ANALYSIS OF COOPERATIVE RELATIONSHIPS IN PARTNERING PROJECTS IN THE CONSTRUCTION INDUSTRY OF HONG KONG

A thesis submitted in partial fulfillment of the requirements for the Degree of Master of Philosophy

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CERTIFICATE OF ORGINALITY

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 which has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

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ABSTRACT

The construction industry has long been associated with chronic problems such as breakdowns in communication, disputes, and adversarial working relationships. Calls have long been raised for a change in the traditional paradigm of hierarchal management for a more collaborative network approach. Partnering is an innovative management strategy in the construction industry to engineer collaboration within a project team and thus improve the performance of the project. There is now an abundant literature on partnering, in such areas as the key elements of successful partnering, the benefits, and the difficulties. Criticisms have been raised that the extant research on partnering is ubiquitous and prescriptive. Partnering is a process of relational management; however, little research has been done on the socio-psychological aspect of partnering relationships. There is even less in-depth research on the complex and dynamic process of forming and sustaining partnering.

To fill in this gap, this study develops an integrated research framework explaining why and how partnering brings about a cooperative relationship. The study first explains the conditions of the formation of partnering. The core study examines the cooperative relationships formed in partnering projects, from the determinants of the cooperative partnering relationship to the interaction among the partners. It uses a social network approach to analyse the relational and behavioural structures of the partnering process and examines how these structures contribute to improving performance. This study examines the structure of partnering relationships with respect to three behavioural aspects: (1) communication, (2) problem solving, and (3) working relationships.

This study generally confirms the propositions that the formation of partnering requires the presence of both inducements and opportunities. The sharing of risk is the most important inducement for an organization to form a relationship of partnering, whereas technical capital is a necessary condition for opportunities for partnering to occur. The proposition on the determinants of a cooperative partnering relationship is confirmed, and it is found that the determinants of a cooperative partnering relationship have more psychological constructs than structural ones. This study provides evidence that a cooperative partnering relationship leads to improvements in performance in terms of project goals and satisfaction.

The core findings of this study are on cooperative partnering relationships. This study confirms the proposition that partnering facilitates a better environment of open communication, efficient problem solving, and close working relationships. A mature partnering project would exhibit a relational network structure of more open communication, efficient problem solving, and closer working relationships than less mature ones. This study also further validates the findings with a non-partnering project. Comparing with a non-partnering project, it is found that partnering project use more informal communication and information sharing is more even. Conflict occurrences may not be lowered in partnering projects. However there is joint problem solving and partnering projects have higher level of cooperative working relationship and team building.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

This chapter explains the background of the study, identifies the problem statement, determines the aims and objectives for research, outlines the methodology, and sets out the context of the study.

1.2 BACKGROUND

The construction industry is highly divisive and fragmented (Li et al., 2001). In the industry, there is a mixture of client companies and professional consultants, contractors, subcontractors, and suppliers, drawn together temporarily for a single project. Each of them has conflicting goals and interests. Emmitt and Gorse (2003) have described this relationship as ‘a collection of groups and individuals’ rather than ‘a project team’. Added to this complexity is the dynamic nature of construction; different parties may join in and leave the project as construction progresses to another stage. The diverse cultural and behavioural characteristics of various parties in the construction industry make coordination and integration of the construction process very difficult (Emmit and Gorse, 2003). Thus, the construction industry has long been associated with chronic problems such as breakdowns in communication, inefficient problem solving, and adversarial relationships. These problems adversely affect construction performance outcomes, efficiency and productivity.

A paradigm change has been well documented in the earliest Emmerson Report, the Latham report, and up to the latest Egan report in the UK (Emmerson, 1962, Latham, 1994; Construction Task Force, 1998) and report produced by the Construction Industry Review Committee in Hong Kong (CIRC, 2001). Particular attention has been drawn to improving the quality of the relationship between the participants in the project and to encouraging feedback and mutual adjustment between the design and construction processes (Higgin and Jessop, 1965). The traditional adversarial approach should be changed to a more collaborative network approach (Bennett, 2000). Partnering is recognized as an innovative management strategy that can be used to help bring about a cooperative relationship, and thus to improve project performance.

In construction, it is generally agreed that partnering is a relationship management strategy that offers an alternative way for the members of a project team such as clients, consultants, contractors, and sub-contractors to work together rather than against each other to tackle the challenges of the project. With partnering, partners work as a team through formal strategies and focusing on common objectives. It is commonly agreed by the industry (AMP SIG, 2003) that partnering provides a basis for removing wasteful practices and adversarial relationships by concentrating on meeting agreed objectives. 'The focus of the relationship is on jointly improving value and reducing cost through waste reduction and innovation, instead of gaining an advantage through onerous contract terms or claim situations' (AMP SIG, 2003).

'Partnering not only improves relationships on a project but also improves the bottom line for all involved. In construction there has been too much effort spent

on activities that add little value to the end result. Partnering is about moving the focus away from confrontation to waste reduction through the development of constructive, cooperative relationships' (AMP SIG, 2003).

'Examples of waste are in the multi-layer supervision and submission processes, which result in duplication of effort and miscommunication. This has developed because of lack of trust in the supplier to deliver the product right the first time. It leads to a great deal of waste, not just in manpower, but also in the delays and re-work resulting from poor communication. The best partnering relationships work at improving the root cause of these problems, and through streamlining processes achieve significant improvements in time and cost' (AMP SIG, 2003).

1.2.1 The Construction Industry of Hong Kong

The construction industry is one of the main pillars of Hong Kong's economy. Since 1990, the industry's contribution to Hong Kong's GDP has ranged from 4.9% to 6%. The gross value of construction work performed by main contractors at construction sites increased from $44.7 billion to $102 billion between 1990 and 1998. In 1999, 9.2% of workforce in Hong Kong was employed in construction. Construction activities in Hong Kong can be broadly divided into three areas, namely public housing projects undertaken by the Housing Authority; other public sector works commissioned by government bodies; and private sector construction projects undertaken by property developers (CIRC, 2001).

Although construction is one of the main pillars in Hong Kong's economy, the

industry is rife with instances of substandard work, shoddy workmanship, costs overrun, and project delays. Not unlike other construction industries in the UK and in the USA, the construction industry of Hong Kong is beset with many problems. The situation has become even worse after the financial turmoil of the recent past. Short piling scandals have attracted particular attention to the quality of public housing. In order to survive, contractors submit unrealistically low tenders. This, together with the lowest bidding policy on the part of the government-related owners, results in cutthroat competition. Quality is the first to be scarified in order to meet cost and time schedules (Tam et al., 2000). In the face of intense financial pressure, contractors grasp every opportunity to file claims. These result in adversarial relationships among different stakeholders in a construction project. Multi-layered subcontracting further fragments the industry and makes coordination more difficult (CIRC, 2001).

In response to the myriad concerns about the construction industry of Hong Kong, the Hong Kong government has undertaken a comprehensive review of the industry with the aim of improving its quality and its competitiveness. The recently released CIRC report (2001) highlighted the chronic problems of fragmentation and an adversarial culture in the industry, and has recommended that in order to 'achieve a steep improvement in its overall performance, the construction industry needs a new culture that focuses on delivering better value to the customers on a continuous basis'. The Committee advises the construction industry to seek continued improvements in performance instead of just meeting the minimum requirements set by clients and by the regulatory authorities.

The CIRC report (2001) also called for building up ‘an integrated construction industry that is capable of continuous improvement towards excellence in a market-driven environment’. It is recognized that more strategic business relationships should be sought within the industry to improve efficiency and productivity. Basically, project team relationships need to be better integrated across disciplines and along the supply chain. As an innovative management strategy, partnering has been actively implemented in the industry to build integrated project teams, fundamentally change the traditional adversarial culture, improve construction efficiency, and reduce unnecessary waste.

1.2.2 Partnering in the Construction Industry of Hong Kong

The concept of partnering was first introduced in the construction industry of Hong Kong in the early 1990s. Two public sector clients, the Hospital Authority (HA) and the Airport Authority (AA), adopted the partnering concept in managing projects. From 1994 onwards, the Hospital Authority (HA) adopted partnering to build the North District Hospital, the United Christian Hospital, the Heaven of Hope Hospital, and the Tseung Kwan O Hospital (Fan and Hon, 2002). The Airport Authority (AA) also adopted partnering concept for a few special contracts that were a part of the new Airport Core Programme Projects, which were completed in the late 1990s. Some government departments also adopted partnering in infrastructure projects. For instance, the Water Supplies Department adopted partnering in projects of the Tai Po Water Treatment Works and Pumping Station (the tunnel contract and the treatment plant contract) and the Tuen Mun Water Treatment Works (Fan and Scott, 2000). Other public sector clients such as the Mass Transit Railway Corporation (MTRC) adopted partnering in the railway

project involving the Tseung Kwan O Extension. The Kowloon-Canton Railway Corporation (KCRC) also adopted partnering in the West Rail. However, it was not until the Hong Kong Housing Authority, the largest provider of public housing in Hong Kong, suggested using partnering in a consultative document entitled ‘Quality Housing: Partnering for Change’ (HKHA, 1999) that partnering gained full awareness and recognition in the industry. Partnering has become increasingly widespread since the recent CIRC report (2001) advocating wider application of partnering in the industry. A remarkably successful example of partnering was found in the railway project of the Mass Transit Railway Company Ltd (MTRC) on the Tseung Kwan O Extension, completed in 2002. By now, most leading companies in the construction industry of Hong Kong have had experience in making use of partnering. In less than a decade’s time, over fifty projects in Hong Kong have used partnering (Chan et al., 2002).

Partnering has become an innovative management strategy that has attracted a great deal of attention from the industry. The Association for Project Management Hong Kong Partnering Specific Interest Group (APM Partnering SIG) has recently developed a report entitled ‘Partnering Guidelines for Construction Projects in Hong Kong’. The report revealed that although the root cause of poor project performance is the same in the UK, Australia, and Hong Kong, the practice of partnering in Hong Kong has developed a unique flavor. There have been some remarkably successful examples of partnering projects in Hong Kong such as the MTRC’s Tseung Kwan O Extension Railway project. Unsuccessful examples can also be found. However, even in the less successful partnering projects, the partners still believe that the results of using partnering are better than or at least comparable to what would have been in a traditional

arrangement. The report stated that although there are no measurable improvements in time, cost, or quality, nearly all teams agree that the better relationships alone have made partnering worthwhile.

1.3 PROBLEM STATEMENT

Partnering has been proliferating both in the industry and in research. Numerous studies on partnering are readily available. The following topics have been widely discussed: the reasons for adopting partnering (e.g., Badger and Milligan, 1995), the critical success factors (Cheng et al., 2000, Cheng and Li, 2002), partnering models (Cheng and Li, 2001), the benefits of doing so (Chan et al., 2003, 2002), and the problems and difficulties involved (Chan et al., 2003, 2002; Ng, et al., 2002). Yet, such studies have been criticized as being ubiquitous (Li et al., 2000), prescriptive, and overly reliant on anecdotal data (Brensen and Marshall, 2000a). Partnering is a relationship management strategy; however, its socio-psychological aspect has largely been ignored in research. Although partnering is a dynamic process that changes during the different stages of construction, it has generally been presumed to be static. Extant research on collaborative partnering relationships has underplayed the complexities and dynamics of cooperation (Brensen and Marshall, 2002). It is still a myth that some partnering projects successfully engineer cooperation among partners, while some fail. Only a handful of studies have tried to examine the process and mechanism for building a cooperative partnering relationship.

Lazar (1997) has described partnering as a black box and pointed out that why and how the partnering process works is affected by the conditions for the

formation of partnering. The first wave consists of two groups of organizations that make successful use of partnering. They are the early adopters and those with a pent-up demand for a better way to manage projects. The early adopters are the first on the bandwagon. Those with a pent-up demand are those who had wanted to run their business in an ethical, trust-based way for some time, but had not been able to find a way to do so. Partnering simply provides the answer. To these two groups of companies, financial success resulting from partnering is a justification rather than a primary motivating force for adopting partnering. Conversely, the second wave of users of partnering is attracted by the better economic performance of applying partnering. Different conditions of partnering formation affect how the partnering process goes and how it should be managed.

Although it is noted that reasons for partnering influence the level of cooperation of partners towards partnering, there have been no studies taking into account the conditions for the formation of partnering as an alliance that includes both inducements and opportunities for forming cooperative, inter-organizational relationships. Besides, discussions on the behavioural characteristics of partnering have been superficial and have not been taken into account until recent research by Lazar (2000) and Cheung et al. (2003), which explain the process of cooperation by game theory and the building of trust. They both acknowledge that collaborative behaviour is associated with frequent project team interactions in a cooperative way to achieve common goals. Partnering is not panacea and cooperative inter-organization relationship would not automatically occur. Partnering is not a contract, but a way to build up non-adversarial working relationships among project participants through mutual commitment and open communication. It also helps to foster an environment for cooperation and teamwork. For partnering approach to work, project participants

must engage in the process of constructive communication, efficient problem solving and closer working relationship.

Cheung et al. (2003) review that most of the critical success factors of partnering are behavioural or attitudinal. The critical success factors of partnering have been reviewed by many researchers (CII, 1991; Cheng, 2001; Chan et al., 2002). Trust, commitment, open communication and efficient problem solving/ conflict resolution are the most frequently mentioned key elements for success with partnering. Despite the above, no one publication focuses on examining the determinants of the behavioural characteristics of a cooperative partnering relationship.

Moreover, a recent partnering guideline issued by APM (2003) pointedly notes that although partnering deals with people and relationships, so far no proper diagnostic tool has been devised to analyse partnering relationships. APM (2003) also suggested that it is necessary to look behind the hard measures, such as cost, programme, and quality, to examine to the extent to which the quality of the relationships between the parties has influenced or contributed to achieving the end product.

From the literature and context of the construction industry in Hong Kong, several gaps in the research have been identified and will be tackled in this study. First, only a limited number of publications have been found that explain the conditions leading to the *formation* of partnering as an alliance in construction. Second, there are few studies on the *process* of partnering to build cooperative alliances throughout the construction period from the design phase to the

construction phase. This comprises the core of the whole study. Third, using critical success factors, researchers have tried to explain improvements in the performance *outcomes* of partnering. However, they have ignored the guiding force of conditions behind the formation of alliances on the behaviour of partners towards partnering, which greatly affects performance. To address the above gap in the research, this study sets out an integrated research framework to discuss why and how partnering works as an alliance to bring about improvements in performance through cooperative relationships. The framework focuses on examining the behavioural characteristics of partnering, collating them with the formation and outcomes of partnering. In this study, partnering and alliance is used inter-changeably to collectively represent a cooperative inter-organizational relationship. A social network analysis is introduced to deal with communication and interaction.

1.4 RESEARCH AIM AND OBJECTIVES

This study aims to examine why and how partnering brings about a cooperative relationship throughout the construction process and to examine the effect it has on improving performance.

Objectives:

1. To examine the conditions for the formation of partnering;
2. To examine the determinants of cooperative partnering relationships;
3. To analyse the network structure of cooperative partnering relationships, particularly with regard to:

a) communication,

b) problem solving and,

c) working relationships; and

4. To examine the performance outcomes of the cooperative partnering relationships.

1.5 RESEARCH APPROACH

To accomplish the above aim and objectives of the study, a comprehensive literature review was conducted on the background of the construction industry and on the concepts of cooperative inter-organizational relationship, alliance, and partnering. A case study approach was adopted and project partnering projects in Hong Kong were selected as case studies for investigation. A case study protocol for conducting interviews and surveys was set out. The data collected was analysed with SPSS for a statistical analysis and UCINET 6.0 for a social network analysis. The findings were examined and discussed. Finally, conclusions were drawn and recommendations were given.

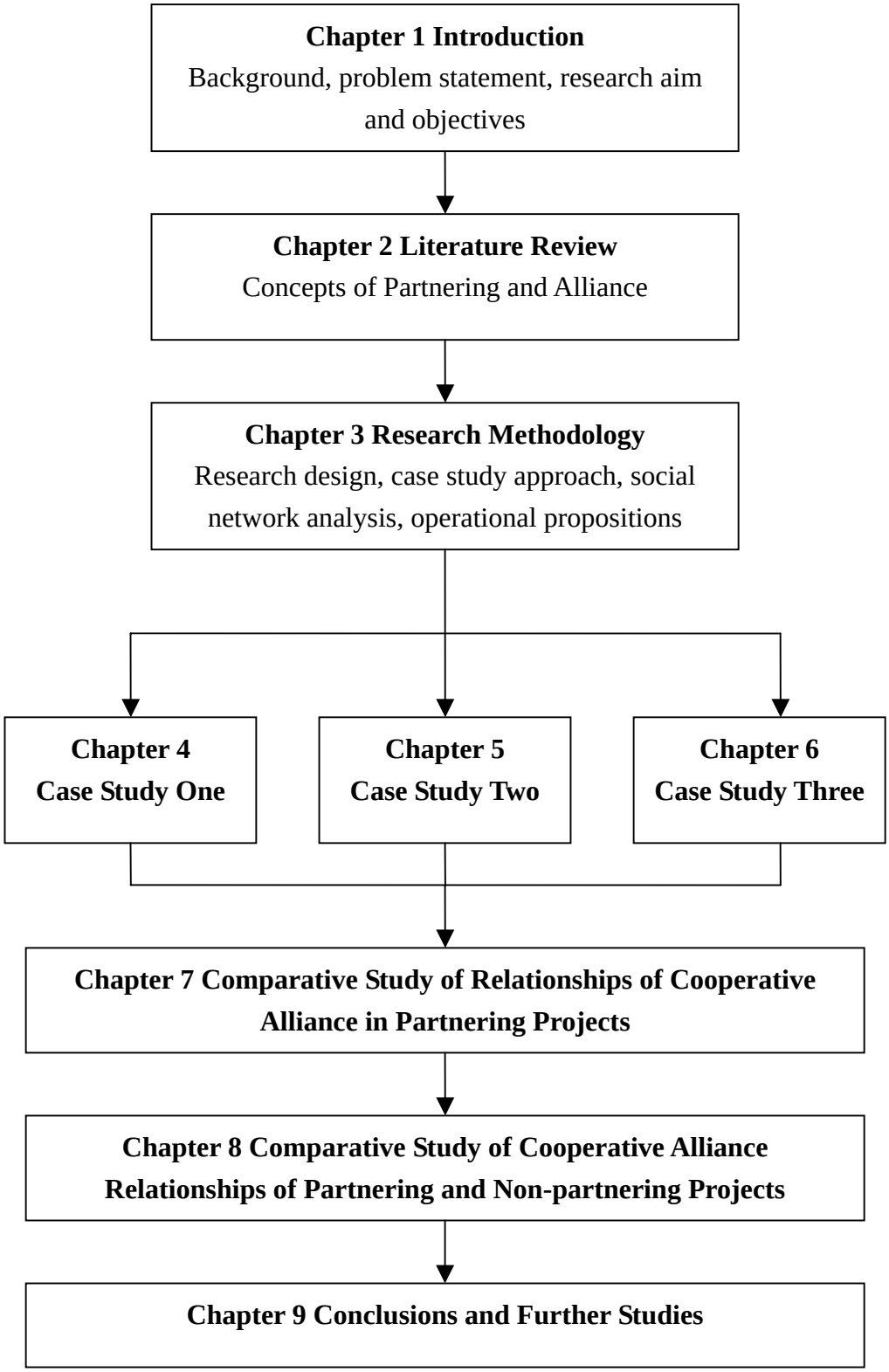
1.5.1 Structure of the Thesis

The thesis can be divided into three major parts. The first consists of Chapters 1 to 3, which offer theoretical support for the study. Chapter 1 gives an outline of the study, sets out its context and determines the problem statement, formulates the research question, and also sets out the aim and objectives of the research. Chapter 2 gives a comprehensive review of the concepts of partnering and a synthesis of the literature, and derives theoretical propositions to be tested

empirically. Chapter 3 clearly explains the setting of the research design, the case study approach, the algorithm of social network analysis and the structural indices used, and also derives operational propositions.

The second part is Chapters 4 to 8, which present the empirical findings of the study. Chapters 4 to 6 report the empirical findings of three case studies with reference to propositions. Chapter 7 discusses the overall findings of three cases, examining trends and commonalities, and contrasting results. Chapter 8 further compares and validates the findings of the partnering case studies with a non-partnering case study.

The last part is Chapter 9, which summarizes the major findings and contributions of the study and gives pertinent recommendations both for practice and future research.


Chapter 1 Introduction
Background, problem statement, research aim and objectives
Chapter 2 Literature Review
Concepts of Partnering and Alliance
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Research design, case study approach, social network analysis, operational propositions
Chapter 4
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Figure 1.1: Structure of the Thesis

1.6 LIMITATIONS OF THE STUDY

The scope of this study is limited to partnering projects in the construction industry of Hong Kong. The three project cases that have been selected are international projects involving contracts of significant value. The participants in the projects included local and overseas professionals. Although only three case studies are selected, they represent typical partnering projects in major construction undertakings in Hong Kong and include clients of a privatized public corporation, a private developer, and the government (CIRC, 2001). They reflect a true picture of partnering projects at different levels of maturity, namely the mature, growing, and primitive stages of partnering. The projects selected have different time frame. Case study one involves a project that is half way through the construction period. Case study two is one that is very close to the stage of completion, while case study three is of a project that is just beginning. Although it is arguable that this may affect the perceptions of the project participants on partnering, it also reflects dynamic partnering relationships at various stages in a construction project.

This study is also limited in that cognitive network data on a non-partnering project were used in a comparative analysis of case studies of partnering. This limitation is minimized by selecting project participants with past experience in similar non-partnering projects. Their experiences are regarded as reliable proxy of the non-partnering relationship. Their direct comparisons between partnering and non-partnering relationships are real and reliable. This research methodology was further justified by choosing a real non-partnering project as validation case

study.

At the core of this study is an analysis of the network structure of partnering behaviour, taking into account dynamic changes in the design and construction phases. The participants involved in this study were in the production stage. Their view would reflect the true picture of partnering behaviour in the construction phase; however, only a few of them were involved in the design phase. Thus, this study is limited with regard to the design phase. All the projects that were selected have yet to be completed. Thus, it is rather early to draw conclusions on the performance outcomes of the projects but project progress can still be measured. Since the core of the study is on the relationship with the partnering process, it was appropriate to conduct the study during the construction phase. The performance of the relationship of alliance was therefore measured by the satisfaction felt by the participants in the project and their perceptions to of the achievement of the project's goals in terms of project progress.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is mainly divided into two parts. The first specifically explains partnering as an alliance in construction; while the second extends the foundation of this study by tracing back to the multi-faceted theoretical backgrounds of cooperative inter-organizational linkages, alliances, and networks.

Alliances in the form of partnering have proliferated in the construction industries of the USA, UK and, more recently, Hong Kong. As with other industries, the existing research on partnering in the construction industry is atomistic, yet no attempt has been made to study partnering from a social network perspective.

As suggested by Nohria and Garcia-Pont (1991), the study of inter-organizational linkages is not new. However, their form and substance have evolved from 'tactical' to 'strategic' in response to a changing global environment. Research on inter-organizational linkages is readily available, but most of the studies have been on a dyadic level. Little attention has been paid to how these individual linkages interact with each other. It is argued that inter-firm linkages have become so dense that firms are embedded with each other in a network structure (Norhia and Garcia-Pont, 1991; Jarillo, 1998; Gulati et al., 2000). Although alliances are essentially dyadic exchanges, key precursors, processes, and

outcomes associated with them can be defined and shaped by the social networks within which most firms are embedded (Gulati, 1998). The need to study alliances from a social network perspective was not recognized until recent years. Studies on strategic linkages from a network perspective have been carried out on a few industries, such as the automobile, biotechnology, and telecommunications industries. Many facets of alliances from the social network perspective have not been explored (Nohria and Garcia-Pont, 1991). Much knowledge can be contributed by extrapolating social network analysis to the construction industry.

2.2. RELATIONAL CONTRACTING IN THE CONSTRUCTION INDUSTRY

Construction projects involve many complex processes and uncertainties. Classical confrontational contract cannot encapsulate all the possible contingencies occur in construction and is difficult to counter opportunism of each party. Relational contracting (RC), in the form of partnering, alliance, joint venture and other collaborative working arrangements emerged in the construction industry. RC basically recognizes mutual benefits and win-win situations through more cooperative relationships between the parties. With RC, the legal mechanisms offered by specific contracts are not strictly followed, but the parties themselves govern the transaction within mutually accepted social guidelines. RC considers contracts as the ‘ongoing dynamic state’ of relations among the contracting parties (Rahman and Kumaraswamy, 2002).

Common relationship-based approaches to bring about cooperation in the construction industry are partnering, project alliancing and strategic alliance. Strictly speaking, partnering itself is not a contract and is not legally binding while the project alliancing agreement is a legally binding contract and legally enforceable. Strategic alliance is an interogranizational arrangement that extends beyond a specific project. Although alliancing and partnering seems to be confusing, Walker and Hampson (2003) found out that alliancing and partnering differentiated one another in a number of areas:

- level of trust and commitment;
- degree to which the relationship is planned and nurtured rather than forced or required as a condition of contract;
- way in which the relationship is initiated, fostered and maintained as part of an integrated procurement process;
- the degree to which transparency/ open book philosophy is maintained; and
- the way in which risk and reward is treated.

The most important distinction between alliance and partnering is that with partnering, aims and goals are agreed upon and dispute resolution and escalation plans are established, but partners still remain independence, and may individually suffer or gain from the relationship. With alliancing, the alliance parties form a cohesive entity, which jointly shares risks and rewards to an agreed formula (Walker and Hampson, 2003).

2.3 PARTNERING AS ALLIANCE IN CONSTRUCTION

Gulati and Singh (1998) have defined an alliance as ‘any voluntarily initiated cooperative agreement between firms that involves exchange, sharing or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets’ (Harrigan, 1986; Parkhe, 1993; Gulati, 1998). An alliance is a spectrum of relationships with different structures of governance and distinguished by the degree of hierarchical elements they embody and the extent to which they replicate the control and coordination features associated with organizations. At one end of the strategic alliance spectrum is the joint venture, which involves partners creating a new entity in which they share equity and which most closely replicates the hierarchical features of organizations. At the other end are alliances that do not share equity and that only have a few hierarchical controls built into them, such as partnering (Gulati and Singh, 1998).

As reviewed by Cheng (2001), numerous terms in management are used to describe an alliance, for example: partnering, integration, partnership, network, strategic alliance, strategic partnership, vertical integration, and cooperative partnership.

There are also numerous definitions of strategic alliance. As suggested by Love et al. (2002), the leitmotif, however, with all definitions is that an inter-organizational relationship is established for a specific purpose, where all involved parties are engaged in cooperative behaviour. Strategic alliance is a

term commonly accepted in the manufacturing industry. Instead of using the term strategic alliance, the construction field refers to such a close relationship as partnering (CII, 1991). These two terms are often regarded as synonymous (Cheng et al., 2000). Love et al. (2002) have suggested that more effort should be made to compare the literature on strategic alliance and partnering.

Love et al., (2002) has argued that alliances can be either collaborative or cooperative in nature according to their duration. Collaborative strategic alliances refer to parties that work together for the short-term and cooperative strategic alliances for the long-term. The aim of a short-term alliance is to turn a contractual relationship into a cohesive project team that complies with a common set of objectives. However, these objectives may not be compatible or even conflicting with each individual party. That of a long-term alliance is to achieve competitive advantages. Partners commit themselves to build a synergistic relationship to develop core competencies and pursue corporate and business strategies through mutual learning (Cheng et al., 2001b).

In the construction industry, two types of partnering are prevalent: strategic and project partnering. Project partnering focuses on short-term benefits, while strategic partnering seeks gains in the long-term (Love et al., 2002). As the construction industry is dominated by one-off projects, it appears that short-term alliances will likely take the leading role in the promotion of closer relationships in construction projects.

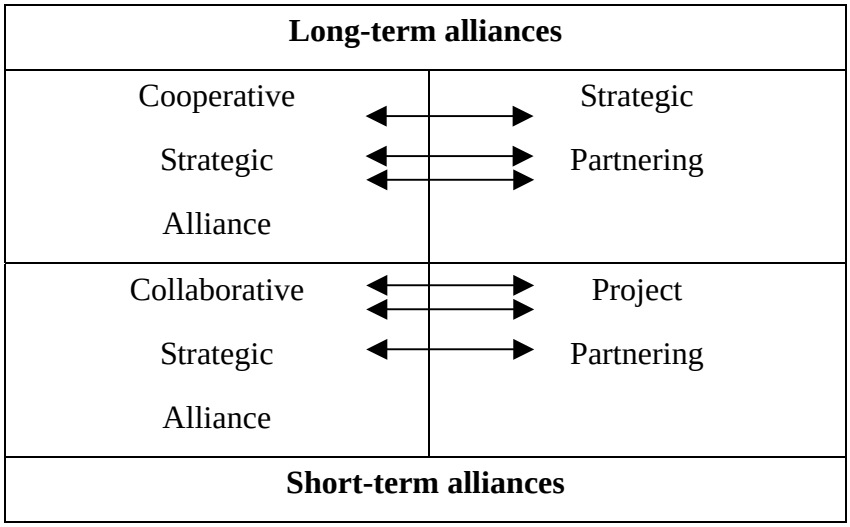

Figure 2.1: Long-term and Short-term Alliances. (Source: Love et al., 2002)

This study sets out partnering in the context of alliance in the sense of creating an inter-organizational collaborative relationship among partners. For simplicity, partnering will sometimes be referred generically as alliance.

2.3.1 Definitions of Partnering in Construction

Numerous attempts have been made to offer a clear definition of partnering. Central to the concept of partnering is the goal of improving relationships among participants in a project; that is, to move away from adversarialism and litigation; and to resolve problems in a more cooperative way. The CII (1991) of the USA gave the following commonly accepted definition of partnering as

> ‘a long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant’s resources. This requires changing traditional relationships to a shared culture without regard to organizational

> boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services' (CII, 1991).

An alternative to the CII's definition is that put forward by the National Economic Development Council (NEDC):

> 'In its simplest terms, partnering is a contractual arrangement between a client and a chosen contractor which is either open-ended or has a term of a given number of years rather than the duration of a specific project. During the life of the arrangement, the contractor may be responsible for a number of projects, large or small and continuing maintenance work and shut downs. The arrangement has either formal or informal mechanisms to promote cooperation between the parties' (NEDC, 1991).

Besides these two commonly accepted definitions, partnering has been defined in different contexts as well. Some definitions of partnering focus on project partnering (Dozzi et al., 1996; Loraine, 1995), while some regard partnering relationships as an alliance (Badger and Mulligan, 1995). Others situate partnering in a specific context, such as cultural change, the resolution of issues (Moore et al. 1992), and organization (Crowley and Karim, 1995).

Despite these attempts, partnering is said to be an imprecise and inclusive concept encapsulating a wide range of behaviour, attitudes, values, practices,

tools, and techniques, which makes it difficult to define (Bresnen and Marshall, 2000a; Li et al., 2000; Liu and Fellows, 2001).

Crowley and Karim (1995) have stated that partnering is defined in two ways. One is by attributes such as trust, shared vision, and long-term commitment. The other is by process, where partnering continues to be seen as a verb, such as developing a mission statement, agreeing on goals, organizing/ conducting partnering workshops. This semantic difference in the meaning of partnering further drives research on partnering into two branches. Bresnen and Marshall (2000a) discovered that there are two distinct approaches to examining partnering. Some researchers adopt a formal instrumental approach, perceiving that a collaborative relationship, such as trust, commitment can be engineered in short period of time through appropriate sets of tools and techniques. Thus, such researchers pragmatically emphasize the building up of systems and practices, such as charters and dispute-resolution mechanisms, teambuilding exercises and facilitation workshops, continuous improvement processes, total quality management, business process mapping, and benchmarking (e.g., Loraine, 1995). On the other hand, some researchers adopt the instrumental development approach. They believe that attitudes and behaviour in the construction industry are deeply ingrained and that it would be difficult to engineer any rapid movements away from such an embedded culture. They argue that partnering should be ‘the result of the natural evolution of long term relationships between two parties who have realized the financial benefits of combining production processes and by-passing the traditional tender procedures, and have through this working relationship begun to trust one another’ (Bresnen and Marshall, 2000a).

In light of ambiguities in the definition of partnering, Bresnen and Marshall (2000a) have put forward the plausible idea of adopting a pluralistic approach to define partnering. As Bresnen and Marshall (2002) explained, 'behaviour is not determined simply by formal structures and systems, but instead is the result of conscious choices and actions and a complex interplay between structural imperatives and their subjective interpretation and enactment.' Similarly, Liu and Fellows (2001) have suggested defining 'partnering from the perspectives of its process and its nature'. The process is a structural description of the partnering arrangement, i.e. the equity stake between the partners, the power structure, the organizational structure (of the partnering arrangement), the procurement path of the project, and so forth. 'The nature of the partnering arrangement is understood through an examination of the characteristics of partnering (the partnering culture), including conflict resolution, trust, common goals, mutual benefits, commitment and respect.' The process element of partnering merely provides the mechanistic framework for its operation, while the nature dictates the organic fluidity/ dynamism of 'how to make it work'.

2.3.2 Types of Partnering

There are two main types of partnering, namely project partnering and strategic partnering. According to RCF (1995), project partnering is partnering undertaken on a single project. At the end of the project the partnering relationship is terminated and another relationship is commenced with the next project. Strategic partnering takes place when two or more firms use partnering on a long-term basis to undertake more than one construction project, or some continuing construction activity. Other authors have also made a similar

classification.

Added to this classification, partnering is perceived to be a spectrum of relationships. Ellison and Miller (1995) categorized partnering into four levels, from traditional adversarial relationships to synergistic relationships:

1. Arms-length contractual relationships
2. Team-oriented relationships
3. Value-added integrated teams
4. Synergistic strategic partnerships

Similarly, Thompson and Saunders (1998) treated the concept of partnering as a continuum, from competition, cooperation, and collaboration to coalescence. It is a philosophy that must be custom-tailored for each situation to which it is applied. The manner of partnering that is selected is dependent on the objectives identified, resources available, and length of commitment expected. Different types of partnering with different degrees of collaborative relationship will bring about different levels of potential benefits.

Thompson and Saunders (1998) described a cooperative environment as including the following characteristics:

- Common objectives that are project specific;
- Improved interpersonal relationships;
- Team members who are likely to be involved in projects outside the partnering relationship;

- Partnership measures that may or may not resemble organizational measures used on other projects;
- Multiple points of contact;
- Limited trust and shared risk; guarded information sharing.

A collaborative environment is described by Thompson and Saunders (1998) as one of improving processes through teamwork. The characteristics of a collaborative relationship include:

- A long-term focus on accomplishing the strategic goals of involved parties;
- A multi-project agreement; long-term relationships without a guaranteed workload;
- A common measurement system for the projects and the relationship;
- Improved processes and a reduction in duplication;
- Relationship-specific measures tied to team incentives;
- Shared authority;
- Openness, honesty, and increased risk sharing.

Thomson and Saunders (1998) described an environment characterized by coalescence as including:

- One common performance measurement system;
- Cooperative relationships supported by collaborative experiences and activities;
- Cultures integrated and directed to fit the application;
- A transparent interface;

- Implicit trust and shared risk.

Thompson and Saunders (1998) conceptualized the partnering relationship according to the degree to which objectives are aligned regardless of the duration of time. In cooperative partnering relationships, the degree to which objectives are aligned is lower than in collaborative partnering relationships. However, Love et al. (2002) conceptualized the relationship of alliance according to duration. A cooperative relationship is more synergistic than a collaborative one. Although Thompson and Saunders (1998) and Love et al. (2002) used different terminology, the substances of partnering and alliance relationships they described were not in contrary. Since this study focuses on the relationship and behaviour of partnering project participants, this study will generally regard cooperation and collaboration as the way people work together to achieve common goals. To be consistent, the terms ‘cooperation’ and ‘cooperative relationship’ will be used in this thesis.

2.3.3 Characteristics of Partnering

Crowley and Karim (1995) put forward an organization model of partnering in which cooperative partnering is conceptualized using diagrammes of permeable boundaries and cell-like organizations (Li et al., 2001). Partnering has a decentralized pseudo-organizational structure that could be represented by boundaries. Flexible boundaries enable an organization to decentralize or restructure, while permeable boundaries allow the use of resources to actively communicate and interact through these boundaries to facilitate the exchange of

ideas and information (Crowley and Karim, 1995).

Li et al. (2001) reinterpreted the model differently. At the first level of the model, the three parties contact each other at one point and form a partnership because of contractual requirements. At the second level, the organizations involved change their structure to accommodate changes, but the boundary is still impermeable. Although there is more communication and interaction, they still protect themselves. At the third level, solid boundaries between the organizations become semi-permeable. This involves a paradigm shift and leads to the formation of an inter-organizational team. At the fourth level, a cooperative partnership based on trust is formed. This involves the formation of a partnering organization. Boundaries become permeable. Permeability benefits members, due to increased interaction, communication, trust, and commitment.

Partnering is not a panacea. Partnering as a management strategy may not bring about successful partnering relationships; by the same token, a traditional management strategy may not result in adversarial relationships. For partnering to be a success, key elements and critical success factors need to be present. Numerous studies on partnering have investigated the key elements and critical success factors of partnering (e.g., Weston and Gibson, 1993; Larson, 1995; Cheng et al., 2000; Cheng and Li, 2001). Cheung et al., (2003) observed that many success factors of partnering are behavioural or attitudinal in nature; for example trust, cooperation, and concern for relationships.

A detailed study of the critical success factors (CSF) of partnering was conducted by Cheng et al. (2000). Critical success factors come from two sources: critical

management skills and critical contextual characteristics. The CSF belonging to critical management skills are effective communication and conflict resolution. Those belonging to critical contextual characteristics are adequate resources, management support, mutual trust, long-term commitment, coordination, and creativity. In Cheng et al., (2002), open communication is the common critical factor contributing to success in the three stages of partnering: partnering formation, partnering application, and partnering reactivation.

Although trust, commitment, communication, and problem solving have been identified in many studies as the key elements or critical success factors of partnering, little has been said on how such elements are to be constructed.

2.3.4 Benefits of Partnering (Chan et al., 2003)

Comprehensive reviews of the benefits of partnering have been conducted in many studies on partnering. Chan et al. (2003) gave a clear review of the literature on thirteen benefits of partnering and empirically determined that ‘improved relationships’, ‘improved communication’, and ‘responsive to changing needs’ are the three most significant. They found that the benefits of partnering occur on two major levels: relational outcomes and project performance.

Relational Outcomes

Benefits working relationships

Partnering helps to create closer working relationships, remove adversarialism,

and improve the working culture (Chan et al., 2003). Partnering provides more interaction in a cooperative framework. Working relationships are significantly improved due to mutual trust and commitment. Partnering workshops and informal social events foster team building.

Benefits communication

Partnering demonstrates a more cooperative framework for communicating and coordinating projects (Cheng et al., 2001). Chan et al. (2003) showed empirically that improved communication is one of the most important benefits of partnering.

Benefits problem solving/dispute resolution

When problems arise, people will become sensitive to the redistribution of benefits. Some may adopt a disinterested approach, which keeps the problem from being brought to light (Loosemore, 1994). However, this can lead to the acceleration of conflict. With partnering, there is a pre-determined process of dealing with conflict and problems. Partnering facilitates an environment of joint problem-solving through open communication and cooperation.

This study examines the process of interaction in cooperative relationships by using social network analysis to analyse the network structure of communication, problem-solving, and working relationships.

Performance Outcomes (Chan et al., 2003)

Better time control

Partnering contributes to better time control by speeding up the process of problem-solving. A fair and equitable attitude resolves many disputes.

Better cost control

Partnering allows for the sharing of risk through different types of contract management, and for the sharing of financial risks.

Better quality products

With partnering, a team approach reveals many potential problems in design work earlier, thus reducing much wasted work. The partnering process facilitates the communication of quality issues.

Reduced litigation

The number of claims is reduced because many issues are dealt with and resolved halfway through the project before they escalate.

Continuous improvement

Partnering provides incentives for the participants in the project to pursue active value engineering and to focus on customer satisfaction. Because partnering allows for greater flexibility, there are more chances for innovation.

Lower administrative costs

Partnering lowers administrative costs through a reduction in documentation, in

changes to the submission, and in unnecessary waste.

Better safety performance

A safe working environment is fostered by the joint effort of all of the members of the project team. Partnering generates team spirit, and setting issues of safety in the partnering charter is a reminder of the project team's commitment to safety. This study examines the performance outcomes of partnering projects by the extent to which the goals of the project have been achieved and by the degree of satisfaction felt by the partners towards the alliance.

2.4 FORMATION OF ALLIANCES

Like other industries, the construction industry faces pressure to change paradigms. The construction industry's traditional management paradigm is certainly inadequate for coping with drastic changes in the environment. Technology, communication, and market advances due to globalization are fundamentally changing the global perspectives of time, distance, and spatial boundaries. Technological innovation is the impetus for the emergence of strategic management in the context of construction (Chinowsky, 2000).

Management practices have been undergoing fundamental changes since the early 1990s. The strategic management approach is recognized as essential if organizations are to survive in a continuously changing business environment. Globalization destroys an industry's previous structural and competitive

equilibrium. It enhances the value of some existing capabilities and diminishes the value of others. Global competition stimulates global-scale efficiencies, worldwide learning, and local responsiveness. Forming alliances is one way for firms to respond to these challenges. Typical inter-firm linkages include: mergers, acquisitions, equity partnerships, consortia, joint ventures, technology licensing and development agreements, supply agreements, manufacturing collaborations, and marketing agreements (Nohria and Garcia-Pont, 1991).

2.4.1 Inducements to Form Alliances

Gulati (1993) categorized the reasons why alliances form into the need-based perspective, transaction costs perspective, and resource dependence perspective. Gulati (1993) stated that the need-based perspective is the most common explanation for the formation of alliances. The underlying reason for firms to enter into alliances is functionality, usually because of financial and technological necessities and imperatives. Other researchers have also given reasons for the formation of alliances based on the need-based perspective. For example, Ahuja (2000) states that ‘firms form linkages to obtain access to needed assets, learn new skills, manage their dependence upon other firms, or maintain parity with competitors.’ Powell et al. (1996) also identified that the most common rationales offered for the upsurge in collaboration involve some combination of risk sharing, obtaining accesses to new markets and technologies, speeding products to market, and pooling complementary skills.

The cost of transactions is also another major reason to form alliances.

Transaction cost economists (TCE) have argued that a firm's decision to enter into an alliance is based in part on its evaluation of the transaction costs of a specific exchange. From this perspective, alliances are seen as intermediate hybrid forms between the extremes of markets and hierarchies (Williamson, 1975, 1985) that occur when the transaction costs associated with a specific exchange are too high for an arm's-length market exchange but not high enough to mandate vertical integration. Hierarchy occurs when a market fails.

The resource dependency theory argues that the primary motivation for a firm to enter into an alliance is to reduce the uncertainty deriving from its external dependencies. The decision to enter into an alliance is thus closely linked with its choice of partner. Pairs of firms sharing strong co-dependencies are most likely to enter into alliances. The theory suggests that firms will ally with those with whom they are most interdependent. Institutional theorists have suggested that there is a bandwagon effect, in which firms succumb to isomorphic pressures and mimic other firms that have entered into alliances. Yet others have pointed out that alliances might result from quests by firms for legitimacy (Baum and Oliver, 1992; 1991).

The above explanation of the formation of alliances is at the dyadic level, that is, the unit of analysis assumes an atomistic notion of firms that evaluate alternative courses of action and does not take into account the actions of other firms or the relationships in which they themselves are already embedded (Gulati, 1998). However, it has been argued that the dyadic level is increasingly inadequate because it ignores the fact that firms are embedded in networks. The social

network perspective has thus been proposed.

There is growing interest in understanding the influence of the social context in which firms are embedded on their behaviour and performance. Ahuja (2000) stated that 'the patterns of inter-firm linkages reflect the prior patterns of inter-firm relationships. A firm's ability to form new relationships is determined by the set of opportunities provided by its position in the prior network structure.' Gulati, for his part, argued that '[The] proclivity of firms to enter alliances is influenced not only by their financial and technological attributes, but also by how they are embedded in social networks between firms. Social networks of prior ties not only influenced the creation of new ties but also affected their design, their evolutionary path, and their ultimate success' (Gulati, 1998).

Gulati also stated that 'firms can be interconnected with other firms through a wide array of social and economic relationships, each of which construct a social network. These include supplier relationships, resource flows, trade association memberships, interlocking directorates, relationships among individual employees, and prior strategic alliances' (Gulati, 1998). Gulati (1993) suggested that the network of prior alliances is a rich source of information from which firms can also learn about new firms of which they were previously unaware.

2.4.2 Opportunities to Form Alliances

Ahuja (2000) criticized the current social network approach for assuming that the availability of opportunities is not a constraint and that the supply of linkage

partners is infinitely elastic. However, collaborative opportunities are not equally available to all parties. An alliance is formed only when actors with inducements to form linkages are successful in finding opportunities to collaborate. He suggested adopting an inducement-opportunities framework and identifying technical, commercial, and social capital as variables. Firms with such accumulated capital have more opportunities to collaborate and a higher chance of forming an alliance.

2.5 DETERMINANTS OF A COOPERATIVE ALLIANCE RELATIONSHIP

A comprehensive review of the literature on cooperation in inter-organizational relationships was carried out by Smith et al. (1995). Cooperation is commonly defined as the process by which individuals, groups, and organizations interact and form psychological relationships for mutual gain or benefit (Smith et al., 1995). Ring and Van de Ven (1994) took a more dynamic view of cooperative relationships, defining them as ‘socially contrived mechanisms for collective action, which are continually shaped and restructured by actions and symbolic interpretations of the parties involved’. There are two main types of cooperation: formal and informal. Formal cooperation is where the parties are bounded by contractual obligations and formal structures of control, while informal cooperation involves adaptable arrangements and behavioural norms (Smith et al., 1995).

The determinants of a cooperative relationship have been widely discussed in the

literature. They can be classified into structural determinants and behavioural determinants. A wider perspective has been adopted in some studies, which consider both the structural and behavioural determinants of cooperation. According to Murnighan (1994), the structural determinants of cooperation include increasing the reward for mutual cooperation; increasing the punishment for mutual non-cooperation; and expectations by the partners that the interaction will continue for a long time. The behavioural determinants of cooperation include individual values, knowledge, communication, and group identity.

Smith et al. (1995) also argued that the antecedents of cooperation can, on the one hand, be behaviourally/ psychologically determined by similarities in the values, perceived status, and legitimacy of the partners, and by the perception that the interactive process is just. On the other hand, cooperation can be structurally determined by the number of partners in a particular relationship, the extent of prior social ties, and the social context in which cooperation occurs.

