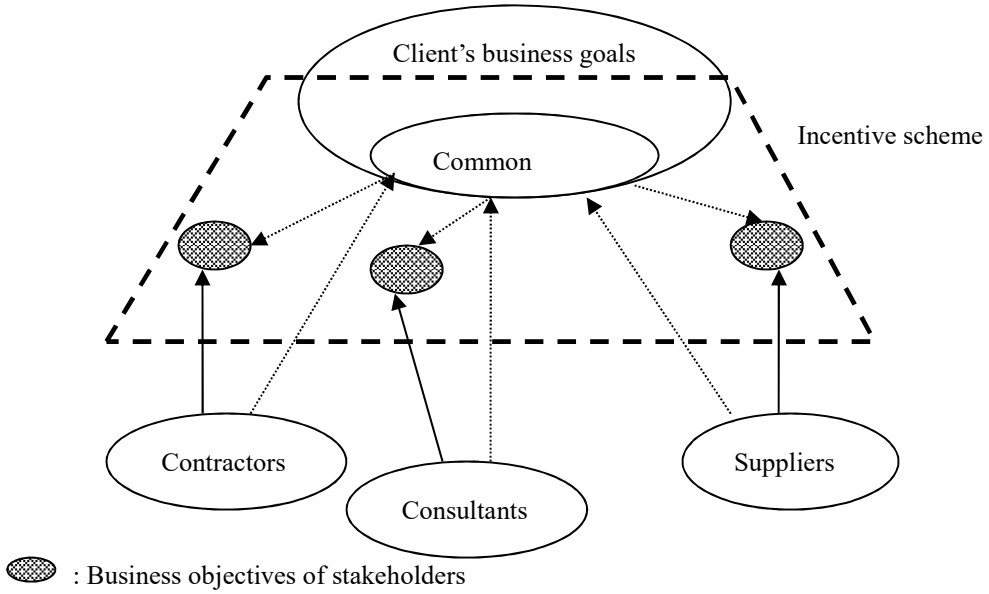


Figure 10-4. Concept of incentive scheme. Adopted from Chan et al. (2015)

10.4.2. Refined Management Structure and Implementation Process

Partnering Champion was included in the Implementation Process of the framework. Under the 3-layer management structure, a team member of the Project Management Team (middle management) with appropriate training and attitude towards partnering should be appointed as Partnering Champion, who focuses on driving the development of partnering culture among the contracting parties and following up the action derived from the partnering workshop as shown in Figure 10-5. The Partnering Champion should also be properly empowered to identify improvement areas and derive corrective actions for a better implementation of partnering. The Partnering Champion plays an important role of promoting partnering to all the project stakeholders at all the 3 layers of the management structure, to nurture partnering culture at a wider perspective and to gain more buy-in from the stakeholders throughout the process. The refined implementation process with addition of Partnering Champion is shown in Figure 10-6.

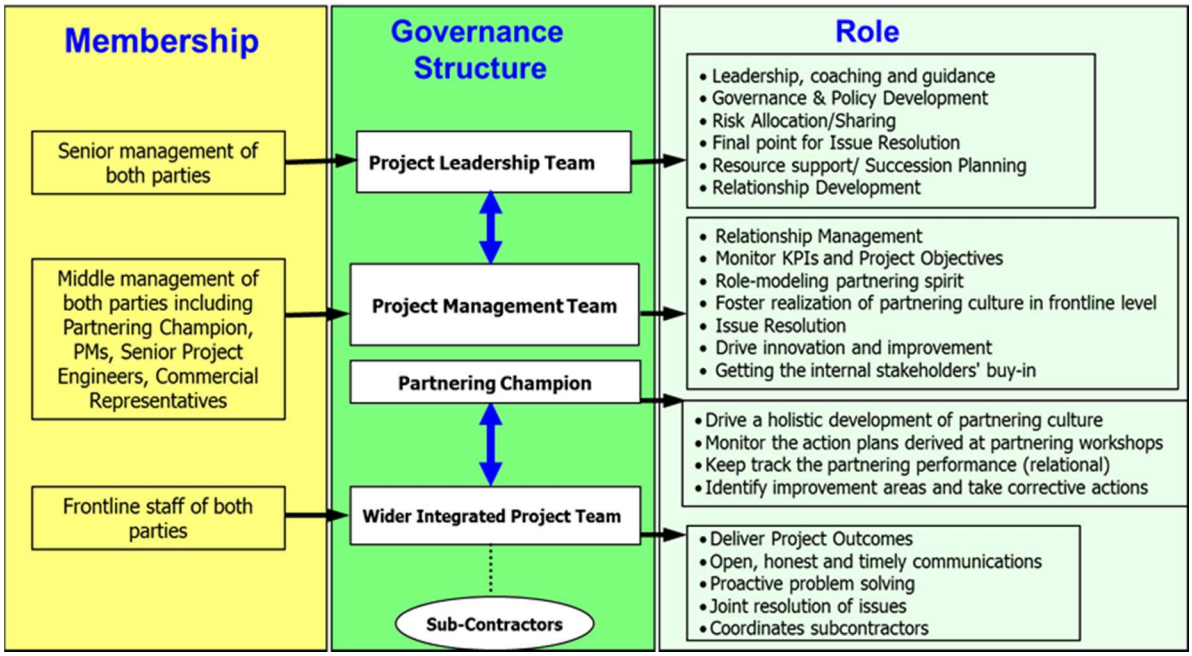


Figure 10-5. The final 3-layer management structure for effective partnering implementation. Adopted from Ford et al. (2006)

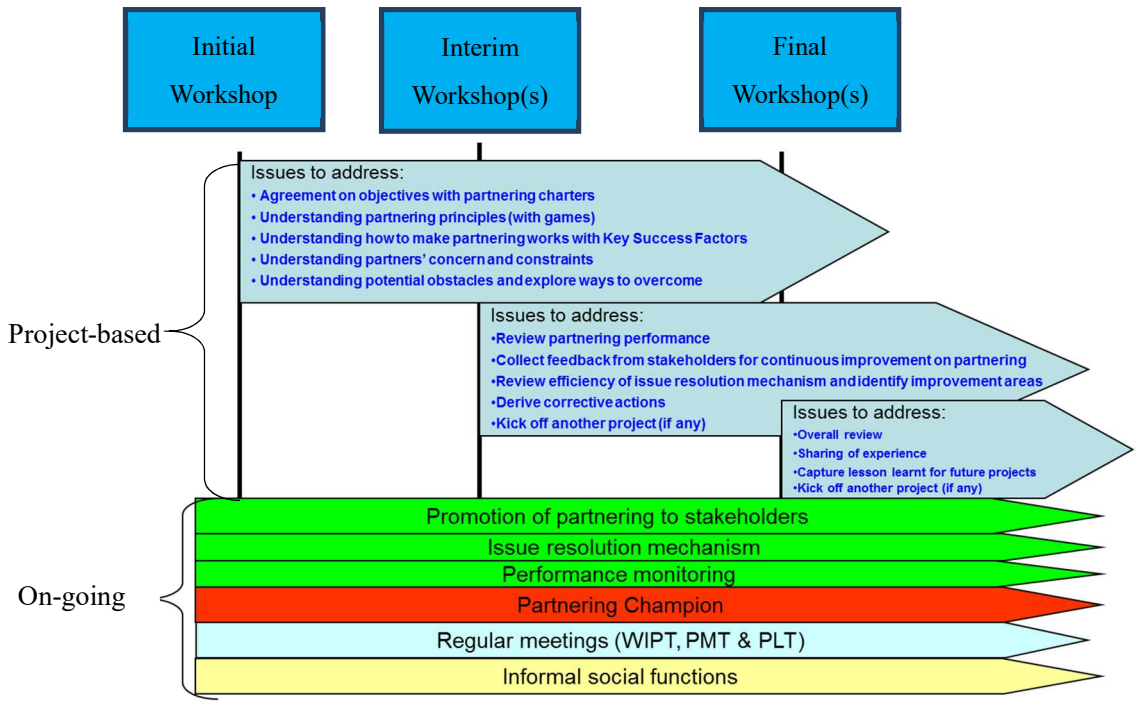


Figure 10-6. The final structured partnering process. Adopted and expanded from the Latham Report (1994)

10.5. Chapter Summary

This chapter presented a management framework based on the findings of the six specific research objectives. The framework consisted of 4 key elements which are Guiding Principle, Commercial Arrangement, Management Structure, and Implementation Process respectively. The framework was validated by conducting a series of structured interview with the senior management from the Utility Company and the related contractor company. The framework was then refined by incorporating the Performance-based Incentive Scheme and Partnering Champion as suggested by the structured interview results.

The final management framework is showed in Figure 10-7. The Guiding Principle stated the five facilitating conditions, three mediating processes and five success factors required throughout the partnering implementation. The Commercial Arrangement stated two measures to be incorporated into the partnering agreement, including Performance-based Incentive Scheme and Shared Risk Mechanism. The Management Structure specified the 3-layers management hierarchy for managing the projects teams coming from client, contractor and sub-contractors organizations. The Implementation Process indicated how the essential partnering tools and the performance measurement should be implemented during the partnering process.

Objective Performance Measurement by Partnering Project Performance Index:

0.152 x Long-term business relationships + 0.146 x Top management commitment + 0.140 x Cost performance + 0.121 x Time performance + 0.121 x Safety performance + 0.114 x Harmonious working relationships + 0.108 x Stakeholder's satisfaction + 0.098 x Innovation and improvement

Commercial Arrangement

- Performance-based Incentive Scheme
- Shared Risk Mechanism

Management Structure

- 3 – layer Management Structure
- Including Partnering Champion and related sub-contractors

Implementation Process

- Application of essential partnering tools: Workshops, Regular Meetings, Issue Resolution Mechanism, Partnering Champion and social gatherings

Guiding Principle

- Facilitating conditions to be maintained: (1) Equal Status, (2) Cooperative Interaction, (3) Common Goal, (4) Authority Support, and (5) Friendship,
- Mediating processes required for the participants : (1) Understanding Each Other, (2) Reduction of Anxiety and (3) Enhancing Empathy
- Factors to be addressed : (1) Commitment to Partnering, (2) Realizing Partnering Spirit, (3) Stakeholder Involvement, (4) Fair Commercial Framework, (5) Collaborative Working Environment

Figure 10-7. The Finalized Effective Management Framework for Partnering Implementation

Chapter 11. Conclusion and Recommendation

11.1. Introduction

This chapter aims to conclude the findings of this research study. The 6 specific objectives and the research aim are first reviewed. The contributions of this research are also discussed. The limitations encountered throughout this research and recommendations for future work are followed at the end.

11.2. Review of research objectives

All the 6 research objectives were successfully achieved by employing various research methods including literature review, case study, focus group, survey, structured interview, Delphi survey and Analytical Hierarchy Process.

11.2.1. Objective 1: Understand the concept and application of partnering

A comprehensive literature review was conducted to examine various definitions of partnering, common partnering elements and tools, and issues related to implementation of partnering, covering benefits, challenges and success factors of implementing partnering reported from the literature. Types and potential benefits of partnering were also discussed. The significant contribution of this objective was the development of a conceptual model, based on the Intergroup Contact Theory, to explain how partnering can improve

relationship among the project participants and enhance project performance in the psychological perspective. The model essentially clarified the overarching objective of employing partnering tools is to create the five facilitating conditions and facilitate the three mediating processes. The model enriched the understanding on the operating principle of partnering in practice.

11.2.2. Objective 2: Review why and how the Utility Company implemented partnering

Through a case study on the partnering application on the Utility Company in Hong Kong, the 10 partnering tools employed by the Utility Company were introduced, including Partnering Charter, Partnering Workshops, 3-layer Management Structure, Regular meeting at senior, middle and front line levels, Issue Resolution Mechanism, Joint Performance Measurement, Shared Risk Mechanism, and Performance-based Incentive Scheme were discussed in details. The significant contribution of this objective was the documentation of the partnering application in utility business, which can serve a reference for practitioners.

11.2.3. Objective 3: Examine the applicability of partnering in the Hong Kong power utility business

The applicability of partnering in the Utility Company was examined by the document analysis and survey method, through which the perceived benefits and values of partnering were identified. The top three perceived benefits identified were "Development of long term business relationship", "Improved safety performance", "Faster construction time", "More responsive to the short-noticed emergency or changing project requirements", "Reduction in dispute / conflict" and "Improved relationship amongst project participants". The empirical project data supported that partnering is beneficial to the Utility Company.

The perceived difficulties, outlining the areas should be addressed in the outset of implementing partnering, were identified. The top 3 major difficulties were "Key subcontractors had not been included in the process", "Parties had little experience with the partnering approach", "Concept of partnering was not fully understood by participants" and "Parties did not have proper training on partnering approach".

11.2.4. Objective 4: Identify the essential partnering tools for nurturing partnering spirit in the Hong Kong power Utility business

By evaluating the effectiveness of the partnering tools adopted by the Utility Company employing a survey method, six essential partnering tools in nurturing partnering spirit were identified, including: (1) Regular Project Management Team (PMT) Meetings, (2) Regular Project Leadership Team (PLT) Meetings, (3) Partnering Workshops, (4) Issue Resolution Mechanism, (5) Shared Risk Mechanism and (6) the 3-layers Governance Structure.

11.2.5. Objective 5: Develop a set of reliable and objective Key Performance Indicator (KPI) for measuring partnering performance

8 KPIs for measuring partnering performance in the Utility Company context was identified, through employing the Delphi survey method. The 8 KPIs identified include: (1) Long-term Business Relationships with weighting of 15.2 %; (2) Top Management Commitment with weighting of with weighting of 14.6 %; (3) Cost Performance with weighting of 14.0%; (4) Safety Performance with weighting of 12.1 %; (5) Time Performance with weighting of 12.1%; (6) Harmonious Working Relationships with weighting of 11.4%; (7) Stakeholder Satisfaction with weighting of 10.8% and (8) Innovation and Improvement with weighting of 9.8%. The corresponding quantitative

indicators and the measurement range against the 5 performance levels from "Poor" to "Excellent" have also been identified.

11.2.6. Objective 6: Determine and prioritize the success factors for implementing partnering in the Hong Kong power utility

A combination of survey and Analytical Hierarchy Process (AHP) were employed for identifying and prioritizing a set of Main Success Factors of implementing partnering in the Utility Company. The 5 Main Success Factors were, in descending order of importance, "Commitment to Partnering", "Realizing Partnering Spirit", "Stakeholder Involvement", "Fair Commercial Framework" and "Collaborative Working Environment". This set of Main Success Factors with relative importance can facilitate a more strategic resource allocation and draw management attention to certain areas during the course of implementing partnering.

11.2.7. Development of an Effective Management Framework for Enhancing Partnering Performance of Utility Business in the Hong Kong Power Industry

A management framework was developed by synthesizing the research findings. The framework consists of four key elements: (1) Guiding Principle, (2) Commercial Arrangement, (3) Management Structure, and (4) Implementation Process. To ascertain the effectiveness of the proposed framework, a series of structured interviewed was conducted

with the senior management from the Utility Company and related contractor company. The proposed management framework was refined to incorporate the findings from the structured interviews.

11.3. Contributions of the research

11.3.1. Practical Contributions

In the practical perspective, the research findings answered the two questions raised by the Utility Company as stated in Section 1.2: "Is partnering suitable for managing Transmission Substation Projects in the power industry?" and "How partnering can be implemented effectively in the power utility context?". The applicability of partnering in the Utility Company was examined and the research findings (Chapter 6) suggested that partnering can outperform the conventional management approach and create values to the contacting parties at both project and personal levels. The management framework presented in this research (Chapter 10) provided a skeleton showing the key areas of concerns for implementing partnering effectively in the power utility context. More importantly, due to the unique nature of Transmission Substation Projects in the utility sector, such a management framework development based on an empirical case could facilitate a wider partnering application in the power industry and foster development of partnering culture in the engineering related industries in Hong Kong as a whole. In

addition, this research could provide practical insights of partnering application in the power industry context to the world-wide research community.

11.3.2. Theoretical Contributions

Another major contribution of this research to partnering research was the enhancement of understanding on partnering in the following aspects:

1. The developed conceptual model of partnering clarified how partnering can lead to relationship improvement and project performance enhancement in the physiological perspective, based on the Intergroup Contact Theory. The model stated that project performance enhancement is the end result of two mediators achieved under partnering approach, which are: (1) implementation of effective project management measures and (2) positive cognitive and behavioral effects, resulting from creating a project environment characterized by five facilitating conditions: (1) equal status, (2) cooperative interaction, (3) common goal, (4) authority support, and (5) friendship, and realizing three mediating processes: (1) understanding each other, (2) reduction of anxiety and (3) enhancing empathy. In addition, the model could be applied to explain the overarching reason of employing various partnering tools was to create the five facilitating conditions,

which actually the essential partnering elements for successful partnering implementation. The conceptual model laid a theoretical foundation for future research regarding partnering.

2. The case study on the partnering application in the utility sector in the Hong Kong Power Industry provided empirical evidences on how partnering can be implemented in the power utility business context, which received is not well reported in the prevailing literature. The empirical project data showed that partnering was able to create values at the project level and personal level, demonstrating the applicability of partnering in the power utility sector. This implied the feasibility of wider application of partnering approach in other engineering related sector or industry.

3. The six essential partnering tools identified could serve as a reference to practitioners for determining what kind of partnering tools should be included in the partnering arrangement. The effect of individual partnering tools on nurturing specific partnering attributes was also evaluated, which can assist practitioners to determine which areas should pay attention to, in the case of reinforcing a particular partnering attributes is required.

4. The 8 KPIs developed in this research provided an objective and reliable partnering assessment method for monitoring partnering projects in the power utility context. The developed KPIs revealed that measurement of partnering performance should comprise of both result-oriented and relationship-oriented KPIs. This result inferred that the concept of partnering success means both project success and relationship improvement, but not either one. Furthermore, by comparing the eight KPIs identified with that by Yeung et al. (2007b) for construction industry in Hong Kong, it could be seen that four out of the eight KPIs identified by this research are different to that for the construction industry. It implied that there is no universal partnering performance measurement, and it should be context-dependent.

5. The five success factors for partnering implantation indicated the key areas of concern during partnering implementation and outlined a clear picture on the most influential factors or areas should be addressed in order to successfully implement partnering. It can facilitate practitioners to exercise an optimal resource allocation when implementing partnering. The findings also enriched the understanding on the key factors leading to partnering success in different context.

11.4. Limitation of the research

Limitations of this research are addressed as follow:

11.4.1. Limited sample size

Since it was the first time for the Utility Company to adopt partnering approach to managing its Transmission Substation Projects, the number of stakeholders who have hands-on experiences from the client and contractor company was limited. The limited sample size imposed restriction on research method selection. For example, there were only 28 eligible participants identified for joining the survey and Analytical Hierarchy Process for the success factor identification and prioritization (Chapter 9). Due to the small sample size, some statistical techniques like Factor Analysis could not be adopted. Likewise, Structural Equation Modeling could not be adopted for examining the causal relationship between the partnering tools and the partnering spirit development (Chapter 6). It was expected that more stakeholders will gain partnering experiences when the Utility Company continues adopting partnering approach to manage its projects, which would facilitate the choice of different statistical techniques for the related research in the future.

11.4.2. Company-specific framework development

This management framework developed in this research was developed based on the partnering application for managing Transmission Substation Projects in the Utility Company in the Hong Kong power industry. The applicability of the framework in other industry or sector required further verification.