There are also studies that only focus on psychological/ behavioural constructs. For instance, Levi (2001) considered the building up of cooperation from group dynamics. Partners are basically motivated by common goals to cooperate. They need to learn from each other through supportive communication. This means that they need to increase communication and improve the coordination of tasks, build up group cohesion and team spirit through open communication and feedback, and achieve satisfaction with team performance.

Mohr and Spekman (1994) argued that partnerships tend to exhibit behavioural characteristics that distinguish these more intimate relationships from more

traditional business relationships. While partnerships in general tend to exhibit such behavioural characteristics, more successful partnerships will exhibit these characteristics with more intensity than less successful one. These behavioural characteristics include:

- Attributes of the partnership – commitment, coordination, interdependence, trust;
- Communication – quality, information sharing, participation;
- Conflict resolution – joint problem solving, persuasion, smoothing, domination, harsh words, and arbitration.

This study will focus on trust, commitment, communication, and conflict resolution. Trust and commitment are examined as they are two important elements of cooperation that are worth a more in-depth investigation (Young, 1996; McAllister, 1995; Jones and George, 1998; Das and Teng, 1998; Mayer et al., 1995). Trust and commitment are constructed from both behavioural and structural determinants. Communication and conflict resolution will also be discussed.

2.5.1 Trust

Definitions of trust

Zucker (1986) defined trust as a ‘set of expectations shared by all those involved in an exchange’. Zucker suggested that there are three modes of trust: process-based, which is tied to past or expected behaviour; characteristic-based, which depends on shared characteristics and values; and institutional-based,

which is linked to formal societal structures. Rousseau et al., (1998) defined trust as the willingness to be vulnerable under conditions of risk and interdependence. Risk and interdependence are regarded as necessary conditions for trust. Ring and Van de Ven (1992) found that two different definitions of trust are frequently used in the literature: confidence or predictability in one's expectations (Zucker, 1986), and confidence in the goodwill of the other party.

Attributes of trust in an alliance

Although trust is recognized as an important determinant in an alliance, there is no systematic theoretical explanation of how it is developed (McAllister, 1995). An attempt will be made here to summarize some of the explanations, but this attempt is not exhaustive because trust is a very broad socio-psychological concept. Das and Teng (1998) have suggested that there are several techniques to build trust in an alliance. They are: risk taking, equity preservation, communication, and inter-firm adaptation.

Trust from risk taking

According to Das and Teng (1998), trust and risk taking form a reciprocal relationship in that trust leads to risk taking, and risk taking in turn buttresses a sense of trust. Such reciprocity has been found to be a key element in the building of trust (Larson, 1995). A non-recoverable investment in a strategic alliance signals one's commitment and trust. Although the taking of risks breeds trust, firms do not blindly take unjustified risks in the hope of developing a relationship of trust. Gulati (1995) suggested that trust is most likely to be the accumulation of prior satisfactory experiences. A partner's reputation is a

decisive factor. A firm with a reputation for being honest, fair, and trustworthy gives a party the first piece of evidence that is needed to take an initial risk.

Trust from the preservation of equity

Equity and fairness must be preserved. Equity means that the firm contributing the most resources to an alliance should get the most from it. An unfair relationship may lead one firm to feel that someone is taking advantage of it. A high level of trust tends to encourage partners to tolerate short-term inequities or to exercise mutual forbearance (Das and Teng, 1998).

Trust from communication

Communication and the proactive exchange of information will boost trust among partners. Open and prompt communication among partners is believed to be an indispensable characteristic of relationships of trust. Without proper communication, a cooperative relationship tends to suffer. Communication irons out the potential kinks in daily operations and makes for a satisfactory working relationship. Communication provides the basis for continued interaction, from which partners further develop common values and norms (Das and Teng, 1998).

Trust from inter-firm adaptation

Inter-firm adaptation refers to the adjusting of one’s own behavioural patterns to bring about a fit between the partners or between the alliance and the environment (Das and Teng, 1998).

Young (1996) has argued that trust is built from: previous relations, attachment, communication, and shared values.

Previous relations

Trust is based on an organization's reputation. This reputation can be established either through previous relationships or alliances (Gulati, 1995), or over time as the length of the attachment between the partners increases. Trust among partners develops over time and is intimately tied to past experiences. Firm-specific information concerning prior exchanges provides data on the trustworthiness of the exchange partner. Ring and Van de Van (1992) have proposed that reliance on trust between organizations can be expected to emerge only after the organizations have successfully completed transactions and perceive that their partner has acted equitably.

Shared values

Trust can be a function of a person's faith in another. Faith is a result of shared values (Zucker, 1986). Shared values refer to the extent to which partners to an exchange have common beliefs regarding the importance of the motives for engaging in transactions, of goals, and of the objectives of the exchange.

Risk taking

According to Das and Teng, (1998), risk lies at the core of trust. There is a reciprocal relationship between trust and risk taking. Only in risky situations is trust a relevant factor. Trust essentially means to take risks and to leave oneself vulnerable to the actions of others whom one trusts.

Reputation

The reputation of the organization leads to the building of trust. Generally, people are willing to trust an organization when they know or are familiar with it. Reputation provides cognitive evidence upon which people can base their trust.

It can be seen that the determinants of trust differ according to the researcher. In this study it is proposed that trust is determined by: previous relationship, shared values, risk taking, and reputation.

2.5.2 Commitment

Definitions of Commitment

According to Mohr and Spekman (1994), commitment refers to the willingness of trading partners to exert an effort on behalf of the relationship.

Determinants of Commitment (Young, 1996)

Transaction cost economics: Firms entering into alliances are potentially vulnerable to the opportunistic behaviour of their partners. Opportunistic behaviour is conscious deceitful behaviour engaged in by one party to the exchange that is meant to enhance that party's own position or outcomes, usually at the expense of the other party. These actions may lead to limited commitment to the alliance or to a premature exit from the relationship. Thus, firms may seek to erect economic constraints to such opportunistic behaviour, with the safeguards varying according to the nature of the exchange. Transactions cost

economists have recognized that these intermediate structures of governance have proliferated and have suggested that such intermediate forms be maintained by economic weapons. Economic constraints such as asset specificity, hostages, and reciprocal investments may be utilized to reduce the potential for opportunism by locking in partners to a strategic alliance with commitments that are in their own economic interest.

Asset specificity: refers to the nature of the transferability of assets from one use to another. A partner may be committed to the alliance because of its dependence on it, due to the investment of specific assets. The non-tradability of the assets may lead to commitment to a strategic alliance. Because organizations will prefer to exert additional effort to protect their investments, it is unlikely that they will act in a manner detrimental to the relationship (Young, 1996).

Hostages: refers to the extent to which an alliance member is involved with other members of the alliance. Hostage arrangements refer to the existence of other current relationships between the partners to the focal alliance. These hostages are another type of safeguard that has been discussed in transaction cost economics against a partner's opportunistic behaviour (Williamson, 1985). Williamson (1985) believed that organizations involved in more than one alliance with the same partners have created a 'mutual hostage' arrangement. The termination of one relationship may threaten the strength or viability of others. Involvement in more than one collaborative relationship led to the stability of the focal joint venture. It is expected that the existence of hostage arrangements with exchange partners in the alliance will cause an organization to commit to a strategic alliance (Young, 1996).

Reciprocal investments: refers to investments in a relationship of transaction-specific assets by the other partners to the exchange. The existence of reciprocal investments will alleviate fears of opportunism and the impact of opportunism on the governance of the relationship.

Dependency: The resource dependence theory has argued that an organization is likely to create alliances to reduce uncertainty (Pfeffer and Salancik, 1978). Such uncertainty is generated by the scarcity of resources and by a lack of perfect knowledge about the environment in which the organization operates. The resource dependence approach stresses the use of strategic alliances when the environment is uncertain and when an organization becomes dependent on the alliance for reducing environmental uncertainty and interdependence. The options approach argues for a reduction in the dependence on any one alliance. An organization's dependence on a strategic alliance will be positively related to its commitment to the strategic alliance.

2.5.3 Communication

According to Mohr and Spekman (1994), in order to achieve the benefits of collaboration, effective communication between partners is essential.

Mohr and Spekman (1994) addressed three aspects of communication behaviour: communication quality, extent of information sharing between partners, and participation in planning and setting goals.

Communication quality includes the accuracy, timeliness, adequacy, and credibility of the information that is exchanged (Mohr and Spekman, 1994). Information sharing refers to the extent to which critical, often proprietary, information is communicated to one's partner. Closer ties result in more frequent and more relevant exchanges of information between high-performing partners (Mohr and Spekman, 1994). Participation refers to the extent to which partners engage jointly in planning and the setting of goals (Mohr and Spekman, 1994). Researchers on communication have identified three factors that affect perceptions of trustworthiness: (1) accurate information; (2) explanations for decisions, and (3) openness.

2.5.4 Resolving Conflicts

Conflict exists in inter-organizational relationships due to the inherent interdependencies between parties. Partners in a strategic alliance are motivated to engage in joint problem solving (Mohr and Spekman, 1994).

2.5.5 Others

Apart from the above, it has also been found in the literature that the following also affects the development of cooperation: building cooperation in an alliance, the inter-firm adaptation of partners (Das and Teng, 1998), interactions with the process (Doz, 1996), similarities in partner, group dynamics (Levi, 2001), and rewards and punishments (Murnighan, 1994).

2.6 INTERACTION OF COOPERATIVE RELATIONSHIPS

Although many studies on cooperative alliances have been static and from single perspective, as Osborn and Hagedoorn (1997) have noted, evolutionary and dynamic perspectives have begun to gain recognition. Lui (2000) identified four categories of studies on the process of cooperation: economic exchange, social relationship, value creation, and interaction dynamics. No matter what the perspective taken in a study, all of the studies acknowledge that a cooperative relationship is built by interaction among partners and can change.

Cooperation as economic exchange

Parkhe (1993) explained the process of cooperation using Game Theory, which is derived from the Prisoner's Dilemma game. In each round of action, partners either cooperate with or deflect from each other. The rationale behind this theory is that when one party deflects while the other cooperates, the deflected party gains the most. Both parties would gain if they both cooperate, but they would lose most if they both deflect. The pay-off structure determines whether one cooperates or deflects. It is assumed that the players will behave opportunistically. One mechanism for achieving cooperation in game theory is reciprocity; that is, to follow the last action of other party. It is suggested that a partner should exhibit some unilateral commitment. A partner should take the first initiative to demonstrate an act of faith.

Cooperation as social relationship

The social relationship perspective focuses on relations among partners. Unlike game theory, it does not assume that a partner will behave opportunistically. For

example, Ring and Van de Ven (1994) regarded a cooperative relationship as a process of developmental interaction, consisting of a repetitive sequence of negotiation, commitment, and execution. The process is driven by the social-psychological dynamics of making sense and forming a psychological contract. Each sequence is assessed with efficiency and equity.

Cooperation as value creation

Lui (2000) noted that some researchers have conceptualized cooperation as a process of learning. For example, Doz (1996) developed a framework to analyse the evolution of cooperation in alliances. He found that 'successful alliance projects are highly evolutionary and progress with interactive cycles of learning, reevaluation and readjustment. Failing projects, on the other hand, are highly inertial, with little learning, or divergent learning between cognitive understanding and behavioural adjustment or frustrated expectations.'

Dynamics of interaction

Lui (2000) combined the above three approaches and proposed an action pattern model of cooperation. The premises underlying the model are that cooperative behaviour does not come naturally and unequivocally in every instance of cooperation (Das and Teng, 1998). Initial conditions are important determinants of the outcome of an alliance. The outcome of an alliance also depends on the process of emergent cooperation, where partners signal to each other through interactions.

A partner relationship (inter-organizational trust, asymmetric dependence, and firm similarity) and a structure of governance (asset specificity and partnering

reputation) is the initial condition, while an action pattern (action acquiescence, action simplicity, and action reciprocity) is the process. The process of cooperation is made up of the discrete actions and reactions that occur between cooperating partners when they face disruptive events: the unfolding of this process of interaction affects cooperation.

The formation of alliances and cooperative relationships

Although the formation of alliances and the building up of cooperation are two lines of research on alliance, it is argued that an integrative approach should be adopted to examine their interplay and how this affects the performance of alliance. For instance, Saxton (1997) suggested an integrative approach to studying alliances that would focus not only on economic resources but also on characteristics of the relationship, to determine how these affect the performance of the alliance. Das and Teng (2002) set out a model to explain the process of the development of an alliance, taking into account the conditions of an alliance and the co-evolution of alliances and their environment.

2.7 RESEARCH OBJECTIVES AND INTEGRATED RESEARCH FRAMEWORK

After reviewing the literature, an integrated research framework to achieve the objectives of this study is set out in Figure 2.2. To examine the conditions of the formation of partnering as alliance (objective 1), both inducements and opportunities to form alliances will be examined. To examine the determinants of a cooperative partnering relationship (objective 2), trust, commitment, communication, and conflict resolution will be examined, but the focus will be

on the first two factors. To analyse the pattern and network structure of a cooperative partnering relationship (objective 3), communication, problem solving, and working relationships will be investigated. Finally, to examine the relationship between a cooperative partnering relationship and performance outcomes (objective 4), the achievement of the goals of a project and the resulting satisfaction to the partnering relationship will be examined.

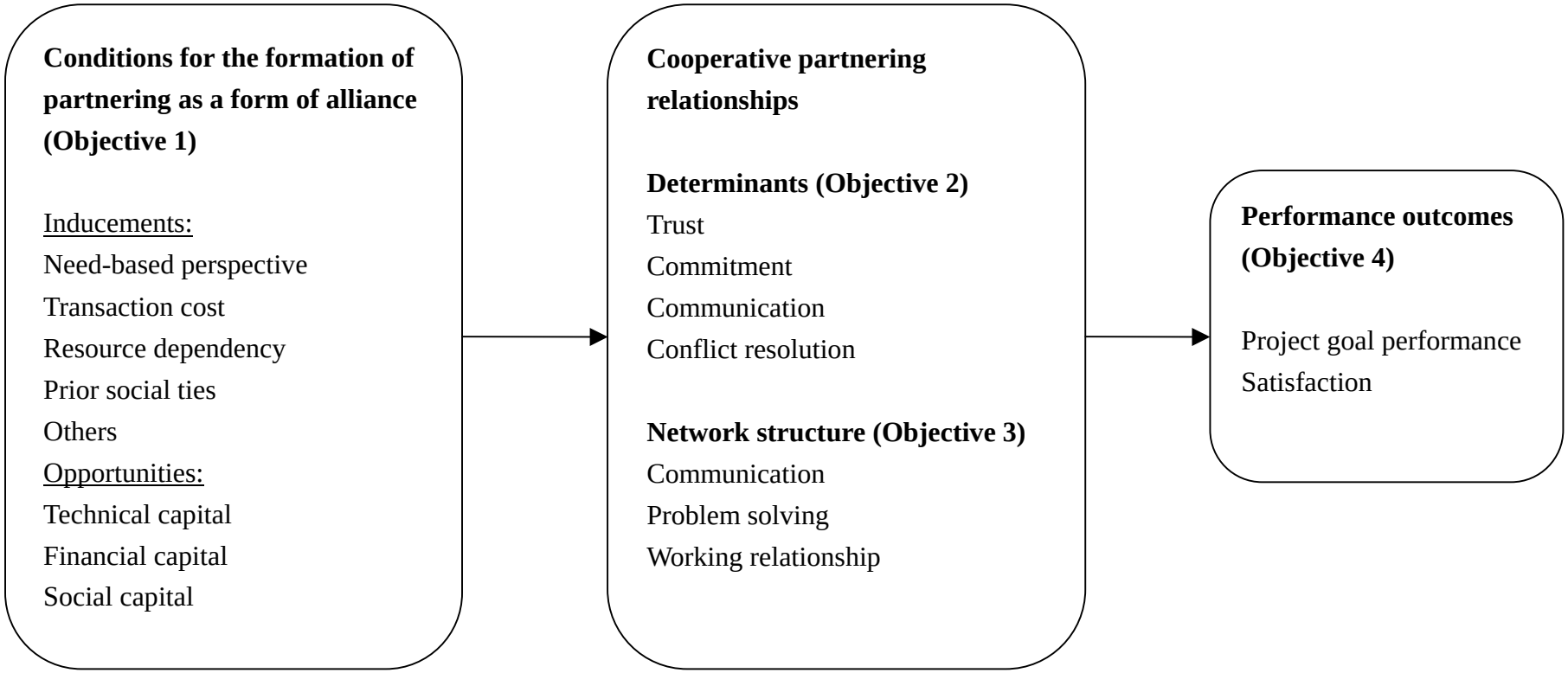

Figure 2.2: Integrated Research Framework

CHAPER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter explains the methodological approach designed to explore the theoretical propositions developed from the literature. This chapter also describes the concept and application of social network analysis on partnering behaviour, which is the main feature distinguishing this study from previous research on partnering.

3.2 REVIEW OF THE METHODOLOGY EMPLOYED IN STUDIES ON PARTNERING

The primitive stage of research on partnering in construction can be traced back to the early 1990's. The primary aim of these studies was to introduce the concept to the industry. Most of the studies were literature reviews and were descriptive, advocating the key elements, benefits, and difficulties of partnering and finished by giving guidelines for implementation (c.f. CII, 1991; Cook and Hancher, 1990). Later, qualitative research on successful examples and stories of the failure of construction partnering projects were reported, but little was done to advance the guiding theory. Some researchers then attempted to use both quantitative and qualitative methods to collate partnering principles with practice by looking for critical success factors, and formulating conceptual as well as practical models of construction partnering (Cheng, 2001). With the wider application of the concept in the industry, several large-scale quantitative surveys

on partnering began to emerge, providing sound statistical evidence to the field (Chan et al., 2003, 2002).

In a decades' time, studies on partnering have proliferated (Li et al., 2000). However, although these have included both qualitative case studies and quantitative survey studies, such research has been criticized as being thin on the ground, prescriptive, and heavily reliant on anecdotal data (Bresnen and Marshall, 2000a & b). The many studies have focused on sketchy prescriptions of tools and guidelines of best practices in partnering; they have thus over-simplified the complex relationship of cooperation. Few studies on partnering make use of comparative cases and systematically seek to analyse the socio-psychological aspects of partnering from different perspectives within a construction project team (Bresnen and Marshall, 2000c).

This study uses a case study approach as a strategy for conducting an in-depth investigation of the processes and outcomes of cooperative partnering relationships, and incorporates different perspectives within a construction project team using social network analysis.

3.3 PROPOSITIONS OF THE INTEGRATED RESEARCH FRAMEWORK

The integrated research framework shown in Figure 2.2 presents the logical flow of the study by synthesizing the literature and empirical context of the research. In order to achieve four objectives, testable propositions are set against the literature reviewed.

Proposition for Objective 1: Conditions for the Formation of Partnering

The first objective is to investigate the underlying conditions in Hong Kong's construction industry for the formation of a partnering relationship as an alliance, since the construction industry is a complex and dynamic industry where high risk, informal non-equity based alliances in the form of partnering are prevalent. The successful formation of this type of cooperative relationship needs certain inducements and opportunities. Ahuj (2000) argues that opportunities for cooperation are not equally available to all parties, suggesting that an inducement-opportunities framework should be adopted to provide explanations for partnering. Specific project characteristics would determine the level of risk and hence the level of cooperation. According to the preliminary findings of Fan and Hon (2002), the formation of a construction alliance relationship is stimulated by the sharing of risks, dependency on resources, and technological innovations. Construction firms in Hong Kong have strong prior social ties with certain contractors and sub-contractors. Firms with asset specificity, such as large developers, have more collaborative opportunities and greater bargaining power to choose their own partners. Hence, social networks comprising prior ties and the degree to which a firm is embedded in social networks should not be neglected when investigating the formation of alliances in the construction industry.

Proposition 1

A partnering project requires both inducements and opportunities for a cooperative relationship to form.

Proposition for Objective 2: Determinants of a Cooperative Partnering Relationship

Inter-organizational cooperative behaviour is determined by a number of structural and psychological/ behavioural determinants. Partnering as an alliance aiming to bring about cooperation should exhibit certain levels of cooperative behavioural characteristics. The literature on partnering has emphasized trust, top-down commitment, open communication, and efficient conflict resolution as critical success factors. This study examines the determinants of cooperative partnering from the attributes of behavioural characteristics.

Proposition 2

A cooperative partnering relationships is determined more by the behavioural or psychological constructs rather than by the structural constructs of an inter-organizational cooperative relationship.

Proposition for Objective 3: Network Structure of Cooperative Partnering Relationships

A cooperative relationship is a dynamic process by which partners interact with each other to achieve common goals. Das and Tseng (2002) have stated that a relationship of cooperation should not only be viewed by its determinants, but that the dynamics of interaction should also be considered. One way of looking at the dynamics of interaction in a relationship is to adopt a social network perspective to unfold the structure of relations in the network. Partnering is also a dynamic process to engineer cooperation in the short term using formal strategies

and to systematically construct it in the long term through interaction (Bresnen and Marshall, 2000a & c). A project with a cooperative partnering relationship would create a different network structure from a non-partnering one. A mature partnering project would also be likely to exhibit a different pattern of relationships than a less mature one. Partnering creates an environment for open communication, efficient problem solving, and closer working relationships. This study attempts to uncover the pattern of interaction in the relationship and to reveal the relational and behavioural structure of a partnering relationship with social network analysis.

Proposition 3

A more mature cooperative partnering project would have a relational network structure and interaction pattern demonstrating more open communication, more efficient problem solving, and closer working relationships than a less mature cooperative partnering project.

Proposition for Objective 4: Performance Outcomes of Cooperative Relationships

A cooperative partnering relationship would bring about two types of improvements in performance. One would be improvements in project performance, such as time, cost, and quality; the other would be improvements in relational outcomes. (Mohr and Spekman, 1994; Cheng et al., 2000; APM, 2003). Since this study focuses on analysing alliances at the production stage of construction projects, it would be more appropriate to adopt subjective measures of cooperative performance from the perspective of the project participants at the

production stage rather than objective measures of project success upon completion of the project. This study therefore measures the performance outcomes of partnering relationships from the degree to which the goals of the project have been achieved at the moment of research and from the level of satisfaction with the relationship. However, the ongoing performance progress of the project in terms of time, cost, and quality are also included in interviews for reference.

Proposition 4

A cooperative partnering relationship leads to improvements in performance in terms of achievement of the project goals and satisfaction.

3.4 RESEARCH DESIGN

To operationalize the conceptual framework of the study, a proper research design has to be established as blueprint to guide the whole research process and ensure that the research questions are being answered. This is the logical way to link the data collected with the concepts being studied. The research design specifically deals with four problems: what questions to study, what data are relevant, what data need to be collected, and how the results are to be analysed (Yin, 2003; Punch, 1998).

Traditionally, a research design can be divided into a spectrum of two approaches: quantitative and qualitative. These two approaches differ in the nature of their data and in the methods used to collect and analyse the data. Common examples of a quantitative research approach are surveys and experiments, while a

qualitative research approach employs case studies, ethnographies, field research, and grounded theories. The quantitative approach conceptualizes reality in terms of variables and the relationships between them. It enables standardized, objective comparisons to be made, and the measurements of quantitative research permit overall descriptions of situations or phenomena to be made in a systematic and comparable way. On the other hand, a qualitative approach is sensitive to context and process, to lived experience and local groundedness (Punch, 1998).

For decades, heated debates have taken place over these two approaches. As Trochim (2001) has claimed, at the core of this 'quantitative-qualitative' debate is a radical difference in research philosophy rather than in methodology. Qualitative researchers operate under different epistemological and ontological assumptions from quantitative researchers. The alleged claim that the quantitative approach is inductive while the qualitative approach is deductive has been discredited. Both approaches can be designed to test or build theories, and the difference in the type of data they employ is minimal, as qualitative data can be coded quantitatively by assigning numeric values while quantitative data can be explained qualitatively (Trochim, 2001). Since each approach has its own strengths and weaknesses, it has been suggested that a 'mixed research methodology' with a triangulation of these two approaches be established (Bryman, 1992; Creswell, 1994; Miles and Huberman, 1994; Punch, 1998; Trochim, 2001).

Triangulation is the combining of methodologies to study the same phenomenon. It can provide more complex and holistic interpretations, allow new and deeper dimensions to emerge, and eliminate the weaknesses of relying on a single

method (Jick, 1979). ‘Between method’ triangulation, which uses multiple methods, is popular because it improves the external validation of the findings when two distinct methods are congruent and yield comparable results. ‘Within-method’ triangulation, which uses multiple techniques within a given method, is also useful because it improves internal consistency or reliability through cross-checking (Jick, 1979). Bryman (1992) has advocated many ways of combining the quantitative and qualitative approaches. For instance, the findings of the two approaches can be compared and checked against each other for convergence and divergence. In addition, qualitative research may help to provide background information, explain the process, and facilitate the interpretation of relationships between variables; while quantitative research helps in choosing the subject for investigation and numerically revealing the structural features of social life.

In this study, a triangulation of the quantitative and qualitative approaches will be used. Quantitative data was collected by questionnaire and qualitative data was collected by semi-structured interviews and documentation.

3.5 THE CASE STUDY APROACH AS A RESEARCH STRATEGY

To address the research questions set out in this study, a case study with a triangulation of surveys, semi-structured interviews, and an archival analysis is predominantly employed as the research strategy.

Yin (2003) gave two technical definitions of a case study:

> ‘A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.’ (Yin, 2003:13).

> ‘The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulation fashion, and as a result benefits from the prior development of theoretical propositions to guide data collection and analysis’ (Yin, 2003:13-14).

The above definitions shed some light on the features and merits of case studies. The case study as a research strategy is not necessarily a qualitative technique and is not restricted to any particular type of qualitative or quantitative evidence. Yin (2003) further pointed out that the ‘case study is the preferred strategy when “how” or “why” questions are being posed, when there is little control over events, and when the focus is on a contemporary phenomenon with a real-life context’.

The primary objective of this study is to examine *how* the structure of collaborative partnering relationship leads to improvements in performance. More specifically, this study focuses on examining *how* partnering affects the structural behaviour of communication, problem solving, and working relationships; and *how* these variables are inter-related. The research question, being ‘how’ in nature, is most appropriately tackled using the research strategy of the case study. Moreover, it allows an investigation to retain the holistic and meaningful characteristics of real-life events and to provide a richly detailed

longitudinal portrait of a particular social phenomenon in a real life context (Yin, 2003).

3.5.1 Validity and Reliability

Like other research methodologies, the case study has its limitations. Case studies are often criticized as lacking in research rigour and scientific generalization (Yin, 2003), but a careful research design can take into account construct validity, internal validity, external validity, and reliability. Construct validity means to establish correct operational measures for the concepts being studied. This can be tackled by using multiple sources of evidence, establishing a chain of evidence, and having key informants review the draft case study report. Internal validity involves establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships. This can be tackled by pattern matching, building explanations, addressing rival explanations, and using logic models. External validity is establishing the domain by which the findings of a study can be generalized. This can be tackled by using theory in single-case studies and replication logic in multiple-case studies. Particular attention has been drawn to the alleged problem of generalization. Unlike quantitative research methods, a case study is used as an ‘experiment’ to test a specific theory. Rather than looking for statistical generalizations, it aims for analytical generalizations. A theory is developed as a template to guide the development of the research. Empirical evidence is tested with the theory that was developed. Replication is claimed when two or more cases support the same theory. The empirical results may be considered yet more potent if two or more cases support the same theory but do not support an equally

plausible rival theory. Reliability means demonstrating that the operations of a study – such as the data collection procedures – can be repeated with the same results. This can be tackled with the case study protocol and by developing a case study database (Yin, 2003).

The tactics used in this study to improve validity and reliability are listed below:

Construct validity

This study uses multiple sources of evidence to improve construct validity. These include questionnaires, semi-structured interviews, and documentation.

External validity

To achieve external validity, this study adopted the multiple case study approach. Three case studies are presented in this study.

Reliability

To improve the reliability of the study, a preliminary case study was conducted before the research methodology was finalized. In the preliminary case study, valuable comments were solicited from experienced practitioners in the construction industry. Their opinions helped to improve the feasibility of the study, ensure that appropriate questions were being asked, and that reliable data would be collected. They were particularly useful in improving the application of social network analysis. The findings of the preliminary case study are shown in Appendix F.

3.5.2 Selecting Case Studies

Case study research relies on theoretical sampling rather than statistical sampling. The cases may be chosen to replicate previous cases or extend an emergent theory, or they may be chosen to fill theoretical categories and provide examples of polar types (Eisenhardt, 1989). Yin (2003) also stated that the cases chosen should either predict similar results (literal replication) or contrasting results, but for predictable reasons (theoretical replication). There are no general guidelines on the number of case studies that should be chosen because this depends largely on the timeframe of the research, the homogeneity of the population, the research strategy, and the experience gained from the pilot study; however, it is agreed that robustness of a case study increases as the number of cases increases. The greatest improvement in robustness occurs when a study of a single case is increased to involve multiple cases (Yin, 2003). Ideally, cases should be added to the study until theoretical saturation is reached, that is, the point at which incremental learning is minimal because the phenomena can already be observed (Eisnhardt, 1989).

This study adopts a multiple case studies design. The processes by which the cases to be studied are described as follows:

The preliminary case study provided an account of current applications of partnering in Hong Kong. Taken such information into account, in April 2003 seven letters of invitation to participate in this research (Appendix A) were sent to major clients and contractors in Hong Kong that had implemented partnering. They included the MTRC, the Hospital Authority of Hong Kong, the Hong Kong

Housing Authority, private developers, and several government departments. Case studies were selected according to the criteria that they were carrying out projects that had adopted formal partnering with a facilitator, partnering workshops, a partnering charter, and monthly evaluations. A sincere response was received from three clients and two contractors, who promised to provide five partnering projects for investigation. After careful consideration of the nature, the contractual arrangements, the stage of completion of the available projects and their maturity in the implementation of partnering, three projects were selected as case studies to reveal a balanced picture of the application of partnering in Hong Kong. Concurrent construction projects with different procurement methods and maturities in the implementation of partnering were selected.

Nature of the Project

Major partnering projects in Hong Kong can be categorized into government projects, hospital projects, housing projects, projects of the Kowloon-Canton Railway Corporation (KCRC), projects of the Mass Transit Railway Corporation (MTRC), private sector projects, and others (Chan et al., 2002). In this study, representative cases were selected from different categories, namely the MTRC (case study one), the private sector (case study two), and a government project (case study three).

Contractual Arrangement of the Project

The prevailing contractual arrangements of partnering projects in Hong Kong are post-contract project partnering, management contracting, guaranteed maximum price (GMP), and open book target cost (APM, 2003). To fully represent

partnering relationships in Hong Kong, open book target cost (case study one), guaranteed maximum price (case study two), and post-contract project partnering (case study three) were selected.

Stage of Completion of the Project

A partnering relationship is dynamic and changes as the project enters different stages of completion. Case studies involving projects with different timeframes were selected for investigation. Case study one features a project that is mid-way to completion, case study two is of a project that is nearly completed; and case study three is of a project that has just begun.

Maturity of Partnering Implementation

The implementation of partnering in Hong Kong has grown rapidly. Different companies with various partnering experiences have different levels of maturity in implementing partnering. To analyse Hong Kong's partnering relationships in a more comprehensive manner, three case studies were selected to represent case of the implementation of partnering at a mature level (case study one), at a growing level (case study two), and a primitive level (case study three). In the mature partnering project, all project participants have partnering experience. In the growing partnering project, most of the project participants have partnering experience while in the primitive partnering project, none of the project participants have partnering experience.

3.5.3 Data Collection

Data were collected by a triangulation of questionnaires, semi-structured

interviews, and documentation.

The questionnaire (Appendix B) is divided into five parts: 1) personal particulars and project information; 2) the formation of an alliance; 3) the determinants of a relationship of cooperative alliance; 4) the interaction process in cooperation; and 5) the performance of cooperation. Particular attention is drawn to part 4, in which relational data was collected by questions on the frequency of formal and informal contacts, the frequency of conflicts, and the degree to which cooperation exists in working relationships. A detailed construction of the questionnaire will be discussed separately for each proposition.

Semi-structured interviews (Appendix C) were conducted to collect qualitative data. A total of 23 interviews were conducted. Each of them lasted for about 45 minutes and they were conducted on a one-to-one basis to simulate conversation. Since interviews are often criticized as being biased, involving poor recall, or inaccurate articulation, this study has tried to corroborate data from the interviews with information from surveys and documentation to ensure that the facts converge. Moreover, the interviews were recorded and transcribed. To get a true picture of the case study and eliminate any bias from the interviewer, the interviewee was allowed to talk freely without interruption or intervention, and the interviewer tried to maintain a neutral role as far as possible. The interviewer was also careful not to introduce any ideas that might influence the answers of the interviewees or to give overt signals such as smiles and nods. Both the verbal and non-verbal responses of the interviewees were noted. A report on the interview was then sent to the interviewee for perusal. The real names of the participants were left out, while essential information on the case study was

retained for analysis.

Documentation and archival records also provided useful information. The minutes of meetings championing the use of partnering, documentation from partnering workshops, partnering charters, partnering newsletters, company publications, and the like were used.

3.6 RESEARCH STRATEGY FOR PROPOSITION ONE

To investigate the veracity of proposition one, data were collected by questionnaire and supplemented by semi-structured interviews.

Part two of the questionnaire is on the formation of alliances. It elicits questions on conditions for the formation of partnering as alliance (objective one). There are ten questions on inducements to form an alliance and three questions on opportunities to form alliances. Sources of literature to draw up these questions are shown in Table 3.1.

Inducements to Form Alliances:		***Different Perspectives***	***Sources of Literature***
2.1	Avoid opportunistic behaviour	Transaction cost	Gulati (1993)
2.2	Reduce uncertainty of interdependence	Resource dependency	Gulati (1993)
2.3	Share risk among partners	Need based	Powell et al., (1996)
2.4	Share resource capabilities	Need based	Powell et al., (1996)
2.5	Acquire new skills or knowledge	Need based	Ahuja (2000)
2.6	Enhance market competitive power	Need based	Ahuja (2000)

2.7	Peer influence from the industry	Others	Baum and Oliver (1991;1992)
2.8	Pressure from the government or regulations	Others	
2.9	Follow the successful experience of other firms	Others	
2.10	Prior social relationship	Social Network	Gulati (1993)
Opportunities to form alliances:			
2.11	Possess technical capital or expertise	N.A.	Ahuja (2000)
2.12	Possess commercial capital		
2.13	Possess social capital		

Table 3.1: Sources of Literature for Constructing Part Two of the Questionnaire

Interview questions Q2.1 were designed to collect qualitative data to reconcile the quantitative data.

The data were analysed by mean score and then ranked in descending order to show their relative importance.

$$MS = \frac{\Sigma(f \times s)}{N}, \quad (1 \leq MS \leq 5)$$

Where s = score given to each item by the respondents, ranging from 1 to 5, where 1 is 'strongly disagree' and 5 is 'strongly agree';

F = frequency of response to each rating (1-5) for each question;

N = total number of responses concerning that question.

3.7 RESEARCH STRATEGY FOR PROPOSITION TWO

To investigate the veracity of proposition two, part 3 of the questionnaire is designed to elicit questions on the determinants of a relationship of cooperative alliance (objective two). Forty-three questions were set. The sources of literature that were drawn upon for this part of the questionnaire are shown in Table 3.2.

	Questions	**Determinants**	**Sources of literature**
3.1	The partners have contributed effort and resources to form a cooperative relationship	Commitment	Mohr and Spekman, 1994
3.2	The partners have concurrent relationships in other projects	Commitment	Young, 1996
3.3	The partners are equally dependent on each other	Commitment	Young, 1996
3.4	The partners have a top-down commitment to cooperate	Commitment	Young, 1996
3.5	The partners are working to complete the project in an effective manner	Commitment	Young, 1996
3.6	The partners are allowed to participate in setting goals	Commitment	Young, 1996
3.7	The partners are allowed to participate in planning activities	Commitment	Young, 1996
3.8	The partners had a successful previous relationship	Trust	Das and Teng, 1998
3.9	The partners have shared values and common goals	Trust	Das and Teng, 1998
3.10	The partners are willing to take risks	Trust	Das and Teng, 1998
3.11	The partners are known to be trustworthy	Trust	Das and Teng, 1998
3.12	The partners have a good reputation in the industry	Trust	Das and Teng, 1998
3.13	Effective and efficient communication	Communication	Mohr and Spekman, 1994
3.14	The partners share information with each other	Communication	Mohr and Spekman, 1994
3.15	The partners are encouraged to participate and exchange ideas	Communication	Mohr and Spekman, 1994
3.16	The partners have full access to all useful information	Communication	Mohr and Spekman, 1994
3.17	The partners have no hidden agenda	Communication	Mohr and Spekman, 1994
3.18	The partners solve problems jointly	Conflict resolution	Mohr and Spekman, 1994
3.19	Problems are solved before they escalate	Conflict resolution	Mohr and Spekman, 1994
3.20	The partners try to avoid disputes and reduce the use of litigation	Conflict resolution	Mohr and Spekman, 1994
3.21	The partners are open to innovative ideas	Conflict resolution	Mohr and Spekman, 1994
3.22	The partners are responsive to emergencies or changing needs	Conflict resolution	Mohr and Spekman, 1994
3.23	The possibility of inter-organizational learning	Adaptation	Das and Teng, 1998
3.24	The partners are very likely to interact in the future	Interaction	Doz, 1996
3.25	The process of interaction is perceived to be equitable and just	Interaction	Doz, 1996

3.26	One partner cooperates and the others follow	Interaction	Doz, 1996
3.27	The partners seek to achieve a win-win situation	Interaction	Doz, 1996
3.28	A mechanism has been set up for effective decision-making	Communication	Mohr and Spekman, 1994
3.29	Rewards are given to motivate cooperation	Rewards and punishment	Murnighan, 1994
3.30	Punishments are imposed for mutual non-cooperative actions	Rewards and punishment	Murnighan, 1994
3.31	A mind open to new possibilities and new alternatives	Adaptation	Das and Teng, 1998
3.32	Full authority for action has been delegated to the project team	Trust	Das and Teng, 1998
3.33	Fully comply with the request of the other partner, even at the expense of one's own short-term interests	Trust	Das and Teng, 1998
3.34	The goals of the company and the objectives of the partners are compatible with each other	Partners' similarity	Levi, 2001
3.35	The technical capabilities of both partners are compatible with each other	Partners' similarity	Levi, 2001
3.36	The organizational procedures of the partners are compatible	Partners' similarity	Levi, 2001
3.37	The employees of the partnering companies have similar professional or trade skills	Commitment	Young, 1996
3.38	Constructive handling of differences	Group dynamics	Levi, 2001
3.39	Building a sense of belonging and pride	Group dynamics	Levi, 2001
3.40	Feedback and performance evaluations	Group dynamics	Levi, 2001
3.41	Clearly setting out the roles, duties, and responsibilities of each party	Group dynamics	Levi, 2001
3.42	The leaders are supportive and know how to cooperate	Group dynamics	Levi, 2001
3.43	The organizational culture supports cooperation	Group dynamics	Levi, 2001

Table 3.2: Sources of Literature to Construct Part Three of the Questionnaire.

SPSS 11.0 was used to perform a descriptive statistical analysis of the data for part three of the questionnaire. The determinants of a cooperative partnering relationship were analysed with mean scores. Mean score is a commonly adopted method of analysis in construction to determine 'relative importance' (Chan et al., 2003). The mean score (MS) of each determinant was computed by the following formula (Chan et al., 2003):

$$MS = \frac{\Sigma(f \times s)}{N}, (1 \leq MS \leq 5)$$

where s = score given to each determinant by the respondents and ranges from 1 to 5, where 1 is 'strongly disagree' and 5 is 'strongly agree';

F = frequency of response to each rating (1-5) for each question;

N = total number of responses to that question.

A five-point Likert scale with '1' representing 'strongly disagree', and '5' representing 'strongly agree' was used to calculate the mean score of each determinant. These results were used to determine the relative importance of the determinants that go into forming a relationship of cooperative alliance. Mean score of each determinant were then discussed separately using structural constructs and psychological/ behavioural constructs.

Determinants with mean scores of above 4.33 were regarded as 'relatively very important'; those with scores of between 3.67 and 4.33 were regarded as 'relatively important'; those with mean scores of between 3.00 and 3.66 were considered to be 'relatively less important'; and those with a mean score of less than 3.00 were regarded as 'not important' and were disregarded (Fan, 2001).

3.8 RESEARCH STRATEGY FOR PROPOSITION THREE

To investigate the validity of the proposition three, the methodological implications of social network analysis will first be explained. The design of the questionnaire and interview questions used to collect relational data will then be

discussed, followed by a discussion of the choice of structural measures to analyse the data. Finally, operational propositions are derived.

3.8.1 Introducing Social Network Analysis

SNA has been applied in a wide range of disciplines in the social and behavioural sciences, such as social support, group problem solving, diffusion and the adoption of innovations, cognition or social perception, exchange and power, consensus and social influence, and the formation of coalitions (Degenne and Forse, 1999). Borgatti and Foster (2003) recently noted that there has been a radical increase in social network research on management since the second half of the twentieth century, focusing on areas such as social capital, embeddedness, network organizations, board interlocks, joint ventures and inter-firm alliances, knowledge management, social cognition, and group processes. SNA is being used in more and more studies to visualize inter-firm collaboration both at the organizational level and also at the project level (Cross et al., 2002).

Despite the wide application of SNA in many fields, its application in construction management has yet to be explored. An early attempt to use SNA in the construction industry was made by Harkola (1995) who examined the diffusion of construction technology in a Japanese firm. Another attempt was made by Loosemore (1996), who used it to investigate structures of communication in crisis management. Mead (1999, 2001) primarily used SNA to visualize computer-mediated networks of communication in construction project teams. SNA has also been applied to design-and-build projects to examine patterns of communication in work groups (Moore and Dainty, 2000). This study

applied SNA to examine the process of interaction involved in cooperation in a partnering project.

3.8.2 Rationale for Using SNA

This research attempts to reveal the relational and behavioural characteristics of partnering, focusing specifically on the behaviour of partnering project teams with regard to communication, problem solving and working relationships. As suggested by Wasserman and Fraust (1994), research focusing on relations and their patterns requires a set of methods and analytic concepts that are distinct from the methods of traditional statistics and data analysis. Social network analysis can provide answers. Social network analysis is a recognized method of dealing with relational data (Scott, 2000). More importantly, network analysis has unique mathematical analytical power and sociometric visualization power to detect the patterns and implications of relationships. So far, no other techniques are comparable. The limitation of SNA, however, is that the data is purely numerical. SNA results must be placed in context by a parallel qualitative analysis.

Different types of data require different techniques of analysis. Attribute data such as attitudes and opinions collected through surveys and interviews are regarded as the attributes of particular individuals. However, traditional statistical techniques developed for variable analyses of these attribute data have limited value for studies using relational data. Relational data such as contacts, ties, and connections, relate one agent to another and thus cannot be reduced to the properties of the individual agents themselves. The methods appropriate to

relational data are those of network analysis, whereby the relations are treated as expressing the linkages that run between agents (Scott, 2000).

SNA differs in fundamental ways from standard studies and methods used in the social and behavioural sciences. Rather than focusing on the attributes of autonomous individual units, the associations among these attributes, or the usefulness of one or more attributes for predicting the level of another attribute, the social network perspective views the characteristics of social units as arising out of structure of relational processes or focuses on the properties of the relational systems themselves. The task is to understand the properties of the social (economic or political) structural environment, and how these structural properties influence observed characteristics and associations among characteristics (Wasserman and Fraust, 1994).

The criticism is increasingly raised that many sociological studies ignore the fact that behaviour is rooted in structures to which people belong. For example, surveys assume that the respondents are structurally independent and the resulting analysis focuses on aggregating individual attributes. The result is that relations between variables rather than individuals are studied (Degenne and Forse, 1999). The social relationships of the individuals are unrealistically simplified or even stripped away (Galaskiewicz and Wasserman, 1993).

This critique also applies to current studies on partnering in construction. None have paid attention to the relational linkages between individuals and their embeddedness, concentrating instead on the use of variable analysis to investigate data on attributes. This study therefore calls for partnering

relationships to be analysed from a network perspective. This is because network analysis can examine overall relations in an inductive way to identify patterns of behaviour, the concrete constraints of structure on behaviour, as well as constraints on structure from group interaction (Degenne and Forse, 1999).

3.8.3 The Basic Principles Underlying SNA

Graph theory underpins many of the techniques of SNA. In graph theory, a graph is an abstract mathematical concept consisting of a series of points connected by a set of lines (called edges). A pair of points is called a dyad and a group of three a tryad. In SNA, points are used to represent people and edges represent relationships.

Distance is equal to the number of edges in a path. The shortest paths linking a given pair of points are called geodesics. Points falling on the only geodesic or on all geodesics linking a given pair of points are said to stand between the end points. The direction of the relationship can be shown in edges with arrows. The edges connecting points can also be given values that reflect the strength of the relationship. Such graphs are referred to as networks. Figure 3.1 shows an example of a network consisting of four numbers of actors and six relationship edges.

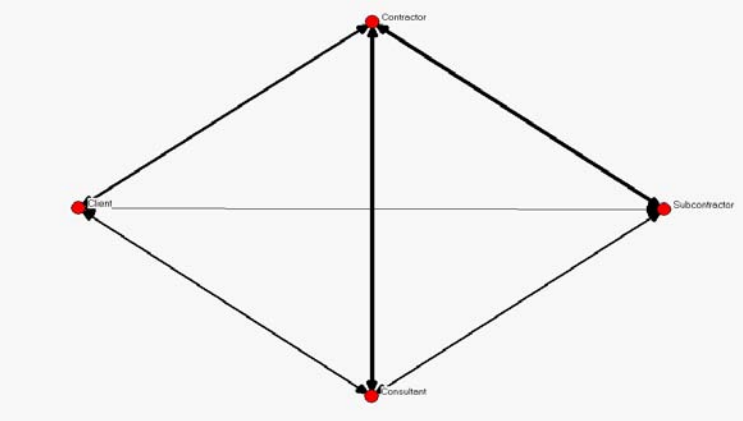

Figure 3.1: An Example of a Network. (Source: UCINET)

3.8.4 Collection of SNA Data

There are many ways to collect network data. The interactional analysis method was considered to be the most appropriate for collecting network data. It requires individuals to report their interactions or attempts to influence over the period studied and for particular content areas (Tichy, et al, 1979).

Quantitative interactional sociometric network data were collected primarily through a questionnaire, which is the most commonly used instrument, and were qualitatively supported by semi-structured interviews and documentary evidence. Since it would be difficult, if not impossible, to examine the relational ties of everyone in a construction project, a network boundary of eleven key stakeholders in a typical construction project was delineated (Loosmore, 1996; Mead, 2001). This network boundary guides the design of the questionnaire and also acts as a roster from which actors make their choices.

The following members of a project team come from the client's side: the project manager (CPM), architect (ARCH)/ design engineer (DgnE), quantity surveyor

(CQS), building services engineer (CBSE), and structural engineer (CSE). Those from the contractor's side include: the project manager (ConPM), site agent (SA), quantity surveyor (ConQS), building services engineer (ConBSE), structural engineer (ConSE), and subcontractor (SC). They are reasonable representatives of a typical project team.

In part four of the questionnaire, the participants in this study were required to provide the following information about their relations: (1) formal contact, (2) informal contact, (3) conflict, and (4) working relationship with the rest of the actors in the boundary. One-mode valued data were measured using a Likert Scale from 1 to 5, with '1' representing very infrequent/ adversarial and '5' representing very frequent/collaborative.

To perform SNA, network data in the form of sociometrics have to be drawn. Data collected in part four of the questionnaire will be put in the form of an adjacency matrix. A matrix is a numerical representation of the relational data contained within a network.

An example is shown in Table 3.3. Network data can be one mode or two-mode, directional or non-directional, dichotomous or valued (Tichy et al., 1979). The numbers inside the matrix indicate the strength of interactions between each pair of actors. For example, in Table 3.3, the interaction between CPM and ARCH is five, which indicates that their interaction is 'very frequent'.

		Receiving Unit										
Sending Unit		CPM	ARCH	CQS	CBSE	CSE	ConPM	SA	ConQS	ConBSE	ConSE	SC
	CPM		5									
	ARCH	5									3	
	CQS							4		2		
	CBSE		4				4					
	CSE											
	ConPM											
	SA		2	5								
	ConQS					5						
	ConBSE											
	ConSE								5			
	SC											

Table 3.3: An Example of an Adjacency Matrix (Source: UCINET)

Interaction dynamics evolve over different phases of construction. In this study, the data on the partnering relationship in the design and construction phases are collected separately. To better analyse the partnering relationship, data on perceptions of the non-partnering relationship are collected as a benchmark for comparison. The participants in this study were asked to give their perceptions of the non-partnering network relationship based on their past experiences of similar non-partnering projects. Their perceptions of non-partnering projects are considered to be a reliable generalization of the situation in Hong Kong's construction industry and a valid proxy of a benchmark non-partnering project

team relationship. Qualitative data were collected with interview questions Q2.6, 2.7, 2.8, 2.9, 2.10 to reconcile the quantitative relational data.

3.8.5 Accuracy of the Network Data

Very often, data on interactions are accused of being inaccurate. The underlying argument is that recall is used as a surrogate for or measure of behaviour (Krackhardt, 1987). However, a few subsequent studies such as those by Krackhardt (1987), and Marsden (1990), have shown that people are able to recall and report typical, routine relations, but that interactions occurring in a very specific timeframe are not reliably reported. People report interactions that are in fact related to the long-range social structure, rather than to particular instances. The recall of interactions should be understood using principles of memory and cognition (Wasserman and Fraust, 1994). People would remember something more accurately if a roster is given for them to choose from.

As for this study, to obtain reliable network data, questions about typical relations, rather than specific interactions were asked in the questionnaire. The questionnaire was therefore designed with a given roster rather than by using free recall. Actors can have a free number of choices within the roster. In addition, the responses of the actors were cross-checked with one another and were also substantiated by interviews.

3.8.6 SNA Software

A number of different types of software for social network analysis are available

on the market, such as GRADAP, STRUCTURE, UCINET, PAJEK, KRACKPLOT, NETIMAGE, NEGOPY, and so forth. Of these programs, Scott (2000) has suggested that UCINET, developed by Stephen Borgatti, Martin Everett, and Linton Freeman, is the best and most accessible to the novice user. The most updated version, UCINET 6.0 was used in this study for the data analysis.

3.8.7 Data Analysis

SNA has a number of structural measures. In this study, only those that contribute to a meaningful interpretation of the propositions that were set were selected, namely centrality, cohesive sub-groups, and regular equivalence.

Centrality

Basically, the following three most commonly used measurements of centrality developed by Freeman (1979) were applied in this study: degree centrality, closeness centrality, and flow betweenness centrality.

Degree centrality

Actors who have more ties to other actors may be in an advantageous position. If an actor has many ties, he/she is often prominent and enjoys high prestige. That is, many other actors seek to form direct ties with such people, and this indicates their importance.

$$D = \sum n_x$$

where n_x = number of other positions in direct contact with position x

Closeness centrality

Closeness centrality emphasizes the distance of an actor to all others in the network by focusing on the geodesic distance from each actor to all others. The sum of the geodesic distance for each actor is the 'farness' of the actor from all others. Closeness centrality is calculated by taking the reciprocal (one divided by farness) and norming it relative to the most central actor (Hannenman, 2001). Actors who are able to reach other actors at shorter path lengths, or who are more reachable by other actors at shorter path lengths have favoured positions.

$$C = \frac{N-1}{\sum d_{xk}}$$

where N = number of positions in a net; and d_{xk} = distance (number of links) from x to k

Flow betweenness centrality

Unlike betweenness centrality, which counts only geodesic distance, flow betweenness advances itself to capture the concept of flow on the rationale that people do not only interact through geodesic distance but also via all other paths. Betweenness centrality is measured by the proportion of the entire flow between two actors (that is, through all of the pathways connecting them) that occurs on paths of which a given actor is a part.

$$B = \frac{2\left(\sum p_{jk(x)}\right)}{N^2 - 3N + 2}$$

where $p_{jk(x)}$ = the probability that communication between *j* and *k* must pass through *x*; and *N* = number of positions in a net.

The concept of centrality is important to this research because it gives structural indices to show the position of different actors and their relative importance to the network. More importantly, it shows the intensity and directness interdependency of the targeted network.

Cohesive Sub-groups

Identifying sub-groups also helps to identify the roles that people play in interacting and reveal how cohesive the network is. Organizational barriers and stereotypes of different professionals impede the integration of the project team. Sub-groups show how the network is integrated.

Clique

With reference to Wasserman and Faust (1994), a clique is defined in a graph as a maximal complete subgraph of three or more nodes. It consists of a subset of nodes, all of which are adjacent to each other, and there are no other nodes that are also adjacent to all of the members of the clique. The restriction that the clique contains at least three nodes is included so that mutual dyads are not considered to be cliques.

The UCINET 6.0 program finds cliques greater than a specified size. The routine will also provide an analysis of the overlapping structure of the cliques. This analysis gives information on the number of times each pair of actors are in the same clique, and gives a hierarchical clustering based upon this information. It also carries out a dual operation by examining the number of actors a pair of cliques has in common. This is submitted to a hierarchical clustering routine (Borgatti, et al., 2002).

As shown in Figure 3.2, UCINET produces results on the number of cliques that have formed and shows their relationship in a dendrogram.

The following three cliques were found:

1: CPM ARCH CQS CBSE
2: ARCH CQS CBSE SC
3: CQS ConPM SC

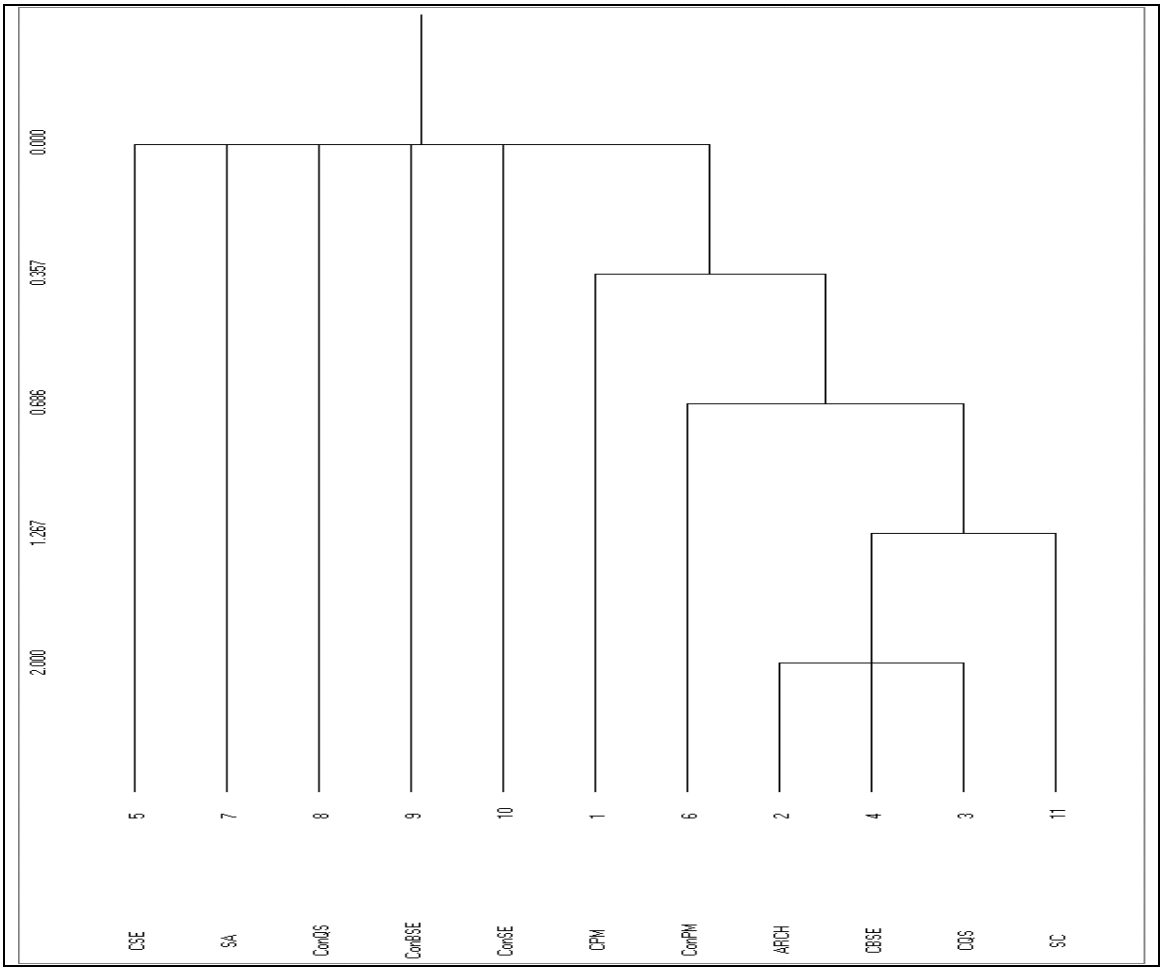

Figure 3.2: Dendrogram Showing a Hierarchical Clustering Clique Relationship (Source: UCINET)

Structural and Regular Equivalence

Two actors are said to be exactly structurally equivalent if they have the same relationships to all other nodes. In reality, structural equivalence seldom occurs. Regular equivalence is an important concept in sociology as well as in this study because it provides a method for identifying 'roles' from the patterns of ties present in a network. Rather than relying on the attributes of actors to define social roles and to understand how social roles give rise to patterns of interaction, regular equivalence analysis identifies social roles by regularities in the patterns

of network ties. Interaction gives rise to culture and norms, and norms and roles constrain interaction.

Two actors are regularly equivalent if they are equally related to equivalent others. That is, regular equivalence sets are composed of actors who have similar relations to members of other regular equivalence sets. The concept does not refer to ties to specific other actors, or to presence in similar sub-graphs; actors are regularly equivalent if they have similar ties to any members of other sets. Regular equivalence was calculated by using REGE in UCINET. The output was a hierarchical clustering matrix and a dendrogram.

The concept of regular equivalence is useful in this study because people in highly equivalent groups would have a similar ideology upon interaction and a common neighbour, meaning shorter communication routes and less distortion through filtering. The clustering matrix groups people on the basis of their regular equivalence, where an index of 100 indicates strict regular equivalence between people and an index of zero indicates no regular equivalence. An example is presented in Figure 3.3.

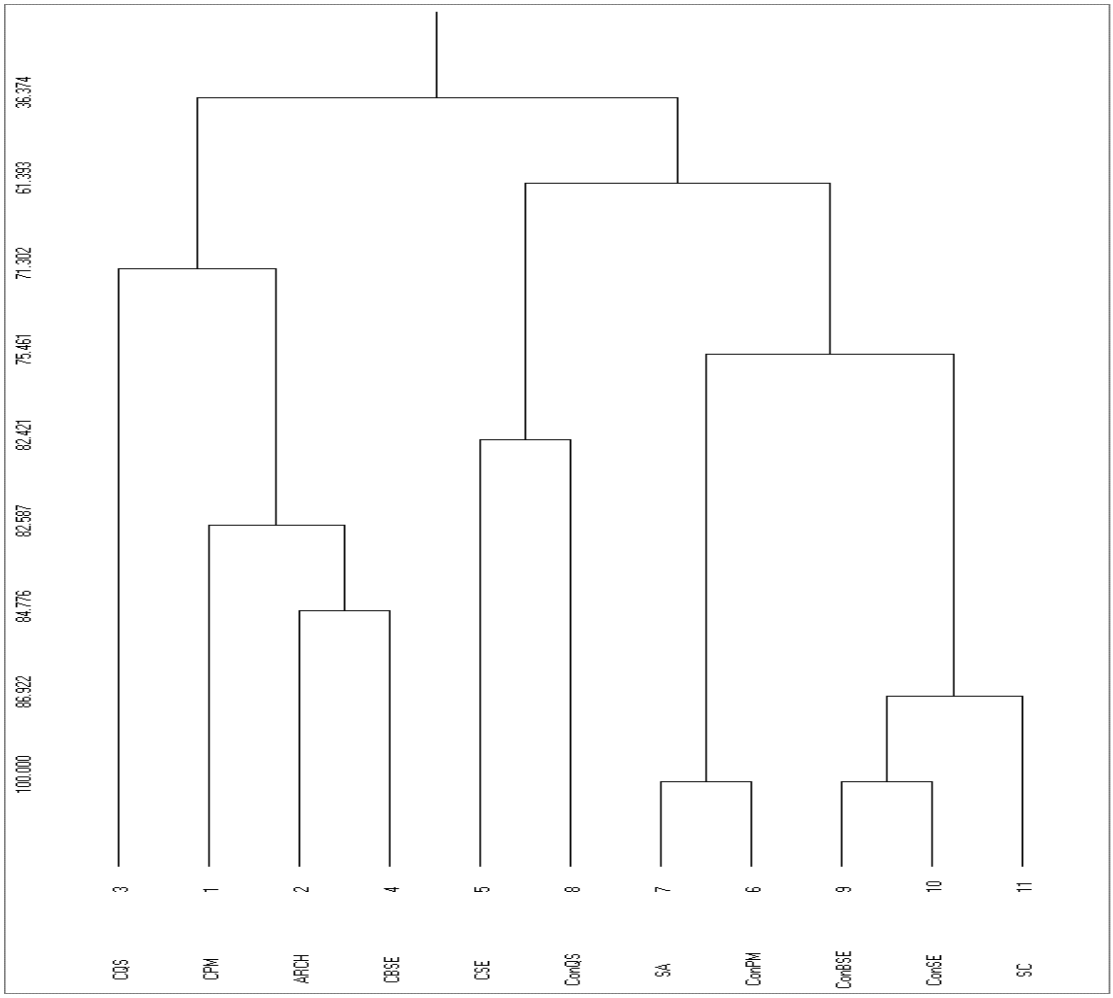

Figure 3.3: Dendrogram Showing a Hierarchical Clustering Matrix (Source: UCINET)

As in Figure 3.3, SA and ConPM and another pair of actors ConBSE and ConSE have a very high regular equivalence of 100. In contrast, CSE and ConQS have a lower regular equivalence of 82.421.

3.8.8 SNA on Communication Structure

To investigate the veracity of the first part of proposition three (partnering brings about an open communication structure), the communication structure was scrutinized using the structural indices of SNA described above.

With the help of a matrix set in the questionnaire, the participants in this study indicated the frequency with which they have ‘formal’ and ‘informal’ contacts with members of the project team set in the roster. They rated their frequency of contact from one, representing ‘very infrequent’; to five, representing ‘very frequent’; and N/A if not applicable. Two separate adjacency matrices were formed, with columns and rows representing actors.

Centrality not only reveals the prominence of actors in a communication network, but also reflects the effectiveness and efficiency of the flow of information in that network. Degree centrality shows the frequency of interaction. A high frequency of interaction is represented by a high degree centrality. A high closeness centrality means that communication links are direct and that actors in network are closely connected. Building on the work of Bavelas (1950), Leavitt (1951) showed that communication networks with centralized structures (e.g. a wheel) improved the diffusion of information in simple tasks; while decentralized structures (e.g., a circle) delayed the diffusion of information. However, Shaw (1954) demonstrated that groups with decentralized communication networks took less time to finish complex tasks than groups with centralized communication nets. In this analogy, a complex construction project should have a decentralized structure of communication. Low and evenly distributed

betweenness centrality reflects a decentralized structure.

Besides centrality, when actors from different companies with different interests form sub-groups this means that barriers to inter-organizational communication have been removed. A high regular equivalence among actors means that they would be more likely to achieve consensus in communication.

The following operational propositions were therefore derived:

Proposition 3.1: Partnering leads to an open communication structure

3.1a. More mature partnering projects have a communication structure with higher degree centrality, higher closeness centrality, and more evenly distributed betweenness centrality than less mature partnering projects.

3.1b. More mature partnering projects have a communication structure with more cohesive sub-groups and fewer isolates than less mature partnering projects.

3.1c. More mature partnering projects have a communication structure with higher regular equivalence than less mature partnering projects.

3.8.9 SNA on Problem Solving Structure

To investigate the veracity of the second part of proposition three (partnering leads to an efficient problem solving structure), the structural indices of SNA were investigated.

The respondents were asked to indicate the frequency with which conflict

occurred among key members of the project team. Low degree centrality represents a low frequency of conflict. Problems are resolved before they accelerate to become a conflict. Again, problem solving would be more efficient in a decentralized structure. A high closeness centrality indicates that the flow of information in a conflict would be direct, and low betweenness centrality would mean a high level of interdependency in solving problems and resolving conflicts. A larger-sized clique would indicate that more actors are involved in resolving conflicts, and a higher regular equivalence means that it is easier for them to perceive conflicts and resolve them. The following operational propositions are derived:

Proposition 3.2: Partnering brings about efficient problem solving

3.2a. More mature partnering projects have a lower degree centrality, a higher closeness centrality, and more evenly distributed betweenness centrality of conflicts than less mature partnering projects.

3.2b. More mature partnering projects form larger and more numerous cohesive sub-groups for problem solving than less mature partnering projects.

3.2c. More mature partnering projects have a higher regular equivalence upon the solving of problems than less mature partnering projects.

3.8.10 SNA on Working Relationship Structure

To investigate the veracity of the last part of proposition three, the respondents were required to indicate their perceptions of their working relationship with other project team members. A high degree centrality represents a high level of collaboration, a high degree of closeness represents a direct working relationship, and low betweenness means that no one can dominate and manipulate in team building. More overlapping cliques represent a higher level of cohesiveness in a team. Higher regular equivalence would show that actors have similar perceptions about their working relationship.

The following operational propositions have been derived:

Proposition 3.3: Partnering brings about closer working relationships

3.3a. More mature partnering projects have a higher degree centrality, greater closeness, and more evenly distributed betweenness centrality of collaboration in working relationships than less mature partnering projects.

3.3b. More mature partnering projects lead to the formation of more cohesive sub-groups than less mature partnering projects.

3.3c. More mature partnering projects have a higher regular equivalence in their working relationships than less mature partnering projects.

3.9 RESEARCH STRATEGY FOR PROPOSITION FOUR

Part five of the questionnaire is designed to collect data on cooperative performance. Two questions are set on the performance of the relationship of cooperative alliance (objective four). The sources for the formulation of these questions are Saxton (1997), Lui (2000) and Cheng et al. (2000). Interview question Q2.11 is designed to collect qualitative data to reconcile the quantitative data. Since the case studies had not been completed at the time of research, the performance outcome was measured by the project participants' perception to project progress and their satisfaction.

The quantitative data was analysed using SPSS 11.0 to derive descriptive statistics with means, and perform an inferential statistical analysis with correlations. A Pearson correlation coefficient was calculated to determine whether a relationship of cooperative partnering improves performance outcomes.

CHAPTER 4: CASE STUDY ONE – A MATURE PARTNERING PROEJCT

4.1 INTRODUCTION

This chapter presents information gathered from the documentation of a railway infrastructure project and data collected from 11 questionnaires and 8 interviews. The participant representing the client is a railway corporation, the main contractor is a large construction firm, and the subcontractor is an electrical and mechanical engineering services provider. Project participants involved are a client project manager (CPM), client civil engineer (CCE), client building services engineer (CBSE), architect (ARCH), client quantity surveyor (CQS), contractor project manager (ConPM), site agent (SA), contractor building service engineer (ConBSE), contractor structural engineer (ConSE), contractor quantity surveyor (ConQS), and subcontractor (SC).

Case study 1	Client	Consultant	Contractor	Subcontractor
Questionnaire survey	5	0	5	1
Interviews	3	0	4	1

Table 4.1: Distribution of Project Participants in Case Study One

In this case most of the participants in the project had a significant amount of experience in partnering projects. This project is one of the client's partnering projects. Partnering was introduced at the tender stage. This case can be

described as a ‘mature partnering’ project.

4.2 PROJECT CONTEXT OF A RAILWAY PROJECT

The contract for this case began in April 2002 and will end in 2005. The contract period is 42 months, with a contract sum of over HK$300M (US$37.5M). The scope of work is spilt into two distinct parts. At the north end, there are provisions for an additional entrance, escalators, and lifts; a new station control room; and a modified concourse layout. At the south end the station extends by some 60 m to accommodate the relocation of plant rooms for the new subway link connected to a railway station now under construction. This project adopted a target cost approach with two-stage tendering. Five contractors were invited to tender in the first stage and two were short-listed to submit tender in the second stage. During that period, the client seconded a separate design team to work with the two contractors to develop a detailed statement of the method to be used in construction.

4.2.1 Target Cost Contract

This project is the first contract to be administered under a Target Cost Contract. This actualizes the concept of pain share and gain share. $286 million is the ‘target cost’, including a contingency fund of $26 million covers risks. A large part of management is focused on not spending the $26 million. Savings are shared between the client and contractor, and risks are also shared.

4.2.2 Two Tendering Stages

This project adopted two-stage tendering. In the first stage, five to six contractors were invited to submit tenders; and in the second stage, two contractors were selected. These stages lasted a total of three to four months. Each contractor works with a separate group of the client's staff in developing an actual method statement so as to arrive at the best option for constructing the job. Since the client's staff have worked through the whole design stage, they can give a lot of advice to the contractor. A partnering workshop was held. This pre-contract stage of partnering allows for the early involvement of the contractor to work out a more detailed method statement and identify risky items to better develop the cost plan. With the contractor's input into the design scheme, the learning curve was shorter and the contractor could catch up with the project very quickly.

4.3 PROJECT PARTNERING OF A RAILWAY PROJECT

Partnering workshops were carried out in two phases, with one in the design phase and one after the awarding of the contract. During the construction stage, refreshment workshops were also held.

4.3.1 Partnering Workshops and Monthly Monitoring Meetings

Partnering was introduced in the design stage. Separate workshops were held in the design stage with two potential contractors and a design consultant. Following the successful award of the contract, the team consisting of the contractor, the client, the consultants, and the workforce organized the first

partnering workshop in June 2002 to formulate a charter. This project adopted second-stage partnering as the project delivery mechanism and had the following expectations:

- The contractor will make a profit;
- The corporation will get a quality product;
- The contract will be jointly managed;
- A wealth of experience will be call upon;
- Delivery will be according to the programme;
- Delivery will be made within the target cost.

The second project partnering workshop was conducted on 16th January 2003 to reinforce the 'value-adding' principles of partnering with the new teammates. There are also monthly Partnering Champions Review Meetings to carry out evaluations. Partnering social functions such as BBQ, bowling evening have also been arranged.

4.3.2 Partnering Charter

The partnering charter includes the following 10 goals for achievement. Goals 1, 2, 6, 7, and 10 relate to the performance of the project, while goals 3, 4, 5, 8, and 9 relate to soft issues.

1. Promote a zero accident environment.
2. Do not disrupt existing railway operations.
3. Generate individual pride and team satisfaction.

4. Continually promote and encourage innovative ideas from the workforce.
5. Use effective communications to reduce waste.
6. Identify time savings, minimize disruption, and complete the project in the shortest practical time.
7. Maximize ‘gain’ and minimize ‘pain’.
8. Actively champion partnering and respect alternative ideas.
9. Build a long-term relationship.
10. Complete the works to the required quality and standards.

4.3.3 Issue Evaluation Ladder

The issue evaluation ladder sets out the levels and corresponding personnel to whom any issue can be referred. It is emphasized that, under partnering, the lowest possible levels of management and supervision shall be empowered to resolve issues, thereby avoiding delays and unnecessary time in responding. Partners at each level should attempt to reach agreement on an issue twice before passing it to the next level for resolution. Each level should handle any particular problem within a two-day period.

4.3.4 Partnering Champions

Partnering Champions are selected at the site level to consolidate the implementation of partnering. The team charged with the responsibility of disseminating the Partnering philosophy on site and convening the monthly Partnering meetings was selected.

4.3.5 Sharing Resources

Partnering emphasizes working as one team. The client and the contractor work as a team physically, by sharing the same office and sharing the costs. There is no separation between them in the office. The client seconded its own land survey staff to work with the contractor's survey team. The client sent no checking team, only one senior land surveyor who oversees many projects. This saves a great deal of money and human resources, and also increases the cohesiveness of the team as those involved are working as one team.

4.3.6 Value Engineering

Value engineering meetings are held to look for innovative ways to save money. Anyone in the team may propose an innovative proposal as long as they feel that such a proposal will make the job easier, save money, or improve the end product. So far, $2.3 million has been saved. The money saved is shared between the client and contractor by the pain share and gain share principle.

4.4 CONDITIONS OF PARTNERING FORMATION IN A RAILWAY PROJECT

4.4.1 Quantitative Data Analysis

With reference to Table 4.2, the participants in the project agreed that nine inducements and three opportunities to form an alliance were the conditions of partnering formation for a railway project. Among them, four inducements and

two opportunities to form an alliance are relatively important conditions for partnering formation, and their mean is between 3.7 and 4.2; while five inducements and one opportunity to form an alliance are relatively less important conditions, with a mean of between 3.3 and 3.6.

The sharing of risk among the partners (Q2.3) ranked highest; the possession of technical competence (Q2.11) ranked second; and the possession of social capital (Q2.13) ranked third. One inducement not considered to be a condition leading to the formation of an alliance was pressure from the government or from regulations (Q2.8).

		Mean	Rank
Inducements to form an alliance:			
2.1	Avoid opportunistic behaviour	3.5263	8
2.2	Reduce uncertainty of interdependency	3.7895	4
2.3	Share risk among partners	4.2105	1
2.4	Share resource capabilities	3.7368	5
2.5	Acquire new skills or knowledge	3.5263	8
2.6	Enhance competitive power in the market	3.7368	5
2.7	Influence from peers in the industry	3.3158	11
2.8	Pressure from the government or regulations	2.6842	13
2.9	Follow the successful experience of other firms	3.5789	7
2.10	Prior social relationship	3.5263	8
Opportunities to form an alliance:			
2.11	Possess technical capital or expertise	3.9474	2
2.12	Possess commercial capital (e.g., financially sound)	3.2632	12
2.13	Possess social capital (e.g., good reputation)	3.8421	3

Table 4.2: Mean and Rank of Inducements and Opportunities for the Formation of Partnering in Case Study One

4.4.2 Qualitative Data Analysis

From the interviews, it was found that the client in this case study adopted partnering as a project management strategy. The client had formally

implemented partnering in a previous project, with very successful results. In light of this, the client widely applied partnering to subsequent projects, including this case study. This project is a contract for the second phase of the construction of the airport railway line. The first phase did not use partnering and ended in huge claims and disputes, and in frosty and hostile relationships. The various claims had not been settled even after two years. To avoid a repetition of this dreadful experience, the client emphasized and proactively adopted partnering to improve project performance and relationships.

The sharing of risk is the most important inducement for the formation of this relationship of partnering. As supported and confirmed by the quantitative data shown in Table 4.2, the main reason why the client resorted to the use of partnering in this project is the risks and complications involved in the project. Without partnering and setting a target cost, it would be impossible for any contractor to take up the job, or the contractor would submit a very high-priced bid. The client wanted to seize the chance to work with the contractor to come up with the best price for this job. This project is particularly risky, as the project involves modifications to a very busy Mass Transit Railway station. As this project involves work inside the station, the client has to ensure that the work of construction will not pose any danger to the passengers and lead to a drop in revenue. Second, this project involves many structural modifications, such as cutting holes from slabs; this poses safety risks. Third, this project may cause subsidence of ground, utilities problems, and so forth. Fourth, this project may affect the environment of the surrounding commercial areas, the pedestrians, and the people who work and live there. It is therefore very important for the client to work closely with the contractor as a partner to resolve all of these problems and

find ways of minimizing any adverse effects.

As validated by the quantitative data, technical competence and social capital are also considered to be important. During a period of economic downturn, the client wants to further improve its business efficiency and is trying to move to the second stage of partnering to share resources with the contractor and reduce waste. The client has staff with technical competency, and their ability can be utilized in a partnering arrangement. The staff can make use of their knowledge and work with the contractor as one team. It is also hoped that partnering will lead to improvements in communication, better resolution of conflicts, and a more cooperative working relationship. This confirms with the literature that a relationship of cooperative alliance is not unilaterally formed but must also involve attractive partners. Although a prior social relationship is not considered to be relatively important to induce the formation of an alliance, social capital shows the importance of social networks.

The inducement of ‘pressure from the government or regulations’ is not considered as a condition for the formation of partnering because the client in this case study is proactively using partnering as an innovative project management strategy to improve business efficiency.

4.5 DETERMINANTS OF A COOPERATIVE PARTNERING RELATIONSHP IN A RAILWAY PROJECT

The participants in the project agree with 41 determinants of a cooperative partnering relationship, of which 26 are behavioural constructs and 15 are

structural constructs. Four behavioural constructs are the most important determinants, with a mean of over 4.33. In addition, 19 behavioural constructs and 10 structural constructs are 'relatively important' determinants, with a mean of between 3.67 and 4.33. Three other behavioural and 5 structural constructs are 'relatively less important' determinants, with a mean of between 3.0 and 3.66. Generally speaking, a certain amount of cooperative behaviour is seen in the partnering relationship in this project.

It is also noted that participants do not believe that to 'fully comply with the request of the other partners, even at the expense of own short-term interests' is a determinant of a cooperative relationship of a railway project, as this statement only scored 2.8421.

	Determinants of a Cooperative Relationship	**Structural/ Behavioural**	**Average**
3.1	The partners have contributed effort and resources to form a cooperative relationship	S	4.3158
3.2	The partners have concurrent relationships in other projects	S	3.5263
3.3	The partners are equally dependent on each other	S	3.2105
3.4	The partners have a top-down commitment to cooperate	B	3.8889
3.5	The partners are working to complete the project in an effective manner	B	4.2105
3.6	The partners are allowed to participate in setting goals	B	4.1579
3.7	The partners are allowed to participate in planning activities	B	4.3684
3.8	The partners had a successful previous relationship	S	3.8947
3.9	The partners have shared values and common	B	4.0526

	goals		
3.10	The partners are willing to take risks	B	3.5263
3.11	The partners are known to be trustworthy	B	3.8421
3.12	The partners have a good reputation in the industry	S	4.0000
3.13	Effective and efficient communication	B	4.2105
3.14	The partners share information with each other	B	4.2105
3.15	The partners are encouraged to participate and exchange ideas	B	4.4737
3.16	The partners have full access to all useful information	B	3.8947
3.17	The partners have no hidden agenda	B	3.5789
3.18	The partners solve problems jointly	B	4.1053
3.19	Problems are solved before they escalate	B	4.2105
3.20	The partners try to avoid disputes and reduce the use of litigation	B	4.1579
3.21	The partners are open to innovative ideas	B	4.4737
3.22	The partners are responsive to emergencies or changing needs	B	4.1053
3.23	The possibility of inter-organizational learning	S	3.6316
3.24	The partners are very likely to interact in the future	B	3.8333
3.25	The process of interaction is perceived to be equitable and just	B	3.9412
3.26	One partner cooperates and the others follow	B	3.3684
3.27	The partners seek to achieve a win-win situation	B	4.4211
3.28	Set up a mechanism for effective decision-making	S	4.0000
3.29	Rewards are given to motivate cooperation	S	4.0000
3.30	Punishments are imposed for mutual non-cooperative actions	S	2.8947
3.31	A mind open to new possibilities and new alternatives	B	4.3158
3.32	Full authority for action has been delegated to the project team	S	3.7895
3.33	Fully comply with the request of the other partner, even at the expense of one's own short-term interests	B	2.8421
3.34	The goals of the company and the objectives of	S	3.6842

	the partners are compatible with each other		
3.35	The technical capabilities of both partners are compatible with each other	S	3.6316
3.36	The organizational procedures of the partners are compatible	S	3.4211
3.37	The employees of the partnering companies have similar professional or trade skills	S	3.7895
3.38	Constructive handling of differences	B	3.7895
3.39	Building a sense of belonging and pride	B	3.7895
3.40	Feedback and performance evaluations	S	3.9474
3.41	Clearly setting out the roles, duties, and responsibilities of each party	S	3.7368
3.42	Supportive leaders know how to cooperate	B	3.8947
3.43	The organizational culture supports cooperation	B	3.7895

Table 4.3: Mean of Determinants of the Cooperative Partnering Relationship in Case Study One

4.6 ANALYSIS OF NETWORK STRUCTURE – COMMUNICATION IN A RAILWAY PROJECT

In this project, partnering significantly improves the efficiency and effectiveness of communication. Partnering acts as a framework/baseline for more informal forms of communication that would otherwise not possible in a traditional contract. Unlike a traditional contract, which requires everything to be documented in black and write, this project based on the spirit of partnering to work as one team offers more flexibility in communication. There is a great reduction in paperwork. The paper was reduced to about 20% of that of the MTRC's previous Yau Tong project. Communication is direct and informal. The dominant channel of communication is the face-to-face discussion. Decisions are then confirmed mostly by e-mail or later documented by a one-time exchange or

submission of correspondence.

Case Study 1	Case Study One		Non-partnering Project	
Means of Communication	**Mean**	**Rank**	**Mean**	**Rank**
Formal written	2.0000	5	4.2500	1
Informal written	3.5263	2	2.8125	4
Formal face-to-face	3.5263	2	3.4375	2
Informal face-to-face	4.4737	1	2.5625	2
Verbal	3.2105	4	3.0625	3

Table 4.4 Means of Communication in Case Study One as Compared with a Non-partnering Project

To better illustrate the pattern and network structure of partnering behaviour, a substantial amount of effort has been made to collect relational data from surveys. A social network analysis was employed to analyse the data collected. Both the design and construction stages were taken into account.

4.6.1 Centrality of Communication in a Railway Project

Design Phase

With reference to Figure 4.1a for communication in the design phase, the degree centrality of communication for each actor sampled is perceived to be significantly higher than in a non-partnering (NP) project for both formal and informal means of communication. Both formal and informal forms of communication are equally important. In the pre-tender stage of partnering, the client's project team works closely with the contractor to finalize the design and develop a more practical method statement. The involvement of the contractor

and subcontractor in the design phase is significantly improved as compared with a non-partnering project. It is found that people have similar patterns of formal and informal communication in the design phase.

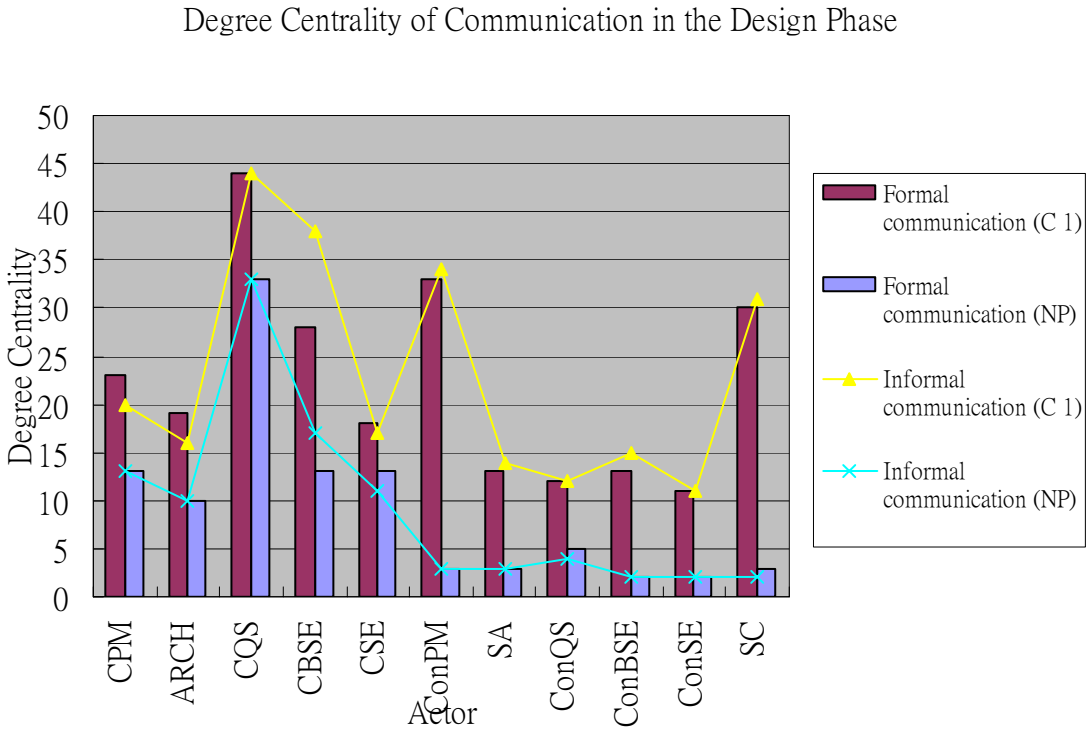

Figure 4.1a: Degree Centrality of Communication in Case Study One in the Design Phase

Construction Phase

Similar to the design phase, in a partnering project there is also a higher degree centrality of formal and informal communication in the construction phase than in a non-partnering project, but the difference is smaller. There is a high degree of centrality in the communication structure in this case study, which means that the interaction in communication is intense.

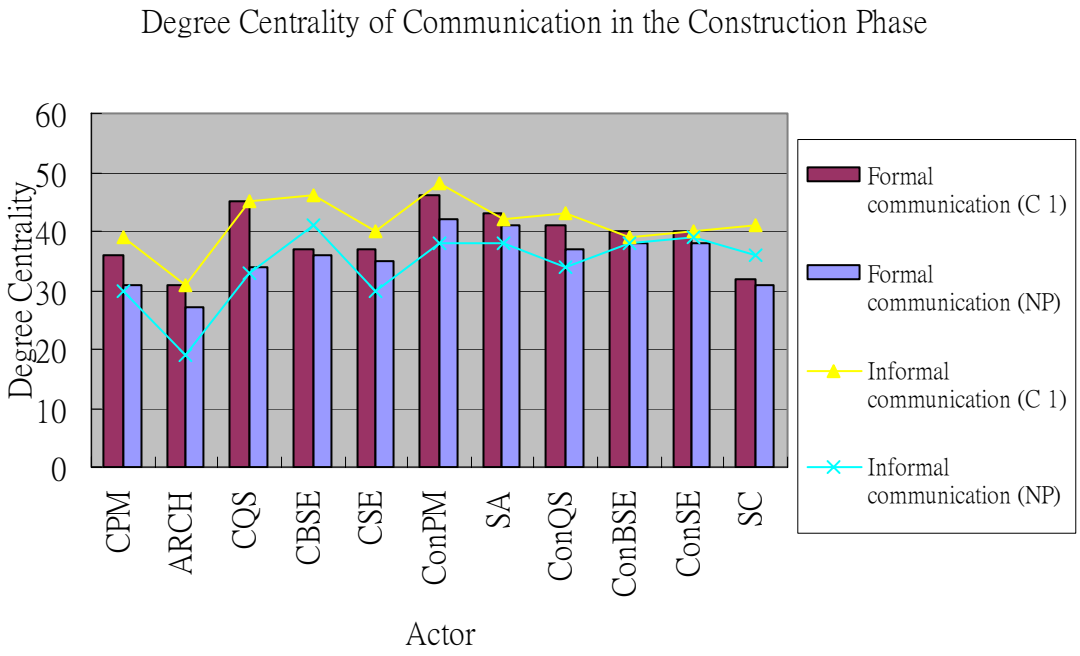

Figure 4.1b: Degree Centrality of Communication in Case Study One in the Construction Phase

Design Phase

For efficient communication, the closeness centrality should be high. This means that actors are close to each other and the flow of information can be direct and does not have to pass through many intermediates. In the design phase, the CQS, ConPM and SC have a closeness centrality of 100%. This means that they can reach each actor directly. The closeness centrality for the ConPM and SC is greatly increased in this case study as compared with a non-partnering project. The role of the ConPM and SC in communication has become more important.

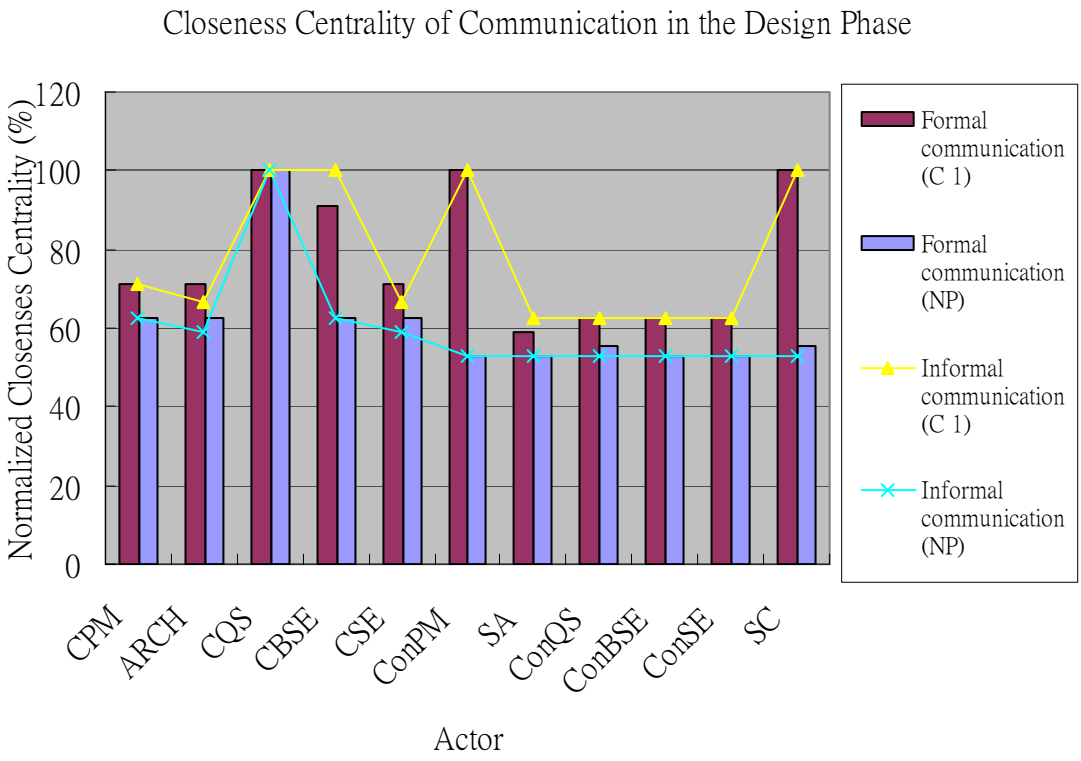

Figure 4.2a: Closeness Centrality of Communication in Case Study One in the Design Phase

Construction Phase

The closeness centrality is very high for nearly all actors. Again, with partnering in this project, communication is more direct. Some improvement can be found in the ARCH, CSE, ConBSE, and SC.

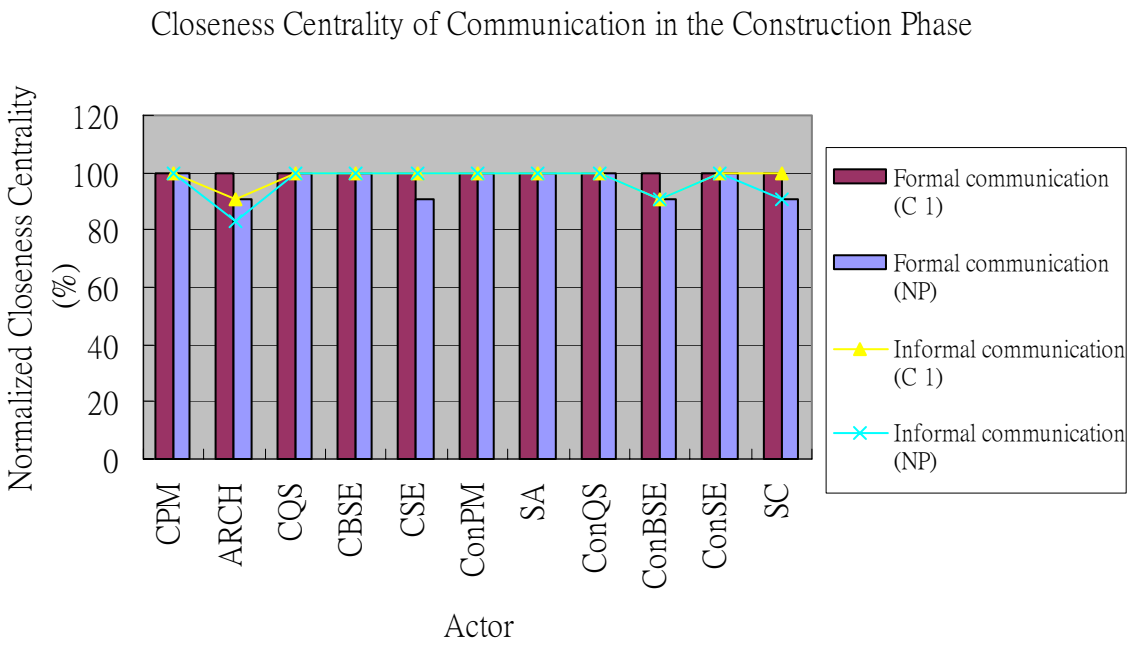

Figure 4.2b: Closeness Centrality of Communication in Case Study One in the Construction Phase

Design Phase - Flow Betweenness Centrality

The CQS is in a powerful position to control information. The position has the greatest flow betweenness centrality, which means that a huge amount of information will pass through the CQS. Efficiency of communication depends on the CQS's ability to handle the information. Problems usually arise because the CQS is overloaded with information. Partnering successfully evens out the flow betweenness of communication. The flow betweenness of the CQS is reduced from 90% to 30%, whereas that of the ConPM and SC are increased from nearly zero to 23% and 18%, respectively.