11.4.3. Practical-oriented research method selection criteria

In order to increase the applicability, repeatability and practicality of the KPIs development process for other partnering projects in the Utility Company in the future, a straight forward approach was adopted for determining the measurement range of each quantitative indicator as stated in Section 8.8, instead of adopting a more rigorous approach, like the Fuzzy logic approach as suggested by Yeung et al. (2012).

11.5. Recommendation

This research developed a management framework for partnering implementation, laying down a foundation for partnering research in the power utility context. The following recommendations were drawn from the experiences of this research:

1. This research solely investigated the implementation of non-contractual partnering, future research effort should be spent on studying the issues of contractual

partnering, since there is a trench of adopting some partnering-friendly contract, like the New Engineering Contract (NEC) in the industry.

2. The scope of this research was limited to the Transmission Substation Projects. Future research should study the application of partnering for other types of projects in the power industry, like cable tunnel projects, overhead line construction projects or generation plant projects to enrich the current body of knowledge in this area.

3. This research investigated the effect of various partnering tools on nurturing partnering spirit and the positive relationship between partnering spirit and project performance was assumed. Thus, future research should investigate and verify the causal relationship between the partnering spirit and project performance.

4. The cost of partnering implementation was not considered in this research. Future research should take the cost of partnering implementation into account and develop a project selection guideline, assistant practitioners to determine what type and scale of projects should employ partnering approach so that the benefits gained from partnering can outweigh the cost incurred for implementing partnering.

5. For the Commercial Arrangement of the management framework, future research

effort should be spent on studying how to deal with commercial issues caused by market dynamics in materials or labor costs over a certain period, say in 5 years, since partnering arrangement advocates long-term commitment and business relationship and the market dynamics may affect the partnering spirit if it is not addressed properly.

6. Based on the experiences of this research, Teaching Company Scheme (TCS) was recommended for empirical based study, as it ensured the accessibility to empirical data, which is hard to collect otherwise, and the support from the research stakeholders. For example, all the questionnaire surveys conducted in this research received 100% response rate, which is rare in other normal cases.

11.6. Chapter Summary

This chapter reviewed the six research objectives and the research aim, illustrating that they were all well achieved in this research. The synopsis of the contributions of this research in both practical and theoretical perspectives was also discussed. The key limitations of this research were explained and recommendation for future research works was also presented.

Appendices

Appendix 1

Round 1 of the Delphi Survey in Stage 1

Identification of KPI for partnering project

Round 1

Thank you for participating in this survey by providing valuable opinions on identifying Key Performance Indicators (KPIs) for evaluating the success of partnering projects. Below are the 16 KPIs identified from previous research studies.

Please select **a minimum of 5 to a maximum of 10** KPIs, which you believe are the most vital KPIs for **evaluating the success of partnering projects** based on your experiences on partnering projects, in the space provided. You are also encouraged to insert additional KPI in the last row if deemed appropriate.

KPIs	Your Selection
1. Time performance Referring to the time variation of a project, such as ahead of schedule, on schedule, or behind schedule	☐
2. Top management commitment Referring to level of senior management commitment on supporting partnering approach	☐
3. Cost performance Referring to the total cost of a project, such as within budget, on budget or over budget	☐
4. Employee's attitude Referring to employee's attitude towards the implementation of partnering approach of a project	☐
5. Quality performance Referring to the quality of a project, such as high quality, average quality, or low quality	☐
6. Efficiency Referring to how effective the project is executed in different aspects, such as scope of rework, communication, or productivity.	☐
7. Safety performance Referring to accident rate of a project, such as low accident rate, average, or high accident rate	☐
8. Professional image establishment Referring to the degree of pride and reputation of each contracting party enhanced by the successful completion of a project	☐
9. Harmonious working relationships Referring to developing harmonious working relationships among all project stakeholders at all levels	☐
10. Long-term business relationships Referring to building up long-term business relationships with other contracting parties involved in a project	☐
11. Conflict Occurrence Referring to numbers of litigation/claim/dispute occurred throughout a project	☐

Appendix 2

Round 2 of the Delphi Survey in Stage 1

Identification of KPI for partnering project

Round 2

Thank you for your reply in round 1 of this study. To make the result more reliable, you are requested to review your selected KPIs in around 1 and **you can make changes on the KPIs selection in this round if deemed appropriate**. Please note that two new KPIs are proposed by the participants at shown in the bottom of the table, leading to a total of 18 KPIs for your selection in this round.

The overall selection result and your inputs in round 1 are presented in the table below for reference. Please again select **a minimum of 5 to a maximum of 10** KPIs, which you believe are the most vital KPIs for **evaluating the success of partnering projects** based on your experiences on partnering projects, in the space provided.

Those KPIs with 50% or more participants selected will be taken for further study in stage 2, in which the weighting of the selected KPIs will be determined.

Participant:

KPIs	% of participants selected in round 1	Your selection in around 1	Your selection in around 2
1. Top management commitment	79%	☐	☐
2. Long-term business relationships	79%	☐	☐
3. Time performance	71%	☐	☐
4. Cost performance	71%	☐	☐
5. Innovation and improvement	71%	☐	☐
6. Harmonious working relationships	64%	☐	☐
7. Stakeholder's satisfaction	64%	☐	☐
8. Efficiency	57%	☐	☐
9. Safety performance	57%	☐	☐
10. Employee's attitude	50%	☐	☐
11. Quality performance	50%	☐	☐
12. Conflict Occurrence	36%	☐	☐
13. Environmental performance	36%	☐	☐
14. Job satisfaction	14%	☐	☐
15. Introduction of partnering workshop	14%	☐	☐
16. Professional image establishment	0%	☐	☐
17. Risk Management Referring to the effort on identification of project risk, assisting risk owners and action owners to monitor, implement and review risk mitigation measures on a monthly basis	Newly Proposed	☐	☐
18. Award Recognition Referring to the recognized award or certificate obtained by the project team, e.g. Quality Building Award, Safety Award, Considerate Site Award	Newly Proposed	☐	☐

Appendix 3

Round 3 of the Delphi Survey in Stage 1

Identification of KPI for partnering project

Round 3

Thank you for your reply in stage 1 of this study. Those KPIs chosen by 50% or more participants are selected for further study as shown in the table below.

In stage 2, we focus on determining the importance of the 8 selected KPIs **on evaluating the success of partnering projects.**

You are requested to rate the importance of the KPIs in the 5-point Likert Scale from 1 to 5.
(1 = least important, 2 = slightly important, 3 = important, 4 = very important, 5 = most important)

For example, if you think the KPI is <u>very important</u> to evaluating the success of partnering projects, you should rate it as 4.

KPIs	% of participants in round 2	Your rating on the importance of the KPI on evaluating success of partnering projects (from 1=least importance to 5 = most importance)
1. Top management commitment	93%	
2. Long-term business relationships	86%	
3. Time performance	79%	
4. Cost performance	79%	
5. Innovation and improvement	79%	
6. Harmonious working relationships	71%	
7. Safety performance	71%	
8. Stakeholder's satisfaction	50%	
9. Efficiency	36%	
10. Quality performance	36%	
11. Award Obtained by the team	36%	
12. Conflict Occurrence	29%	
13. Risk Management	29%	
14. Employee's attitude	21%	
15. Job satisfaction	14%	
16. Environmental performance	7%	
17. Introduction of partnering workshop	7%	
18. Professional image establishment	0%	

~Thanks for your input~

Appendix 4

Round 4 of the Delphi Survey in Stage 1

Identification of KPI for partnering project

Round 4

Thank you for your reply in round 3 of this study.

To ensure the reliability of the weighting of the 8 selected KPIs, you are requested to review your rating on the 8 KPIs in around 3 and **you can make changes on the KPIs rating in this round if deemed appropriate**. The average rating and your rating of each KPI in round 3 are shown in the table below for reference.

Please review your rating

Please rate again the importance of the KPIs in the 5-point Likert Scale from 1 to 5. (1 = least important, 2 = slightly important, 3 = important, 4 = very important, 5 = most important)

Participant:

KPIs for partnering projects	Average rating by all participants	Your rating in round 3	Your rating in round 4
1. Top management commitment	4.67		
2. Long-term business relationships	4.67		
3. Time performance	3.87		
4. Cost performance	4.27		
5. Innovation and improvement	3.13		
6. Harmonious working relationships	3.60		
7. Safety performance	3.80		
8. Stakeholder's satisfaction	3.40		

~Thanks for your input~

Appendix 5

Survey for Exploring Potential Quantitative Indicators for Each KPIs in Stage 2

Identification of KPI for partnering project

Round 5

Thank you for your reply in round 4 of this study. A total of 8 KPI has been identified and their average ratings are shown in the table below in descending order. The weighting of each KPI is computed by dividing the average rating of each KPI by the sum of the average rating. With weightings of the KPIs, a CLP Partnering Project Performance Index is formulated as follow:

Partnering Project Performance Index *= 0.152 x Long-term business relationships + 0.146 x Top management commitment + 0.14 x Cost performance + 0.121 x Time performance + 0.121 x Safety performance + 0.114 x Harmonious working relationships + 0.108 x Stakeholder's satisfaction + 0.099 x Innovation and improvement*

This survey aims to determine **how the KPIs should be measured in practice**. In this connection, **you are requested to suggest 1 – 3 quantitative indicators for each KPI** for further analysis. Examples of quantitative indicators are shown below for you reference:

KPI	Proposed Quantitative Indicators (Example)
Time performance	Variation of actual completion time expressed as a percentage of finally agreed completion time
Top management commitment	Subjective assessment by using Likert scale (1-10)

KPIs for partnering projects	Average rating	Weighting	Proposed Quantitative Indicators
Long-term business relationships	4.80	15.2%	
Top management commitment	4.60	14.6%	
Cost performance	4.40	14.0%	
Time performance	3.80	12.1%	
Safety performance	3.80	12.1%	
Harmonious working relationships	3.60	11.4%	
Stakeholder's satisfaction	3.40	10.8%	
Innovation and improvement	3.13	9.9%	

~Thanks for your input~

Appendix 6

Round 1 of Delphi Survey in Stage 2

Development of CLP specific KPIs for partnering projects

Thank you for your participation first stage of this study. A total of 8 KPIs have been identified and their weightings are shown in the table below in descending order. In the last stage, we are interested to operationalize the KPIs by identifying a suitable indicator and the measurement range for each KPIs.