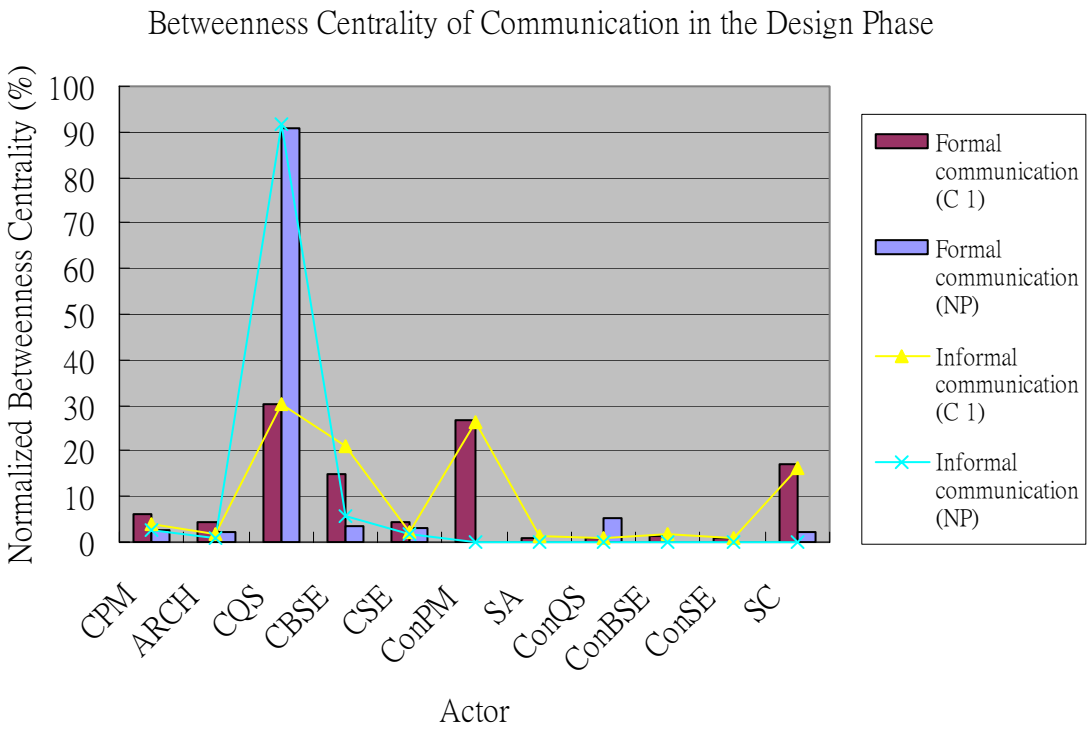

Figure 4.3a: Betweenness Centrality of Communication in Case Study One in the Design Phase

Construction Phase - Flow Betweenness Centrality

Flow betweenness is again more evened out in this case study when compared with a non-partnering one. The communication structure in this case study has an even distribution of flow betweenness centrality, which means that more actors have the power to control and obtain access to information. This prevents one or two actors from being overloaded with information. The communication structure is decentralized.

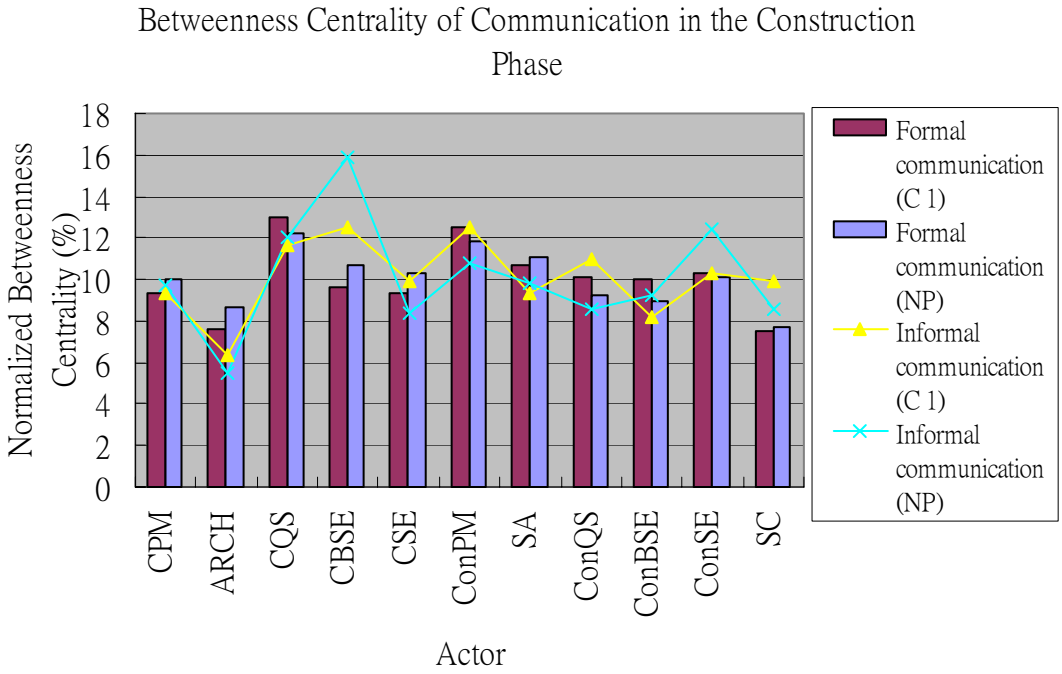

Figure 4.3b: Betweenness Centrality of Communication in Case Study One in the Construction Phase

4.6.2 Cohesive Sub-groups: Cliques

Design Phase

For formal communication, three cliques were formed. It is particularly noted that the ConPM formed a clique with the CQS and SC. In a non-partnering project, only one clique containing people from the client's side would be formed. For informal communication, two cliques were formed. Again, the ConPM formed a clique with the CBSE, CQS, and SC; however, without partnering, no clique would have been formed.

Construction Phase

For formal communication, eight cliques were formed, while only six cliques

would have formed in a non-partnering project. For informal communication, six cliques were formed while in a non-partnering project only five cliques would have formed. No one is isolated in the construction phase.

4.6.3 Regular Equivalence

Design Phase

The CSE in this case study has a high regular equivalence (96.106) in formal communication with the ConQS and SA, which does not happen in a non-partnering project. This is especially important for the CSE to work closely with these people and for the CSE's thinking and perspective to be similar to those of the contractor because this project involves heavy civil engineering work. In general, the communication structure in this case study, both formal and informal, is more hierarchically clustered than in a non-partnering project.

Construction Phase

Actors belonging to the same company have more regular equivalence with each other. Intra-organizational consensus can easily be reached. It is found that the CQS has a high level of regular equivalence (98.798) with the ConPM, which shows that the CQS is inclined to make decisions that are in line with those of the ConPM. The situation would be different in a non-partnering project. There, the CQS is usually not open or even hostile to any alternative proposals made by the contractor that involve changing cost.

4.6.4 Analysis of the Qualitative Interview Data on Communication

From the interviews, it is clear that in the tender stage, the contractor and client work together and communicate to exchange their expertise. The contractor is aware of the client's concerns and the client understands the contractor's difficulties at an early stage when everything can still be changed. For example, with regard to the selection of the subcontractor, the contractor can discuss the matter with the client and choose the most suitable subcontractor.

The idea of the joint office associated with partnering has greatly improved the accessibility of communication. The client and contractor work in the same office and everyone can discuss matters with the relevant person directly over the partition. It is not necessary to spend time traveling or making appointments. In other projects, it is usually difficult to reach the client, especially the people who make the decisions, but in this project, there is no such barrier.

In a traditional contract, people interact with only the people they encounter at work. Some of the members of the project team may never meet. However, a joint office enables all of the members of the project team to quickly get to know each other well. In addition, partnering workshops and meetings provide a forum and channel for partnering champions to discuss and resolve problems. People in different positions who would not normally come across with each other will meet during the meetings. They can pinpoint their problems and raise the concerns of the whole project team.

Usually, when a contractor submits a claim, he first discusses with the client

whether the claim is justified or whether there is another way of handling the matter. This makes the whole process quicker and easier. However, communication can also become too informal and lack traceability. It is difficult to communicate verbal agreements across the whole project team.

A significant improvement in communication is found between the client and the subcontractor. In an ordinary project, (for example the airport project in Hong Kong), it is hard for a contractor to communicate with the client. The contractor has no direct contact with the client, and any contact has to be arranged. Sometimes, at least two consultants have to be reached before the contractor is able to see the client. However, in this project, a subcontractor is invited to join in the partnering. The subcontractor can approach the client directly and simply keep the contractor informed of any decisions that have been made.

For example, at the beginning of the project, a communication problem occurs between the client and the subcontractor and its sub-subcontractors. At the beginning, the subcontractor has not stationed enough staff on the site to oversee the project. The people on the site have been overloaded with information. The situation improved when the subcontractor put seven more members of staff, including mechanical and electrical engineers, on this project. The subcontractor does not have a target cost contract with its sub-subcontractors, and some of their work is not up to the required quality. Since the subcontractor does not have enough staff to deal with its sub-subcontractors, the MTRC bypasses the subcontractor and communicates directly with the sub-subcontractors. There have been some disputes over such a practice. However, they have been resolved by the subcontractor delegating the decision-making authority to the

sub-subcontractor's engineer, with the requirement that he report afterwards.

4.7 ANALYSIS OF A NETWORK STRUCTURE – PROBLEM SOLVING IN A RAILWAY PROJECT

4.7.1 Centrality of Problem Solving in a Railway Project

Design Phase

With reference to Figure 4.4, the frequency of conflict is quite low in the design phase. The CQS is the one involved in the most conflicts. This may be due to his prominent role in the design phase in making decisions on the contract document.

Construction Phase

As shown in Figure 4.4, a significant reduction in the degree centrality of conflicts occurs in the construction phase in this case study, as compared with a non-partnering one. With partnering, problems can be resolved quickly before they escalate into conflicts. However, as the ConBSE does not believe in partnering, he remains the main source of conflict.

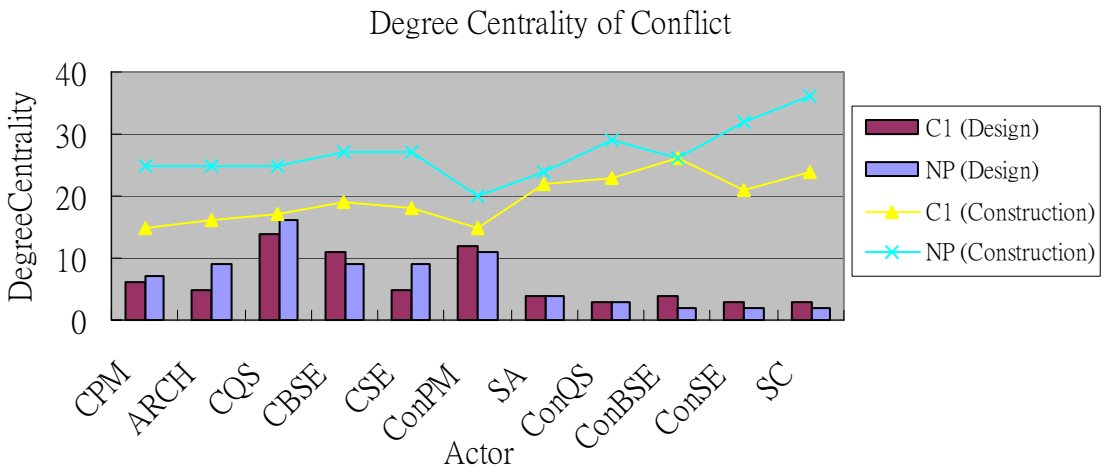

Figure 4.4: Degree Centrality of Problem Solving in Case Study One

Design Phase

As shown in Figure 4.5, the closeness centrality of conflict in the design phase is low and there is not much difference whether or not partnering is employed. This means that partnering does not change the pattern of resolving conflicts.

Construction Phase

At 100%, closeness centrality is at a maximum level for making contact with the other 10 actors in the network. A similar pattern occurs in non-partnering projects. This shows again that partnering does not change the pattern of problem solving and conflict resolution.

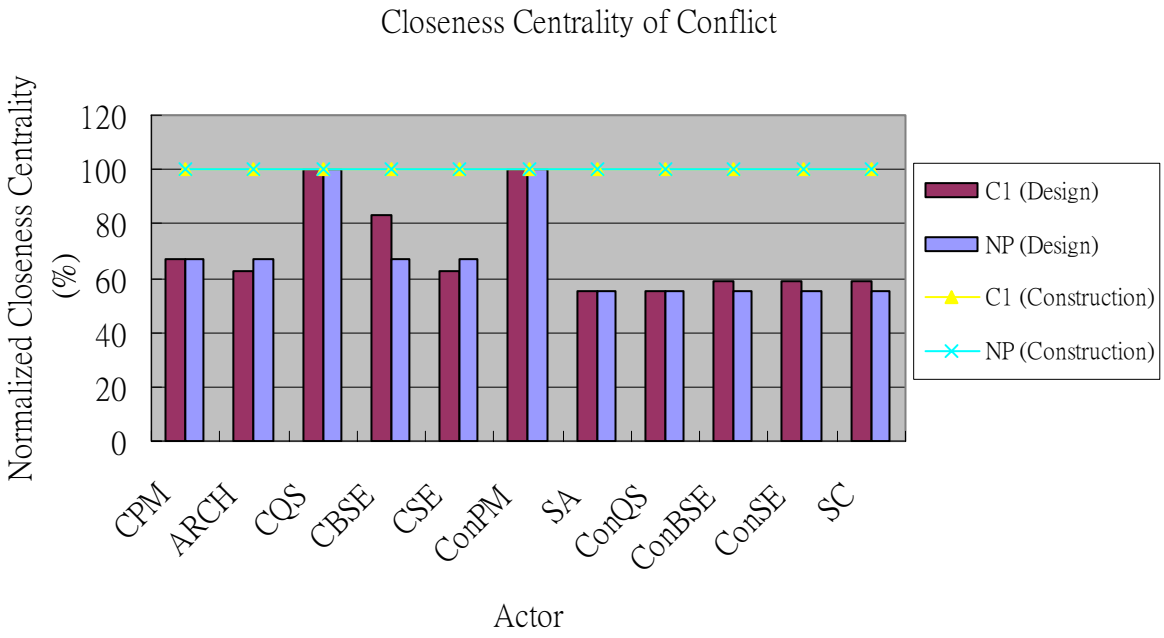

Figure 4.5: Closeness Centrality of Problem Solving in Case Study One

Design Phase

Similar to the communication structure, the pattern of flow betweenness for problem solving is more evenly distributed than without partnering. In this case, the flow betweenness of the CQS and ConPM is reduced, while that of the CBSE is greatly increased as compared with non-partnering projects. This pattern also reveals the CBSE's central role in dealing with engineering and mechanic conflicting issues at the design stage, as no detailed E & M drawings are available in this project.

Construction Phase

The ConBSE and SC are the two actors with the highest betweenness centrality of conflict. This reflects the fact that many problems arise in the area with E & M works. The ConBSE and SC therefore come across many other actors in trying to resolve conflicts.

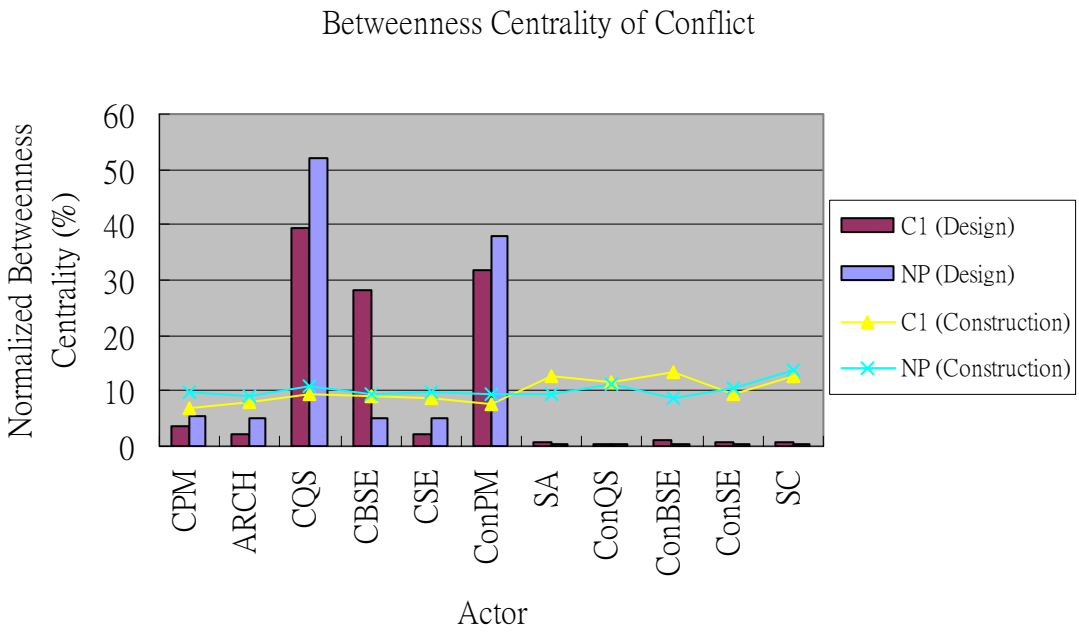

Figure 4.6: Betweenness Centrality of Problem Solving in Case Study One

4.7.2 Cohesive Sub-groups: Cliques

Design Phase

Two cliques were formed to resolve problems and conflicts. Again, ConPM, CQS and CBSE formed a clique to resolve conflicts. For a similar project without partnering, only one clique would be formed, containing only participants from the client's side.

Construction Phase

Two cliques were formed both in this case study and in non-partnering projects, but the cliques in this case study are larger, with more actors in each clique.

4.7.3 Regular Equivalence

Design Phase

To solve problems, the group ARCH and CSE; and the group ConSE and SC are 100% regularly equivalent with one another. This means that they are likely to take the same approach and have the same attitude on the resolution of conflicts. The next equivalence level worth noting is 95.466, which joins the SA, ConQS, CSE, ARCH, and ConBSE. The ARCH and CSE tend to reach agreement with the contractor more easily than other actors on the client's side.

Construction Phase

The highest level of regular equivalence for the contractor to join with the client's side occurs at 95.380 (CPM, ARCH, and ConPM). However, a higher equivalence can be found in a non-partnering project.

4.7.4 Analysis of the Qualitative Interview Data on Problem Solving

From the interviews, the client of this project was perceived to be a professional and competent client. The client participates actively, and experienced staff are put in the project to manage the job. The client supervises the job and has placed a strong engineering project team on the site that is empowered to make decisions right away. The client's staff are experienced in dealing with such jobs and with the contractor. The client proactively becomes involved to resolve problems rather than relying on the contractor. With the issue elevation ladder of partnering, conflict can be resolved at the site management level. When conflicts

arise, people know exactly whom they need to talk to. Conflicts are resolved through discussion by a commitment from both the client and the contractor.

Conflict cannot be eliminated but can better be managed with partnering. Conflict may even be good because hidden problems can be revealed. The difference between partnering and non-partnering work is that partnering will not delay the progress of work while non-partnering would. With partnering, based on a relationship of trust people would continue the work even before a final settlement. However, in a traditional contract, nothing would be done when the EOT, VO, and L/E are not settled and the work would be delayed.

Pure partnering does not help to resolve conflicts. It has to be tied in with other financial arrangements. In a value engineering forum, the contractor can become involved before decisions are made. Conflict occurs in a non-partnering project because letters are exchanged without consulting the contractor. The contractor then submits his claims and a confrontation results. Although partnering has reduced the major conflicts, it has also led to unnecessary confrontations. For example, in the VE forum, partners raised more arguments and aired their concerns, and many issues were not settled.

The major sources of conflict in this project are variations to the contract; for example, an argument might arise on whether the risk should lie with the employer and whether the employer should therefore make the payments or share the risk of the targeted costs. In addition, there are some conflicts associated with the subcontractor. The BS subcontractor has been found to be too concerned

about the cost of the project. Subcontractors do not have a target cost and are very conservative about undertaking any extra work outside the contract. It is suggested that partnering should include subcontractors, who can give their input on the design and engineering work.

Another source of conflict is that some people may not be used to the partnering approach; they always want documentation in black and write instead of a verbal agreement. However, if speedy progress is to be made on a project, not everything can be written down. The conflict can be resolved by the contractor proactively giving design support and obtaining the agreement of the client.

4.8 ANALYSIS OF NETWORK STRUCTURE – WORKING RELATIONSHIPS IN A RAILWAY PROJECT

4.8.1 Centrality of Working Relationships in a Railway Project

Design Phase

As in Figure 4.7, the ConPM is perceived to have more cooperative working relationships than anyone else. Generally, this case study on partnering brings about a higher centrality of working relationship than in a non-partnering relationship, or at least equal centrality.

Construction Phase

Referring to Figure 4.7, in general the degree centrality, which indicates the degree of cooperation, is very high, with a mean of over 40. The actors enjoy

working on this project. A particularly high score is given by the ConPM (49) and CBSE (47).

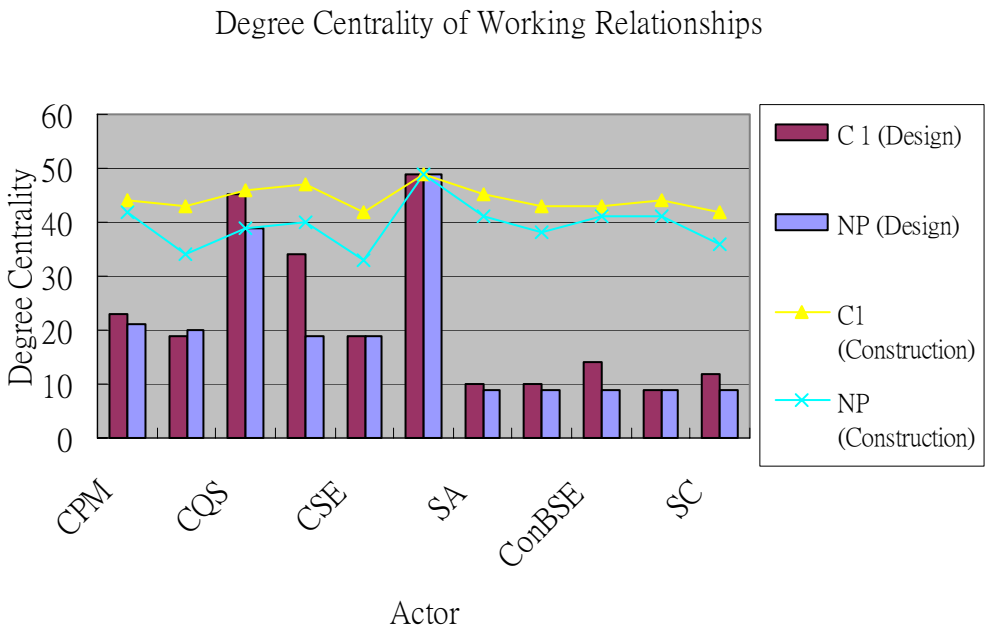

Figure 4.7: Degree Centrality of Working Relationships in Case Study One

Design Phase

As in Figure 4.8, the closeness centrality in the design phase is relatively low except that of the ConPM and CQS (100). They have a direct working relationship with every actor in the network.

Construction Phase

Closeness centrality is very high in the construction phase. All of the scores are 100.00, which means that nearly all of the actors have a direct working relationship network with the rest of the project team and are free from the control of others. This is particularly true in this project because of the joint office.

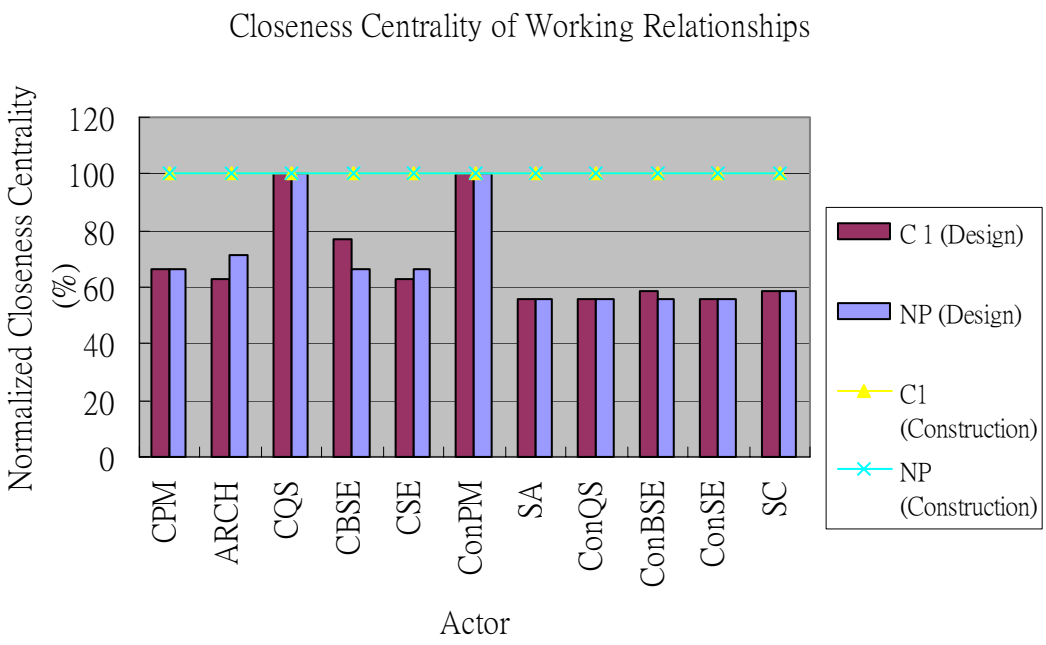

Figure 4.8: Closeness Centrality of Working Relationships in Case Study One

Design Phase

The ConPM has the highest flow betweenness for the project team working relationship. The next is the CQS. They have the power to play with relationships among the actors because many actors will go through them to develop a project team working relationship. Their attitude to partnering will influence the whole project team.

Construction Phase

With partnering, the CBSE (11.035%) has high flow betweenness and remains in a relatively important position in terms of working relationships in the project team. The one with highest betweenness centrality of working relationships is the ConPM (11.063%). This reflects the ConPM's leading role in transferring information and his influence to his subordinates. It is therefore very important that ConPM is supportive of partnering and develop a cooperative relationship

with other actors. Overall, the working relationship is direct and decentralized without any actor obviously dominating the network.

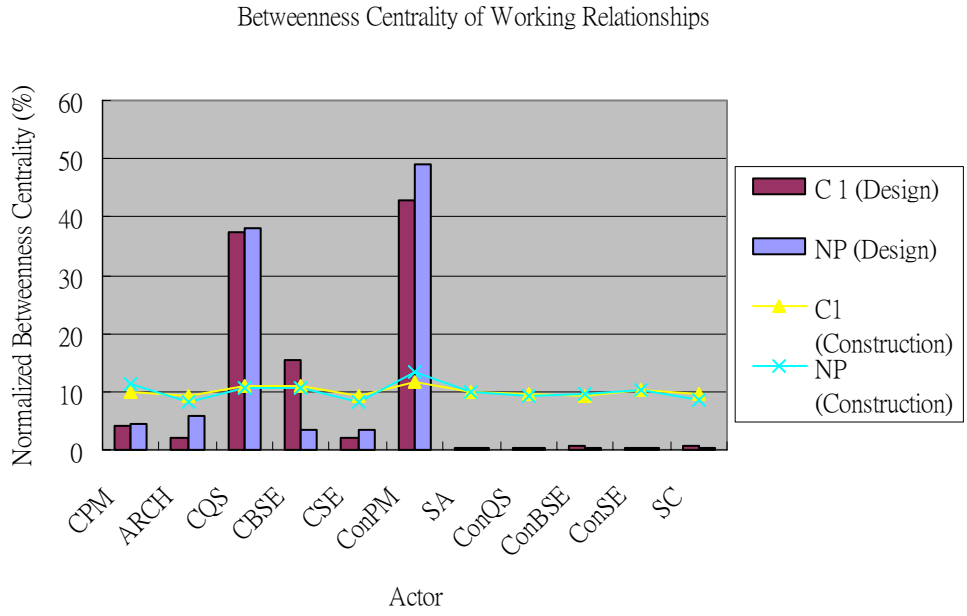

Figure 4.9: Betweenness Centrality of Working Relationships in Case Study One

4.8.2 Cohesive Sub-groups: Cliques

Design Phase

Two cliques were found: those of the ConPM and CQS, and of the CBSE. The two groups have a particularly close and direct working relationship with one and other. This again shows that the ConPM is successfully working with project participants from the client's side. Without partnering, the ConPM would be excluded from the clique.

Construction Phase

Four highly overlapping cliques were formed in this project with partnering.

Without partnering, only two cliques would be formed.

4.8.3 Regular Equivalence

Design Phase

More actors have 100% regular equivalence than in a non-partnering project (CSE and ARCH; SA, ConQS and ConBSE; ConSE and SC). This shows that they have a similar attitude towards their working relationship.

Construction Phase

The whole project team is regularly equivalent at a level of 96.966, while in a non-partnering project the level is 90.523. This shows that the participants in the project have a higher level of similarity in their working relationship and are more likely to work as a team. In addition, the ConPM is regularly equivalent with the CBSE and CQS at 99.714, while for non-partnering project regular equivalence would not occur until 95.264.

4.8.4 Analysis of the Qualitative Interview Data on Working Relationships

Judging from the interviews, both the client and the contractor consider the working relationship to be very cooperative. They have tried to build a cohesive team. Cooperation is not built from day one. Partnering acts as a tool to bring the two sides together as partners and provide mechanisms by which they can build up their relationship. The relationship has to be supported by behaviour. A cooperative working relationship is built up by open communication and joint resolution of conflicts. Building trust and commitment in a working

relationship involves trial and error. At the very beginning, the two sides must be assured that no one will abuse the partnering system to take advantage of the other and both must fundamentally believe that partnering works. Then comes the continuous interaction process of tuning in, debating, and even confrontation. Through this process, partners can make their differences converge, achieve common objectives, find a win-win situation and, ultimately, an incentive to continue using partnering. After that, mental reinforcement is required, perhaps a refreshment workshop, to actually help the participants internalize the concept of partnering.

Working relationships in the design stage

In the design stage, the design consultant worked together with a small group of the client's staff. The client played the role of checking on the design produced by the consultant. In the second tendering stage, the client's staff worked together with two potential contractors. Relationships can be built in this project because some personnel have been working close together for three years from the design stage to the start of the contract.

Working relationships in the construction stage

In the construction stage, there is different attitude. The project team has experience of working on the site and it is easier to partner when on the site. At start of the contract, the members of the project team are quite separate, but they successfully come together in a few months' time. There is continuous improvement in building a team.

4.9 COOPERATIVE RELATIONSHIPS AND IMPROVEMENTS IN PERFORMANCE

4.9.1 Overall Performance

In the questionnaire survey, participants assessed the overall performance of partnering in terms of the achievement of the goals of the project and the overall performance of the relationship of alliance. Their means are 3.8947 and 4.000, respectively. The participants are quite satisfied with the performance of the project and the relationship of alliance.

4.9.2 Time Performance

Time is saved due to faster turnover in submissions. In this case, only 14 days were required to turn over each submission, while 30-60 days would be needed in a normal project.

4.9.3 Cost Performance

Costs are saved and waste is reduced. With partnering, the number of submission is reduced and fewer staff are needed when a joint team is formed.

4.9.4 Quality Performance

With partnering, a quality product can be produced due to improved working relationships, communication, and conflict resolution.

4.10 LESSONS LEARNED FROM A MATURE PARTNERING PROJECT

This case study illustrates the application of partnering and cooperative behaviour in a mature partnering project in Hong Kong. First, the partners in this mature partnering project have strong inducements to form a cooperative inter-organizational relationship. They realize the vital importance of entering into an alliance to make the project a success. Besides, the partners possess the high technical, financial, and social capital to be competent partners. Second, a mature partnering project has great number and high intensity of determinants of cooperation. Other than behavioural constructs, many structural constructs of a cooperative relationship are also encapsulated. A mature partnering project allows structural modifications to build inter-organizational cooperation. Third, a mature partnering project has a structure of open communication, efficient problem solving, and close working relationships. Fourth, a cooperative relationship leads to improved performance both in terms of the performance of the project and relationships.

CHAPTER 5: CASE STUDY TWO – A GROWING PARTNERING PROEJCT

5.1 INTRODUCTION

This chapter presents information gathered from documentation of an office building project and data collected from 11 questionnaires and 11 interviews. The participants represent a client who is a large private developer in Hong Kong; the consultants provide architectural, building services, and structural consultancy; the main contractor is a construction firm; and the subcontractor is a large electrical and mechanical engineering services provider. Participants involved included the client project manager (CPM), the architect (ARCH), the consultant quantity surveyor (CQS), the consultant building and services engineer (CBSE), the consultant structural engineer (CSE), the contractor project manager (ConPM), the site agent (SA), the contractor building and services engineer (ConBSE), the contractor structural engineer (ConSE), and the subcontractor (SC).

Case study 2	**Client**	**Consultants**	**Contractor**	**Subcontractor**
Questionnaire survey	1	4	5	1
Interviews	1	4	5	1

Table 5.1: Distribution of Project Participants in Case Study Two

In this case, most of the project participants have past partnering experience. Both of the client and the contractor have past experience in partnering. The

client, being a prominent property developer in Hong Kong, has tried to practice partnering in its recent projects; and the contractor is an acclaimed 'partnership contractor', as it has been adopting project partnering for five years and is moving a step forward to develop strategic partnering with subcontractors. This case can be described as a 'growing partnering project'.

5.2 PROJECT CONTEXT OF AN OFFICE BUILDING PROJECT

Case study two is a Grade 'A' office building project located in a prime area of the city centre. The project lasted for two years, from May 2002 until May 2004. It adopted the Guaranteed Maximum Price (GMP) contract. The value of the contract value is HK$870 million (US$112 million). The project consists of a 38-storey office tower, a 3-storey basement carpark, and retail area at the basement level. The site area is 3720m^2. The usable floor area is 64, 722m^2. The scope of the work also includes landscape works, a footbridge link, and a 280 m long underpass to the Mass Transit Railway.

5.3 PROJECT PARTNERING IN AN OFFICE BUILDING PROJECT

Partnering, which is not legally binding, was introduced into this project jointly by the client and the contractor.

5.3.1 Partnering Workshop

An external independent facilitator was employed to foster the concept of partnering in the project. The first partnering workshop at the executive level was

held on 26th April 2002, and was attended by major stakeholders in the project. Half of the participants in the project had previous experience in partnering. During the workshop, the facilitator gave an introduction to partnering in Hong Kong and its application in the construction industry.

Several subsequent partnering review workshops were also held to revive the concept of partnering, and these were attended by frontline staff and late comers to the project.

5.3.2 Commitment to Partnering

Success in partnering depends on support and encouragement given from the 'top down'. Senior executives of the primary stakeholder groups demonstrated their personal commitment to the partnering process and the desire of their organizations to enhance real project performance through partnering.

The client stressed that the success of the project depended on how the participants of the project performed as a team. It affirmed that full support would be given to partnering as a fundamental precept to the success of the project. The contractor also expressed its commitment to partnering by sharing its business plan, which includes specific partnering targets for directors of all divisions.

5.3.3 Partnering Principles

The removal of threats and a willingness to participate with an open and honest

attitude are central to the principles of partnering, which ultimately rely on the mutual trust and commitment of the stakeholders. These principles were enshrined in the Charter, and its Pledge depended on all partners appreciating the project and the requirements formally expressed in the Contract. Partnering set out to achieve these requirements by employing a collaborative method rather than the normal confrontational approach. Throughout the workshop, the partners enhanced their personal commitment to partnering by working through the facilitator's structured process. They developed confidence in their own ability to undergo change, to 'get along with each other', and acknowledged that each party has its own goals.

5.3.4 Partnering Charter

A partnering charter was signed as a reminder of the stakeholders' commitment to partnering. It consisted of the following resolutions:

Promote a zero injury environment.
Minimize the impact on our neighbors and the public.
Work proactively to generate pride in the quality of our work.
Encourage innovative ideas and actively 'value engineer' them.
Communicate efficiently to reduce wastage of time and resources.
Identify time savings, minimize disruptions, and complete the project on time.
Achieve a realistic profit for all partners.
Actively champion partnering and respect alternative perspectives.
Maximize individual job satisfaction and career development.
Develop long-term relationships that are mutually beneficial to all.

The charter is in a ‘three level’ format. Level one is the partnering pledge; level two is the shared objectives; and level three is the strategies and then the actual action plan. The critical details in the level three strategies were devised by the actual stakeholders at a subsequent partnering section specifically designed to involve subcontractors, frontline staff and key members of the consulting team, who were not present at the executive level workshop.

5.3.5 Partnering Champion Meeting

Eight Partnering Champions were nominated in the first partnering workshop to bring partnering to the site level. Their role was to lead those people who either scored themselves low or believed that the partnering process was not fulfilling the intended objectives of the Partnering Charter. A Partnering Champion Meeting was held every two months. The Champion would rotate the chairing of the meeting without the participation of the facilitator. The scores from an evaluation of partnering performance and how they could be improved would be discussed in the meeting.

5.3.6 Partnering Tools

- An Issue Elevation Ladder;
- A Performance Monitoring Matrix; and
- A Guide to champions, would be employed by the partners on the job site to avoid delays to the decision-making process and, most importantly, to reduce waste.

5.4 CONDITIONS OF THE FORMATION OF PARTNERING IN AN OFFICE BUILDING PROEJCT

5.4.1 Quantitative Data Analysis

As shown in Table 5.2, the participants in the project agreed to eight inducements and three opportunities for the formation of an alliance as the conditions for partnering in a road infrastructure project. Among them, six inducements and all three opportunities to form an alliance are relatively important conditions for partnering. Their mean is between 3.7273 and 3.9091 (3.67-4.33), while two inducements are relatively less important and their means are 3.4545 and 3.5455 (3.00-3.66).

The three highest rankings of conditions leading to the formation of an alliance were technical capital or expertise (Q2.11), sharing risks (Q2.3), and enhancing competitive power in the market (Q2.6). Pressure from the government (Q2.8) and prior social relationship (Q2.10) were disregarded.

		Mean	Rank
Inducements to form alliances:			
2.1	Avoid opportunistic behaviour	3.7273	6
2.2	Reduce uncertainty of interdependence	3.8182	5
2.3	Share risk among partners	3.9091	2
2.4	Share resource capabilities	3.7273	6
2.5	Acquire new skills or knowledge	3.7273	6

2.6	Enhance competitive power in the market	3.9091	2
2.7	Peer influence from the industry	3.4545	11
2.8	Pressure from the government or regulations	2.5455	13
2.9	Follow the successful experience of other firms	3.5455	10
2.10	Prior social relationship	2.6364	12
Opportunities to form alliances:			
2.11	Possess technical capital or expertise	4.000	1
2.12	Possess commercial capital (e.g., financially sound)	3.7273	6
2.13	Possess social capital (e.g., good reputation)	3.9091	2

Table 5.2: Mean and Rank of the Inducements and Opportunities for the Formation of Partnering in Case Study Two

5.4.2 Qualitative Data Analysis

The qualitative data generally confirmed the quantitative data. It was found that both client and contractor had both been induced to adopt partnering because they wanted to enhance competitive power in the market. To a certain extent, the client adopted innovative management tools such as partnering to promote its image. The contractor adopted partnering as a company policy to improve its competitive edge in the market. In this project, the contractor developed strategic partnerships with some of the sub-contractors to be able to obtain a better supply of materials.

As claimed by the contractor, the project was not a very risky one. The most

risky aspect of it would be the building of the tunnel. However, this project faced a heavy financial risk. The rental market was tough and the client had a very tight budget. The client wanted to finish the project on time and within budget. The client believed that partnering would improve the cost-efficiency and smooth running of the project. It was emphasized by the contractor and consultant that technical competence was an important condition in the formation of a possible alliance. Partnering is working together to achieve mutual common goals but not passing on responsibilities. Highly competent partners are required.

5.5 DETERMINANTS OF A COOPERATIVE PARTNERING RELATIONSHIP

The participants in the project agreed with 42 determinants of a cooperative partnering relationship, of which 26 are behavioural constructs and 15 structural constructs. Fifteen of behavioural constructs and 2 of the structural constructs are relatively important determinants, and the mean is between 3.7143 and 4.25 (3.67-4.33). Moreover, 11 of the behavioural and 13 of the structural constructs are relatively less important determinants, and the mean is between 3.00 and 3.625 (3.0-3.66).

	Determinants of a cooperative partnering relationship	**Structural/ Behavioural**	**Average**
3.1	The partners have contributed effort and resources to form a cooperative relationship	S	4.1818
3.2	The partners have concurrent relationships in other projects	S	3.5455
3.3	Partners are equally dependent on each other	S	3.1818
3.4	The partners have a top-down commitment to	B	4.0909

	cooperate		
3.5	The partners are working to complete project in an effective manner	B	4.0000
3.6	The partners are allowed to participate in setting goals	B	3.7273
3.7	The partners are allowed to participate in planning activities	B	3.9091
3.8	The partners had successful previous relationship	S	3.0909
3.9	The partners have shared values and common goals	B	3.7273
3.10	The partners are willing to take risks	B	3.2727
3.11	The partners are known to be trustworthy	B	3.3636
3.12	The partners have a good reputation in the industry	S	3.7273
3.13	Effective and efficient communication	B	4.2727
3.14	The partners share information with each other	B	3.7273
3.15	The partners are encouraged to participate and exchange ideas	B	4.0909
3.16	The partners have full access to all useful information	B	3.2727
3.17	The partners have no hidden agenda	B	3.0909
3.18	The partners solve problems jointly	B	3.7273
3.19	Problems are solved before they escalate	B	3.9091
3.20	The partners try to avoid disputes and reduce the use of litigation	B	3.7273
3.21	The partners are open to innovative ideas	B	3.7273
3.22	The partners are responsive to emergencies or changing needs	B	3.9091
3.23	The possibility of inter-organizational learning	S	3.2727
3.24	The partners are very likely to interact in the future	B	3.7273
3.25	The process of interaction is perceived to be equitable and just	B	3.1818
3.26	One partner cooperates, the others follow	B	3.1818
3.27	Partners seek to achieve a win-win situation	B	3.8182
3.28	Set up a mechanism for effective decision-making	S	3.4545
3.29	Rewards are given to motivate cooperation	S	3.3636
3.30	Punishments are imposed for mutual non-cooperative actions	S	2.8182
3.31	A mind open to new possibilities and new	B	3.8182

	alternatives		
3.32	Full authority for action has been delegated to the project team	S	3.3636
3.33	Fully comply with the request of the other partner, even at the expense of one's own short-term interests	B	3.0000
3.34	The goals of the company and objectives of partners are compatible with each other	S	3.4545
3.35	The technical capabilities of both partners are compatible with each other	S	3.1818
3.36	The organizational procedures of the partners are compatible	S	3.0909
3.37	The employees of partnering companies have similar professional or trade skills	S	3.0000
3.38	Constructive handling of differences	B	3.6364
3.39	Building a sense of belonging and pride	B	3.4545
3.40	Feedback and performance evaluations	S	3.5455
3.41	Clearly setting out the roles, duties, and responsibilities of each party	S	3.5455
3.42	Supportive leaders know how to cooperate	B	3.8182
3.43	The organizational culture supports cooperation	B	3.7273

Table 5.3: Mean of Determinants of the Cooperative Partnering Relationship in Case Study Two

5.6 ANALYSIS OF NETWORK STRUCTURE – COMMUNICATION IN AN OFFICE BUILDING PROJECT

Partnering changes the relative importance of different means of communication. For case study two, with the adoption of partnering, informal written communication is the most frequently used method. The next most frequently used is informal face-to-face and then verbal communication. Compared with similar non-partnering projects, formal written communication would be the

most commonly used means of communication.

Case study 2	**Partnering adopted**		**Non-partnering Project**	
Communication means	**Mean**	**Rank**	**Mean**	**Rank**
Formal written	3.9091	4	4.3636	1
Informal written	4.4545	1	3.6364	3
Formal face-to-face	3.6364	5	3.6364	3
Informal face-to-face	4.1818	2	3.5455	5
Verbal	4.0909	3	3.8182	2

Table 5.4: Means of Communication in Case Study Two as Compared with a Non-partnering Project

5.6.1 Centrality of Communication in an Office Building Project

With reference to Figure 5.1, communication degree centrality is highest for ConBSE and next for ARCH. It is obvious that both the formal and informal communication frequencies of this case study are higher than those of a non-partnering project, although the difference is not that great.

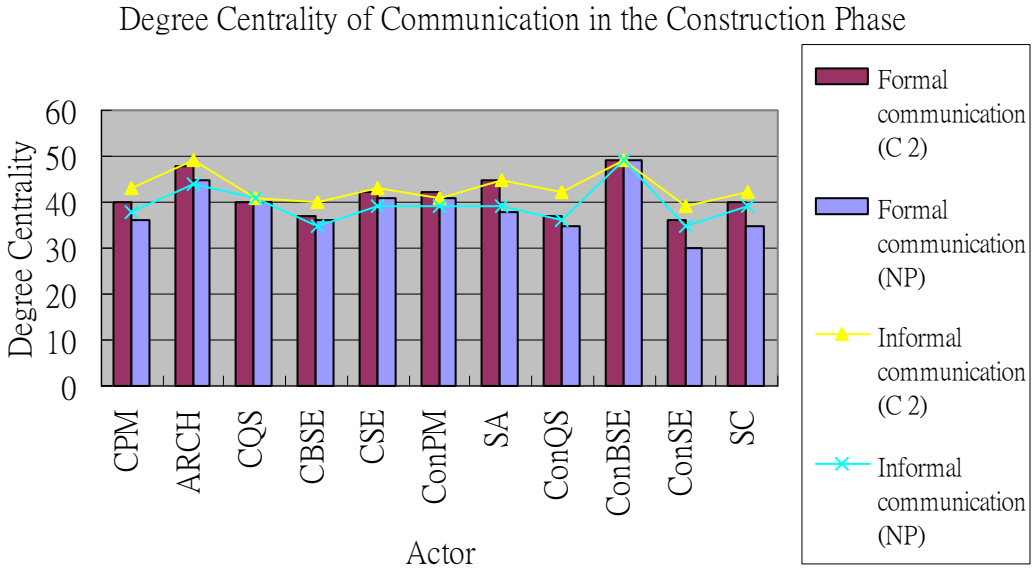

Figure 5.1: Degree Centrality of Communication in Case Study Two

From Figure 5.2, no difference was found in closeness centrality, whether or not this project adopts partnering. Communication is direct (100%) for all actors except for the CQS and ConSE.

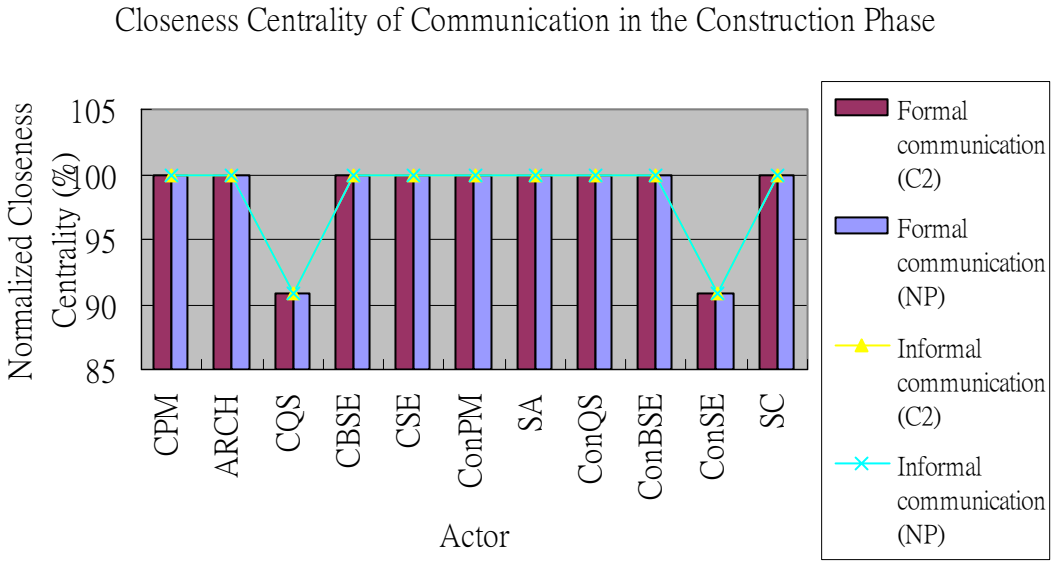

Figure 5.2: Closeness Centrality of Communication in Case Study Two

Referring to Figure 5.3, the betweenness centrality in this project is slightly more evenly distributed than in a non-partnering project, with the ConBSE and ARCH still the two most powerful actors in controlling information.

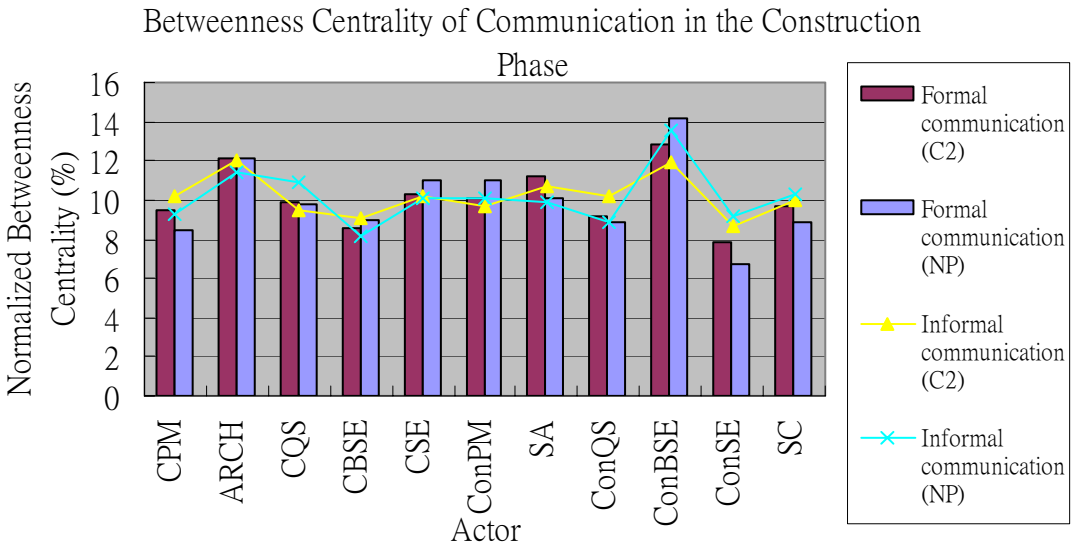

Figure 5.3: Betweenness Centrality of Communication in Case Study Two

5.6.2 Cohesive Sub-groups: Cliques

For formal communication, there is not much difference in the cliques that are formed whether or not there is partnering. Three cliques were found in this case study as well as in a non-partnering one. However, the ConSE has higher equivalence (0.595) than in a non-partnering project (0.132).

5.6.3 Regular Equivalence

Referring to the dendrogram in Appendix E, interesting results were found in construction phase, where partnering was found to have a significant amount of influence in increasing the similarity of the project team's communication, both

formal and informal. With the presence of partnering, the whole project team clusters at 95.074 for formal communication and 97.237 for informal communication; however, if partnering were not in place, their hierarchical clustering levels would drop to 92.271 and 93.855, respectively. It is obvious that partnering successfully brings the communication behaviour of different parties together and greatly smoothens out their differences. It is also found that informal communication structure is a successful supplement to formal communication. For example, the contractor's QS (ConQS) is relatively isolated (96.200) in formal communication, but highly clustered with the CPM and SC in informal communication (99.984).

5.6.4 Analysis of Qualitative Interview Data on Communication

Most of the interviewees agreed that partnering in this project improved communication. More informal communication was allowed. Discussions and exchanges of ideas became possible between the client and contractor before decisions were made. However, one interviewee did not believe that the behaviour of people would be particularly influenced simply because of the implementation of partnering.

5.7 ANALYSIS OF NETWORK STRUCTURE – PROBLEM SOLVING IN AN OFFICE BUILDING PROJECT

5.7.1 Centrality of Problem Solving in an Office Building Project

With reference to Figure 5.4, reducing the occurrence of conflict is significant for

this partnering project. Conflicts are mainly found among the ARCH, CSE, and ConQS. The CSE thinks that the ARCH has missed many key dates to produce drawings and has greatly affected the progress of the CSE's work. The CSE takes a skeptical attitude towards partnering, as he believes that partnering allows the contractor to pass the buck.

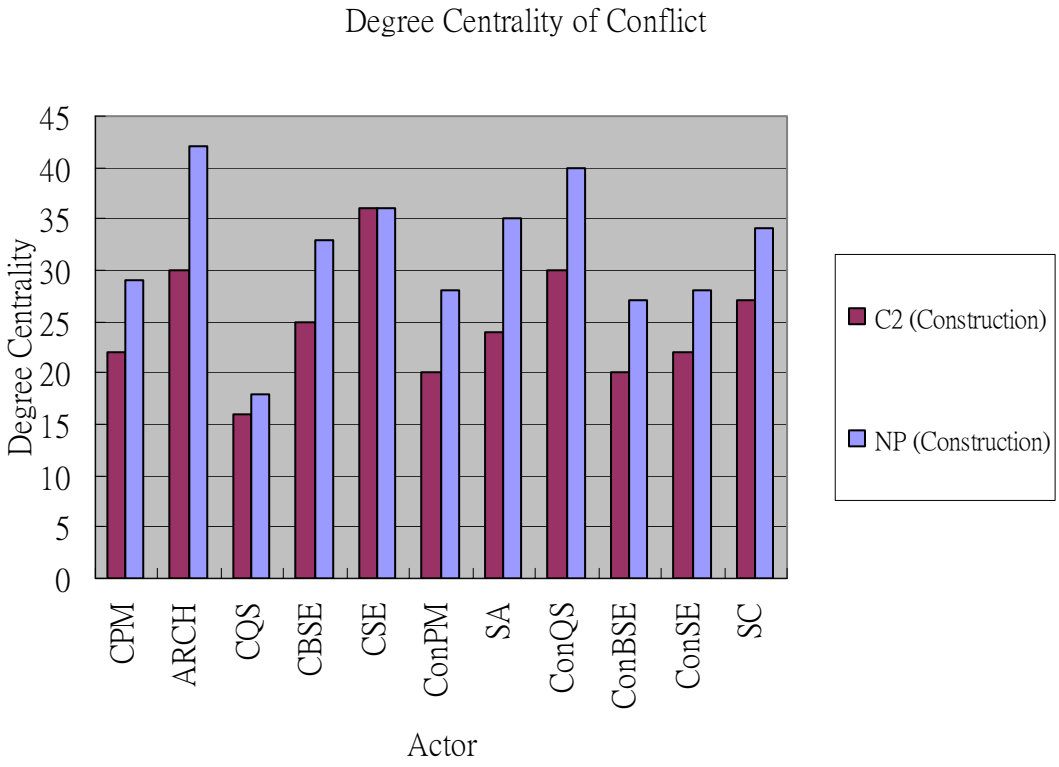

Figure 5.4 Degree Centrality of Problem Solving in Case Study Two

As shown in Figure 5.5, there is minimal or even no difference in the closeness centrality of this partnering project and a non-partnering project. The SA has the highest closeness centrality for conflict in the design phase. This means that he has conflicted directly with every other actor in the project team.

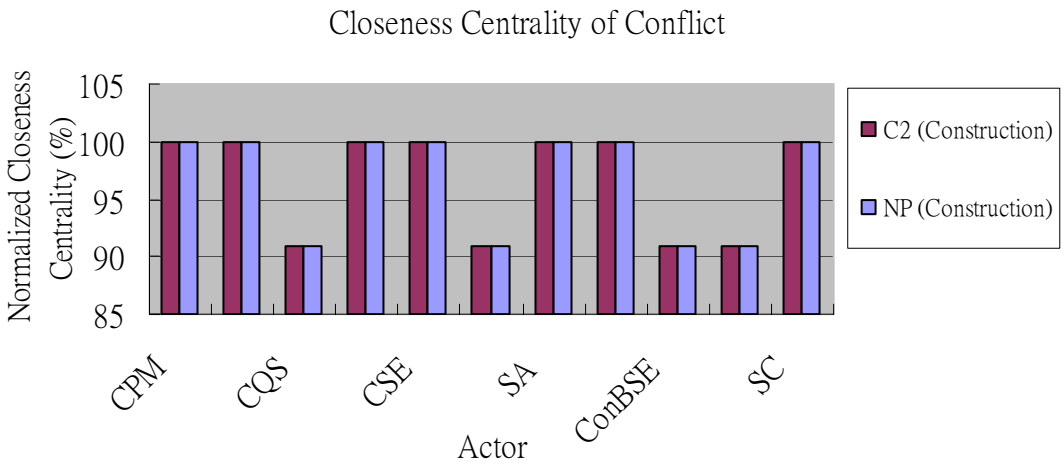

Figure 5.5: Closeness Centrality of Problem Solving in Case Study Two

From Figure 5.6, the betweenness centrality of conflict is low for the whole project team, which means that the problem solving network is very decentralized.

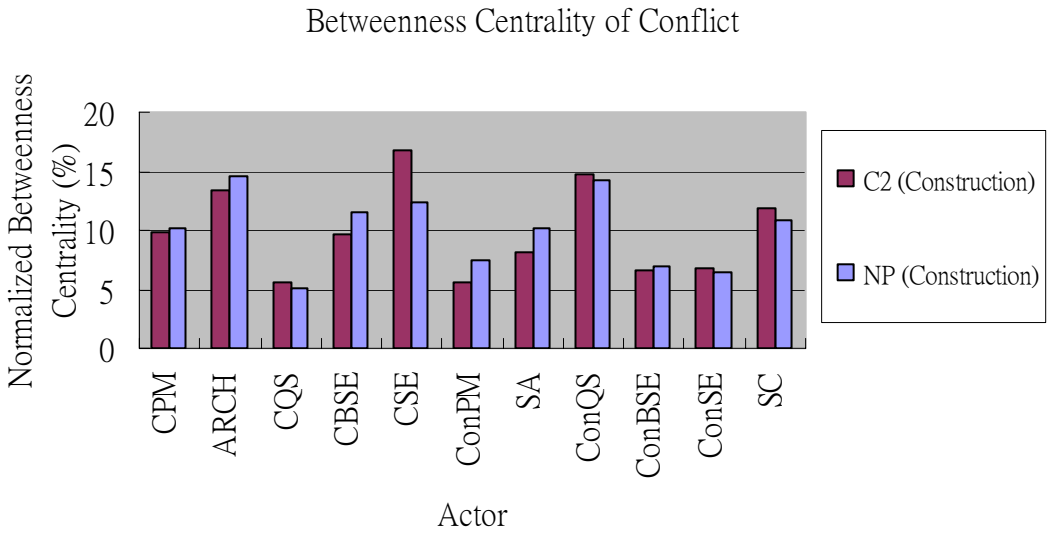

Figure 5.6: Betweenness Centrality of Problem Solving in Case Study Two

5.7.2 Cohesive Sub-groups: Cliques

Four cliques were formed, with CQS being an isolate. The CQS deliberately

keeps himself away from disputes and is quite sceptical about resolving problems on the basis of partnering.

5.7.3 Regular Equivalence

In the construction phase, three pairs of actors have a high regular equivalence. They are the SA and CBSE (97.495), the ARCH and ConQS (96.683), and the CPM and SC (95.309). The CSE was found to distance himself from problem solving in contrast to the prominence of his role if there is no partnering. This shows that the CSE does not believe in partnering to solve problems and has reservations and is even sceptical approaching matters with a partnering attitude to solve problems.

5.7.4 Analysis of Qualitative Interview Data on Problem Solving

Most of the interviewees agreed that partnering led to some improvements in solving problems. However, the effect was not significant. It was surprising to discover from the interviews that the issue elevation ladder was largely disregarded in the actual problem-solving process. Some interviewees expressed the view that the usefulness of partnering was to remind project team members that they were partners in resolving conflicts. One interviewee commented that the client holds a superior role in resolving problems. Debates usually arose over the GMP contract's term of 'Design Development'.

5.8 ANALYSIS OF NETWORK STRUCTURE – WORKING RELATIONSHIPS IN AN OFFICE BUILDING PROJECT

5.8.1 Centrality of Working Relationships in an Office Building Project

Referring to Figure 5.7, case study two has a higher degree centrality of working relationships than are found in non-partnering projects.

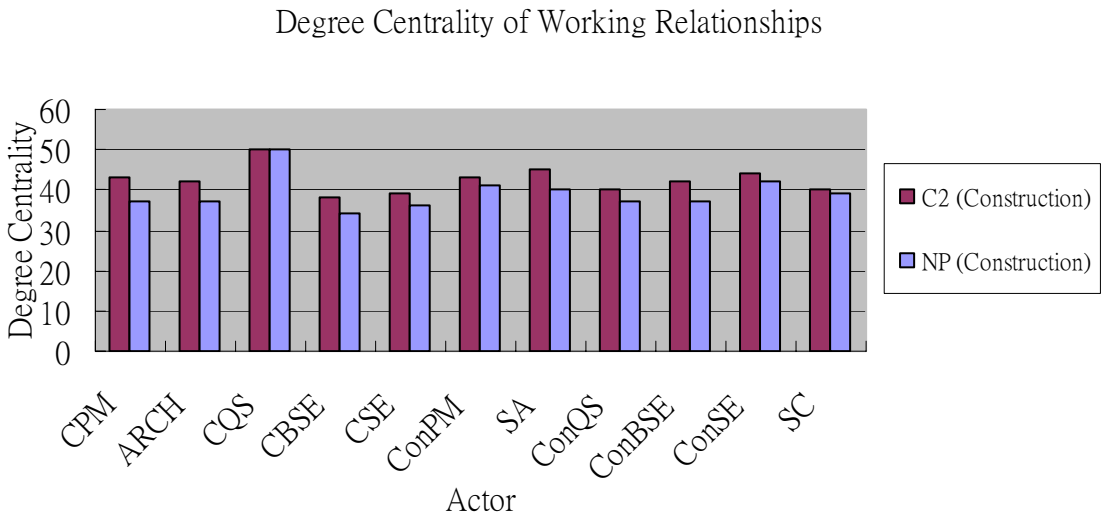

Figure 5.7: Degree Centrality of Working Relationships in Case Study Two

As shown in Figure 5.8, the closeness centrality of the working relationships in case study two and in a non-partnering project is 100%, which is the same as if there were no partnering.

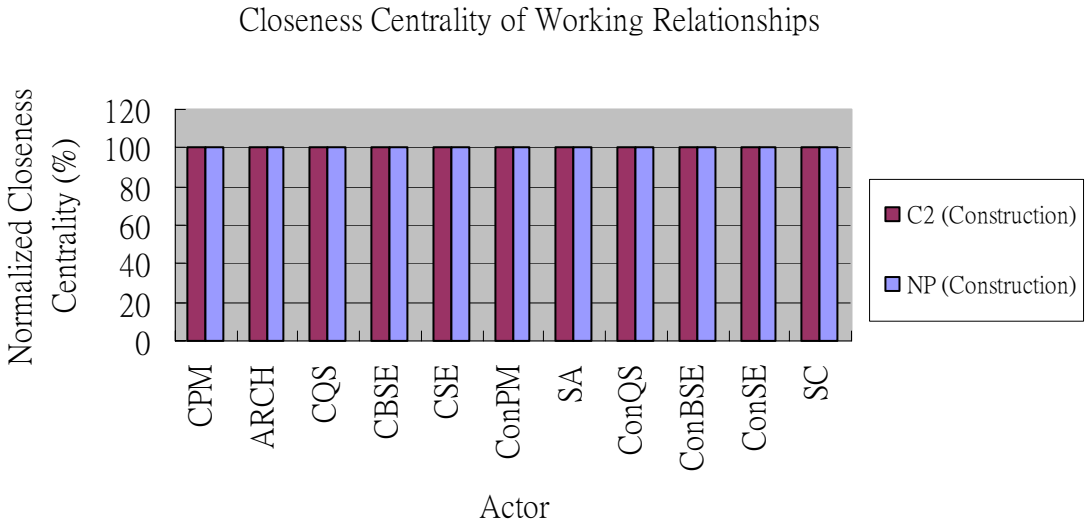

Figure 5.8: Closeness Centrality of Working Relationships in Case Study Two

From Figure 5.9, there is only slightly difference in case study two in the betweenness centrality of the working relationships when compared with a similar project without partnering. The CQS is slightly more important in forming a team's working relationship. Every actor has a similar level of prominence to construct or destroy the working relationship.

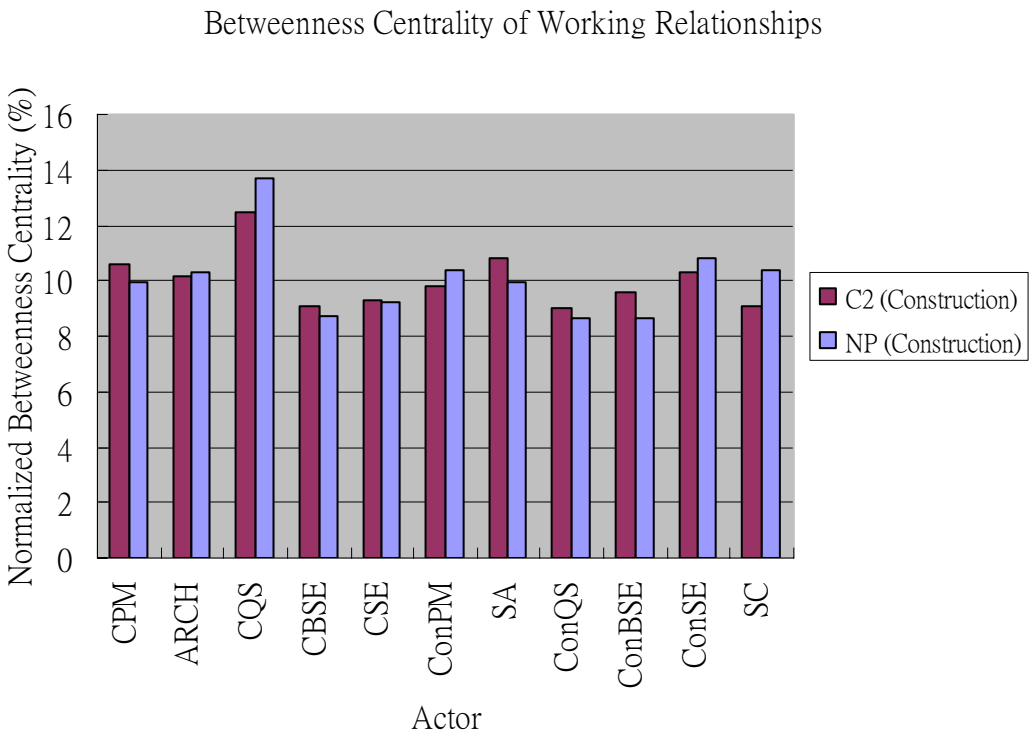

Figure 5.9: Betweenness Centrality of Working Relationships in Case Study Two

5.8.2 Cohesive Sub-groups: Cliques

Two cliques were formed, and there is no difference whether or not there is partnering. Partnering does not change the sub-group pattern.

5.8.3 Regular Equivalence

In the construction phase, the project team of this case has a lower regular equivalence than in a non-partnering project (93.644< 94.512). Partnering does not improve their differences in perception.

5.8.4 Analysis of the Qualitative Interview Data on Working Relationships

It was generally agreed that working relationships improved or at least did not worsen over those in a non-partnering project. Most of the interviewees expressed the view that partnering is an effective tool for improving working relationships. However, the ConBSE held the contrary opinion that partnering does not improve working relationships. Based on his past experience in successful partnering, he realized that partnering has the huge potential to improve relationships. However, in case study two, there was insufficient trust and commitment in the whole project team to use partnering. He queried whether the client really understood the concept of partnering. He thought the client used partnering as a tool for publicity. Although the working relationship did not worsen with partnering, it did not significantly improve, either.

5.9 COOPERATIVE RELATIONSHIPS AND IMPROVEMENTS IN PERFORMANCE

5.9.1 Overall Performance

In this case study, the overall score for the performance of the goals of the project was 3.6364 and the overall score for satisfaction of the relationship of alliance was 3.7273. This means that the partners are quite satisfied with the performance of the project performance and the achievements of partnering in this project.

5.9.2 Time Performance

The project was more or less on schedule and the participants expressed the view that the time need to make the submissions had speeded up as more discussions were held based on the spirit of partnering.

5.9.3 Cost Performance

Little real difference in cost performance was experienced by the participants in the project, but unnecessary waste has been reduced due to better communication.

5.9.4 Quality Performance

No direct improvements could be found in the quality of the performance due to partnering. This is because a quality performance largely depends on the contractual specifications.

5.10 LESSONS LEARNED FROM A GROWING PARTNERING PROJECT

In this study, the participants agreed to many inducements and opportunities to form an alliance. The most important condition in the formation of partnering was still the sharing of risks. However, the participants in the project were actually not very clear about the underlying reason for partnering. The determinants of a cooperative relationship of alliance were mainly behavioural

constructs rather then structural constructs. For a social network analysis, the greatest difference found from a non-partnering project is degree centrality. A relationship of cooperative alliance also leads to a quite satisfactory improvement in performance and satisfaction with the relationship of alliance, which is certainly better than nothing.

CHAPTER 6: CASE STUDY THREE – A PRIMITIVE PARTNERING PROJECT

6.1 INTRODUCTION

This chapter presents information gathered from the documentation of a road infrastructure project and data collected from nine questionnaires and four interviews. The participants represent the client, the Works Bureau (a government department) of the Hong Kong Special Administrative Region (HKSAR); the consultant, a design engineer; the main contractor, a construction firm; and the subcontractor, an electrical and mechanical engineering services provider. They are the client's project manager (CPM), the client's structural engineer (CSE), the client's quantity surveyor (CQS), the design engineer (DgnE), the contractor's project manager (ConPM), the site agent (SA), the contractor's structural engineer (ConSE), the contractor's quantity surveyor (ConQS), and the subcontractor (SC).

Case study 3	Client	Consultant	Contractor	Subcontractor
Questionnaire survey	1	3	4	1
Interviews	1	2	1	0

Table 6.1: Distribution of Project Participants in Case Study Three

In this case, all of the participants in the project had no experience in projects involving partnering. This project was the client's first partnering project, as well as the consultant's and the contractor's. Partnering was introduced after the

commencement of construction. This case can be described as a 'primitive partnering' project.

6.2 PROJECT CONTEXT OF A GORVENMENT INFRASTRUCTURE PROJECT

Case Study Three is a government infrastructure project involving the construction of a 2.1 km long section of trunk road. The project began in November 2002 and is expected to be finished in early 2007. The sum of the contract is $1,074 million, and a traditional lump sum contract was adopted. Upon completion, the road will provide a direct route to link up the northeast New Territories in Hong Kong to the Hong Kong International Airport at Chek Lap Kok. The work on this project includes:

Construction of 1.0 km dual three-lane tunnels and two portal buildings;
Preparation of a 5.6 ha site for the toll plaza;
Construction of a 0.6 km dual two-lane road;
Construction of 1.0 km long single-lane slip road viaducts;
Construction of 3.0 km noise barriers and enclosures;
Reconstruction of a 600 m long road; and
Associated slope works, drainage, and landscaping works.

6.3 PROJECT PARTNERING OF A GOVERNMENT INFRASTRUCTURE PROJECT

As the client is one of the government departments under the Works Bureau of

the HKSAR, it followed the technical guidelines of the Works Bureau to use partnering in mega projects. A partnering workshop, partnering charter, monthly evaluation meetings, and some other initiatives of partnering are described as follows:

6.3.1 Partnering Workshop

The partnering is not binding. The cost is being shared equally by the client and the contractor. Complying with the contract, an external facilitator was employed to hold a partnering workshop within 60 days of the commencement of the contract. The first start-up one-day partnering workshop was held on 27th January 2003, which 30 people at the senior management level attended. A half-day induction workshop for site staff was then held on 28th February 2003. Another half-day partnering cascade workshop for site-level staff was held on 30th May 2003, attended by 14 people attended. The cascade workshop involved the resident engineer, the supervision team, the contractor, and the subcontractor. So far, three partnering workshops have been held.

6.3.2 Partnering Charter

The partnering charter includes the goals to be achieved, as shown below:

MUTUAL OBJECTIVES	
On Programme Safety ➢ Working Environment Low Accident Rate	Early Finalization of Contract Model Site Less Paperwork Long-term Thinking

Environmental Considerations ➢ Environmentally Friendly ➢ Reduce Risk of being Prosecuted Reduce Waste Minimize Disputes Good Relationship with the Public	Remain within Budget Good Quality Right the First Time Sufficient Time Time and Cost Saving through Value Engineering

VALUES & BEHAVIOUR

● Trust	● Respect	● Open-mindedness
● Fairness	● Consideration	● Understanding
● Proactiveness	● Honesty	● Communication

6.3.3 Monthly Evaluation Meeting

A partnering steering group meeting was initially held every month and, later, every two months. The partnering evaluation score is generally over 4, which is quite satisfactory. The scores that are worth special attention are those for cooperation and communication (4.21), trust (4), reducing disputes (3.58), and reducing paper work (3.85). The partnering performance is generally satisfactory.

6.3.4 Other Partnering Initiatives

Posters to promote partnering are circulated to convey ideas of partnering to the lower levels of the project. Social functions are organized to encourage the partners to develop team feelings. For example, on 25th April 2003, the project team participated in the Shatin Dragon boat competition to have fun and to build up team spirit. A BBQ was also held.

6.4 CONDITIONS OF PARTNERING FORMATION IN A GOVERNMENT INFRASTRUCTURE PROJECT

6.4.1 Quantitative Data

As shown in Table 6.2, the participants in the project agreed that all ten inducements and three opportunities to form an alliance were conditions for the formation of partnering in an office building project. Among them, four inducements and all three opportunities to form an alliance are 'relatively important' conditions for the formation of partnering. Their mean is between 3.67 and 4.33, while six inducements are 'relatively less important' conditions, with a mean of between 3.0 and 3.66.

Sharing risk is the most important inducement for partnering, followed by a prior social relationship and enhancing competitive power. Technical, financial, and social capital are found to be important conditions for partnering opportunities.

		Mean	Rank
Inducements to form alliances:			
2.1	Avoid opportunistic behaviour	3.5	10
2.2	Reduce uncertainty of interdependence	3.6579	8
2.3	Share risk among partners	4.0263	1
2.4	Share resource capabilities	3.7368	7
2.5	Acquire new skills or knowledge	3.6579	8
2.6	Enhance competitive power in the market	3.8158	4

2.7	Peer influence from the industry	3.375	12
2.8	Pressure from the government or regulations	3	13
2.9	Follow the successful experience of other firms	3.5	10
2.10	Prior social relationship	3.875	2
Opportunities to form alliances:			
2.11	Possess technical capital or expertise	3.875	2
2.12	Possess commercial capital (e.g., financially sound)	3.75	5
2.13	Possess social capital (e.g., good reputation)	3.75	5

Table 6.2: Mean and Rank of the Inducements and Opportunities for the Formation of Partnering in Case Study Three

6.4.2 Qualitative Data

From the interview, it was found that the most important reason why the client adopted partnering was to share the risk among the partners. The project is huge and complex. It involves many external parties such as the police and environmental protection bodies, and involves unclear ground conditions. Being a government project, it was awarded on tendering. A prior social relationship was surprisingly important.

6.5 DETERMINANTS OF A COOPERATIVE PARTNERING RELATIONSHIP IN A GOVERNMENT INFRASTRUCTURE PROJECT

The project participants in this case study agreed with all 43 determinants of a relationship of cooperative partnering, including 26 behavioural constructs and 17 structural constructs. Of these, 15 behavioural constructs and 12 structural constructs are 'relatively important' determinants, and their means are between 3.7143 and 4.25 (3.67-4.33). Moreover, there are 11 behavioural and 5 structural constructs that are 'relatively less important' determinants, with a mean of between 3.00 and 3.625 (3.0-3.66).

	Determinants of a Cooperative Partnering Relationship	**Structural/ Behavioural**	**Mean**
3.1	The partners have contributed effort and resources to form a cooperative relationship	S	4.000
3.2	The partners have concurrent relationships in other projects	S	3.7500
3.3	The partners are equally dependent on each other	S	3.7500
3.4	The partners have a top-down commitment to cooperate	B	4.1250
3.5	The partners are working to complete the project in an effective manner	B	3.8750
3.6	The partners are allowed to participate in setting goals	B	4.1250
3.7	The partners are allowed to participate in planning activities	B	3.8750
3.8	The partners had a successful previous relationship	S	3.5000
3.9	The partners have shared values and common goals	B	3.8750
3.10	The partners are willing to take risks	B	3.5000
3.11	The partners are known to be trustworthy	B	3.6250
3.12	The partners have a good reputation in the industry	S	4.0000

3.13	Effective and efficient communication	B	3.8750
3.14	The partners share information with each other	B	3.6250
3.15	The partners are encouraged to participate and exchange ideas	B	4.0000
3.16	The partners have full access to all useful information	B	3.4286
3.17	The partners have no hidden agenda	B	3.2500
3.18	The partners solve problems jointly	B	3.8571
3.19	Problems are solved before they escalate	B	3.3750
3.20	The partners try to avoid disputes and reduce the use of litigation	B	3.8571
3.21	The partners are open and receptive to innovative ideas	B	3.3750
3.22	The partners are responsive to emergencies or changing needs	B	3.5714
3.23	The possibility of inter-organizational learning	S	3.7500
3.24	The partners are very likely to interact in the future	B	3.8571
3.25	The process of interaction is perceived to be equitable and just	B	3.6250
3.26	One partner cooperates, the others follow	B	3.4286
3.27	The partners seek to achieve a win-win situation	B	4.2500
3.28	Set up a mechanism for effective decision-making	S	4.0000
3.29	Rewards are given to motivate cooperation	S	3.4286
3.30	Punishments are imposed for mutually non-cooperative actions	S	3.0000
3.31	A mind open to new possibilities and new alternatives	B	3.7500
3.32	Full authority for action has been delegated to the project team	S	3.7143
3.33	Fully comply with the request of the other partner, even at the expense of one’s own short-term interests	B	3.3750
3.34	The goals of the company and the objectives of the partners are compatible with each other	S	3.5000
3.35	The technical capabilities of both partners are compatible with each other	S	3.8750
3.36	The organizational procedures of the partners are compatible	S	3.5000
3.37	The employees of the partnering companies have similar professional or trade skills	S	3.8750

3.38	Constructive handling of differences	B	4.0000
3.39	Building a sense of belonging and pride	B	3.6250
3.40	Feedback and performance evaluations	S	4.0000
3.41	Clearly setting out the role, duty, and responsibilities of each party	S	4.0000
3.42	Supportive leaders know how to cooperate	B	3.8750
3.43	The organizational culture supports cooperation	B	3.8750

Table 6.3 Mean of Determinants of Cooperative Partnering Relationship of Case Study Three

6.6 ANALYSIS OF NETWORK STRUCTURE – COMMUNICATION IN A GOVERNMENT INFRASTRUCTURE PROJECT

Partnering changes the pattern of communication. Table 6.4 shows that the most commonly used means of communication when partnering is practiced is informal written communication, followed by verbal communication; whereas formal written communication is the most frequently used form of communication in a similar project without partnering. Partnering facilitates informal communication to smooth the process of construction.

Case study 3	**Partnering Project**		**Non-partnering Project**	
Communication means	**Mean**	**Rank**	**Mean**	**Rank**
Formal written	3.8750	3	4.1250	1
Informal written	4.2500	1	3.5000	3
Formal face-to-face	3.8750	3	3.5000	3
Informal face-to-face	3.5000	5	3.2500	5
Verbal	4.0000	2	3.7500	2

Table 6.4: Means of Communication in Case Study Three as Compared with a Non-partnering Project

The results from the interview are also in line with the above findings. From the interviews, it is found that communication significantly improved. The site agent communicates daily with the engineer. There is a consensus that there should be no paper warfare. Ideas should be exchanged before the formal issuing of documentation. The paperwork has been greatly reduced. The monthly partnering meeting provides one more chance for communication. Daily communication is still maintained. The participants expressed the view that there was not much difference on whether or there was partnering. However, it is definite that overall communication improved with more well-defined and explicit responsibilities to communicate.

In addition, relational data on communication was collected from a questionnaire. Social network analysis was employed to analyse the data, so that the pattern of the network structure can be presented. Since partnering in this project only began after the awarding of the contract in the construction stage, only data on construction was collected. At the time the data were collected, the project was in an early stage of construction.

6.6.1 Centrality of Communication in a Government Infrastructure Project

Referring to Figure 6.1, the degree centrality of communication in this case (C3) is perceived to be higher than in a non-partnering (NP) project. The CQS and CSE were found to use more informal than formal communication. The greatest frequency of contact is the SA, ConPM, and ConQS.

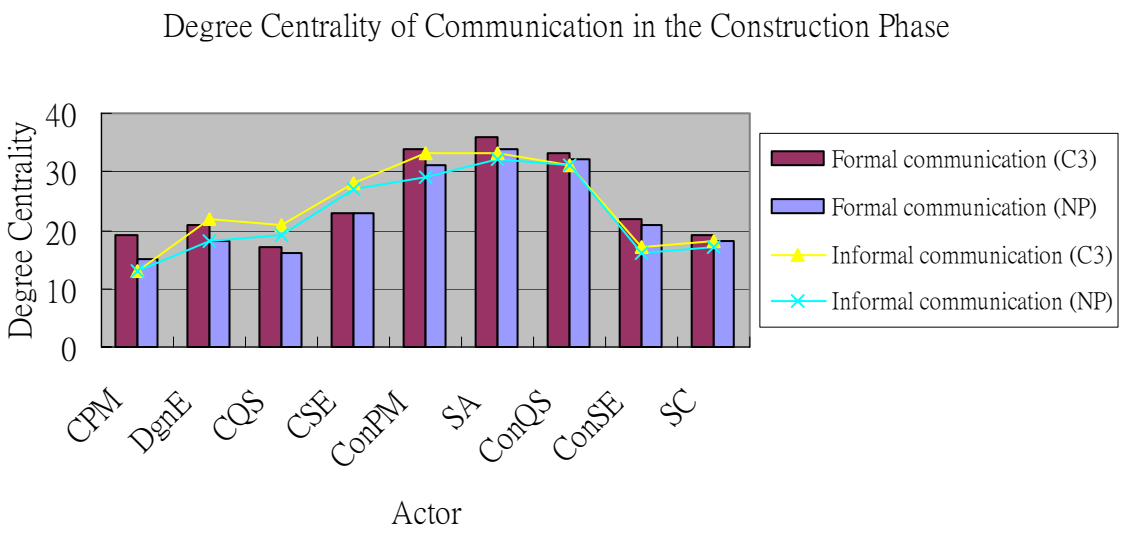

Figure 6.1: Degree Centrality of Communication in Case Study Three

With reference to Figure 6.2, closeness centrality represents the an actor's level of independence. ConPM, SA, and ConQS have 100% closeness, which means that they are independent actors and can directly reach every actor in the network. The results show that there is no difference between partnering and non-partnering behaviour, and also that there is no difference in whether the communication is formal or informal.

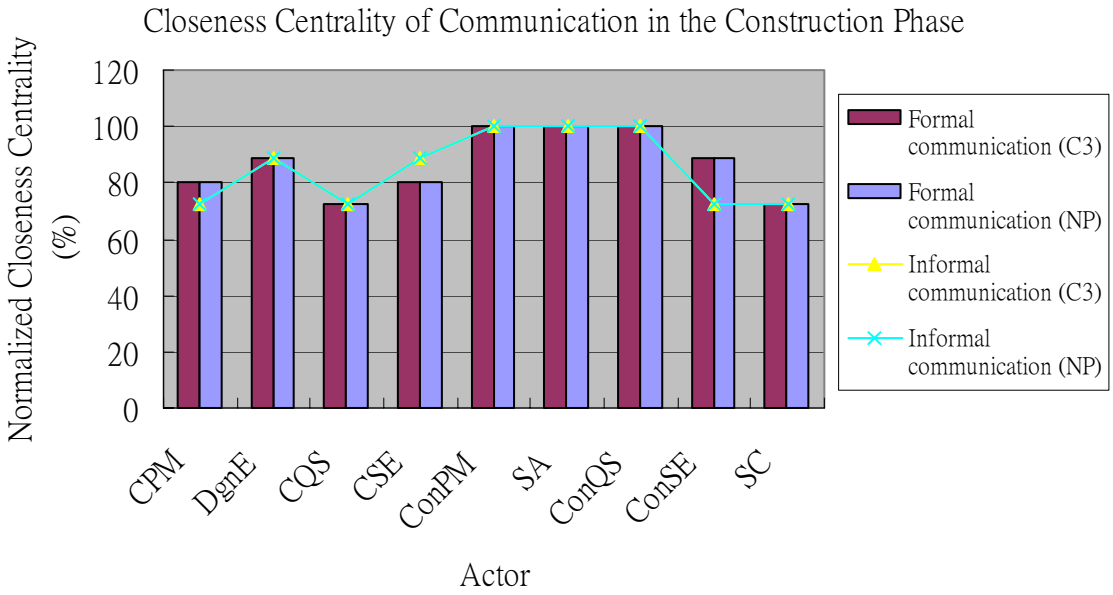

Figure 6.2 Closeness Centrality of Communication in Case Study Three

As shown in Figure 6.3, betweenness is generally low. The three actors with the highest degree of betweenness are the SA, ConQS, and ConPM. They obtain much of the information and can act as information gates. It should be noted that the formal communication betweenness centrality of the CSE decreases. The explanation is that with partnering, there are fewer instances of the formal written communication that is always sent to the CSE, the sole contact point on the site between the client and the contactor.

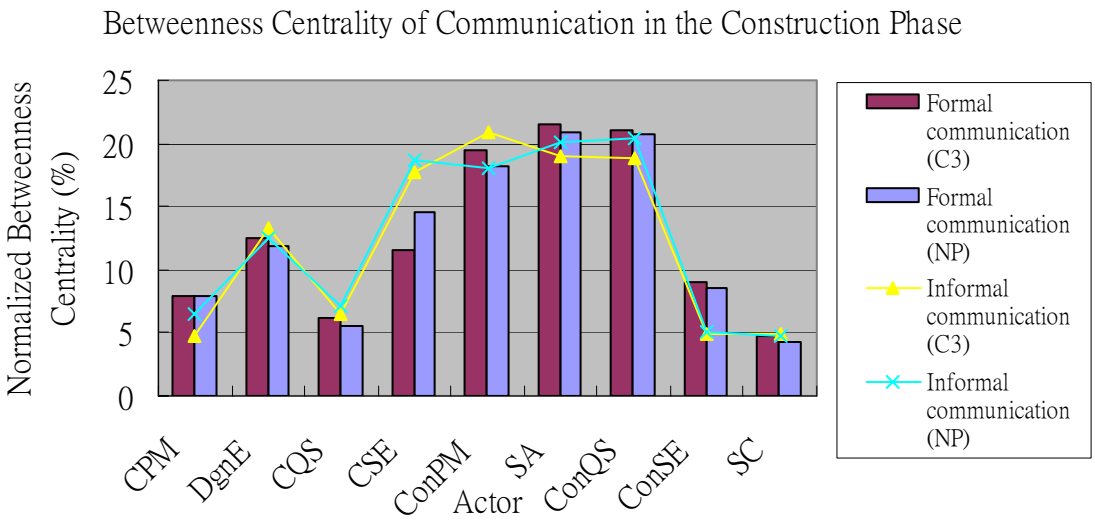

Figure 6.3: Betweenness Centrality of Communication in Case Study Three

6.6.2 Cohesive Sub-groups: Cliques

In formal contact, actors form three overlapping cliques. Two dominant sub-groups for formal and informal communication can be found: the SA and ConSE form one group and the CSE, ConPM, ConQS, and SC the other group. If there is no partnering, the SC is in the clique with the contractor only in formal communication and has low hierarchical clustering to the whole matrix in informal communication.

6.6.3 Regular Equivalence

For formal contact with partnering, the contractor's side has a high level of regular equivalence, with the CPM and CSE coming together at 85.418. For non-partnering, the CPM and CSE only join the contractor's side at 83.815. For informal contact, the CSE has the same regular equivalence as all of the actors in the contractor's side at 85.861. The results show that partnering improves the

regular equivalence of the CPM and CSE in formal communication.

6.6.4 Analysis of Qualitative Interview Data on Communication

Generally, the interviewees reported that communication was effective and efficient. However, they were not certain that the efficiency and effectiveness of communication was due to partnering. The project manager commented that better communication largely depended on the personality and attitude of the whole project team. However, he admitted that partnering at least provides the chance for regular meetings, systematic evaluations, and for the external facilitator to pull the team together.

6.7 ANALYSIS OF NETWORK STRUCTURE – PROBLEM SOLVING IN A GOVERNMENT INFRASTRUCTURE PROJECT

6.7.1 Centrality of Problem Solving in a Government Infrastructure Project

Partnering provides one more way for the contractor to communicate with the client. Problems can be discussed before they are resolved or escalate to a higher level. Problems can be discussed before a formal meeting, to obtain a consensus. Despite this, the pattern of dispute resolution in partnering and non-partnering project is not so different.

In Figure 6.4, the degree centrality of conflict is generally reduced. The most significant reduction can be found with actor ConPM.

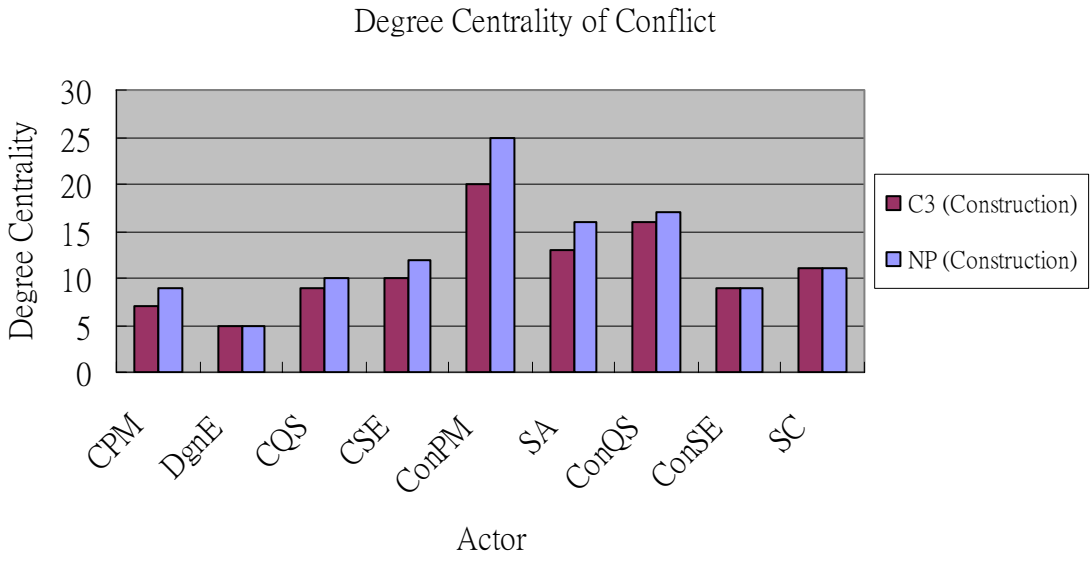

Figure 6.4: Degree Centrality of Problem Solving in Case Study Three

With reference to Figure 6.5, the closeness centrality of conflict is the same even if there is no partnering. One hundred per cent closeness centrality of conflict can be found with the ConPM, SA, and ConQS. The CQS has the lowest closeness centrality. The result shows that partnering does not change the geodesic distance of resolving problems. When a problem or conflict occurs, the actors interact with each other in the same way, regardless of whether or not there is partnering.