Identified KPIs for measuring CLP Partnering projects	**Weighting**
1. Long-term business relationships	15.2%
2. Top management commitment	14.6%
3. Cost performance	14.0%
4. Time performance	12.1%
5. Safety performance	12.1%
6. Harmonious working relationships	11.4%
7. Stakeholder's satisfaction	10.8%
8. Innovation and improvement	9.8%
Total	100%

A pool of indicators was consolidated from your pervious reply. This survey aims to select the most suitable indicator for each KPI based on 3 criteria, namely, importance, measurability and obtainability of the indicators.

You are requested to rate the proposed indicators with respect to the 3 criteria in a 1-5 Likert Scale.

KPI 1: **Long-term business relationships**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:**		
	1 = Very unimportant /	Very difficult to measure /	Very difficult to obtain
	2 = Unimportant /	Difficult to measure /	Difficult to obtain
	3 = Neutral	Neutral	Neutral
	4 = Important /	Easy to measure /	Easy to obtain
	5 = Very Important /	Very easy to measure /	Very easy to obtain
1. Subjective assessment on the criteria – SHEQ, support, delivery, cost/commercial and maturity in a 1-10 scale			
2. No. of disputes/claims per active project			
3. No. of projects the contractor has worked with the clients			
4. No. of joint events organised in a year			
Others: (Please specify)			

KPI 2: **Top management commitment**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:** 1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /	Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /	Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain
1. Subjective assessment in a 1-10 scale			
2. No. of management audits conducted by the senior management for each active project in a year			
3. Financial resources spent on partnering development expressed as a percentage of total project cost			
4. Top management participation rate of attending joint management meetings/events			
Others: (Please specify)			

KPI 3: **Cost performance**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:** 1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /	Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /	Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain
1. Cost variation expressed as a % to the Target Cost			
2. Cost saving generated per project through value engineering			
3. Accumulated no of claims raised per each project			
4. Reduction in overhead and project administration costs			
Ohers: (Please specify)			

KPI 4: **Time performance**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:**		
	1 = Very unimportant /	Very difficult to measure /	Very difficult to obtain
	2 = Unimportant /	Difficult to measure /	Difficult to obtain
	3 = Neutral	Neutral	Neutral
	4 = Important /	Easy to measure /	Easy to obtain
	5 = Very Important /	Very easy to measure /	Very easy to obtain
1. Time variation expressed as a % to the Target Project Duration			
2. Agreed work completion time is shorter than the market norm			
3. No of predefined project milestones achieved in a year			
4. Others: (Please specify)			

KPI 5: **Safety performance**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:** 1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /	Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /	Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain
1. No. of safety related activity conducted eg. training, BBSO or safety audit			
2. No. of reported SHE related incident e.g. DIIR, NC Case			
3. Number of safety related awards received			
4. Performance rated by independent safety auditor			
Others: (Please specify)			

KPI 6: **Harmonious working relationships**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:**		
	1 = Very unimportant /	Very difficult to measure /	Very difficult to obtain
	2 = Unimportant /	Difficult to measure /	Difficult to obtain
	3 = Neutral	Neutral	Neutral
	4 = Important /	Easy to measure /	Easy to obtain
	5 = Very Important /	Very easy to measure /	Very easy to obtain
1. Subjective assessment in a 1-10 scale			
2. No. of non-project related events organized for the work team			
3. Percentage change on the amount of formal correspondence issued from both parties as compared to that of pervious year			
4. Time required to resolve a dispute			
5. Others: (Please specify)			

KPI 7: **Stakeholder Satisfaction**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:**		
	1 = Very unimportant /	Very difficult to measure /	Very difficult to obtain
	2 = Unimportant /	Difficult to measure /	Difficult to obtain
	3 = Neutral	Neutral	Neutral
	4 = Important /	Easy to measure /	Easy to obtain
	5 = Very Important /	Very easy to measure /	Very easy to obtain
1. Subjective assessment on a 1-10 scale			
2. No. of complaint/appreciation from project stakeholders			
3. No. of initiatives with cost saving			
4. Reduction of no. of defects as compared with other similar projects			
5. Others: (Please specify)			

KPI 8: **Innovation and improvement**	**Importance** Important to measure the KPI?	**Measurability** Is the indicator easy to measure?	**Obtainability** Is the data easy to obtain?
Proposed indicators :	**Please score in 5- point scale as interpreted below:**		
	1 = Very unimportant /	Very difficult to measure /	Very difficult to obtain
	2 = Unimportant /	Difficult to measure /	Difficult to obtain
	3 = Neutral	Neutral	Neutral
	4 = Important /	Easy to measure /	Easy to obtain
	5 = Very Important /	Very easy to measure /	Very easy to obtain
1. Saving / benefits as derived from the innovations implemented expressed in the % of the total value of the project			
2. No. of Value Engineering proposal			
3. No. of implemented SHEQ related initiatives			
4. No. of joint-company sharing event			
5. Others: (Please specify)			

- Thanks for your valuable input! -

Appendix 7

Round 2 of Delphi Survey in Stage 2

Development of KPIs for partnering projects

Dear [Participant's name],

Thank you for rating the indicators of the 8 KPIs. To ensure the validity of the ratings, you are allowed to make changes, if deemed necessary, on your ratings of the indicators with reference to the average ratings by the groups and your corresponding rating on each indicators in the previous round.

Two new indicators were suggested for "Long term business relationship" and "Top management commitment" as indicated in the tables below.

Please review and rate the indicators with respect to the 3 criteria in a 1-5 Likert Scale.

Regards,

Ken Chan

KPI 1: **Long-term business relationships**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. Subjective assessment on the criteria – SHEQ, support, delivery, cost/commercial and maturity in a 1-10 scale	4.1			3.8			3.8		
2. No. of disputes/claims per active project	3.8			4.2			4.2		
3. No. of projects the contractor has worked with the clients	4.0			4.8			4.9		
4. No. of joint events organised in a year	3.2			4.5			4.5		
5. Earning/Saving arising from the relationship (Newly suggested in the last round)									

KPI 2: **Top management commitment**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. Subjective assessment in a 1-10 scale	4.1			3.8			3.8		
2. No. of management audits conducted by the senior management for each active project in a year	3.8			4.2			4.2		
3. Financial resources spent on partnering development expressed as a percentage of total project cost	4.0			4.8			4.9		
4. Top management participation rate of attending joint management meetings/events	3.2			4.5			4.5		
5. Visible collaborative leadership setting role model for followers (Newly suggested in the last round)									

KPI 3: **Cost performance**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
5. Cost variation expressed as a % to the Target Cost	4.1			3.8			3.8		
6. Cost saving generated per project through value engineering	3.8			4.2			4.2		
7. Accumulated no of claims raised per each project	4.0			4.8			4.9		
8. Reduction in overhead and project administration costs	3.2			4.5			4.5		

KPI 4: **Time performance**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. Time variation expressed as a % to the Target Project Duration	4.1			3.8			3.8		
2. Agreed work completion time is shorter than the market norm	3.8			4.2			4.2		
3. No of predefined project milestones achieved in a year	4.0			4.8			4.9		

KPI 5: **Safety performance**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. No. of safety related activity conducted eg. training, BBSO or safety audit	4.1			3.8			3.8		
2. No. of reported SHE related incident e.g. DIIR, NC Case	3.8			4.2			4.2		
3. Number of safety related awards received	4.0			4.8			4.9		
4. Performance rated by independent safety auditor	3.2			4.5			4.5		

KPI 6: **Harmonious working relationships**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. Subjective assessment in a 1-10 scale	4.1			3.8			3.8		
2. No. of non-project related events organized for the work team	3.8			4.2			4.2		
3. Percentage change on the amount of formal correspondence issued from both parties as compared to that of pervious year	4.0			4.8			4.9		
4. Time required to resolve a dispute	3.2			4.5			4.5		

KPI 7: **Stakeholder Satisfaction**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. Subjective assessment on a 1-10 scale	4.1			3.8			3.8		
2. No. of complaint/appreciation from project stakeholders	3.8			4.2			4.2		
3. No. of initiatives with cost saving	4.0			4.8			4.9		
4. Reduction of no. of defects as compared with other similar projects	3.2			4.5			4.5		

KPI 8: **Innovation and improvement**	**Importance** Important to measure the KPI?			**Measurability** Is the indicator easy to measure?			**Obtainability** Is the data easy to obtain?		
Proposed indicators:	1 = Very unimportant / 2 = Unimportant / 3 = Neutral 4 = Important / 5 = Very Important /			Very difficult to measure / Difficult to measure / Neutral Easy to measure / Very easy to measure /			Very difficult to obtain Difficult to obtain Neutral Easy to obtain Very easy to obtain		
	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round	Average Rating by the group	Your Rating in last round	Your rating in this round
1. Saving / benefits as derived from the innovations implemented expressed in the % of the total value of the project	4.1			3.8			3.8		
2. No. of Value Engineering proposal	3.8			4.2			4.2		
3. No. of implemented SHEQ related initiatives	4.0			4.8			4.9		
4. No. of joint-company sharing event	3.2			4.5			4.5		

- Thanks for your valuable input! -

Appendix 8

Survey for Determining Measurement Range of Each Quantitative Indicator

Development of KPIs for partnering projects (Final round)

Thank you for your previous inputs. We have successfully identified 8 KPIs and its corresponding indicators as shown below:

Identified KPIs for measuring Partnering projects	Weighting	Indicator
9. Long-term business relationships	15.2%	Number of projects the contractor has worked with the clients
10. Top management commitment	14.6%	Top management participation rate of attending joint management meetings/events
11. Cost performance	14.0%	Accumulated no of claims raised per each project
12. Time performance	12.1%	Number of predefined project milestones (civil works) achieved per each project
13. Safety performance	12.1%	Number of reported SHE related incident e.g. DIIR, NC Case
14. Harmonious working relationships	11.4%	Subjective assessment in a 1-10 scale
15. Stakeholder's satisfaction	10.8%	Number of initiatives implemented with cost saving
16. Innovation and improvement	9.8%	Number of implemented SHEQ related initiatives
Total	100%	

It comes to the last step of this survey. To operationalize the KPIs, **please state your expectation on the above indicators for 5 performance level, from poor to excellent as listed in the following tables.**

KPI 1:	**Long-term business relationships**
Selected indicators:	Number of projects the contractor has worked with the clients
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for each performance level.
Poor	0 ←---------- Your choice : _____ ----------→15 (please specify if out of this range)
Average	0 ←---------- Your choice : _____ ----------→15 (please specify if out of this range)
Good	0 ←---------- Your choice : _____ ----------→15 (please specify if out of this range)
Very Good	0 ←---------- Your choice : _____ ----------→15 (please specify if out of this range)
Excellent	0 ←---------- Your choice : _____ ----------→15 (please specify if out of this range)

KPI 2	**Top management commitment**
Selected indicators:	Top management participation rate of attending joint management meetings/events
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a percentage for each performance level listed below
Poor	0% ←---------- Your choice : _____ ----------→100%
Average	0% ←---------- Your choice : _____ ----------→100%
Good	0% ←---------- Your choice : _____ ----------→100%
Very Good	0% ←---------- Your choice : _____ ----------→100%
Excellent	0% ←---------- Your choice : _____ ----------→100%

KPI 3 :	**Cost performance**
Selected indicators:	Accumulated no of claims raised per each project
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for the five performance levels listed below
Poor	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Average	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Good	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Very Good	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Excellent	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0

KPI 4:	**Safety performance**
Selected indicators:	Number of reported SHE related incident e.g. DIIR, NC Case
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for the five performance levels listed below
Poor	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Average	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Good	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Very Good	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0
Excellent	(Please specify if out of this range) 10←---------- Your choice : _____ ----------→0

KPI 5 :

Time performance

Selected indicators:	<u>Number of predefined project milestones (civil works) achieved per each project</u> Note: The project assumes to be managed under design and built approach, and the key milestones include: Design stage: 1. Government Approval 2. Detailed Design Drawing Completion (BS, Superstructure + Architectural) 3. Tender Award Construction stage: 1. Pilling completion 2. Super structure completion 3. Occupation Permit Approval 4. Handover date
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for the five performance levels listed below
Poor	0 ←---------- Your choice : _____ ----------→7 (Please specify if out of this range)
Average	0 ←---------- Your choice : _____ ----------→7 (Please specify if out of this range)
Good	0 ←---------- Your choice : _____ ----------→7 (Please specify if out of this range)
Very Good	0 ←---------- Your choice : _____ ----------→7 (Please specify if out of this range)
Excellent	0 ←---------- Your choice : _____ ----------→7 (Please specify if out of this range)

KPI 6:	**Harmonious working relationships**
Selected indicators:	Subjective assessment in a 1-10 scale
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for the five performance levels listed below
Poor	0 ←---------- Your choice : _____ ----------→10
Average	0 ←---------- Your choice : _____ ----------→10
Good	0 ←---------- Your choice : _____ ----------→10
Very Good	0 ←---------- Your choice : _____ ----------→10
Excellent	0 ←---------- Your choice : _____ ----------→10

KPI 7:	**Stakeholder Satisfaction**
Selected indicators:	Number of initiatives implemented with cost saving
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for the five performance levels listed below
Poor	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Average	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Good	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Very Good	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Excellent	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)

KPI 8:	**Innovation and improvement**
Selected indicators:	Number of implemented SHEQ related initiatives
	When assessing the above indicator against the five performance levels stated below, from Poor to Excellent, what is you expected value for each level? Please indicate a number for the five performance levels listed below
Poor	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Average	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Good	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Very Good	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)
Excellent	0 ←---------- Your choice : _____ ----------→10 or higher (please specify)

The development process for the KPI measurement model is completed!

Thanks for your valuable input!

Appendix 9

Structure Interview with Senior Management for validating the proposed management framework

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. A (Contractor) Mr. B (Contractor)	**Position:**	General Manager (Business Development) General Manager (Contracts)
Interviewer:	Mr. Ken Chan	**Time:**	30 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, it is effective.
Q2. What do you expect the proposed management framework can achieve? The proposed management framework can enhance inter-firm relationship with mutual recognition and focus on the most essential aspects/elements in the course of partnering implementation.
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included in the framework because it can facilitate achieving mutual satisfaction. It should be noted that incentive scheme may not be essential in implementing partnering if the cooperative culture is mature. Essentially, partnering should focus on fairness and happiness of working.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes. Essentially, the KPIs can serve the performance monitoring purpose for future business. The effectiveness of KPIs depends on how the participants interpret the KPIs, but the development process can facilitate reaching a consensus among the project stakeholders.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. C	**Position:**	Deputy Director
Interviewer:	Mr. Ken Chan	**Time:**	40 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, this kind of specific management framework becomes more important, especially when [the Utility Company] migrates to more commercial oriented.
Q2. What do you expect the proposed management framework can achieve? Cultural change with aid of workshops and informal gatherings Performance monitoring with the special KPIs measuring both project and relational aspects Buy-in of partnering concept among the participants and encouraging appropriate behavior at middle management and frontline staff for effective implementation of partnering
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme and Partnering Champion should be included. Whether an incentive scheme is required depends on the relationship type. Ideally, incentive scheme is not important to a true and mature partnering relationship since each party should focus on the strategic and long-term benefits. However, before reaching this ultimate status, an effective incentive scheme should address the interest of each party, since their behavior and attitude have a direct impact to the project result in terms of quality, safety and timeliness. A Partnering Champion, competent in partnering, is required to drive the whole partnering implementation process to ensure it is on the right track. It should be stressed that how the middle management perceive and implement the concept of partnering is critical to the success of partnering implementation.

Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance?
Yes. This set of special KPIs is required as it can monitor the process, behavior/ relational aspects, and provide indications on the area of concerns.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. D	**Position:**	Senior Manager (Substation Implementation)
Interviewer:	Mr. Ken Chan	**Time:**	20 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? In view of acting as a collaboration platform, the framework is effective. It can facilitate the development of mutual trust and communications among the participants.
Q2. What do you expect the proposed management framework can achieve? The management framework can facilitate promotion and buy-in of the partnering concept at the middle management and front-line level.
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included as it can motivate the contractor to achieve the client's goal.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes. This set of special KPIs is required as it can monitor the process, behavior/ relational aspects, and provide indications on the area of concerns.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. E	**Position:**	Senior Asset Development Manager
Interviewer:	Mr. Ken Chan	**Time:**	30 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, the proposed framework in general should be effective in advocating collaboration and win-win attitude among the stakeholders which are essential in managing projects in a dynamic environment.
Q2. What do you expect the proposed management framework can achieve? 1. Development of a partnering culture 2. Facilitating a clear understanding of parenting 3. The systematic implementation process and management framework can help a wide-spread of promotion of partnering to gain buy-in from the stakeholders
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included as it can motivate the contractor to accomplish a specific objective such as cost saving since the effort spent on achieving the objective can be compensated.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes, since it consists of the conventional KPIs such as safety, time and cost and a set of relational KPIs such as trust or commitment on top. The specific KPIs can measure the performance of partnering so as to guide how the partnering arrangement should be improved.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. F	**Position:**	Deputy Director
Interviewer:	Mr. Ken Chan	**Time:**	20 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, it provides a partnering platform for complex and risky projects such as cable tunnel projects.
Q2. What do you expect the proposed management framework can achieve? Provide guidance on paying attention on the most essential aspects in the course of partnering implementation such that resources can be better utilitized.
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included, but an objective measurement system is required for supporting a fair rewarding system.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes, since it provides an objective and reliable means for measuring partnering performance, which is hard to develop in practice, especially in devising means for measurement.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. G	**Position:**	Deputy Director
Interviewer:	Mr. Ken Chan	**Time:**	40 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, the proposed framework is effective as it can facilitate joint effort for resolving issues arising from complex projects in the dynamic business and regulatory environment.
Q2. What do you expect the proposed management framework can achieve? The management framework should be able to: Develop common goals which can facilitate a win-win situation Encourage commitment to the partnering concept Enhance understanding of partnering principles among the participants Dive continuous improvement by the tailor-made KPIs
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included as it can reward the contactor for their effort made in achieving client's goal. It basically facilitate development of common goal. Partnering Champion should also be included to facilitate the implementation of partnering and reinforce the partnering culture, the benefits of partnering should be communicated to the key staff for the purpose of promotion and getting more buy-in.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes, as it covers both resulted and relationship oriented KPIs and it can objectively measure the indicators with the agreed measurement range.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. H	**Position:**	Senior Strategic Procurement Manager
Interviewer:	Mr. Ken Chan	**Time:**	40 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, the proposed framework is effective and comprehensive as the framework covers the managerial, relational, practical/ implementation, and financial aspects, which are essential to implementing partnering in dynamic business environment.
Q2. What do you expect the proposed management framework can achieve? The management framework should be able to: 1. Assist relationship building by focusing on cultural and relational aspects 2. Manage high risk items 3. Address the essential partnering implementation issues 4. Monitor partnering progress and providing feedback for rectification
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included as it can achieve "pay for performance" principle and can drive for better quality and safety performance.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes, because it also measures the relational performance, which cannot be achieved under the existing set of KPIs.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. I	**Position:**	Chief Procurement Officer
Interviewer:	Mr. Ken Chan	**Time:**	40 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, the proposed partnering framework is effective for managing Transmission substation projects as well as for others complex and high-value projects.
Q2. What do you expect the proposed management framework can achieve? The management framework can facilitate the stakeholders to understand the real needs of each others and create a partnering friendly environment to encourage the project stakeholders to work together.
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? Incentive scheme should be included as it can develop win-win attitude, which can result mutual benefits and reinforce the relationship. A dedicated process owner is required to drive the partnering process.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes, because it is simple but able to measure both qualitative and quantitative aspects.

Interview with senior management

The objective of this interview is to validate the effectiveness of the proposed management framework for enhancing partnering performance and the effectiveness of the developed KPIs for measuring partnering performance.

Interviewee:	Mr. J	**Position:**	Director
Interviewer:	Mr. Ken Chan	**Time:**	45 mins

Q1. Do you rate the proposed management framework for partnering projects effective for managing Transmission Substation Projects? Yes, the partnering framework is fundamentally a sound management concept. Given the coming social and political challenges, different changes in operational and commercial (price) aspects are anticipated; the partnering framework can help facilitate these changes and mitigate the risk.
Q2. What do you expect the proposed management framework can achieve? The management framework should be able to facilitate the achievement of world class SHEQ standard and drive a partnering culture, including change of people mindset regarding the client-supplier relationship. It can also help nurture partnering mentality / culture among the stakeholders through the well defined partnering process.
Q3. What other element(s) should be included in the management framework for a better performance? And why you say so? The concept of "Partnering Champion" can be explored with a central role to lead and drive the implementation of partnering across the various departments of the company.
Q4. Do you think the identified KPIs and the corresponding indicators and the measurement range effective in measuring partnering performance? Yes, because it is systematic and objective in nature. It can facilitate regular assessment on the relational performance for continuous improvement. We can consider applying same or similar relationship performance measurement mechanism to different contracts that adopts partnering approach, and identify room for continuous improvement by comparing and contrasting the relationship performance levels of different contracts.

Reference

1. Aarseth, W., Andersen, B., Ahola, T., and Jergeas, G. (2012). "Practical difficulties encountered in attempting to implement a partnering approach." International Journal of Managing Projects in Business, 5(2), 266-284.

2. Abudayyeh, O. (1994). "Partnering: A Team Building Approach to Quality Construction Management." Journal of Management in Engineering, 10(6), 36-44.

3. Albanese, R. (1994). "Team-Building Process: Key to Better Project Results." Journal of Management in Engineering, 10(6), 36-44.

4. Allport, G. W. (1954). The nature of prejudice, Addison-Wesley, Cambride, Mass.

5. Anvuur, A. M., and Kumaraswamy, M. M. (2007). "Conceptual model of partnering and alliancing " Journal of Construction Engineering and Management, 133(3), 225-234.

6. Aron, A., and McLaughlin-Volpe, T. (2001). Including others in the self. In C. Sedikides, & M. Brewer (Eds.), Individual self, relational self, collective self NY: Psychology Press, New York.

7. Baden-Hellard, R. (1995). Project partnering: principle and practice. Thomas Telford Services Limited, London

8. Balikie, N. (2000). Designing Social Research Cambridge, Polity Press.

9. Barlow, J., Cohen, M., and Jashapara, A. (1997). "Towards Positive Partnering ", The Policy Press, Bristol

10. Bassioni, H. A., Price, A. D. F., and Hassan, T. M. (2004). "Performance measure in construction." Journal of Management in Engineering, 20(2), 42-50.

11. Bayliss, R., Cheung, S. O., Suen, H. C. H., and Wong, S. P. (2004). "Effective partnering tools in construction: A case study on MTRC TKE contract 604 in Hong Kong." International Journal of Project Management, 22(3), 253-263.

12. Bayramoglu, S. (2000). "Partnering: applicability in the Turkish construction sector," PhD Thesis Istanbul Technical University, Turkey

13. Beach, R., Webster, M., and Campbell, K. M. (2005). "An evaluation of partnership development in the construction industry." International Journal of Project Management, 23(8), 611-621.

14. Bell, J. (2005). Doing your Research Project, 4th Ed., Open University Press, Buckingham.

15. Bennett, J., and Jayes, S. (1995). Trusting the team – The Best Practice Guide to Partnering in Construction, Reading Construction Forum.

16. Bennett, J., and Jayes, S. (1998). The Seven Pillars of Partnering : A Guide to Second Generation Partnering, Thomas Telford.

17. Black, C., Akintoye, A., and Fitzgerald, E. (2000). "Analysis of success factors and benefits of partnering in construction." International Journal of Project Management, 18(6), 423-434.

18. Bohmert, M. N., and DeMaris, A. (2015). "Interracial friendship and the trajectory of prominority attitudes: Assessing integroup contact theory." Group Processes & Intergroup Relations, 18(2), 225 - 240.

19. Bresnen, M., and Marshall, N. (2000a). "Motivation, commitment and the use of incentives in partnerships and alliances." Construction Management and Economics, 18(5), 587-598.

20. Bresnen, M., and Marshall, N. (2000b). "Partnering in construction: A critical review of issues, problems and dilemmas." Construction Management and Economics, 18(2), 229-237.

21. Broome, J. (2002). Procurement Route for Partnering - A Practical Guide Thomas Telford, London.

22. Bygballe, L. E., Marianne, J. B., and Sward, A. (2010). "Partnering relationships in construction : A literature review " Journal of Purchasing and Supply Management.

23. Chan, A. P., Chan, D. W., and Yeung, J. F. (2009). Relational Contracting for Construction Excellence: Principles, Practices and Case Studies, Spon Press.

24. Chan, A. P. C., and Chan, A. P. L. (2004). "Key performance indicators for measuring construction success." Benchmarking: An International Journal, 11(2), 203-211.

25. Chan, A. P. C., Chan, D. W. M., Chiang, Y. H., Tang, B. S., Chan, E. H. W., and Ho, K. S. K. (2004). "Exploring critical success factors for partnering in construction projects." J. Constr. Eng. Manage.-ASCE, 130(2), 188-198.

26. Chan, A. P. C., Chan, D. W. M., Fan, L. C. N., Lam, P. T. I., and Yeung, J. F. Y. (2006). "Partnering for construction excellence-A reality or myth?" Building and Environment, 41(12), 1924-1933.

27. Chan, A. P. C., Chan, D. W. M., Fan, L. C. N., Lam, P. T. I., and Yeung, J. F. Y. (2008). "Achieving partnering success through an incentive agreement: Lessons learned from an underground railway extension project in Hong Kong." Journal of Management in Engineering, 24(3), 128-137.

28. Chan, A. P. C., Chan, D. W. M., and Ho, K. S. K. (2003a). "An empirical study of the benefits of construction partnering in Hong Kong." Construction Management and Economics, 21(5), 523-533.

29. Chan, A. P. C., Chan, D. W. M., and Ho, K. S. K. (2003b). "Partnering in Construction: Critical Study of Problems for Implementation " Journal of Management in Engineering, 19(3).

30. Chan, A. P. C., Chan, D. W. M., Fan, L. C. N., Lam, P. T. I. and Yeung, J. F. Y. . (2004). "A Comparative Study of Project Partnering Practices in Hong Kong ", Construction Industry Institute Hong Kong

31. Chan, A. P. C., Yung, E. H. K., Lam, P. T. I., Tam, C. M., and Cheung, S. O. (2001). "Application of Delphi method in selection of procurement systems for construction projects." Construction Management and Economics, 19(7), 699-718.

32. Chan, A. P. C., Hu, Y., Ma, L., Shan, M., and Le, Y. (2015). Improving the Outcomes of Public Drainage Projects through NEC3-Based Relational Contracting: Hong Kong Case Study. Journal of Professional Issues in Engineering Education and Practice, 142(2), 06015003.

33. Chan, E. H. W., and Yu, A. T. W. (2005). "Contract strategy for design management in the design and build system." International Journal of Project Management, 23(8), 630-639.

34. Chan, F. C., and Woo, G. (2001). "Project Management in Transmission Network Development." International Conference on Electrical Engineering

35. Chan, K. T. K., Chan, A. P. C., and Yeung, J. F. Y. (2011). "Enhancing University-Industry collaboration via teaching company scheme: A case study on research partnerships in Hong Kong." In: 36th Annual Conference for Australian University Building Educators, Bond University, Gold Coast.

36. Chan, K. T. K., Chan, A. P. C., and Yeung, J. F. Y. (2015). "An Effective Partnering Implementation Framework for Managing Engineering Projects." International Journal of Mechanical And Production Engineering 3(11), 75 - 80.

37. Challender, J., Farrell, P., & Sherratt, F. (2014). Partnering practices: An investigation of influences on project success. Paper presented at the Proceedings 30th Annual Association of Researchers in Construction Management Conference, ARCOM 2014.

38. Chau, K. W. (1997). "The ranking of construction management journals." Construction Management and Economics, 15(4), 387-398.

39. Chen, W. T., and Chen, T.-T. (2007). "Critical success factors for construction partnering in Taiwan." International Journal of Project Management, 25(5), 475-484.

40. Cheng, E. W. L., and Li, H. (2001). "Analytic hierarchy process." Measuring Business Excellence, 5(3), 30-37.

41. Cheng, E. W. L., and Li, H. (2002). "Construction Partnering Process and Associated Critical Success Factors: Quantitative Investigation." Journal of Management in Engineering, 18(4).

42. Cheng, E. W. L., Li, H., and Love, P. E. D. (2000). "Establishment of Critical Success Factors for Construction Partnering." Journal of Management in Engineering, 16(2), 84-92.

43. Cheung, S. O., Ng, T. S. T., Wong, S. P., and Suen, H. C. H. (2003a). "Behavioral aspects in construction partnering." International Journal of Project Management, 21(5), 333-343.