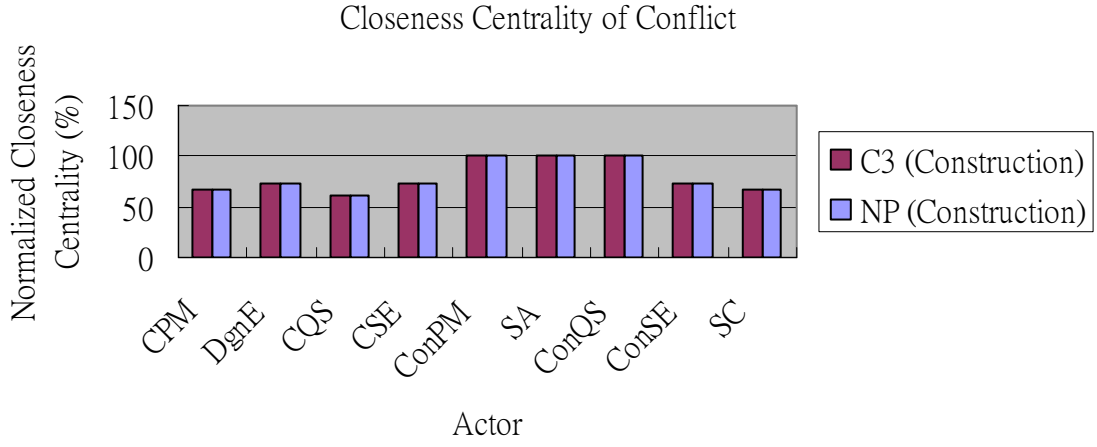

Figure 6.5: Closeness Centrality of Problem Solving in Case Study Three

As shown in Figure 6.6, the ConPM has the highest betweenness centrality of conflict, which means that he has relatively more power to influence the problem-solving process. In this case study, the betweenness centrality of conflict resolution is very much similar to projects without partnering. The result shows that the information flow path for resolving conflict does not change much.

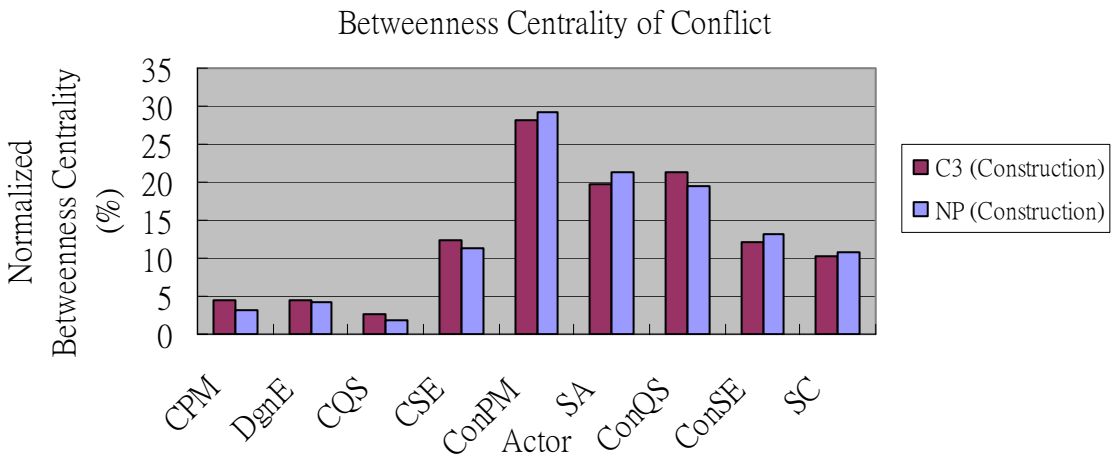

Figure 6.6: Betweenness Centrality of Problem Solving in Case Study Three

6.7.2 Cohesive Sub-groups: Clique

The CPM and CSE form one group; and the ConPM, ConQS, SA, and SC form another. These two groups dominate in the whole network. The situation is the same for non-partnering. In resolving conflicts, the CPM joined to form a clique with the CSE because the client is a government department accountable to the public. Thus, the client is very concerned about conflict, which affects the cost and time required to complete the project, but the client does not involve itself much in daily communication.

6.7.3 Regular Equivalence

In this case study with partnering, the CSE and SA have high regular equivalence for conflict resolution (95.391). By comparison, without partnering the CSE, CPM, and SA come together at 85.308. The result shows that with partnering, the CSE and SA are more likely to perceive the problem from the same perspective and to resolve conflicts in a similar manner.

6.7.4 Analysis of Qualitative Interview Data on Problem Solving

From the interviews, it was found that no big conflicts occurred in this case study. From the project manager's point of view, the attitude towards resolving problems largely depended on the personality of the individuals involved. However, he admitted that partnering provided a formal basis of cooperation for solving problems. Monthly partnering meetings at the senior level of management, as well as at the site level provided an additional chance for discussion and to speed up the process of resolution. It was also found that partnering was still quite a new concept to the whole project team. The members of the project team still needed time to internalize the concept. From the contractor's perspective, partnering helped to resolve conflicts. Claims and decisions would be discussed in advance with the client and the project manager. The contractor was more willing to do the work first rather than waiting for the formal submission of drawings. The major source of conflict was about changes to the design.

6.8 ANALYSIS OF NETWORK STRUCTURE – WORKING RELATIONSHIPS IN A GOVERNMENT INFRASTRUCTURE PROJECT

6.8.1 Centrality of Working Relationships in a Government Infrastructure Project

From Figure 6.7, it is evident that working relationships generally have higher centrality in a partnering project than in a non-partnering project. This shows that the degree of cooperation has increased for every actor. The DgnE's relationship with the project team has been improved with partnering. In an interview, he expressed the view that partnering allows more flexibility in dealing with changes.

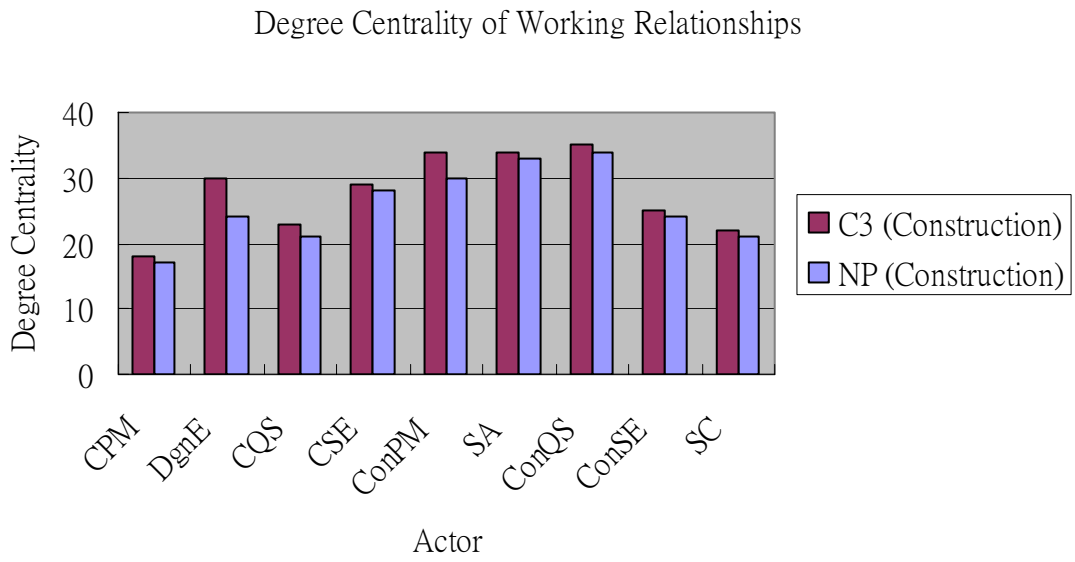

Figure 6.7: Degree Centrality of Working Relationships in Case Study Three

Referring to Figure 6.8, the ConPM, SA, and ConQS have a direct and

independent working relationship with the other actors in the project, as their closeness centrality is 100%.

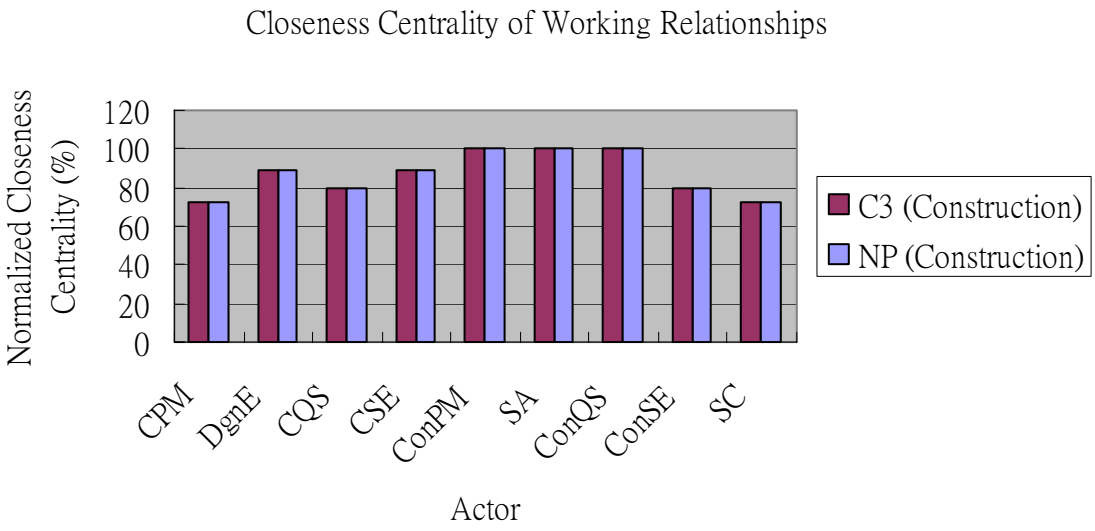

Figure 6.8: Closeness Centrality of Working Relationships in Case Study Three

With partnering, the ConPM and DgnE have higher betweenness centrality in their working relationship than in a non-partnering project. However, the whole relationship network in partnering has low betweenness centrality and is more even. This shows that every actor has a certain amount of power to influence the working relationships of other pairs of actors, but that this power does not amount to much.

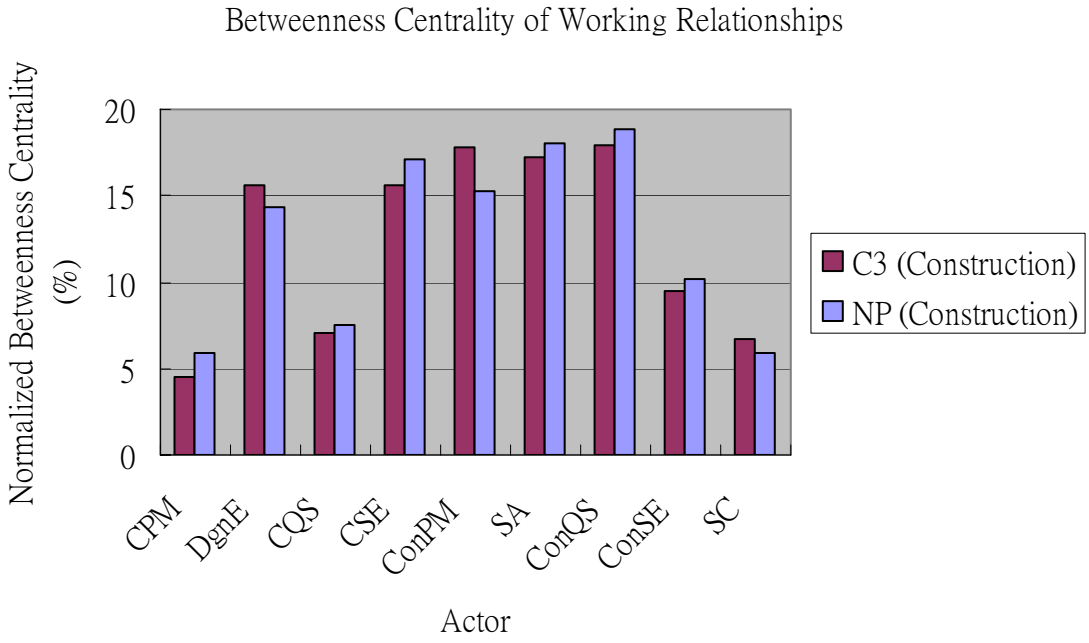

Figure 6.9: Betweenness Centrality of Working Relationships in Case Study Three

6.8.2 Cohesive Sub-groups: Cliques

Five overlapping sub-groups can be found, and the ConPM, CSE, ConQS, and SC are dominant in the network.

6.8.3 Regular Equivalence

It is obvious that actors in the same role of interest have higher regular equivalence. The CQS and CSE have the highest regular equivalence on the client's side. The other dominant group is on the contractor's side. The whole project team is hierarchically clustered at 64.807, which is higher than the 61.827 for non-partnering.

6.8.4 Analysis of Qualitative Interview Data on Working Relationships

From the interviews, it was found that it was difficult to attribute cooperative working relationships to the implementation of partnering. There was no significant difference in working relationships whether or not partnering had been introduced. However, it was agreed that partnering facilitated an environment for discussion and cooperation. Social functions brought the project team together to develop informal relationships.

As supported and supplemented by the interviews, trust was built up in working relationships. Cooperative behaviour was reciprocal. Working relationships were built through communication. When requirements could be fulfilled, relationships of trust were built. It is one year into the project and, so far, everything is satisfactory. The weekly site meetings for the RE and Agent to discuss operations are efficient. Partnering can improve working relationships because it encourages more communication and better understanding. However, partnering is not a panacea. It cannot solve all problems. Should there be critical financial and programme issues, the result would be no compromise. Claims would still be filed. Partnering can be a tool, but it is not the only mechanism for solving problems.

6.9 COOPERATIVE RELATIONSHIPS AND IMPROVEMENTS IN PERFORMANCE

6.9.1 Overall performance

In the questionnaire survey, the participants were asked to rate the degree to which the ‘project goals have been achieved’ and ‘overall performance of alliance relationship is satisfactory’. Their means are 3.75 and 3.88, respectively. This shows that the participants in the project are quite satisfied with the performance of the project and therefore with the relationship of alliance.

6.9.2 Time Performance

With partnering, the project progresses more smoothly and quickly. Otherwise, letter to letter exchanges on a matter can take 8-10 days. With open discussions in partnering steering group meetings, it is possible to speed up progress.

6.9.3 Cost Performance

When there is an alternative design, a supplementary agreement has to be signed. With partnering, negotiations to sign the supplementary agreement proceed more quickly. Without partnering, everything is based on specifications. With partnering, there could be some flexibility on this issue. For example, submitting an inspection form requires at least one day, but with partnering, there is a reduction in formality. Even if the inspection form is submitted late, at around 5-6 p.m., the inspection can be done the next day.

6.9.4 Quality Performance

From the interviews, client believes that poor contractor always produce poor quality no matter there is partnering or not. The effect of partnering on quality performance of the project would be quite limited: however, one improvement is that under the conditions of partnering, it is possible that client can sign a supplementary agreement with better negotiation and bargain. Besides, quality improvement comes from the client which initiates more effort to overcome contractors' problem and share risk so as to achieve better quality product.

6.10 LESSONS LEARNED FROM A PRIMITIVE PARTNERING PROJECT

This case study illustrates the partnering application and cooperative behaviour of a primitive partnering project in Hong Kong. Partnering is a new concept to most of the partners. The client is induced to form partnering with a hope to achieve better performance outcomes. However, other partners are not very highly initiated. It is found that partners have project team behaviour depends very much on the project management rather than partnering. People would be easy to return back to adversarial relationship when problems occur. On surface, there are no difficulties to run partnering. However, different parties have hidden agendas. The client being a new adopter of partnering and a government department has standard government procedures to follow. Its partnering application allows very little flexibility to the contract. It is no more than a concept and regular monthly meetings. Potential benefits of partnering are not utilized to the full.

CHAPTER 7: COMPARATIVE STUDY OF COOPERATIVE RELATIONSHIPS IN PARTNERING PROJECTS

7.1 INTRODUCTION

This chapter compares the research findings obtained from three case studies. They are construction partnering projects in Hong Kong representing three different stages of partnering in construction: a mature partnering stage, a growing partnering stage, and a primitive partnering stage.

At the beginning of this chapter, project information and the project participants in the three stages of partnering projects are compared. The core part of this chapter analyses data collected from a questionnaire survey and interviews of the participants. The results for different stages of partnering projects are compared and used to test four propositions set for examining four research objectives of a relationship of cooperative alliance in partnering projects. The analysis examines (1) conditions for partnering formations, (2) determinants of a cooperative partnering relationship, (3) patterns and structures of partnering in terms of communication, problem solving, and working relationships, and (4) the effect of a relationship of cooperative alliance on project performance. At the end of this chapter, the research findings on relationships of cooperative alliance in partnering projects in Hong Kong are summarized.

7.2 CASE STUDIES: PROJECT PARTNERING IN HONG KONG

The three case studies represent three projects in the following different stages of partnering in construction: ‘mature’, ‘growing’, and ‘primitive’. Case one represents the mature stage of partnering. The client and contractor in case one had substantial and successful experience in partnering with its previous large railway line construction project, which was a huge success. The client therefore advocated using partnering again in case one and in other concurrent projects. Based on its past successful experience with partnering, the client moved a step forward by introducing pre-contract partnering. Although case one involves project partnering, it exhibits some elements of strategic partnering.

Case two belongs to the growing stage of partnering. The contractor had five years of experience in partnering and the client also had some experience with partnering in its recently completed projects, but the QS consultant and structural engineering consultant had no such experience.

Case three belongs to the primitive stage of the application of partnering to a traditional lump-sum contract, which is the most rigid type of contract. Behaviour is influenced by experience and attitude. Success depends more on project management skills. The client’s attitude to partnering is more important than the attitude of the rest of the project team. The client’s commitment is the driving force in the implementation of partnering.

7.2.1 Project Information

A comparison of the project information of the three cases is summarized in Table 7.1. These three cases are typical examples of project partnering in Hong Kong's construction industry.

Partnering project cases	**Project nature**	**Contractual arrangement**	**Partnering arrangement**	**Past partnering experience**
Case one Mature stage	Infrastructure railway project	Target cost	At the tender stage	Client and contractor have substantial partnering experience
Case two Growing stage	Commercial building project	Guaranteed maximum price	After the award of the contract	Client and contractor have partnering experience
Case three Primitive stage	Infrastructure road project	Traditional lump sum	In the construction stage	Client, consultant, contractor, and sub-contractor do not have partnering experience

Table 7.1 Comparison of Project Information of Partnering Projects in Three Different Stages

Project nature

It was found that partnering can be used in projects of different natures. However, it is more effective to use partnering in projects involving a complex project team relationship. Moreover, high-risk projects that require more flexibility in the administration of the contract or those in which there is room for value engineering seem to make better use of partnering. A building project with a short construction period, few alternative designs, and little flexibility to change may not see significant improvements from partnering because such a project can run smoothly even without partnering. Partnering is a tool to manage relationships and reduce waste. Not all projects need to use partnering. Whether or not partnering should be employed depends on how complicated the project team relationship is and how critically the project team relationship affects the performance of the project.

Contractual arrangements for partnering

Contract arrangements critically affect the implementation of partnering. The greatest difficultly in making partnering a success is how to convey the spirit of partnering across a project team and how to implement partnering. If an innovative tool is to be implemented in a construction project, there should be built-in incentives in the contractual arrangement.

Case study one adopted the target cost approach and two-stage tendering. Case study two adopted the guaranteed maximum price (GMP) approach and case study three the traditional lump sum contract. It was found that contract arrangement with built-in financial incentives for sharing pain and gain was a critical success factor in implementing partnering. This was consistent with the

findings in APM (2003), which reported that most parties tend to start with a traditional adversarial standard form of contract, but as they gain experience with partnering, they move to more collaborative forms of contract.

Partnering arrangements

In case study one, the adoption of partnering in the tender stage led to significant improvements in communication, problem solving, and working relationships in the development of the design. In case study two, partnering was adopted after the awarding of the contract, but the contractor still contributed to the design work. In case study three, partnering was adopted in the construction stage when everything had been settled. There was less flexibility to deviate from the contract. Huge potential benefits from partnering were found to occur in the design phase. The earlier partnering was adopted, the more benefits it brought to the project team.

Past experience in partnering

Most members of the project team in case study one and case study two had past experience in partnering while those in case study three did not. The result of case study three was therefore quite different from that of the first two cases. The behaviour in these three cases represented the learning curve of partnering in a different stage of maturity.

7.2.2 Particulars of the Participants

Thirty-one project participants completed the questionnaire survey: 11 from case study one, 11 from case study two, and 9 from case study three. A total of 23

project participants were interviewed: 8 from case study one, 11 from case study two, and 4 from case study three. The particulars of the participants are summarized in Table 7.2. They represent the client, consultant, contractor, and sub-contractor with partnering experience in the construction industry.

Participants	Clients	Consultants	Contractors	Subcontractors
Age				
Less 30		1	1	
30-49	7	5	12	3
50 and above		1	1	
Level of education				
Dip/Certificate			5	2
Degree	3	4	3	1
Master/Doctoral	4	3	4	
Working experience				
Less than 8 yrs		1	2	
8-20 years	4	4	7	2
Over 20 years	3	2	5	1
Management level				
Junior	1	1		
Middle	4	1	7	1
Senior	2	5	7	2
Partnering experience				
No	1	4	4	1
Yes	6	3	10	2
Professional qualifications				
No	1		5	2
Yes	6	7	9	1

Table 7.2: Particulars of the Participants

This table shows the distribution of the data collected. The participants represented typical project team members of partnering projects in Hong Kong.

7.3 CONDITIONS FOR THE FORMATION OF PARTNERING AS ALLIANCE (OBJECTIVE 1)

		Case Study One		Case Study Two		Case Study Three	
		Mean	Rank	Mean	Rank	Mean	Rank
Inducements to form alliances:							
2.1	Avoid opportunistic behaviour	3.5263	8	3.7273	6	3.5	10
2.2	Reduce uncertainty of interdependence	3.7895	4	3.8182	5	3.6579	8
2.3	Share risk among partners	*4.2105*	1	3.9091	2	*4.0263*	1
2.4	Share resource capabilities	3.7368	5	3.7273	6	3.7368	7
2.5	Acquire new skills or knowledge	3.5263	8	3.7273	6	3.6579	8
2.6	Enhance competitive power in the market	3.7368	5	3.9091	2	3.8158	4
2.7	Peer influence from the industry	3.3158	11	3.4545	11	3.375	12
2.8	Pressure from the government or regulations	2.6842	13	2.5455	13	3	13
2.9	Follow the successful experience of other firms	3.5789	7	3.5455	10	3.5	10
2.10	Prior social relationship	3.5263	8	2.6364	12	3.875	2
Opportunities to form alliances:							
2.11	Possess technical capital or expertise	3.9474	2	4	1	3.875	2
2.12	Possess commercial capital (e.g., financially sound)	3.2632	12	3.7273	6	3.75	5
2.13	Possess social capital (e.g., good reputation)	3.8421	3	3.9091	2	3.75	5

Table 7.3: Mean and Rank of the Inducements and Opportunities for the Formation of Partnering in All Case Studies

In this study, ten inducements and three opportunities as conditions for the

formation of cooperative partnering are examined. All conditions for the formation of a cooperative alliance are accepted, except for two inducements. One is (Q 2.8), which the case one and case two participants did not agree to; and the other is (Q2.10), which the case two participants did not agree to.

Scores ranging from 4.33 to 5.00 can be considered the most important condition; however, none of the questions fall in this range. Questions 2.2, 2.3, 2.4, 2.6, 2.11, and 2.13 are in the range between 3.67 and 4.33, which can be regarded as relatively important conditions. Questions 2.10 and 2.12 hold different views across the three case studies. For Q2.10, the project participants of case study three think that a prior social relationship is an important inducement to form an alliance, while those of the first two case studies do not agree. For Q2.12, commercial capital is considered to be less important than in case study one, but relatively important in the latter two case studies. Besides, Q2.1, 2.5, 2.7, and 2.9 fall in the range of 3 and 3.66, which are considered relatively less important. Those items with a score of less than 3 are not conditions to form alliance.

7.3.1 Inducements to Form Alliances

Inducements to form alliances:		***Different perspectives***
2.1	Avoid opportunistic behaviour	Transaction cost perspective
2.2	Reduce uncertainty of interdependence	Resource dependency
2.3	Share risk among partners	Need-based perspective
2.4	Share resource capabilities	Need-based perspective
2.5	Acquire new skills or knowledge	Need-based perspective
2.6	Enhance competitive power in the market	Need-based perspective
2.7	Peer influence from the industry	Others

2.8	Pressure from the government or regulations	Others
2.9	Follow the successful experience of other firms	Others
2.10	Prior social relationship	Social network perspective

Table 7.4 Different Perspectives on Inducements to Form Alliances

The need-based perspective was found to be more important than other explanations on the formation of alliances. The most important inducement found in all three case studies was the sharing of risk (Q2.4). The second most important inducement was to enhance competitive power. This confirms studies arguing that organizations form cooperative inter-organizational alliances because of their specific needs, which may be financial, technological, or some other kind of need. The perception to prior social ties (Q2.10) was quite different from one case to another. It was surprising to find that the participants in the government infrastructure project gave a high rank to prior social ties, whereas the participants in the other two case studies did not.

Although, as reflected from the questionnaire, the participants in all of the cases realized the importance of sharing risks by forming a partnering relationship, it was found from the interviews that only the participants of case study one were particularly clear that the primary reason for the formation of partnering was to share the risks of the project with a target cost partnering arrangement. In the other two cases, some participants only regarded the application of partnering as the company's policy, the client's requirement, or the norm in the industry.

With reference to Lazar (1997), the client in case study one belongs to the first

wave of users of partnering. The client was an early adopter of partnering with a pent-up demand for a better way of managing projects. Early in 1998, the client in case study one investigated the benefits and difficulties of adopting partnering. The primary reason for considering the use of partnering was that the company was committed to continuously improving the cost efficiency of project management and believed that the introduction of project partnering would greatly assist in attaining this objective. Those in case studies two and three belonged to the second wave of users of partnering. Their enthusiasm for adopting partnering would be more on the visible benefits that partnering would bring to the project.

7.3.2 Opportunities to Form Alliances

Technical capital (Q2.11) was regarded as a very important condition for the emergence of partnering opportunities, as it had a high mean and ranked in the top two in the case studies. Financial capital (Q2.12) differed in each project. Social capital (Q2.13) was also regarded as very important, with a high mean and a high rank.

Such statistical evidence was also supported by findings from the interviews. Technical competence was strongly emphasized by many of the project participants, in particular those representing the client in case study one and the consultant in case study two, as an important condition for the formation of a real partnering relationship. The client in case study one was technically competent to closely monitor the project itself and to have adequate knowledge to foresee hidden problems in the project. The client in case study one also possessed social

capital, as it was known to be a reasonable client who had been fair to contractors and sub-contractors.

7.3.3 Inducements and Opportunities for a Cooperative Relationship (Proposition 1)

Proposition 1: It is confirmed that a partnering project requires both inducements and opportunities if a cooperative relationship is to be formed.

From the questionnaire survey and interviews, the following conclusions are drawn:

1. A partnering project requires both inducements and opportunities if a cooperative relationship is to be formed.
2. Eight inducements are conditions for the formation of partnering. They are a combination of the need-based perspective, the transaction cost perspective, and resource dependency. Among the three opportunities, technical and social capital are more important than financial capital as conditions for the formation of partnering as an alliance.
3. There was no agreement on one inducement, 'pressure from the government or regulations (Q2.8)', as a condition for the formation of partnering as an alliance. 'Prior social relationship (Q2.10)' is agreed to be an inducement for public sector and infrastructure projects, but not for private sector and commercial building projects.
4. There are stronger inducements and opportunities to form a cooperative relationship in mature partnering projects than in less mature ones.

7.4 DETERMINANTS OF A COOPERATIVE RELATIONSHIP OF PARTNERING IN CONSTRUCTION (OBJECTIVE 2)

Table 7.5 reports an analysis of data on behavioural constructs while Table 7.6 reports an analysis of data on structural constructs for examining the determinants of a relationship of cooperative alliance in projects involving partnering. Forty-three determinants of a relationship of cooperative alliance are examined. The participants in all of the cases agreed that all of the constructs except for Q3.30 and Q3.33 are determinants of a relationship of cooperative alliance involving partnering in construction.

	Determinants of a relationship of cooperative alliance	**Case Study One**	**Case Study Two**	**Case Study Three**	**Average**
3.4	The partners have a top-down commitment to cooperate	3.8889	4.0909	4.1250	4.0000
3.5	The partners work to complete the project in an effective manner	4.2105	4.0000	3.8750	4.0789
3.6	The partners are allowed to participate in setting goals	4.1579	3.7273	4.1250	4.0263
3.7	The partners are allowed to participate in planning activities	4.3684	3.9091	3.8750	4.1316
3.9	The partners have shared values and common goals	4.0526	3.7273	3.8750	3.9211
3.10	The partners are willing to take risks	3.5263	3.2727	3.5000	3.4474
3.11	The partners are known to be trustworthy	3.8421	3.3636	3.6250	3.6579
3.13	Effective and efficient communication	4.2105	4.2727	3.8750	4.1579
3.14	The partners share information with each other	4.2105	3.7273	3.6250	3.9474
3.15	The partners are encouraged to	4.4737	4.0909	4.0000	4.2632

	participate and exchange ideas				
3.16	The partners have full access to all useful information	3.8947	3.2727	3.4286	3.6216
3.17	The partners have no hidden agenda	3.5789	3.0909	3.2500	3.3684
3.18	The partners solve problems jointly	4.1053	3.7273	3.8571	3.9459
3.19	Problems are solved before they escalate	4.2105	3.9091	3.3750	3.9474
3.20	The partners try to avoid disputes and reduce the use of litigation	4.1579	3.7273	3.8571	3.9730
3.21	The partners are open and receptive to innovative ideas	4.4737	3.7273	3.3750	4.0263
3.22	The partners are responsive to emergencies or changing needs	4.1053	3.9091	3.5714	3.9459
3.24	The partners are very likely to interact in the future	3.8333	3.7273	3.8571	3.8056
3.25	The process of interaction is perceived to be equitable and just	3.9412	3.1818	3.6250	3.6389
3.26	One partner cooperates, the others follow	3.3684	3.1818	3.4286	3.3243
3.27	The partners seek to achieve a win-win situation	4.4211	3.8182	4.2500	4.2105
3.31	A mind open to new possibilities and new alternatives	4.3158	3.8182	3.7500	4.0526
3.33	Fully comply with the request of the other partner, even at the expense of one’s own short-term interests	2.8421	3.0000	3.3750	3.0000
3.38	Constructive handling of differences	3.7895	3.6364	4.0000	3.7838
3.39	Building a sense of belonging and pride	3.7895	3.4545	3.6250	3.6579
3.42	Supportive leaders know how to cooperate	3.8947	3.8182	3.8750	3.8684
3.43	The organizational culture supports cooperation	3.7895	3.7273	3.8750	3.7895

Table 7.5: Mean of the Behavioural Constructs for the Determinants of a Cooperative Relationship

With reference to Table 7.5, the determinants scoring more than 4.33 are regarded as the most important ones. The four most important determinants found in case study one are not found in the other case studies (Q3.7, Q3.15, Q3.21, and Q3.27). Case study one exhibits more determinants of a cooperative relationship than the other two case studies. Most determinants (19 in number) are considered to be relatively important, ranging between 3.67 and 4.33.

	Determinants of a relationship of cooperative alliance	**Case Study One**	**Case Study Two**	**Case Study Three**	**Average**
3.1	The partners have contributed effort and resources to a form cooperative relationship	4.3158	4.1818	4.000	4.2105
3.2	The partners have concurrent relationships in other projects	3.5263	3.5455	3.7500	3.5789
3.3	The partners are equally dependent on each other	3.2105	3.1818	3.7500	3.3158
3.8	The partners have had a successful previous relationship	3.8947	3.0909	3.5000	3.5789
3.12	The partners have a good reputation in the industry	4.0000	3.7273	4.0000	3.9211
3.23	Possibility of inter-organizational learning	3.6316	3.2727	3.7500	3.5526
3.28	Set up a mechanism for effective decision-making	4.0000	3.4545	4.0000	3.8286
3.29	Rewards are given to motivate cooperation	4.0000	3.3636	3.4286	3.7027
3.30	Punishments are imposed for mutually non-cooperative actions	2.8947	2.8182	3.0000	2.8919
3.32	Full authority for action has been delegated to the project team	3.7895	3.3636	3.7143	3.6486
3.34	The goals of the company and the objectives of the partners are compatible with each other	3.6842	3.4545	3.5000	3.5789

3.35	The technical capabilities of both partners are compatible with each other	3.6316	3.1818	3.8750	3.5526
3.36	The organizational procedures of the partners are compatible	3.4211	3.0909	3.5000	3.3421
3.37	The employees of partnering companies have similar professional or trade skills	3.7895	3.0000	3.8750	3.5789
3.40	Feedback and performance evaluation s	3.9474	3.5455	4.0000	3.8378
3.41	Clearly setting out the roles, duties, and responsibilities of each party	3.7368	3.5455	4.0000	3.7368

Table 7.6: Mean of the Structural Constructs for the Determinants of a Cooperative Relationship

With reference to Table 7.6, no determinant has a score of above 4.33, which means that no determinant is very important. Six determinants have a score of between 3.67 and 4.33, which can be considered relatively important. A score of less than 3.00 in Q3.30 is not accepted as a determinant of a cooperative partnering relationship.

7.4.1 Trust, Commitment, Communication, and Conflict Resolution

Determinants of:	Case Study One	Case Study Two	Case Study Three	Average
Trust (Q3.8, 3.9, 3.10, 3.11, 3.12, 3.32, 3.33)	3.7067	3.3636	3.6556	3.5964
Commitment (Q3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.27)	4.0124	3.8068	3.9688	3.9441
Communication (Q3.13, 3.14, 3.15, 3.16, 3.17, 3.28)	4.0614	3.6515	3.6964	3.8691
Conflict Resolution (Q3.18, 3.19, 3.20, 3.21, 3.22)	4.2105	3.8000	3.6071	3.9677

Table 7.7: Trust, Commitment, Communication, and Conflict Resolution

From Table 7.7, it is found that, on average, determinants contributing to conflict resolution score the highest; the next are commitment, communication, and then trust. Case study one scores the highest in these four characteristics of cooperative behaviour.

Q3.9 ‘partners have shared values and common goals’ and Q3.12 ‘partners have a good reputation in the industry’ are the two most important determinants of trust in a partnering relationship. Case study one scored higher than the other two case studies on all determinants of trust except Q3.33, ‘fully comply with the request of the other partner, even at the expense of one’s own short-term interests’.

Q3.1 concerns asset specificity and Q3.27 is ‘win-win situation’. They both score 4.2105.

7.4.2 Others

Other Determinants of Cooperation:	**Average**
Adaptation (3.23, 3.31)	3.8943
Interaction (3.24, 3.25, 3.26, 3.27)	3.6047
Partners’ similarity (3.34, 3.35, 3.36, 3.37)	3.5131
Group dynamics (3.38, 3.39, 3.40, 3.41, 3.42, 3.43)	3.7790

Table 7.8: Other Determinants of Cooperation

As in Table 7.8, other determinants of cooperation are accepted by the participants in the partnering project. This means that, besides the commonly mentioned determinants of trust, commitment, communication, and conflict resolution, other determinants are important as well.

7.4.3 Determinants of a Cooperative Partnering Relationship (Proposition 2)

Proposition 2: It is confirmed that a cooperative partnering relationship is determined more by the behavioural or psychological constructs than by the structural constructs of an inter-organizational cooperative relationship.

Findings:

1. A cooperative partnering relationship is determined more by the behavioural or psychological constructs than by the structural constructs of an

inter-organizational cooperative relationship. 19 behavioural constructs and 6 structural constructs are determined as relatively important (mean between 3.67 and 4.33) determinants of cooperative relationship.

2. The five most important determinants consist of four behavioural constructs and one structural construct. They are:

   The partners are encouraged to participate and exchange ideas (mean = 4.26)

   The partners have contributed effort and resources to form a cooperative relationship (mean = 4.21)

   The partners seek to achieve a win-win situation (mean = 4.21)

   Effective and efficient communication (mean = 4.16)

   The partners are allowed to participate in planning activities (mean 4.13)

3. To build trust in a partnering relationship, it is important that the partners have shared values and common goals; and that partners have a good reputation in the industry.

4. Commitment – Win-win situation is one of the important determinants of commitment

5. Communication – It is important to have an efficient and effective communication system and to allow partners to participate and exchange ideas.

6. Conflict resolution – It is particularly important to be open to innovative changes.

7. A mature partnering project exhibits more determinants of a cooperative relationship than less mature ones.

7.5 NETWORK STRUCTURE OF A COOPERATIVE RELATIONSHIP OF PARTNERING IN CONSTRUCTION (OBJECTIVE 3)

The core part of this study uses social network analysis to examine the 'behaviour' of partnering projects. This study analyses the relational network structure and patterns of interaction in different stages of partnering projects. The structure and pattern of mature, growing, and primitive partnering projects are detailed in Chapters 4, 5, and 6, respectively.

7.5.1 Analysis of the Network Pattern and Structure of Cooperative Relationships and Interactions (Proposition 3)

Proposition 3: It is confirmed that mature partnering projects have relational network structures and patterns of interaction demonstrating more open communication, efficient problem-solving, and closer working relationships than are found in less mature partnering projects.

A mature partnering project will have a relational network structure and patterns of interaction demonstrating more open communication, efficient problem-solving, and closer working relationships than are found in less mature partnering projects. This is evidenced by a network structure of higher degree centrality, higher closeness centrality, and more even betweenness centrality, the presence of cohesive sub-groups and also high regular equivalence.

7.5.2 Network Structure of Communication of Partnering in Construction (Proposition 3.1)

Proposition 3.1: Partnering leads to an open communication structure

3.1a. More mature partnering projects have communication structures with higher degree centrality, higher closeness centrality, and more evenly distributed betweenness centrality than less mature partnering projects.

3.1b. More mature partnering projects have the communication structure of more cohesive sub-groups and fewer isolates than less mature partnering projects.

3.1c. More mature partnering projects have communication structures with higher regular equivalence than less mature partnering projects.

Centrality of the communication structure

Partnering generally increases the frequency of communication, as evidenced by an increased degree centrality of communication in the three case studies than in the respective benchmark non-partnering projects. Case study one experienced the greatest increase in degree centrality. Case study two was next, followed by case study three.

The increase in degree centrality is much more significant in the design phase than in the construction phase. This shows that there is significant room for improvement in communication in the design phase that has been overlooked. In the past, communication in the design phase only involved the client and the design consultants. However, there was always the problem of buildability. The concept of partnering, together with more flexible contract arrangement, enables

the contractor to become involved at an early stage in the design. Only case study one includes partnering in the design phase before the award of the contract. Case study two tries to make use of the skill of the contractors' specialists in the designing of façades, but their contribution to the whole design is limited.

Partnering improves the closeness centrality in the design phase. The extent of improvement depends on the project. Case study one has a higher increase in closeness centrality than case study two. This means that information can be more direct with partnering. There is no difference in construction phase, except that in case study one partnering improves the closeness centrality to 100% for the whole project team. Case one and case two have a high closeness centrality, ranging from 90% to 100%; however case three has a wider range, from 71% to 100%.

Partnering makes the information flow in more diverse ways. The betweenness centrality of communication is more even than in non-partnering. For example in the design phase in case study one, the CQS has sole control over information. He falls on the information flow path for 90% of the network. With partnering, the CQS's position to control information is greatly reduced, and the ConPM and SC are given more access to information. In the construction phase, the betweenness centrality for case one and two is generally low for communication network, representing a decentralized communication network. Case three has a wider range of betweenness centrality (5% to 20%) and the ConPM, SA and ConQS have relatively more control over information.

Cohesive sub-groups of communication structure

Compared with the formal communication in a non-partnering project, case study one experienced an increase in number of cliques from six to eight. With three cliques, case study two showed no difference in clique relationships. Case study three also had the same number of cliques as in a non-partnering project, but the size of the cliques was larger.

For informal communication, case study one and case study two have six cliques; while only three cliques formed in case study three.

It can be seen that a partnering relationship improves communication by enabling more cohesive sub-groups to be formed. A more mature partnering project has more cohesive sub-groups.

Regular equivalence of the communication structure

As compared with the benchmark non-partnering project, partnering improved the highest and lowest regular equivalence in both formal and informal communication for case studies two and three. For case one, partnering significantly improved the lowest level of regular equivalence of informal communication in both the design and construction phase. The lowest limit of formal communication in the design phase and the highest limit of formal communication in the construction phase improved.

In general, case study one and case study two have a similar level of regular equivalence, while that in case study three is somewhat lower.

7.5.3 Network Structure of Problem Solving of Partnering in Construction (Proposition 3.2)

Proposition 3.2: Partnering leads to efficient problem-solving

3.2a. A mature partnering project has a lower degree centrality, higher closeness centrality, and a more evenly distributed betweenness centrality of conflict than a less mature partnering project.

3.2b. For problem-solving, a mature partnering project forms cohesive sub-groups that are larger in size and greater in number than are found in a less mature partnering project.

3.2c. A mature partnering project has a higher regular equivalence upon the solving of problems than a less mature partnering project.

Centrality of problem-solving

In the design phase, some actors experienced a decrease in degree centrality, while some did not or even experience an increase in frequency of conflict when compared with non-partnering projects. This shows that when more parties are involved, there is a greater chance that conflict will break out. A lower degree centrality of conflict in a non-partnering project does not mean that there is no problem, but rather that the problems are not identified until the construction phase, when the contractor comes. The solving of problems is delayed to the next phase of construction. However, for all of the case studies, the degree centrality of conflict in the construction phase was consistently lower than in a benchmark non-partnering project. Partnering seems to be an effective tool to reduce the occurrence of conflict and promote problem-solving in the construction phase.

There is no difference or a very minimal difference in the closeness centrality of problem-solving between the case studies and the non-partnering projects. That is, the geodesic distance for an actor to reach all of the other actors does not change with partnering. Two reasons can be given for this. One is that the closeness centrality is already the shortest for the whole network (100%), and thus there is no possibility for improvement. The other reason is that partnering does not change the structure of problem-solving. People have already identified the right person to resolve conflicts.

For the betweenness centrality of problem solving in the design phase, the pattern is very similar to that found in non–partnering, with more variation in case study one. However, several people hold control over information for the resolution of conflicts. In the construction phase, the betweenness centrality levels off at 10% for case one and case two; while case three has a more diverse pattern, with the contractor having a high betweenness centrality.

Cohesive sub-groups for solving problems

As compared with problem-solving in non-partnering projects, case study one formed one more sub-group in the design phase. Although case study one also formed two cliques in the construction phase, the cliques were larger in size than that are found in non-partnering projects. There are no differences in the clique relationship formed in the other two cases compared with the non-partnering project. Little difference in the cohesive sub-groups for problem solving is found in partnering projects of different levels of maturity.

Regular equivalence of problem-solving

Partnering improved the regular equivalence in case study two and case study three. For case study one, the regular equivalence of problem-solving also improved, but the lowest limit in the construction phase is lower than in non-partnering projects. On the whole, case study one and case study two have a similar level of regular equivalence, but that of case study three is somewhat lower.

7.5.4 Network Structure of Working Relationships of Partnering in Construction (Proposition 3.3)

Proposition 3.3: Partnering leads to close working relationships

3.3a. A mature partnering project has a higher degree centrality, higher closeness, and a more evenly distributed betweenness centrality of cooperation in working relationships than a less mature partnering project.

3.3b. More cohesive sub-groups are formed in a mature partnering project than in a less mature partnering project.

3.3c. A mature partnering project has a higher regular equivalence in its working relationships than a less mature partnering project.

Centrality of working relationship

The degree centrality of working relationships representing the degree of cooperation is generally higher for the three case studies than for non-partnering projects. The effect is much more easily felt in the construction stage. Cooperative relationship has to be built overtime. Case one, which features the earliest formation of a project team with partnering in the design phase was

found to have more cooperation in real terms than the other two case studies.

The closeness centrality of the working relationships in the case studies does not differ from that of non-partnering projects. In the construction phase, the closeness centrality of the working relationships is high. The first two case studies have a 100% normalized closeness centrality.

In the design phase, the betweenness centrality of the working relationships is dominated by several actors located in the centre of the network. In the construction phase, the betweenness centrality of the working relationships has the same pattern, no matter there was partnering or not. The betweenness centrality of the working relationships in case study one and case study two are evenly leveled at 10%, which means that there is no one actor who can dominate in controlling information. The actors are equally dependent on one another. Case study three has a more fluctuating pattern. This means that, in case study three, a handful of actors control information.

Cohesive sub-groups for working relationship

In case study one, the number of cliques increased from one to two in the design phase, and from two to four in the construction phase as compared with the benchmark non-partnering project. As for the other case studies in the construction phase, case two and case three remain unchanged at two cliques and five cliques, respectively. Greater improvement in cohesive sub-groups can be found in more mature partnering projects.

Regular equivalence of working relationships

For working relationships, it was found that partnering improves the highest and lowest regular equivalence in all cases except in case two. Partnering improves the unity of the project team relationship. Again, case study one and case study two have a similar level of regular equivalence, but the level in case study three is much lower.

7.6 EFFECT OF A RELATIONSHIP OF COOPERATIVE PARTNERING ON PROJECT PERFORMANCE (OBJECTIVE 4)

Table 7.9 shows the means of the project performance of the three cases. Case study one, being the most mature partnering project, has the best performance in terms of project goals and also satisfaction. However, it is interesting to find that performance and satisfaction in case study three is better than in case study two. The reason may be that case study three is still in its early stage and the project is still going well. More importantly, as seen from the interviews, it is the project management of this project that induces relatively good satisfaction, rather than partnering. It was found that a more mature partnering project has better project performance and higher satisfaction in terms of relationship.

	Cooperative Relationship and Improvements in Performance	**Case Study One**	**Case Study Two**	**Case Study Three**
5.1	The goals of the project have been achieved	3.8947	3.6364	3.75
5.2	The overall performance of the relationship of alliance is satisfactory	4	3.7273	3.875

Table 7.9: Mean of Project Performance of the Three Cases

7.6.1 Correlation between a Relationship of Cooperative Partnering and Performance

Table 7.10 shows that a relationship of cooperative partnering is significantly and positively correlated with the performance of the goals of the project (0.455) and with the overall satisfaction (0.603).

	Formation of alliance	**Determinants of a cooperative relationship**	**Performance of the goals of the project**	**Overall satisfaction**
Formation of alliance	1.000			
Determinants of a cooperative relationship	0.422**	1.000		
Performance of the goals of the project	0.293	**0.455****	1.000	
Overall satisfaction	0.387*	**0.603****	0.653**	1.000
** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).				

Table 7.10: Pearson Correlation between a Cooperative Relationship and Performance Outcomes

7.6.2 Improvements in Performance in Partnering Projects (Proposition 4)

Proposition 4: It is confirmed that a relationship of cooperative partnering leads to improvements in performance in terms of project goals and satisfaction.

Based on the findings in Table 7.10, the better the cooperative relationship brought about by partnering, the better the performance of the goals of the project and the higher the overall satisfaction.