44. Cheung, S. O., Suen, H. C. H., and Cheung, K. K. W. (2003). "An automated partnering monitoring system--Partnering Temperature Index." Automation in Construction, 12(3), 331-345.

45. Cheung, S. O., Yiu, T. W., and Chiu, O. K. (2009). "The aggressive–cooperative drivers of contruction contracting " International Journal of Project Management, 27, 727-735.

46. Chin, K.-S., Chan, B. L., and Lam, P.-K. (2008). "Identifying and prioritizing critical success factors for coopetition strategy." Industrial Management & Data Systems, 108(4), 437-454.

47. Chow, L. K. (2005). "Incorportaing fuzzy membership functions and gap analysis concept into performance evaluation of engineering consultant - Hong Kong study," Unpublished PhD thesis, The University of Hong Kong, Hong Kong

48. Chow, L. K., and Ng, S. T. (2007). "Expectation of performance levels pertinent to consultant performance evaluation." International Journal of Project Management, 25(1), 90-103.

49. CIB. (1997). "Partnering in the team." Construction Industry Board W12, Thomas Telford, London

50. CII. (1991). "In Search of Partnering Excellence ", Construction Industry Institute, Austin, TX.

51. Cooke-Davies, T. (2002). "The "real" success factors on projects " International Journal of Project Management, 20(3), 185-190.

52. Cowan, C., Gray, C., and Larson, E. (1992). "Project Partnering" Project Management Journal 23(4).

53. Cox, R. F., Issa, R. R. A., and Ahrens, D. (2003). "Management's Perception of Key Performance Indicators for Construction." Journal of Construction Engineering and Management, 129(2), 142-151.

54. Crane, T. G., Felder, J. P., Thompson, P. J., Thompson, M. G., and Sanders, S. R. (1997). "Partnering process model." Journal of Management in Engineering, 13(3), 57-63.

55. Crane, T. G., Felder, J. P., Thompson, P. J., Thompson, M. G., and Sanders, S. R. (1999). "Partnering measures." Journal of Management in Engineering, 15(2), 37-42.

56. Crowe, T. J., Noble, J. S., and Machimada, J. S. (1998). "Multi-attribute analysis of ISO 9000 registration using AHP." International Journal of Quality & Reliability Management, 15(2), 205-222.

57. Crowley, L. G., and Karim, M. A. (1995). "Conceptual Model of Partnering." Journal of Management in Engineering, 11(5), 33.

58. Csete, J. M., and Albrecht, R. R. (1994). "The best of both worlds: synthesizing quantitative and qualitative research in the medical setting." In: 9th Annual Primary Care Research Methods and Statistics Conference, San Antonia, Texas, 13/11-13/15.

59. Dainty, A. R. J., Cheng, M. I., and Moore, D. R. (2003). "Redefining performance measures for construction project managers: an empirical evaluation." Construction Management and Economics, 21(2), 209-218.

60. Danermark, B., Ekstrom, M., Jakobsen, L., and Karlsson, J. (2002). Explaining Society. Critical Realism in the Social Sciences, Routledge, London and New York.

61. Denzin, N. K. (1978). The Reserach Act, 2nd Ed., MchGraw-Hill, New York.

62. Dickey, J., and Watts, T. (1975). Analytic Technique in Urban and Regional Planning. McGraw-Hill, New York.

63. Doloi, H. (2013). "Empirical analysis of traditional contracting and relationship

agreements for procuring partners in construction projects." Journal of Management in Engineering, 29(3), 224-235.

64. Dovidio, J. F., Gaertner, S. L., and Kawakami, K. (2003). "Intergroup Contact: The Past, Present, and the Future " Group Processes & Intergroup Relations 6, 5-21.

65. Eriksson, P. E. (2010). "Partnering: what is it, when should it be used, and how should it be implemented?" Construction Management and Economics, 28(9).

66. Fellows, R., and Liu, A. (2008). Research Methods for Construction Wiley-Blackwell, United Kingdom.

67. Fellows, R., and Liu, A. M. (2012). "Managing organizational interfaces in engineering construction projects: addressing fragmentation and boundary issues across multiple interfaces." Construction Management and Economics, 30(8), 653-671.

68. Glagola, C. R., and Sheedy, W. M. (2002). "Partnering on Defense Contracts." Journal of Construction Engineering & Management, 128(2), 127.

69. Grix, J. (2004). The Foundations of Research, Palgrave Macmillan, New York

70. Hartmann, A., and Bresnen, M. (2011). "The emergence of partnering in construction practice: an activity theory perspective." Engineering Project Organization Journal, 1(1), 41-52.

71. Hong, Y., Chan, D. W. M., and Chan, A. P. C. (2012a). "Exploring the applicability of construction partnering in Mainland China: A qualitative study." Facilities, 30(13), 667-694.

72. Hong, Y., Chan, D. W. M., Chan, A. P. C., and Yeung, J. F. Y. (2012b). "Critical Analysis of Partnering Research Trend in Construction Journals." Journal of Management in Engineering, 28(2), 82-95.

73. Huang, J., and Jie, S. (2009). "The Provision of Incentives in the Construction Projects." In: Management and Service Science, 2009. MASS '09. International Conference on Wuhan, China.

74. ICE (Institution of Civil Engineers). (2013). NEC3 April 2013 Edition Complete Family of Contracts, Thomas Telford, London.

75. Jacobsson, M., and Roth, P. (2014). "Towards a shift in mindset: Partnering projects as engagement platforms." Construction Management and Economics, 32(5), 419-432.

76. Jacobsson, M., and Wilson, T. L. (2014). "Partnering hierarchy of needs." Management Decision, 52(10), 1907-1927.

77. Jick, T. D. (1979). "Mixing Qualitative and Quantitative Methods: Triangulation in Action." Administrative Science Quarterly, 24(4), 602-611.

78. Johnson, R. B., and Onwuegbuzie, A. J. (2004). "Mixed Methods Research: A Research Paradigm Whose Time Has Come." Educational Researcher, 33(7), 14-26.

79. Johnson, R. B., and Turner, L. A. (2003). "Data collection strategies in mixed methods research" In: Handbook of mixed methods in social and behavioral research. , A. Tashakkori and C. Teddlie, eds., Sage, CA.

80. Kadefors, A. (2004). "Trust in project relationships-inside the black box." International Journal of Project Management, 22(3), 175-182.

81. Kagioglou, M., Cooper, R., and Aouad, G. (2001). "Performance management in construction: a conceptual framework." Construction Management and Economics, 19(1), 85-95.

82. Kaplan, R. S., and Norton, D. P. (1992). "The balanced scorecard: measures that drive performance." Harvard Business Review, 70(1), 71-79.

83. KPI Working Group. (2000). "KPI Report for the Minister for Construction." London.

84. Kumaraswamy, M. M., and Matthews, J. D. (2000). "Improved subcontractor selection employing partnering principles." Journal of Management in Engineering, 16(3), 47-57.

85. Lahdenperä, P. (2012). "Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery." Construction Management and Economics, 30(1), 57-79.

86. Lam, K., and Zhao, X. (1998). "An application of quality function deployment to improve the quality of teaching." International Journal of Quality Reliability Management 15(4), 389 - 413.

87. Larson, E. (1995). "Project Partnering: Results of Study of 280 Construction Projects." Journal of Management in Engineering, 11(2), 30.

88. Latham, M. (1994). "Constructing the team: joint review of procurement and contractural arrangements in the United Kingdom construction industry; final report." Her Majesty's Stationery Office (HMSO), UK.

89. Lenard, D. J., Bowen-James, A., Thompson, M., and Anderson, L. (1996). "Partnering - Models for succes. ." Construction Industry Institute Australia, Adelaide, Australia

90. Lendrum, T. (1998). The strategic Partnering Handbook, McGraw Hill, Sydney.

91. Li, H., Cheng, E. W. L., and Love, P. E. D. (2000). "Partnering research in construction." Engineering Construction & Architectural Management (Blackwell Publishing Limited), 7(1), 76-92.

92. Lin, G. B., and Shen, Q. P. (2007). "Measuring the performance of value management studies in construction: critical review." Journal of Management in Engineering, 23(1), 2-9.

93. Lincoln, Y. S., and Guba, E. G. (1985). Naturalistic Inquiry, Sage Publications, Beverly Hill CA.

94. Linstone, H., and Turoff, M. (1975). The delphi method: Techniques and Application,, Addison Wesley, Reading

95. Lo, P. C., Ford, B., and Wimalasena, S. (Year). "A Collaborative Approach in Delivering Optimal Solutions for Cable Tunnel and in-situ 132kV Switchboard Replacement Projects." CEPSI 2004.

96. Loo, R. (2002). "The Delphi method: a Powerful tool for strategic management." Journal of Police Strategies & Management, 25(4), 762-769.

97. Love, P. E. D., Davis, P. R., Chevis, R., and Edwards, D. J. (2011). "Risk/Reward Compensation Model for Civil Engineering Infrastructure Alliance Projects." Journal of Construction Engineering & Management, 137(2).

98. Lu, S., and Yan, H. (2007). "A model for evaluating the applicability of partnering in construction." International Journal of Project Management, 25(2), 164-170.

99. Luo, X., Brown, G., and Huang, S. (2015). "Host perceptions of backpackers: Examining the influence of intergroup contact." Tourism Management, 50, 292-305.

100. Luu, T. V., Kim, S. Y., Cao, H. L., and Park, Y. M. (2008). "Performance measurement of construction firms in developing countries." Construction Management and Economics, 26(4), 373-386.

101. Mason, J. (1998). Qualitative Researching sage, London, Thousand Oaks, CA and New Delhi

102. Meng, X. (2012). "The effect of relationship management on project performance in construction" International Journal of Project Management, 30, 188-198.

103. Miller, N. (2002). "Personalization and the promise of contact theory." Journal of Social Issues 58 (2), 387 - 410.

104. Mollaoglu, S., Sparkling, A., and Thomas, S. (2015). "An inquiry to move an underutilized best practice forward: Barriers to partnering in the architecture, engineering, and construction industry." Project Management Journal, 46(1), 69-83.

105. Naoum, S. (2003). "An overview into the concept of partnering." International Journal of Project Management, 21(1), 71-76.

106. Neely, A. (1999). "The performance revolution: why now and what next?" International Journal of Operations & Production Management, 19(2), 205-228.

107. Neuman, W. L. (2000). Social Reserach Methods. Qualitative and Quantitative Approaches, 4th Ed., Boston.

108. Ng, P., Chu, R., and Kwan, P. (2004). "KCR Hung Hom station modifications - Planning, design and construction." Transactions Hong Kong Institution of Engineers, 11(1), 28-34.

109. Ng, S. T., Rose, T. M., Mak, M., and Chen, S. E. (2002). "Problematic issues associated with project partnering - the contractor perspective." International Journal of Project Management, 20(6), 437-449.

110. Nystrom, J. (2005). "The definition of partnering as a Wittgenstein family-resemblance concept." Construction Management and Economics, 23(5), 473-481.

111. Packham, G., Thomas, B., and Miller, C. (2003). "Partnering in the house building sector: A subcontractor's view." International Journal of Project Management, 21(5), 327-332.

112. Peckiene, A., Komarovska, A., and Ustinovicius, L. (2013). "Overview of Risk Allocation between Construction Parties." Procedia Engineering, 57(0), 889-894.

113. Pettigrew, T. F. (1998). "Intergroup Contact Theory." Annual Review of Psychology, 49(1), 21.

114. Pettigrew, T. F. (2008). "Future Directiona for intergroup contact theory and reserach " International Journal of intercultural Relations, 32(3), 187 - 199.

115. Pettigrew, T. F., and Tropp, L. R. (2006). "A meta-analytic test of intergroup contact theory." Journal of Personality and Social Psychology, 90(5), 751-783.

116. Pettigrew, T. F., and Tropp, L. R. (2008). "How does intergroup contact reduce prejudice? Meta-analytic tests of three mediators." European Journal of Social Psychology, 38(6), 922-934.

117. Pettigrew, T. F., Tropp, L. R., Wagner, U., and Christ, O. (2011). "Recent advances in intergroup contact theory." International Journal of Intercultural Relations, Volume 35, Issue 3, May 2011, Pages 271-280, 35(3), 10.

118. Phua, F. T. T., and Rowlinson, S. (2004). "How important is cooperation to construction project success? A grounded empirical quantification." Engineering, Construction and Architectural Management, 11(1), 45-54.

119. Punniyamoorthy, M., and Murali, R. (2008). "Balanced score for the balanced scorecard: a benchmarking tool." Benchmarking: An International Journal, 15(4), 420-423.

120. Raftery, J., McGeorge, D., and Walters, M. (1997). "Breaking up methodological monopolies: a multi-paradigm approach to construction management research." Construction Management and Economics, 15(3), 291 - 297.

121. Saaty, R. W. (1987). "The analytic hierarchy process? What it is and how it is used." Mathematical Modelling, 9(3 - 5), 161-176.

122. Saaty, T. L. (1980). "The Analytic Hierarchy Process."

123. Saaty, T. L. (1994). "How to make a decision: the analytic hierarchy process." Interfaces, 24(6), 19-43.

124. Salmeron, J. L., and Herrero, I. (2005). "An AHP-based methodology to rank critical success factors of executive information systems." Computer Standards & Interfaces, 28(1), 1-12.

125. Schmader, K. J. (1994). "Partnered project perfromance in the U.S. NavalFacilities Engineering Command," Thesis, The University of Texas at Austin

126. Schneiderman, A. (1999). "Why balanced scorecards fail." Journal of Strategic Performance Measurement, (special edition), January 6-11.

127. Scott, B. (2001). Partnering in Europe - incentive based alliancing for projects, Thomas Telford Services Limited, London.

128. Silverman, D. (2000). Doing Qualitative Research. A Practical Handbook, Sage, London, Thousand Oaks, CA and New Delhi.

129. Subramanian, N., and Ramanathan, R. (2012). "A review of applications of Analytic Hierarchy Process in operations management." International Journal of Production Economics, 138(2), 215-241.

130. Suprapto, M., Bakker, H. L. M., and Mooi, H. G. (2015). "Relational factors in owner–contractor collaboration: The mediating role of teamworking." International Journal of Project Management, 33(6), 1347-1363.

131. Talib, F., and Rahman, Z. (2015). "Identification and prioritization of barriers to total quality management implementation in service industry: An analytic hierarchy process approach." The TQM Journal, 27(5), 591-615.

132. Tang, H. (2001). "Construct for Excellence: Report of the Construction Industry Review Committee." HKSAR Government, Hong Kong

133. Tang, W., Duffield, C. F., and Young, D. M. (2006). "Partnering Mechanism in Construction: An Empirical Study on the Chinese Construction Industry." Journal of Construction Engineering and Management, 132(3).

134. Thompson, P. J., and Sanders, S. R. (1998). "Partnering continuum." Journal of Management in Engineering, 14(5), 73.

135. Tvarnø, C. D. (2015). To bind or not to bind It's in the contract Formalizing collaboration through partnering contracts in the US, British and Danish construction industries. Journal of Strategic Contracting and Negotiation, 1(4), 288-314.

136. Vaidya, O. S., and Kumar, S. (2006). "Analytic hierarchy process: An overview of applications." European Journal of Operational Research 169(1), 1-29.

137. Venselaar, M., Gruis, V., and Verhoeven, F. (2015). "Implementing supply chain partnering in the construction industry: Work floor experiences within a Dutch housing association." Journal of Purchasing and Supply Management, 21(1), 1-8.

138. Walker, D., and Jacobsson, M. (2014). "A rationale for alliancing within a public-private partnership." Engineering, Construction and Architectural Management, 21(6), 648-673.

139. Walker, D. H. T., and Lloyd-Walker, B. M. (2015). Collaborative Project Procurement Arrangements Project Management Institute Pennsylvania, USA.

140. Wang, T., Tang, W., Qi, D., Shen, W., & Huang, M. (2015). Enhancing design management by partnering in delivery of international EPC projects: Evidence from Chinese construction companies. Journal of Construction Engineering and Management, 142(4), 04015099.

141. Warne, T. R. (1994). Partnering for Success, ASCE Press, New York.

142. Watson, P., and Seng, L. T. (2001). "Implementing the European foundation for quality management model in construction." Construction Information Quarterly, construction paper.

143. Westerveld, E. (2003). "The project excellence model: linking success criteria and critical success factors." International Journal of Project Management, 21(6), 411-418.

144. Weston, D. C., and Gibson, G. E. (1993). "Partnering-Project Performance in U.S. Army Corps of Engineers." Journal of Management in Engineering, 9(4), 410-425.

145. Wong, J. K. W., and Li, H. (2008). "Application of the analytic hierarchy process (AHP) in multi-criteria analysis of the selection of intelligent building systems." Building and Environment, 43(1), 108-125.

146. Wong, P. S. P., and Cheung, S. O. (2004). "Trust in construction partnering: Views from parties of the partnering dance." International Journal of Project Management, 22(6), 437-446.

147. Wong, W. K., Cheung, S. O., Yiu, T. W., and Pang, H. Y. (2008). "A framework for trust in construction contracting." International Journal of Project Management, 26(8), 821 - 829.

148. Wright, J. N., and Fergusson, W. (2009). “Benefits of the NEC ECC form of contract: A New Zealand case study.” International Journal of Project Management, 27(3), 243

149. Yang, H., Yeung, J. F. Y., Chan, A. P. C., Chiang, Y. H., and Chan, D. W. M. (2010). "A critical review of performance measurement in construction." Journal of Facilities Management, 8(4), 269-284.

150. Yeung, F. P. (2007). "Developing a Partnering Preformance Index(PPI) for Construction Projects - A Fuzzy Set Theory Approach " Unpublished Thesis The Hong Kong Polytechnic University Hong Kong

151. Yeung, J. F. Y., Chan, A. P. C., and Chan, D. W. M. (2007a). "The definition of alliancing in construction as a Wittgenstein family-resemblance concept." International Journal of Project Management, 25(3), 219-231.

152. Yeung, J. F. Y., Chan, A. P. C., and Chan, D. W. M. (2008). "Establishing quantitative indicators for measuring the partnering performance of construction projects in Hong Kong." Construction Management and Economics, 26(3), 277-301.

153. Yeung, J. F. Y., Chan, A. P. C., and Chan, D. W. M. (2009). "Developing a performance index for relationship-based construction projects in australia: Delphi study." Journal of Management in Engineering, 25(2), 59-68.

154. Yeung, J. F. Y., Chan, A. P. C., and Chan, D. W. M. (2012). "Fuzzy set theory approach for measuring the performance of relationship-based construction projects in Australia." Journal of Management in Engineering, 28(2), 181-192.

155. Yeung, J. F. Y., Chan, A. P. C., Chan, D. W. M., and Li, L. K. (2007b). "Development of a partnering performance index (PPI) for construction projects in Hong Kong: A Delphi study." Construction Management and Economics, 25(12), 1219-1237.

156. Yu, L., Kim, K., Jung, Y., and Chin, S. (2007). "Comparable performance measurement system for construction companies." Journal of Management in Engineering, 23(3), 131-139.

157. Zaghloul, R., and Hartman, F. (2003). "Construction contracts: the cost of mistrust." International Journal of Project Management, 21(6), 419-424.

158. Zhao, F. (2002). "Measuring inter-organizational partnership: the challenge of cultural discrepancy." Proceedings of the 3rd International Conference on Theory & Practice in Performance Measurement, Boston.