7.7 RESEARCH FINDINGS OF COOPEARTIVE RELATIONSHIPS IN PARTNERING PROJECTS

This study empirically investigated the formation, process, and outcomes of the cooperative relationship in partnering projects in Hong Kong. It is found that the conditions leading to the formation of an alliance/ partnering affect the behavioural process of building cooperation and, thus, the performance outcomes of the relationship of partnering. A mature partnering project with more inducements to form a relationship of inter-organizational alliance, also demonstrates more determinants of a cooperative relationship. This also leads to better project performance outcomes and satisfaction with the relationship of alliance. Thus, the prerequisite for determining whether one should form an inter-organizational relationship is to consider the inducements and opportunities for forming an alliance. These conditions fundamentally affect the subsequent partnering behaviour and the success of the relationship. A mature partnering project demonstrates to have more open communication, better problem solving, and more cooperative working relationship than a less mature one. Characteristics of cooperative relationships of partnering projects will be further compared with non-partnering projects in Chapter 8.

CHAPTER 8: COMPARATIVE STUDY OF COOPERATIVE RELATIONSHIPS OF PARTNERING AND NON-PARTNERING PROJECTS

8.1 INTRODUCTION

To study the cooperative relationships of partnering projects, three partnering case studies have been chosen for investigation and they have been compared with the participants' experiences on similar non-partnering projects. Details of the research methodology can be referred to section 3.8.4. However, as stated in section 1.6, there is a limitation that they are not compared with a case study of non-partnering project. A non-partnering project was therefore selected to validate the findings of this study and provide justification to the research methodology. Since case study one and case study two typically reflect more mature partnering projects in Hong Kong, comparisons are made with reference to these two partnering case studies.

8.2 PROJECT CONTEXT OF A NON-PARTNERING PROJECT

The validation case study was an alternation and adaptation work. The project began in Dec, 2003 and was finished in July, 2004. The sum of the contract was HK$ 9 million. About HK$1.2 million of work was finished per month. Although this case study seemed to be small, its financial progress was in fact quite significant. Traditional lump sum contract was adopted. The scope of work included abortion of the existing structure and construction of a new clean room

for laboratory testing. The project was successfully completed. Since this study focuses on analyzing project team's behaviour and relationship, the representativeness of project team members are one of the most crucial factor to choose case study. Project participants of this validation case study were well represented. They included the client's project manager (CPM), the architect (ARCH), the consultant's quantity surveyor (CQS), the consultant's building services engineer (CBSE), the consultant's structural engineer (CSE), the contractor's project manager (ConPM), the site agent (SA), the contractor's quantity surveyor (ConQS), the contractor's building services engineer (ConBSE) and the sub-contractor (SC). Since this project did not include much structural work, there was no structural engineer of the contractor in this project. Data was collected through questionnaire survey and documentary evidence.

8.3 COMPARISON OF RESEARCH FINDINGS OF PARTNERING AND NON-PARTNERING CASE STUDIES

As concluded in section 7.7, the mature partnering projects have more open communication, better problem solving and more cooperative working relationship. In this section, these research findings will be compared with the validation case analysis of a non-partnering project in terms of communication, problem solving and working relationship.

8.3.1 Network Structure of Communication

Formal and Informal Communication

Partnering facilitates an environment for informal discussion. Partnering projects tend to use more informal communication rather than formal communication. Non-partnering project uses more formal communication rather than informal communication. In Figure 8.1, it shows that the validation case study without partnering has higher degree centrality of formal communication than informal communication. This means that project participants of the non-partnering project prefer to use more formal rather than informal communication. Table 8.1 shows that partnering project case studies are found to have more informal communication than the validation case study. That is, people are more willing to use informal means of communication when there is partnering.

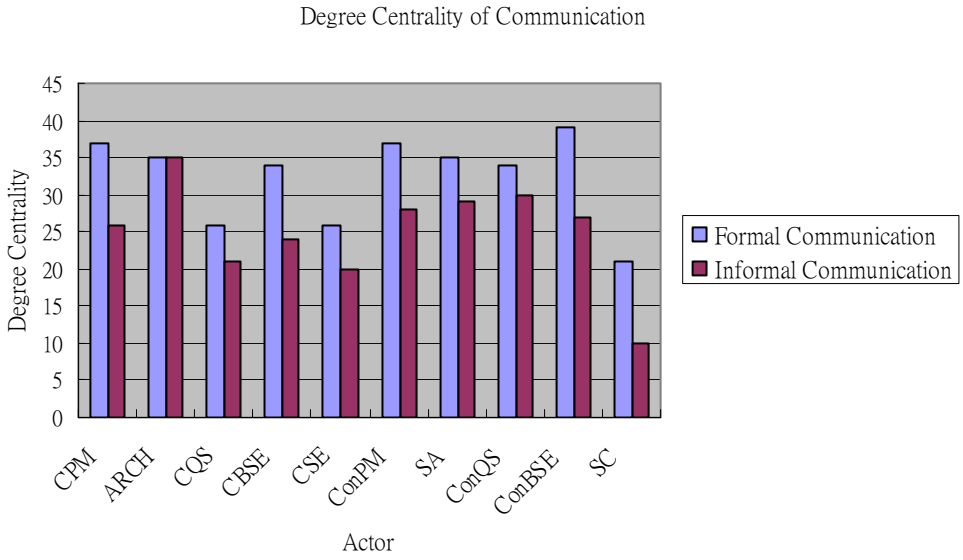

Figure: 8.1: Degree Centrality of Communication in the Non-partnering Project

Mean of Degree Centrality	Case Study One	Case Study Two	Validation Case Study
Formal Communication	38.909	41.455	32.400
Informal Communication	41.273	43.091	25.000

Table 8.1: Comparison of the Means of Degree Centrality of Communication of the Partnering and Non-partnering Projects

Direct and Indirect Communication

Both partnering and non-partnering projects have direct communication pattern. It is found that partnering does not obviously affect the directness of project team communication. In Figure 8.2, it can be seen that most actors' closeness centralities of the non-partnering project are also between 90% and 100%. Referring to Table 8.2, the partnering projects' closeness centralities showing the directness of communication mainly fall in the range of 90% and 100%. There is not much difference if compared with a partnering project. It is common in the construction industry that instruction is given by the client to consultant and contractor directly while subcontractor mainly deals with the contractor. That is why closeness centrality of most actors can reach 90% to 100% while that of subcontractor is usually lower.

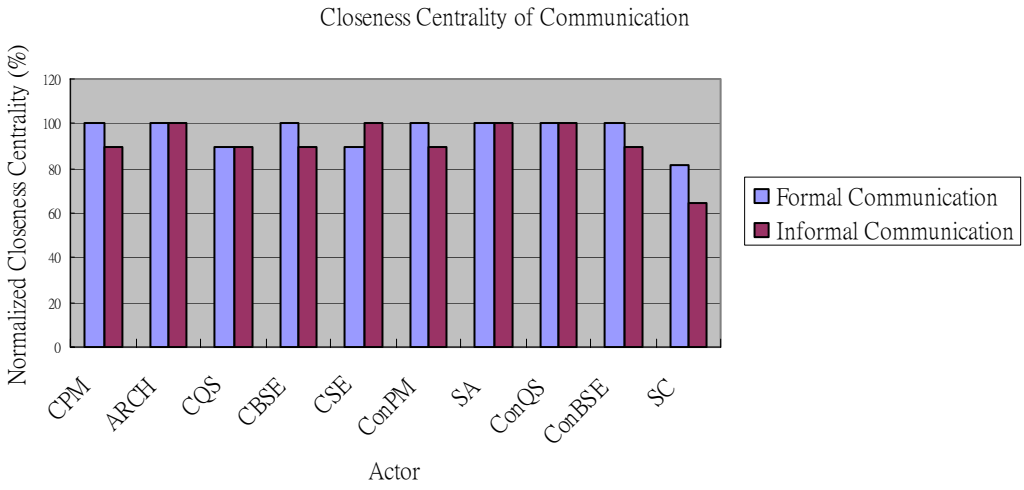

Figure: 8.2: Closeness Centrality of Communication in the Non-partnering Project

Mean of Closeness Centrality	Case Study One	Case Study Two	Validation Case Study
Formal Communication	100.000	98.347	96.182
Informal Communication	98.347	98.347	91.429

Table 8.2: Comparison of the Means of Closeness Centrality of Communication of the Partnering and Non-partnering Projects

Information Sharing

Partnering projects have more even information sharing than non-partnering project. Findings of the partnering case studies show that partnering projects have more evenly distributed betweenness centrality among actors. There is less chance for any one actor to control communication. Referring to Figure 8.3, betweenness centrality of communication in the non-partnering project is

unevenly distributed. ARCH and ConQS obviously have more power to control the informal communication. In Table 8.3, it can be seen that case studies one and two have smaller standard deviation of betweenness centrality than the non-partnering project, that is, the betweenness centralities of these two projects are more evenly spread. Information sharing is better in partnering projects.

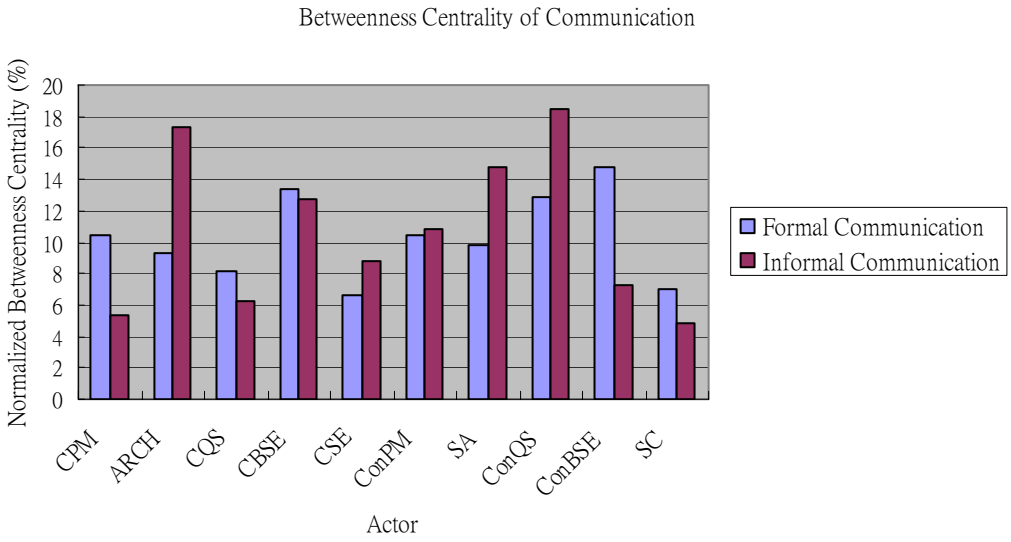

Figure: 8.3: Betweenness Centrality of Communication in the Non-partnering Project

Standard Deviation of Betweenness Centrality	Case Study One	Case Study Two	Validation Case
Formal Communication	1.610	1.408	2.564
Informal Communication	1.760	1.009	4.747

Table 8.3: Comparison of the Standard Deviations of Betweenness Centrality of Communication of the Partnering and Non-partnering Projects

Cohesive Subgroup: Cliques

Two cliques are formed for formal and informal communication respectively. The cliques consist of both actors from client and contractor side. More cliques are formed in partnering projects. Case study one has six numbers of cliques for formal and informal communication respectively. Case study two has three cliques for formal communication and six cliques for informal communication. Partnering project team members form more numbers of smaller subgroups for communication.

Regular Equivalence

For formal communication, the regular equivalence of the non-partnering project of the whole group is quite high (95.438). Case study one has higher regular equivalence of formal communication than the non-partnering project (97.443). For informal communication, the regular equivalence of the whole group is relatively lower (89.714). That of the partnering case study two is 97.237. However, it is quite surprising to find that the regular equivalence of partnering case study one is even lower (73.597).

8.3.2 Network Structure of Problem Solving

Frequency of Conflict

Frequency of conflict is lower in partnering project than in non-partnering project. Case study one has significantly fewer conflict occurrences. However,

case study two is found to have more conflict than non-partnering project. This can be explained that partnering is not a panacea. Partnering itself cultivates an environment for people to resolve problem effectively but it does not necessarily eliminate conflicts and problems. The successful of it depends on partners' commitment and trust to partnering.

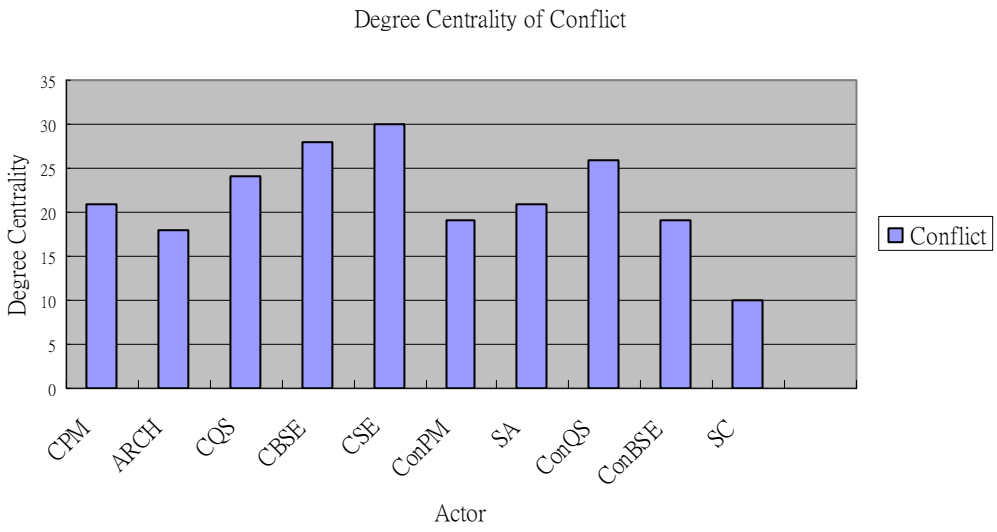

Figure 8.4: Degree Centrality of Conflict in the Non-partnering Project

Mean of Degree Centrality	Case Study One	Case Study Two	Validation Case Study
Conflict	19.636	24.727	21.600

Table 8.4: Comparison of the Means of Degree Centrality of Conflict of the Partnering and Non-partnering Projects

Directness of Problem Solving

Partnering and non-partnering projects have similar pattern of problem solving. Communication is direct in both partnering and non-partnering projects. As in

Figure 8.5, some actors' closeness centrality of problem solving of non-partnering project can reach 100%. As shown in Table 8.5, partnering projects' closeness centralities are slightly higher.

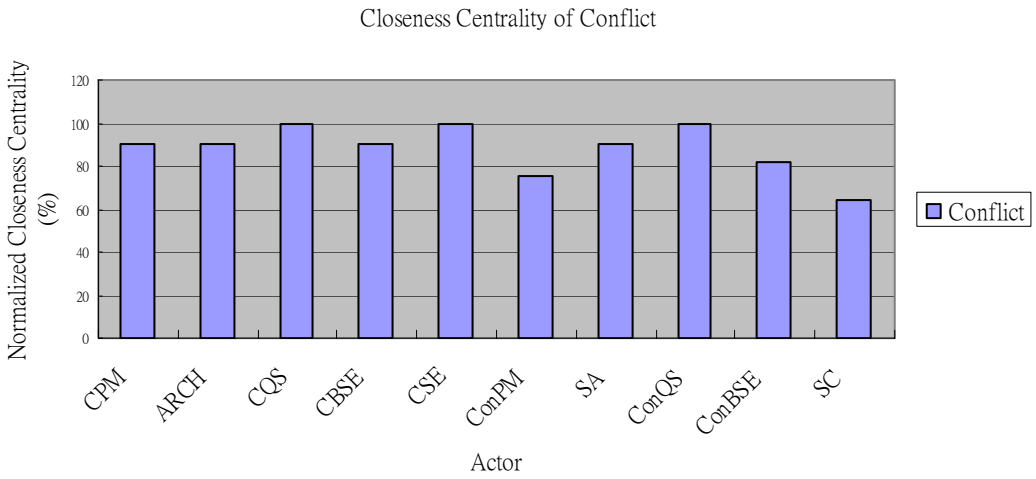

Figure 8.5: Closeness Centrality of Problem Solving in the Non-partnering Project

Mean of Closeness Centrality	Case Study One	Case Study Two	Validation Case Study
Conflict	100	96.694	88.110

Table 8.5: Comparison of the Means of Closeness Centrality of Problem Solving of the Partnering and Non-partnering projects

Joint Problem Solving

Partnering facilitates joint problem solving. Project team members of partnering projects are more likely to resolve problem jointly than those of non-partnering projects. When conflict occurs, it is very important to resolve it quickly and the involved parties are well informed. With the effort and knowledge contribution

of different project team members, problems are more likely to be resolved at the best interests of the project. An evenly distributed betweenness centrality of problem solving enables stakeholders to get access to essential information to resolve the problem. From Figure 8.6, it can be seen that betweenness centrality of a non-partnering project is unevenly distributed. CBSE and SA are in a better position to resolve problem. However, there may also be a problem that other stakeholders are not fully informed of the issue and the best decision cannot be made. As shown in Table 8.6, case study one and case study two have smaller standard deviation of betweenness centrality of problem solving. As seen in these two partnering projects, partnering provides an environment for joint problem solving.

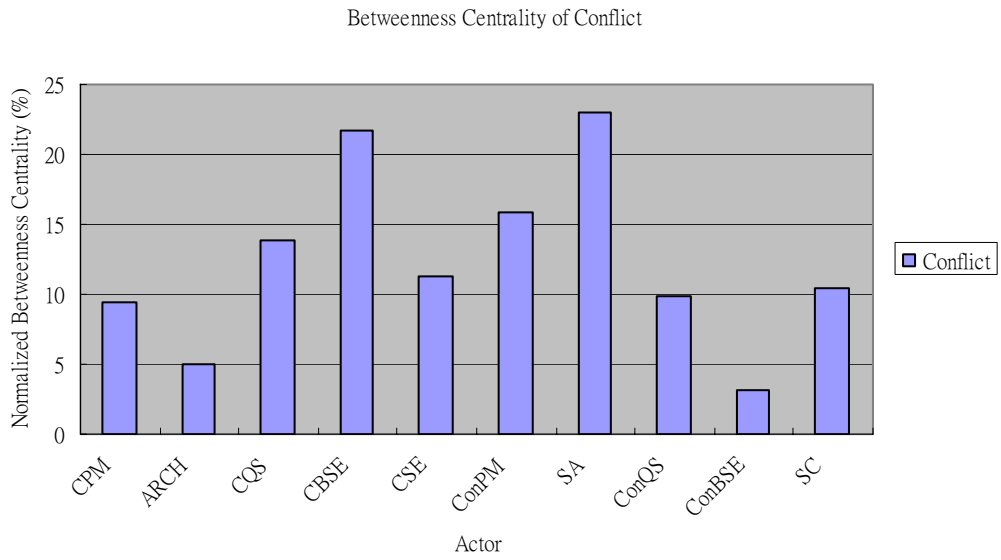

Figure 8.6: Betweenness Centrality of Problem Solving in the Non-partnering Project

Standard Deviation of Betweenness Centrality	Case Study One	Case Study Two	Validation Case
Problem Solving	2.165	3.662	6.117

Table 8.6: Comparison of the Standard Deviations of Betweenness Centrality of Problem Solving of the Partnering and Non-partnering Projects

Cohesive Subgroups: Cliques

Three cliques are formed. They consist of both actors from client side and contractor side. CQS, CSE, ConQS occur in the three cliques and these actors link up all the other actors. Similar numbers of cliques occur in the two partnering case studies.

Regular Equivalence

The regular equivalence of the whole group is low (78.141). It is found that ARCH particularly holds different view from the other actors when dealing with conflict. For case study one, the regular equivalence of the whole group is relatively higher (87.473). It is expected that partners in a mature partnering project have shared vision and common objectives to achieve project goals. They are more likely to hold similar views for problem solving.

8.3.3 Network Structure of Working Relationship

Cooperativeness of Working Relationship

Properly implemented partnering projects can significantly improve the cooperativeness of working relationship. Project team members take pride in their team and receive substantial satisfaction from being a team member. This is evidenced by case studies one and two. In Figure 8.7, it is shown that for a non-partnering project, degree centrality of working relationship ranges from 38 to 16. Working relationship of the non-partnering project is not as close as those partnering projects which can reach over 40 as shown in Table 8.7.

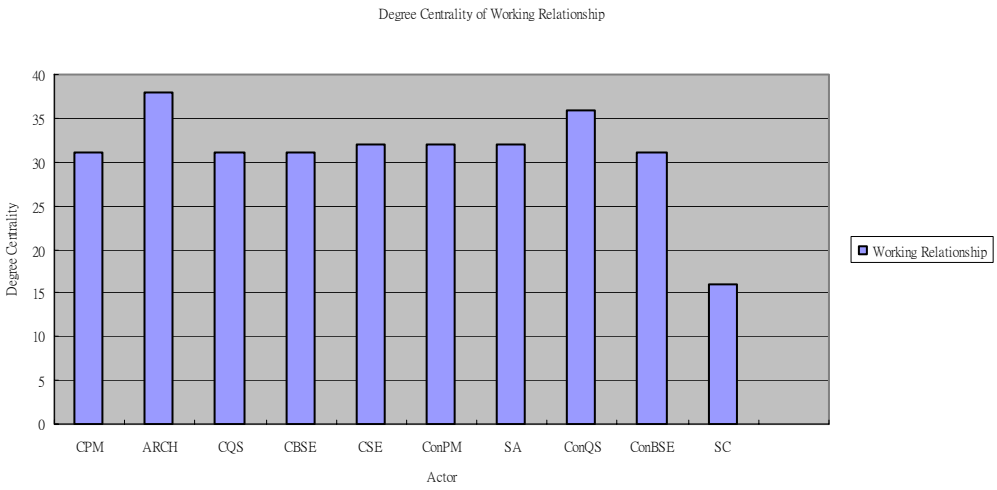

Figure 8.7: Degree Centrality of Working Relationship in the Non-partnering Project

Mean of Degree Centrality	Case Study One	Case Study Two	Validation Case Study
Working Relationship	44.364	42.364	31.000

Table 8.7: Comparison of the Means of Degree Centrality of Working Relationship of the Partnering and Non-partnering Projects

Direct and Indirect Working Relationship

Partnering does not fundamentally change people's attitude to develop working relationship. As shown in Figure 8.8, most actors' closeness centralities of working relationship for the non-partnering project are within the range of 90% to 100%. Case study one and two is 100% for all actors. This confirms with the previous findings that actors in non-partnering projects have similar level of closeness centrality of working relationship with partnering projects.

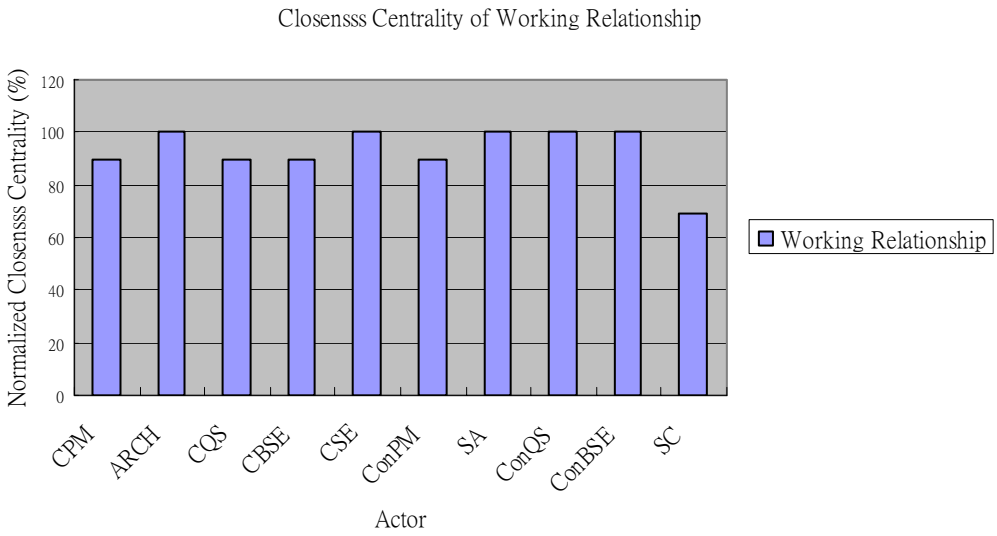

Figure 8.8: Closeness Centrality of Working Relationship in a Non-partnering Project

Mean of Closeness Centrality	Case Study One	Case Study Two	Validation Case Study
Working Relationship	100.000	100.000	92.923

Table 8.8: Comparison of the Means of Closeness Centrality of Working Relationship of the Partnering and Non-partnering Projects

Team Building

Partnering facilitates an environment of team building. An evenly distributed betweenness centrality of working relationship means that no one can manipulate the relationship by withholding information. Project team members are interdependent and have accountability with each other. Instead of working individually, project team members build up a sense of working as a team with shared project goals, trust and commitment. In Figure 8.9, betweenness centrality of working relationship in the non-partnering project unevenly ranges from 6% to 43%. Working relationship of the non-partnering project depends heavily on the attitude of the ARCH. As shown in Table 8.9, betweenness centralities of working relationship of the partnering case studies are more evenly distributed. Particularly small standard deviation of betweenness centralities are found in case study one and two. Partnering provides a level playing field for the partners to build up cooperative relationship.

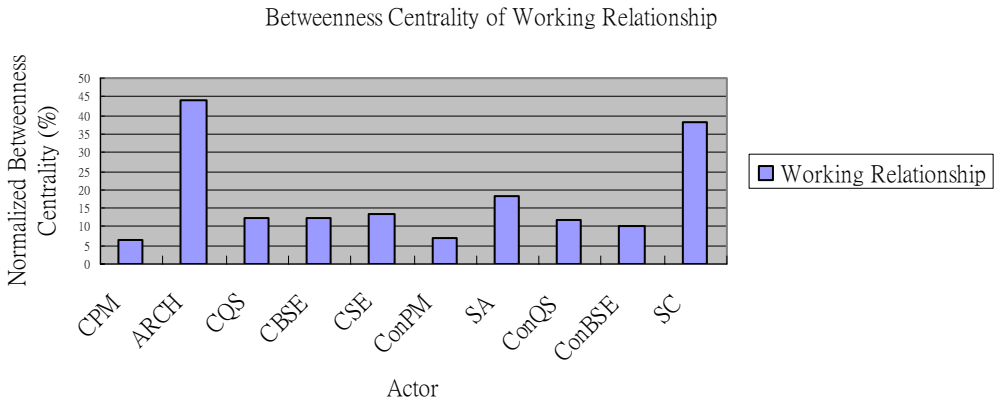

Figure 8.9: Betweenness Centrality of Working Relationship in the Non-partnering Project

Standard Deviation of Betweenness Centrality	Case Study One	Case Study Two	Validation Case
Working Relationship	0.741	0.975	12.283

Table 8.9: Comparison of the Standard Deviations of Betweenness Centrality of Working Relationship of the Partnering and Non-partnering Projects

Cohesive Subgroups: Cliques

Two cliques are formed in the non-partnering project on working relationship. The cliques consist of well mix of actors from client and contractor. For partnering projects, more number of cliques is likely to be formed. For example, case study one has four cliques on working relationship.

Regular Equivalence

Although the ARCH is quite isolated from the group, the regular equivalence of working relationship of the non-partnering project for all the actors is quite high (93.989). It is about the same level with partnering case studies. Case study one is 96.966 while case study two is 93.644.

8.4 LESSONS LEARNED FROM THE COMPARISON BETWEEN PARTNERING AND NON-PARTNERING PROEJCTS

It is concluded from the comparison of the partnering case studies with the validation case study that partnering successfully brings about more cooperative relationship than non-partnering projects in terms of open communication, efficient problem solving and cooperative working relationship.

Communication pattern is different from partnering projects to non-partnering projects. With partnering, project team members tend to use more informal communication and less formal communication than non-partnering project. Information sharing is more even in partnering project. This helps to speed up decision making. However, partnering is not a panacea and partnering projects do not necessarily have fewer conflicts. In fact, partnering contributes to bring about joint problem solving. Partnering significantly improves the cooperativeness of working relation. Partners take pride in the project team and receive much satisfaction from working with each other. Partnering also encourages team building. It provides a level playing field for all project team members.

Partnering is an effective management strategy to deal with complex relational problems of a construction project. However, it should be noted that key elements of partnering such as commitment and trust have to be present. Partnering application requires a learning process. Although this study shows that mature partnering application brings about significant improvements to both behavioural performance and project performance of a construction project, the performance of a primitive partnering project may not be better than a properly managed non-partnering project. It is important for the construction project managers to implant partnering spirit in the project team.

CHAPTER 9: CONCLUSIONS AND FURTHER STUDIES

9.1 INTRODUCTION

Partnering is a relationship management strategy. Its socio-psychological aspect has been studied in this research. This study focused on investigating the cooperative relationships and behavioural structures of partnering projects. It is different from the previous research for statistical findings. This study adopted the case study approach of in-depth investigations so as to reveal a holistic picture of the application of partnering in Hong Kong's construction industry. The selection of case studies include a mature partnering project, a growing partnering project, and primitive project allowed for a comprehensive investigation of different partnering practices in Hong Kong's construction industry. The partnering behaviour of different types of participants including a privatized public corporation, a private developer, and a government department have been revealed.

This study derived from the literature an integrated research framework to analyse cooperative partnering relationships from the conditions for the formation of an alliance, determinants, patterns of interaction, and also improvements in performance. This integrated framework encapsulates the process by which inter-organizational cooperative relationships develop in partnering projects. Generally, all of the objectives set out in this study have been achieved and the propositions have been confirmed with empirical evidence.

This study contributes to the industry the knowledge of developing cooperative alliance relationship and to the academia the social network analysis as a valid research method to reveal the structure of cooperative relationships in partnering projects.

9.2 CONTRIBUTIONS TO COOPERATIVE RELATIONSHP OF PARTNERING

9.2.1 Contributions to the Formation of Partnering

This study proffers an inducement-opportunity framework to investigate the conditions for the formation of partnering. It is found that conditions for the formation of partnering affect the successful development of a relationship of cooperative partnering. It is interesting to find that participants in risky projects are more committed to developing partnering relationships and that the level of technical competence of the partners are also important points affecting the formation of partnering

It was found that, if an alliance is to be formed, both inducements and opportunities are required. Partnering as an alliance cannot be formed unilaterally. The sharing of risk was found to be the most important inducement for partnering. Opportunities to form an alliance were also very important. Technical capital and social capital are considered essential in the formation of alliances. Conditions for the formation of partnering affect the subsequent process of cooperation as well as performance. Details are reported in section 7.3.

9.2.2 Contributions to the Determinants of Cooperative Relationship of Partnering

Determinants of relationships of cooperative alliance in partnering projects are comprised of more psychological/behavioural constructs than structural constructs. This is because partnering is an informal relationship of alliance that is non-binding. Much effort in partnering is spent on changing a partner's attitude of hostility to one of cooperation. The degree of structural modification increases with maturity in applications of partnering. More mature applications of project partnering exhibit some of the behaviour of strategic partnering. Trust, commitment, communication and, particularly, conflict resolution are important determinants of cooperation. Details are reported in section 7.4.

9.2.3 Contributions to the Cooperative Partnering Relationship and Performance Outcomes

The ultimate concern in adopting partnering is to bring about improvements in the performance of a project and also in the whole industry through relationships of cooperative partnering. There have been few studies showing the clear relationship between a cooperative relationship and project performance. This study demonstrates that a relationship of cooperative partnering has a significantly positive correlation with performance outcomes. A better relationship will lead to better project performance. More mature partnering projects are likely to have better performance outcomes. Details are reported in section 7.6.

9.3 CONTRIBUTIONS TO THE SOCIAL NETWORK STRUCTURES OF COOPERATIVE PARTNERING RELATIONSHIP

The major significance of this study is to provide an innovative and valid research method to analyse patterns in partnering relationships. This study adopts the social network perspective for research on partnering in construction. This study successfully demonstrates that social network analysis is a useful tool for investigating and visualizing the interactions in a project team. So far, no other study has revealed the patterns in partnering relationships. The use of this method provides a useful reference and guideline for any future partners to use in assessing their partnering relationship. This study also contributes to knowledge of the proper application of social network analysis to partnering. It demonstrates how sociometric data can be collected with a proper matrix questionnaire design, validated by qualitative interview data and analysed by appropriate measures of structural network.

This study also attempts to generalize the structures and patterns of relationships of cooperative partnering in typical partnering projects in Hong Kong. Case studies consistently demonstrate, on the one hand, an increase in the degree centrality of communication and working relationships at both the dyadic and network level, which represent more interaction and enhanced collaboration among actors. On the other hand, they demonstrate a decrease in the degree centrality of problem solving at both the dyadic and network levels, which means that the frequency of conflict among the actors is reduced. In addition, actors work more closely and directly together in communication, problem solving and working relationship networks. This is shown by the high closeness centrality of

the actors of up to 100%. Partnering raises the status of the subcontractor, who is usually a peripheral actor, to more central position. The flow betweenness is low and dispersed, enabling actors to work together on a more level playing field, with no one playing a dominate role in controlling information, dealing with conflicts, and manipulating relationships. It is concluded from the cases studies that decentralized network relationships are efficient for managing complex projects.

It is generally confirmed from the three cases that more mature cooperative partnering projects will have relational network structures and patterns of interaction demonstrating more open communication, efficient problem solving, and closer working relationships than less mature ones. Details are reported in section 7.5.

9.3.1 Network Structures of Communication

For partnering behaviour in open communication structure, more mature partnering projects have a communication structure with higher degree centrality, higher closeness centrality, and more evenly distributed betweenness centrality than less mature partnering projects. More mature partnering projects have a communication structure of more cohesive subgroups and fewer isolates than less mature partnering projects. More mature partnering projects have a communication structure with higher regular equivalence than less mature partnering projects.

9.3.2 Network Structures of Problem Solving

For a structure with efficient problem solving, more mature partnering projects have lower degree centrality, higher closeness centrality, and more evenly distributed betweenness centrality of conflict than less mature partnering projects. More mature partnering projects form cohesive subgroups that are larger in size and greater in number than less mature partnering projects for problem solving. More mature partnering projects have higher regular equivalence for the solving of problems than less mature partnering projects.

9.3.3 Network Structures of Working Relationships

In terms of the structure of close working relationships, more mature partnering projects have higher degree centrality, higher closeness, and more evenly distributed betweenness centrality of cooperation in working relationships than less mature partnering projects. More mature partnering projects form more cohesive subgroups than less mature partnering projects. More mature partnering projects have higher regular equivalence in their working relationships than less mature partnering projects.

9.3.4 Network Structure of Cooperative Relationship between Partnering and Non-partnering Projects

This study further contributes to validate these research findings on patterns of cooperative alliance relationships by comparing the results with a non-partnering project in Hong Kong in terms of communication, problem solving and working

relationship. Partnering changes the project teams' communication method from more formal to informal one. Partnering provides a trustful environment for partners to have informal discussion rather than formal exchange of letters before reaching the agreement. Partnering also allows better information sharing. Communication is more effective in partnering projects. However, partnering projects do not necessarily have fewer conflicts. Partnering only provides a mechanism to better resolve problems and encourages joint problem solving. Problem solving is more efficient in partnering projects. Partnering significantly improves cooperativeness of working relationship and allows team building. Working relationship among project team members is closer in partnering projects. This study successfully demonstrates that partnering projects exhibit a higher level of cooperative alliance relationships than non-partnering projects.

9.4 FURTHER STUDIES

This study has investigated cooperative relationships of partnering projects in Hong Kong. Further studies on cooperative alliance relationships are suggested, including in carrying out an international study to investigate cooperative alliance relationships of construction projects in different countries like the UK, Australia, the European countries and comparing them with Hong Kong. The outcome of cooperative alliance relationships would be affected by factors like cultural difference, style of leadership, personality of project team members etc. It is useful to build up a model of cooperative alliance relationship encapsulating different cooperative management strategies in the construction industry by comparing and contrasting the factors leading to cooperative alliance relationships in different countries. The relationship model would help the

construction project managers to consider the critical factors that determine formation of cooperative alliance relationship and help them to choose the most suitable cooperative management strategies in their projects.

An alternative research methodology using a longitudinal study of cooperative alliance relationships can be considered, taking into account of planning stage, design stage, construction stage, and testing and commissioning stage. Dynamic patterns of cooperative relationship in different stages of construction can be revealed. The findings would provide useful insights to the construction managers to handle project team relationship properly and find out the key to build up a cooperative relationship from the beginning of the project. The greatest difficulty in carrying out a longitudinal study would be time constraint. However, a longitudinal study is feasible in the construction industry where similar types of projects in different stage of construction are available for investigation at the same time. One such example is the construction industry of China which is experiencing a drastic increase in demand.

9.5 CONCLUSIONS

To conclude, this study of cooperative partnering relationship is useful to the construction industry, it vividly helps those construction project managers who want to build up cooperative partnering relationship in their project consider using partnering. It is also useful to those construction practitioners practicing partnering. They can use the findings of this study as a yardstick to assess the cooperative relationship of their projects. To the academia, the social network analysis adopted in this study provides a valid research method to reveal and

analyse behavioural patterns of cooperative partnering relationship. In addition to dyadic and static analysis, this study is a successful attempt to reveal the complex and dynamic pattern of cooperative relationship of partnering projects from a network perspective. Further studies can be explored in this area.

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APPENDIX A: INIVITATION LETTER

Dear Sir/ Madam,

Re: A Study of Cooperative Alliance Relationship in Construction Industry

I am a research student for the degree of Master of Philosophy in the Department of Building and Real Estate, the Hong Kong Polytechnic University, under the supervision of Dr. Linda Fan, the Associate Head of the Department. My research interest is on cooperative alliance relationship in construction industry.

Since partnering is the prevailing form of construction alliance in Hong Kong, I would like to select real life construction projects with partnering to examine the cooperative relationship among project team members. My study adopts a case study approach and requires ongoing project team members report their experience in partnering by filling in a questionnaire in about fifteen minutes. If possible, follow up short semi-structured interviews with some project representatives would be conducted.

The XXX project of your company, being one of the latest prime commercial developments in Hong Kong to adopt partnering, would be very worth investigating. I shall be very grateful if I could be arranged to collect data from this project.

Your company's contribution in this research, which would improve project team relationship, is much appreciated. Please contact the undersigned at:

E-mail: carol.hon@

Tel: XXXXXXXX (office) / XXXXXXXX (mobile)
Fax: XXXXXXXX

Address: Department of Building and Real Estate, Hong Kong Polytechnic University, Hung Hom, Kowloon.

at your earliest convenience. Looking forward to your reply. Thank your for your attention.

Yours sincerely,

_____	_____
Carol Hon Ka Hung	Dr. Linda Fan
Research student	Associate Head (Supervisor)
BRE Dept.	BRE Dept.
HKPOLYU	HKPOLYU

Encl:) Questionnaire- English version(4 pages)
Interview questions (1 page)

APPENDIX B: QUESTIONNAIRE

Instructions:

(1) Please answer this questionnaire with reference to ***XXX Project****, unless otherwise specified.*

(2)Completed questionnaire will be collected in person by Miss Carol Hon during the interview or you may return it by fax (2764 5131) or by post to the Department of Building and Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon

Part 1: Personal Particulars and Project Information

1.1 Name: _____

1.2 Your title in the project: _____

1.3 Your role in the project: ☐ Client PM ☐ Architect ☐ Client QS ☐ Client BS Engineer ☐ Client Structural Engineer ☐ Contractor PM ☐ Site Agent ☐ Contractor QS ☐Contractor BS Engineer ☐ Contractor Structural Engineer ☐ Subcontractor

1.4Age: ☐ Below 20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ Above 60

1.5 Highest level of education: ☐ Diploma/ Certificates ☐ Bachelor's Degree ☐ Master's Degree ☐ Doctorate Degree ☐ Others_____

1.6 Working experience in the construction industry: ☐ < 3 years ☐ 3 to 8 years ☐ 9 -15 years ☐ 16 - 20 years ☐ > 20 years

1.7 Management Level: ☐ Senior ☐ Middle ☐ Junior

1.8 Professional qualification: _____

1.9 Prior experience in alliance/ partnering: ☐ Yes ☐ No

1.10 Does your firm have the following business relationships with partners of this project?

a) Past business relationship: ☐ Yes ☐ No ☐ Don't know

b) Concurrent business relationship in other projects: ☐ Yes ☐ No ☐ Don't know

c) Future cooperation opportunities: ☐ Yes ☐ No ☐ Don't know

Part 2: Alliance Formation

Please indicate to what extent you agree with the following statements that describe the alliance formation of your project by circling a number in the given scale.		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Alliance formation inducements:						
2.1	Avoid opportunistic behaviour	1	2	3	4	5
2.2	Reduce uncertainty of interdependency	1	2	3	4	5
2.3	Share risk among partners	1	2	3	4	5
2.4	Share resources capabilities	1	2	3	4	5
2.5	Acquire new skills or knowledge	1	2	3	4	5
2.6	Enhance market competitive power	1	2	3	4	5

2.7	Peer influence from the industry	1	2	3	4	5
2.8	Pressure from the government or regulations	1	2	3	4	5
2.9	Follow the successful experience of other firms	1	2	3	4	5
2.10	Prior social relationship	1	2	3	4	5
Alliance formation opportunities:						
2.11	Possess technical capital or expertise	1	2	3	4	5
2.12	Possess commercial capital (e.g. financially sound)	1	2	3	4	5
2.13	Possess social capital (e.g. good reputation)	1	2	3	4	5

Part 3: Determinants of Cooperative Alliance Relationship

Please indicate to what extent you agree with the following statements that describe cooperative alliance relationship by circling a number in the given scale.		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
3.1	The partners have contributed effort and resources to form a cooperative relationship	1	2	3	4	5
3.2	The partners have concurrent relationships in other projects	1	2	3	4	5
3.3	The partners are equally dependent on each other	1	2	3	4	5
3.4	The partners have a top- down commitment to cooperate	1	2	3	4	5
3.5	The partners are working to complete the project in an effective manner	1	2	3	4	5
3.6	The partners are allowed to participate in setting goals	1	2	3	4	5
3.7	The partners are allowed to participate in planning activities	1	2	3	4	5
3.8	The partners had a successful previous relationship	1	2	3	4	5
3.9	The partners have shared values and common goals	1	2	3	4	5
3.10	The partners are willing to take risks	1	2	3	4	5
3.11	The partners are known to be trustworthy	1	2	3	4	5
3.12	The partners have a good reputation in the industry	1	2	3	4	5
3.13	Effective and efficient communication	1	2	3	4	5
3.14	The partners share information with each other	1	2	3	4	5
3.15	The partners are encouraged to participate and exchange ideas	1	2	3	4	5
3.16	The partners have full access to all useful information	1	2	3	4	5
3.17	The partners have no hidden agenda	1	2	3	4	5
3.18	The partners solve problems jointly	1	2	3	4	5
3.19	Problems are solved before they escalate	1	2	3	4	5
3.20	The partners try to avoid disputes and reduce the use of litigation	1	2	3	4	5
3.21	The partners are open to innovative ideas	1	2	3	4	5
3.22	The partners are responsive to emergencies or changing needs	1	2	3	4	5

3.23	The possibility of inter-organizational learning	1	2	3	4	5
3.24	The partners are very likely to interact in the future	1	2	3	4	5
3.25	The process of interaction is perceived to be equitable and just	1	2	3	4	5
3.26	One partner cooperates and the others follow	1	2	3	4	5
3.27	The partners seek to achieve a win: win situation	1	2	3	4	5
3.28	Set up mechanism for effective decision making	1	2	3	4	5
3.29	Rewards are given to motivate cooperation	1	2	3	4	5
3.30	Punishments are imposed for mutual non-cooperative actions	1	2	3	4	5
3.31	A mind open to new possibilities and new alternatives	1	2	3	4	5
3.32	Full authority for action has been delegated to the project team	1	2	3	4	5
3.33	Fully comply with the request of the other partner, even at the expense of one's own short-term interests	1	2	3	4	5
3.34	The goals of the company and the objectives of the partners are compatible with each other	1	2	3	4	5
3.35	The technical capabilities of both partners are compatible with each other	1	2	3	4	5
3.36	The organizational procedures of the partners are compatible	1	2	3	4	5
3.37	The employees of the partnering companies have similar professional or trade skills	1	2	3	4	5
3.38	Constructive handling of differences	1	2	3	4	5
3.39	Building a sense of belonging and pride	1	2	3	4	5
3.40	Feedback and performance evaluations	1	2	3	4	5
3.41	Clearly setting out the roles, duties and responsibilities of each party	1	2	3	4	5
3.42	Supportive leaders know how to cooperate	1	2	3	4	5
3.43	The organizational culture supports cooperation	1	2	3	4	5

Part 4: Interactive Process of Cooperation

4.1 Frequency of Formal Contact **Please indicate *frequency of formal contact* (e.g. correspondences, meetings) you have been made with other project team members by numbers from 0 to 5.** **(0= None; 1 = Very infrequent;** **5 = Very frequent; N/A= Not applicable)**	**Design Stage**	**Construction Stage**	**Completion Stage**	**Design Stage**	**Construction Stage**	**Completion Stage**
	Case Study			*Similar Project WITHOUT Partnering*		
Client Project Manager						
Architect						
Client QS						

Client BS Engineer						
Client Structural Engineer						
Contractor Project Manager	N/A	N/A	N/A	N/A	N/A	N/A
Site Agent						
Contractor QS						
Contractor BS Engineer						
Contractor Structural Engineer						
Subcontractor						

4.2 Frequency of Informal Contact **Please indicate *frequency of informal contact* (e.g. telephone, e-mail) you have been made with other project team members by numbers from 0 to 5.** **(0= None; 1 = Very infrequent;** **5 = Very frequent; N/A= Not applicable)**	**Design Stage**	**Construction Stage**	**Completion Stage**	**Design Stage**	**Construction Stage**	**Completion Stage**
	Case Study			*Similar Project WITHOUT Partnering*		
Client Project Manager						
Architect						
Client QS						
Client BS Engineer						
Client Structural Engineer						
Contractor Project Manager	N/A	N/A	N/A	N/A	N/A	N/A
Site Agent						
Contractor QS						
Contractor BS Engineer						
Contractor Structural Engineer						
Subcontractor						

4.3 Please indicate the frequency of using the following communication channels. (1=Very infrequent, 5= Very frequent, N/A= Not Applicable)		**Case Study**	**Similar Project WITHOUT Partnering**
4.3.1	Formal written documentation (e.g. letter, report)		
4.3.2	Informal written documentation (e.g. site memos, e-mail)		
4.3.3	Formal face-to-face contact (e.g. minuted meeting)		
4.3.4	Informal face-to-face contact (e.g. personal visits)		
4.3.5	Verbal communication (e.g. telephone)		

4.4 Frequency of Conflict **Please indicate the *frequency of conflict* (e.g. disputes, claims) you encountered with project team members by numbers from 0 to 5.** **(0= None; 1 = Very infrequent; 5 = Very frequent; NA= Not applicable)**	**Design Stage**	**Construction Stage**	**Completion Stage**	**Design Stage**	**Construction Stage**	**Completion stage**
	Case Study			*Similar Project WITHOUT Partnering*		
Client Project Manager						
Architect						
Client QS						
Client BS Engineer						
Client Structural Engineer						
Contractor Project Manager	N/A	N/A	N/A	N/A	N/A	N/A
Site Agent						
Contractor QS						
Contractor BS Engineer						
Contractor Structural Engineer						
Subcontractor						

4.5 Working relationship **Please indicate *working relationship* you have been experienced with other project team members by numbers from 0 to 5** **(0= None; 1 =Adversarial; 5 = Cooperative; N/A= Not applicable)**	**Design Stage**	**Construction Stage**	**Completion Stage**	**Design Stage**	**Construction Stage**	**Completion Stage**
	Case Study			*Similar Project WITHOUT Partnering*		
Client Project Manager						
Architect						
Client QS						
Client BS Engineer						
Client Structural Engineer						
Contractor Project Manager	N/A	N/A	N/A	N/A	N/A	N/A
Site Agent						
Contractor QS						
Contractor BS Engineer						
Contractor Structural Engineer						
Subcontractor						

Part 5: Cooperation performance

Please indicate level of cooperation performance of the project by circling a number in the given scale.		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
5.1	The goals of the project have been achieved	1	2	3	4	5
5.2	Overall performance of alliance is satisfactory	1	2	3	4	5

~ End of the Questionnaire ~

~ Thank you for your Contribution ~

APPENDIX C: INTERVIEW QUESTIONS

Section 1: Project information

1.1 Background of the project (Scope of work, GFA, type of project, project duration, contract sum, contract type, stakeholders etc.)

1.2 How do the type/ complexity of project and contract strategy affect implementation of partnering?

Section 2: Partnering implementation

2.1 What are the reasons/ motivations for implementing partnering?

2.2 Who initiate to form partnering? Does it affect the success?

2.3 Briefly describe partnering process (workshops, charter, monthly evaluation meeting) and how well it is actually implemented.

2.3 What are the critical factors to make partnering a success?

2.4 What are the benefits of adopting partnering in this project?

2.5 What are the difficulties in implementing partnering in this project?

2.6 Does partnering improve working relationship? If yes, how? What are the critical factors to achieve cooperative partnering relationship? Can this project achieve?

2.7 Describe partnering working relationship of the project in design stage, construction stage, and completion stage. How do you compare it with non-partnering project?

2.8 How to built trust and commitment for a project with partnering?

2.9 Does partnering improve communication efficiency and effectiveness? If yes, how? Describe the pattern of communication in design, construction and completion stage of this project. How do you compare it with non-partnering project?

2.10 Does partnering improve conflict resolution? If yes, how? What are the sources of conflict in design, construction and completion stage of the project? How are they resolved? How do you compare it with non-partnering project?

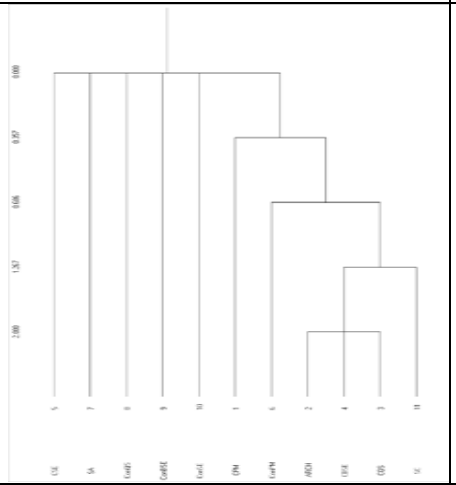
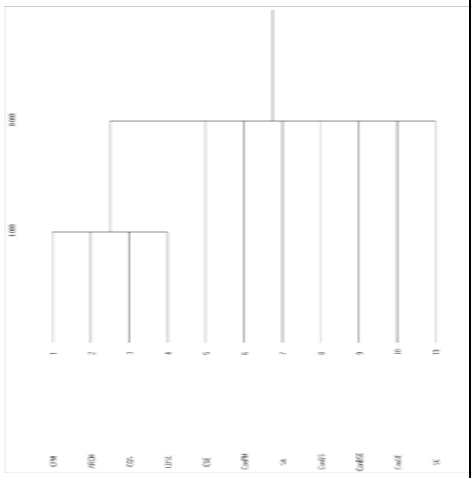
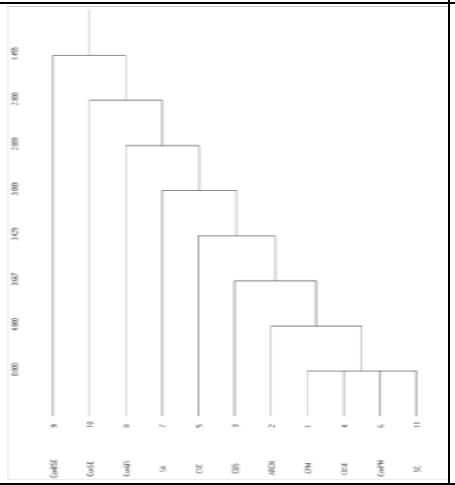
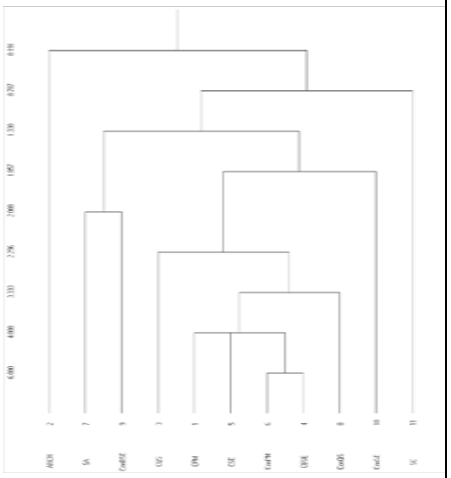
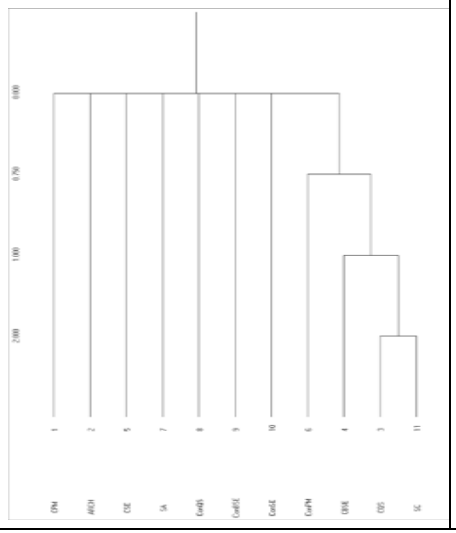
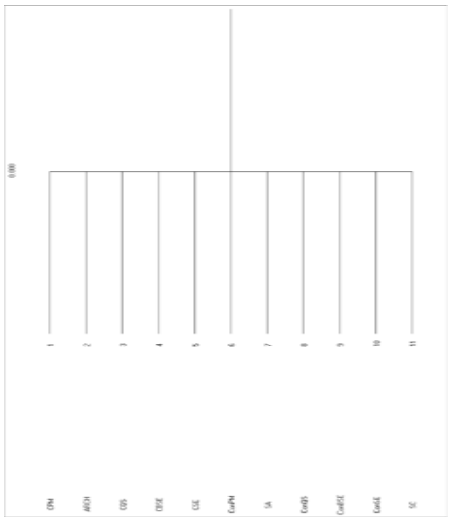
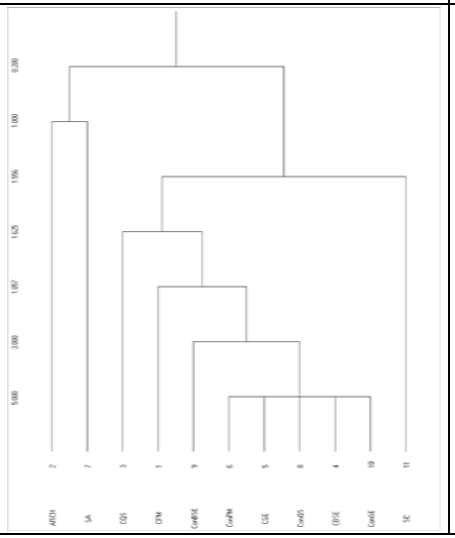
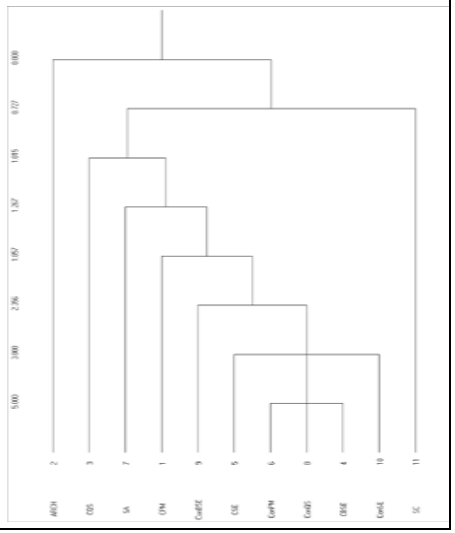
2.11 Does partnering improve project performance outcome? Can all partnering charter goals be achieved in this project?

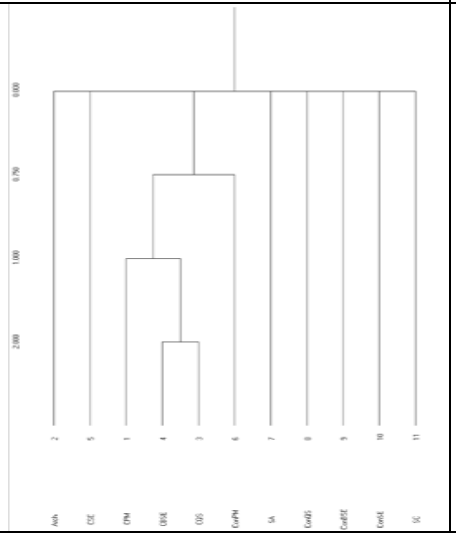
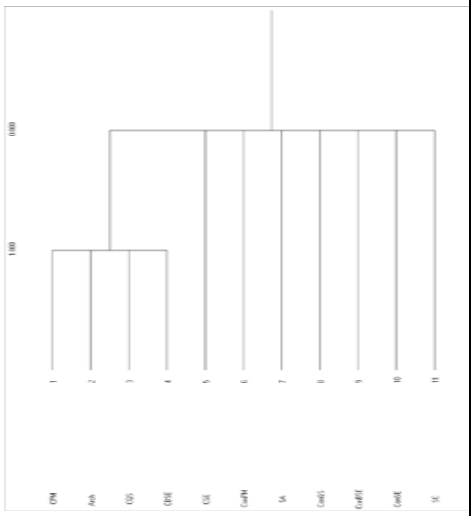
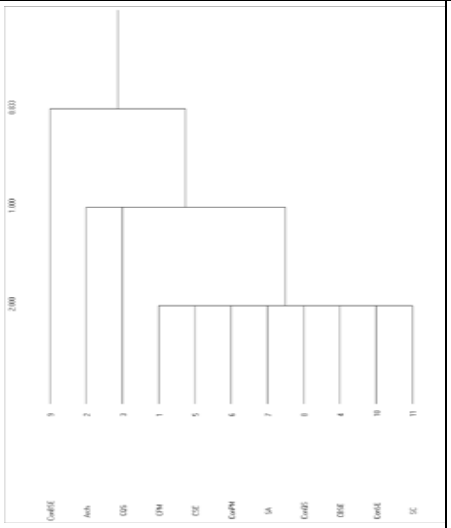
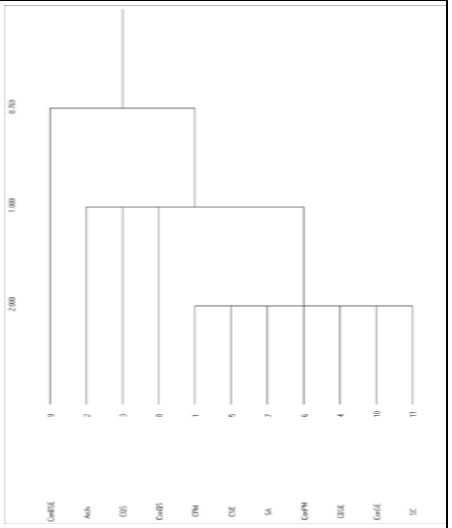
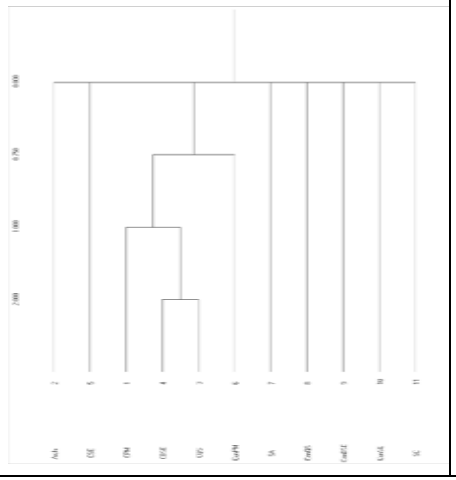
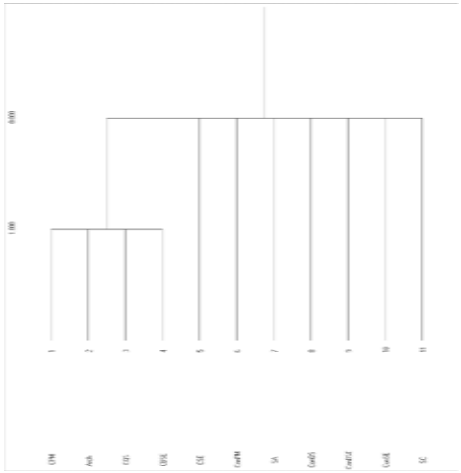
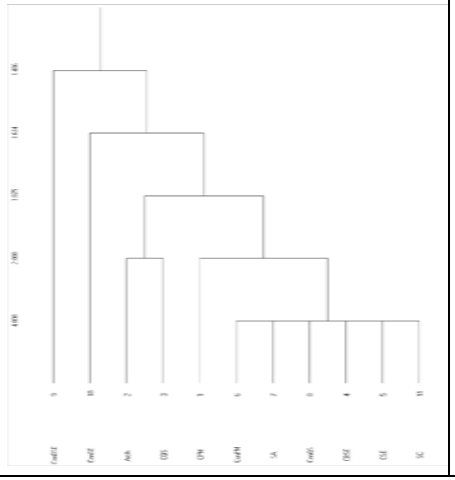
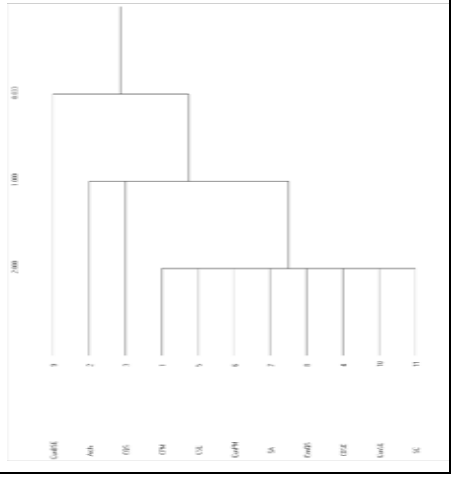
2.12 Does partnering induce long-term business relationship?

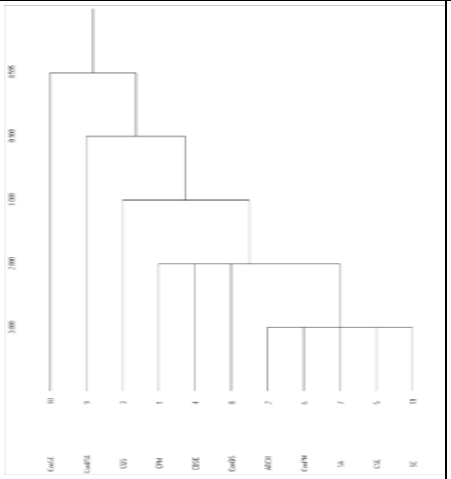
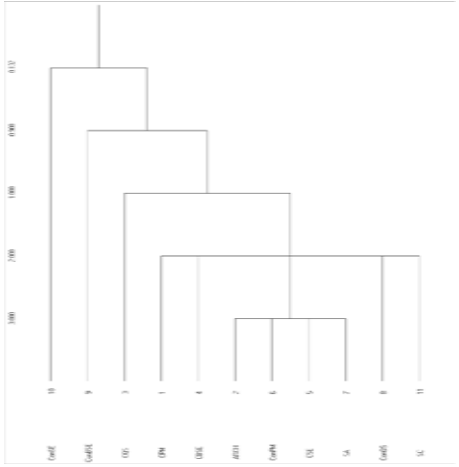
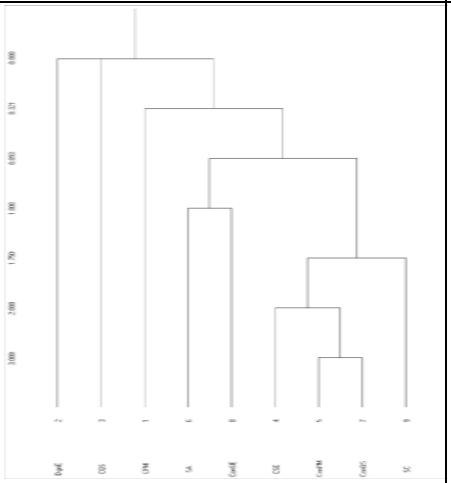
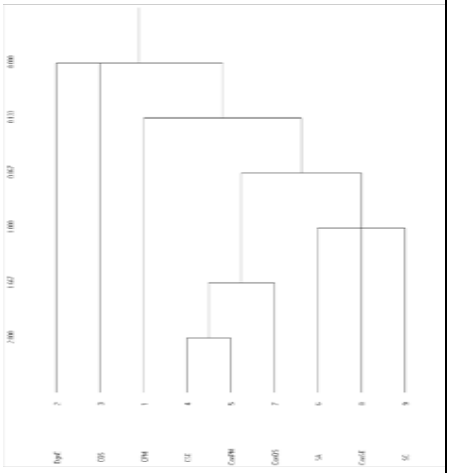
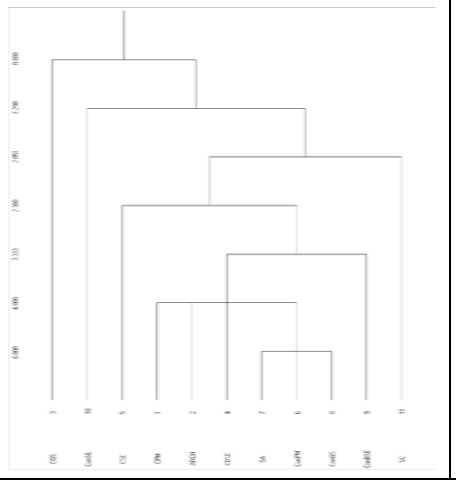
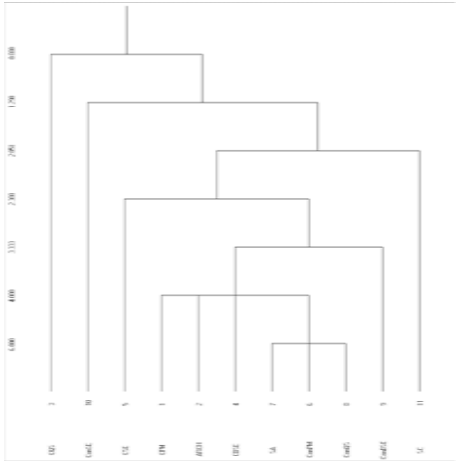
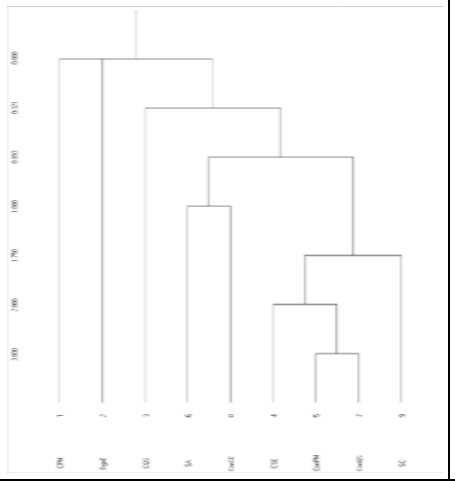
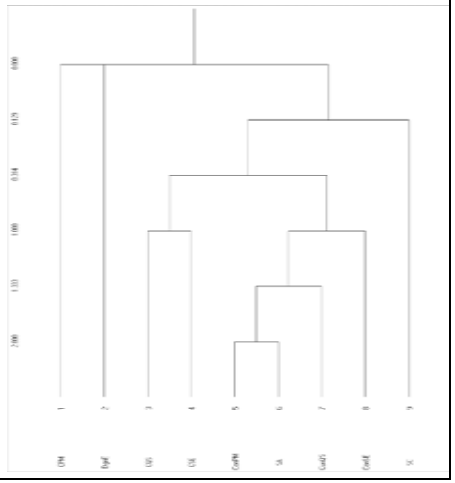
Section 3: Final comments

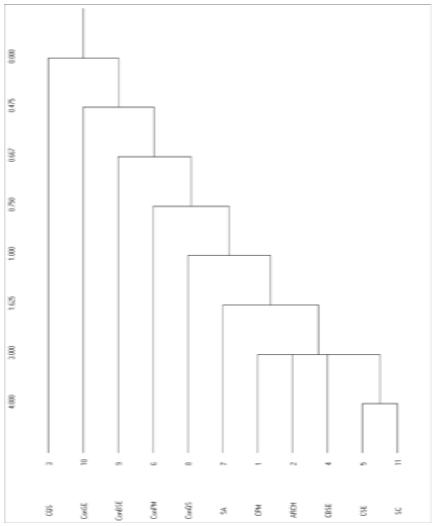
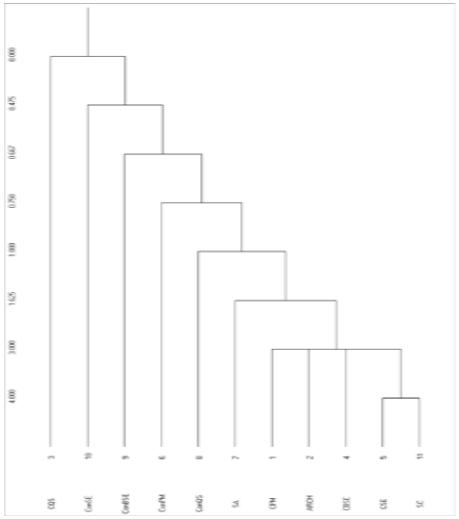
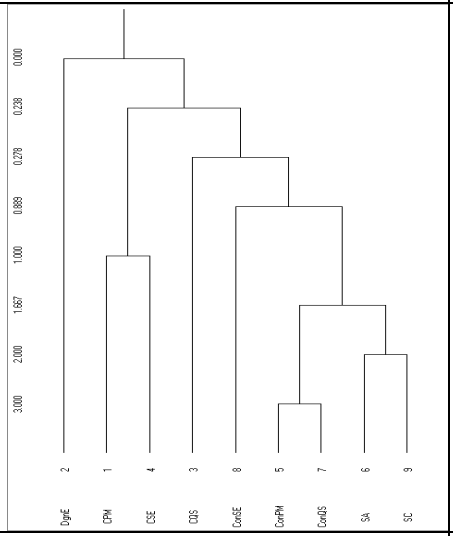
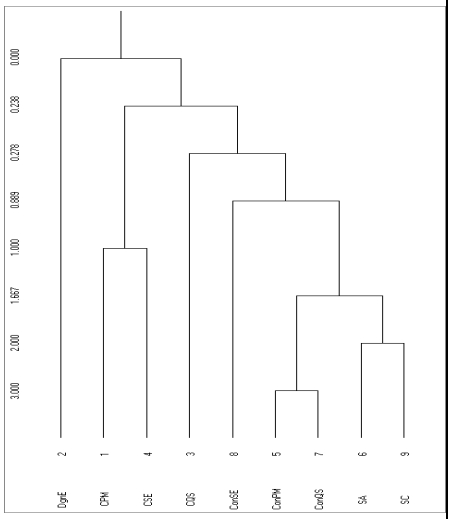
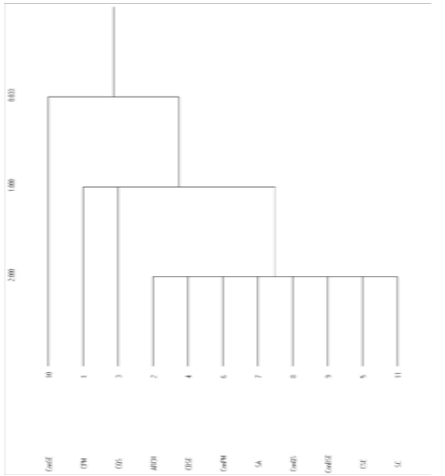
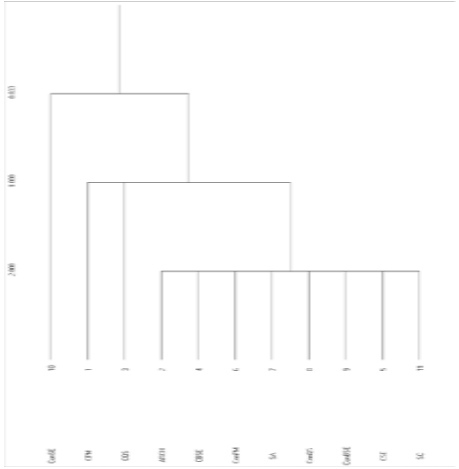
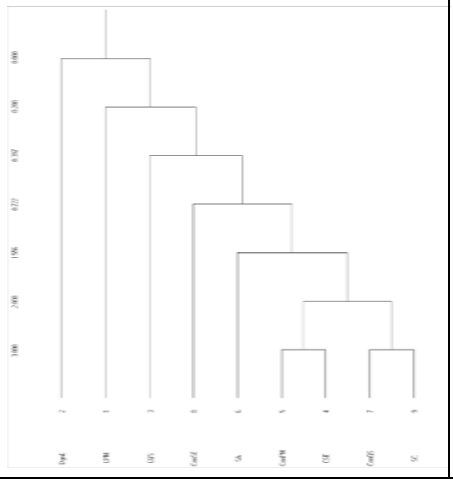
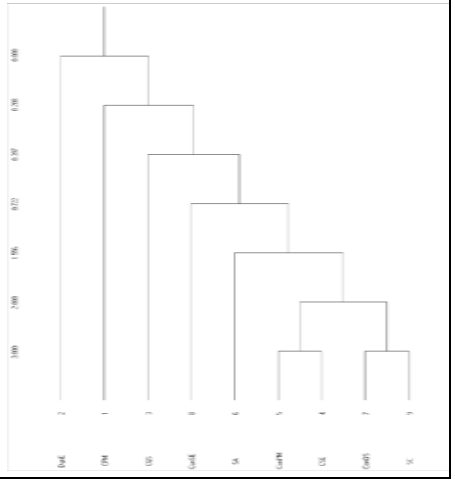
3.1 Do you regard partnering as an effective management tool to bring about cooperative alliance relationship?

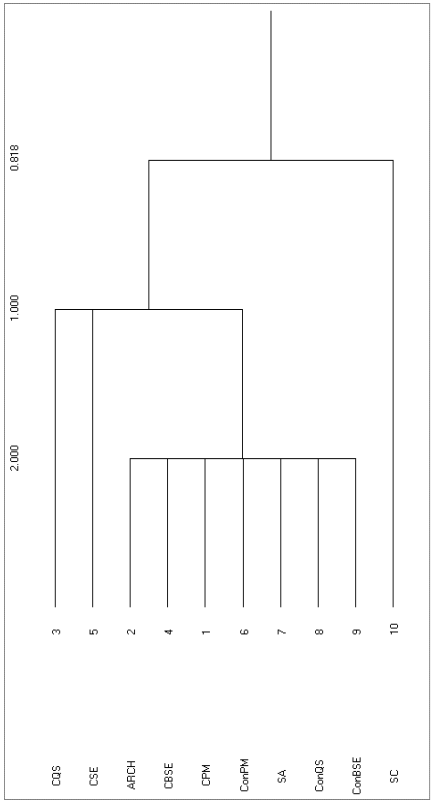
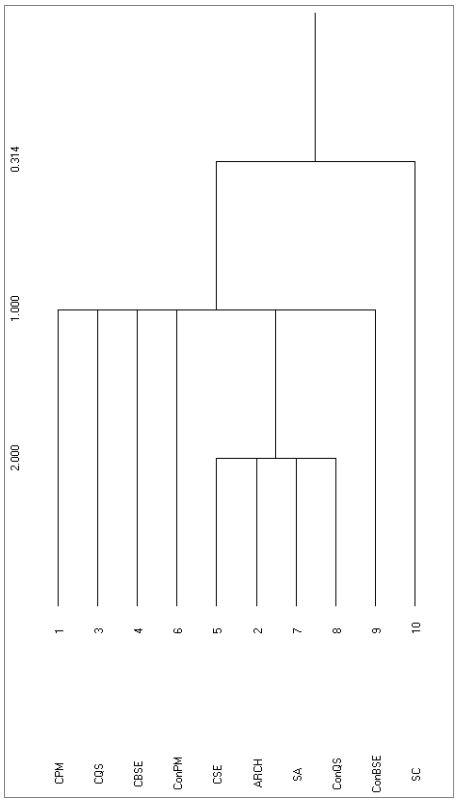
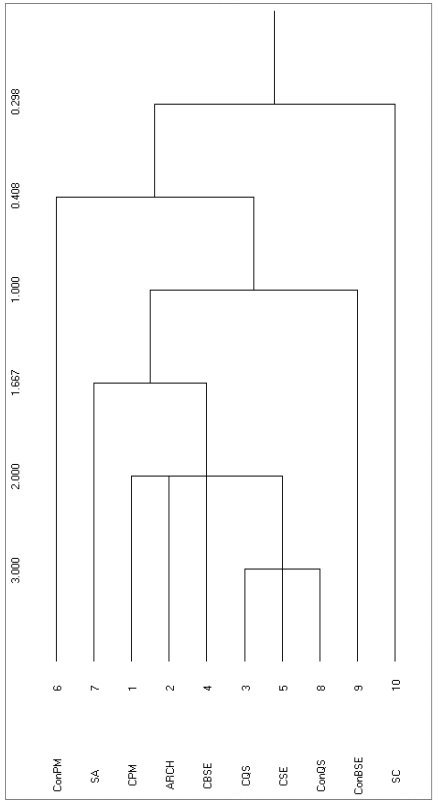
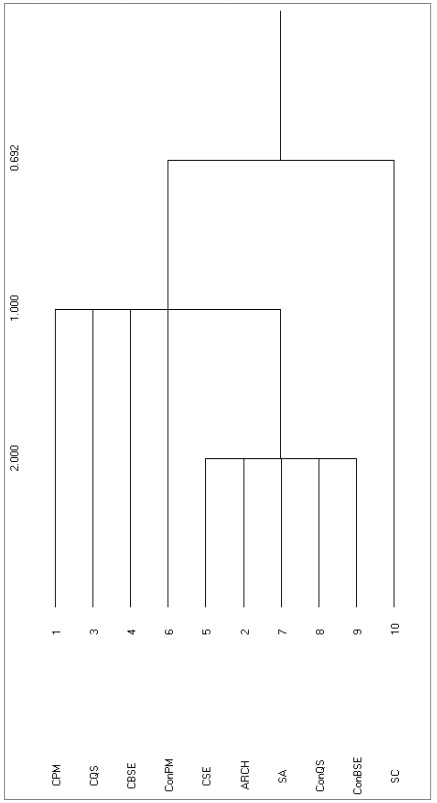
3.2 How do you see the future development of partnering?

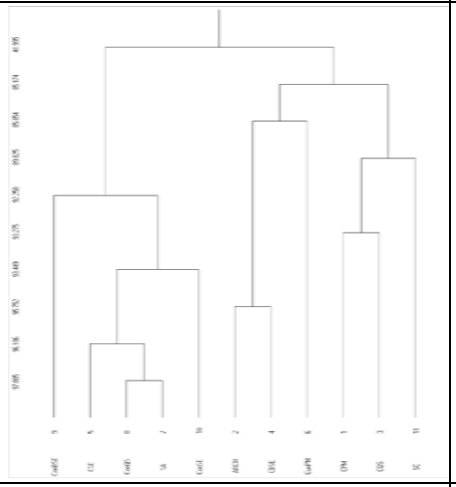
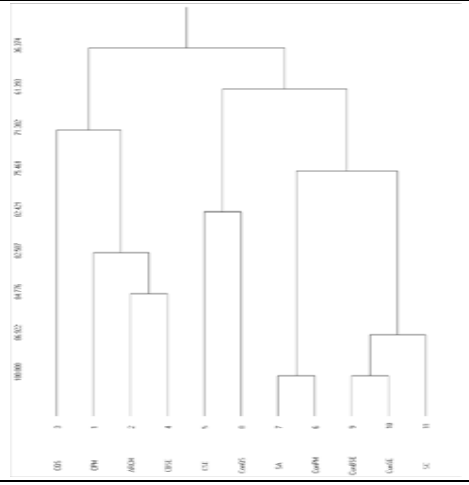
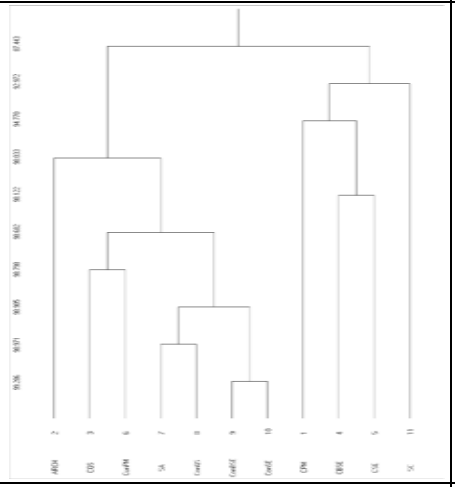
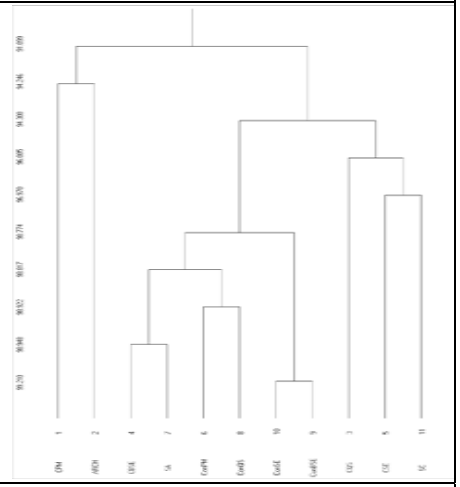
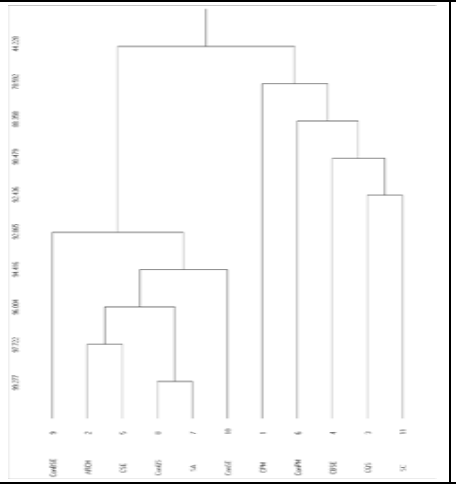
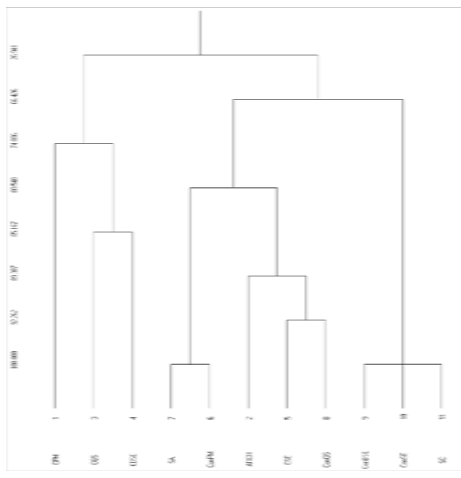
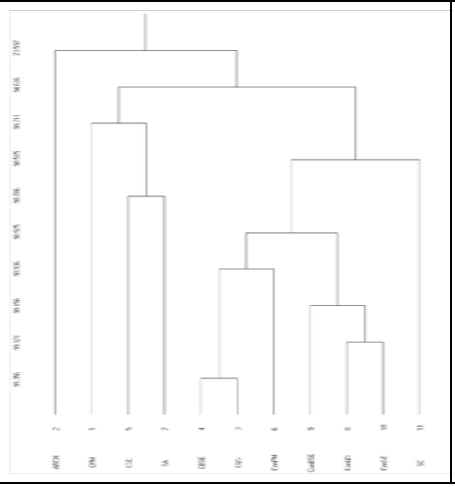
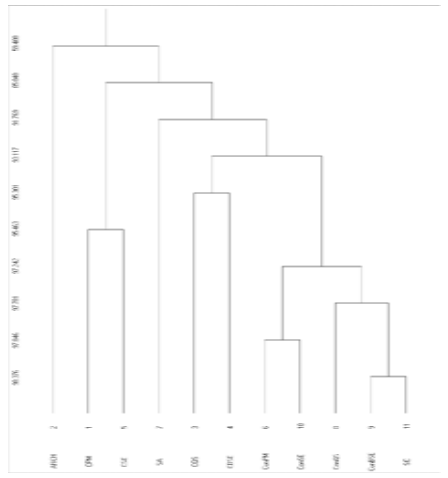
Appendix D	Case One -Design Phase		Case One- Construction Phase	
Clique- Dendrogram	Partnering	Non-partnering	Partnering	Non-partnering
Formal communication				
Informal communication				

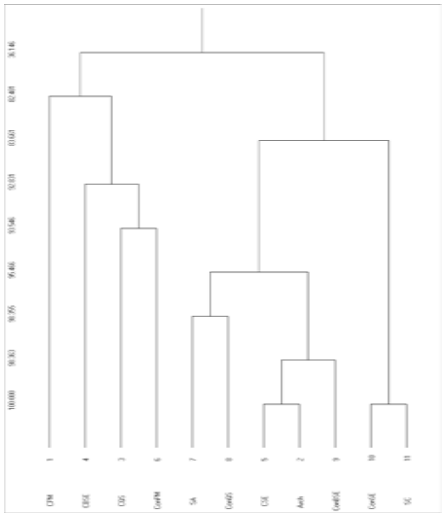
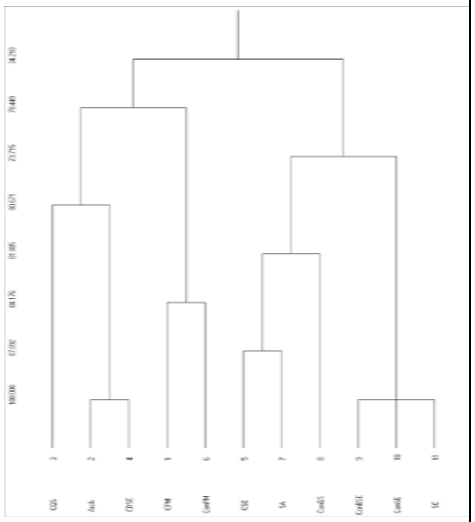
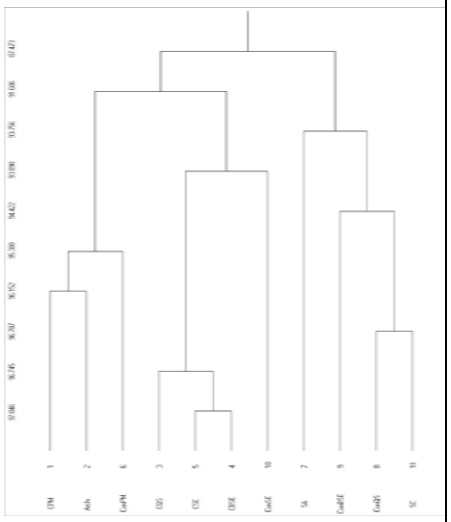
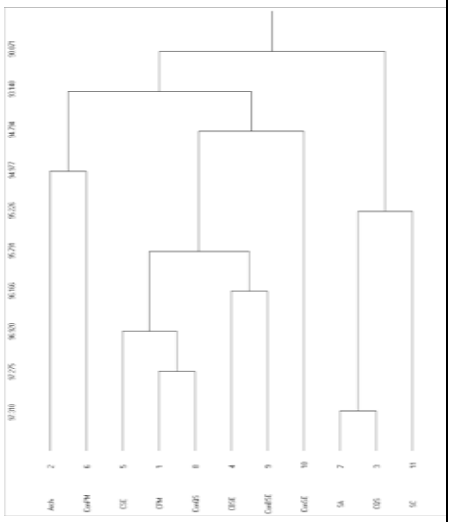
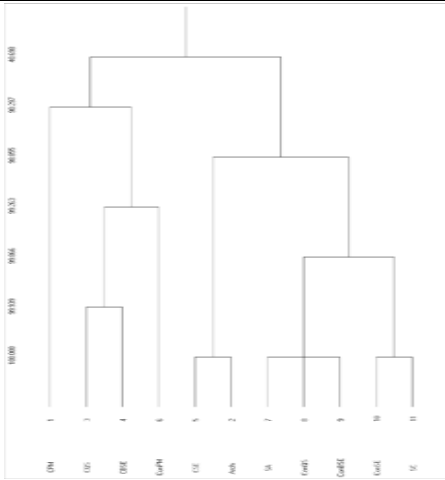
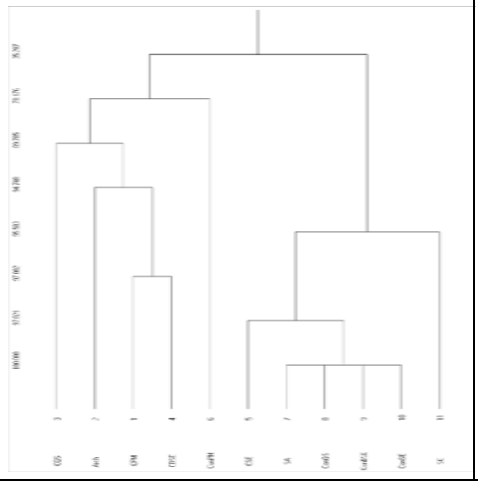
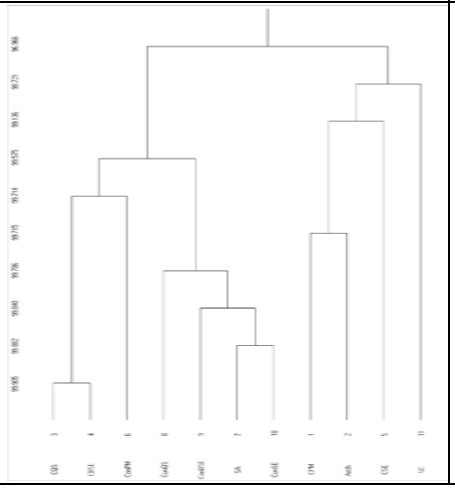
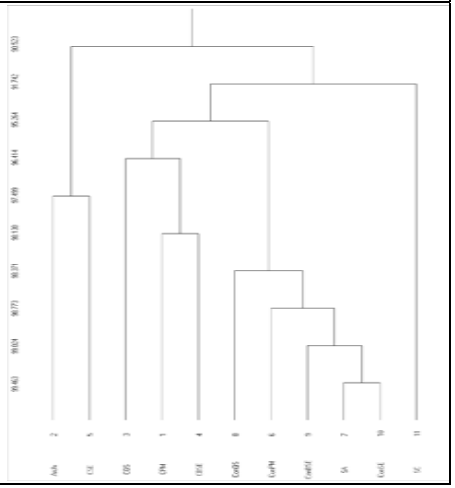
Appendix D Clique- Dendrogram	Case One -Design Phase		Case One- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Problem Solving				
Working Relation				

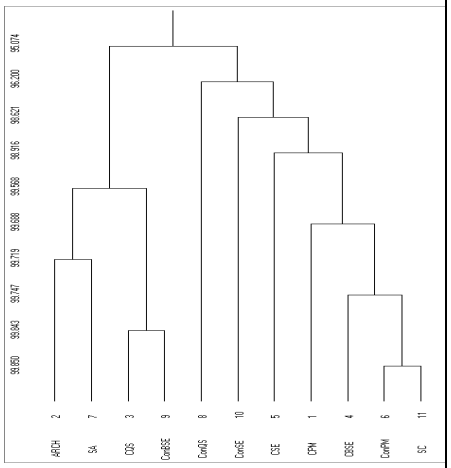
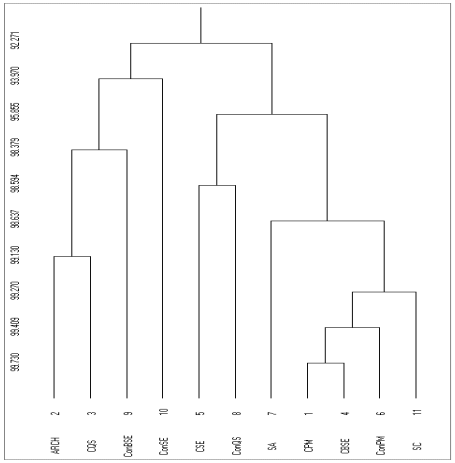
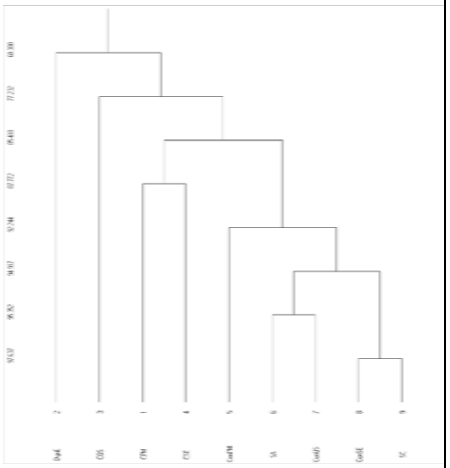
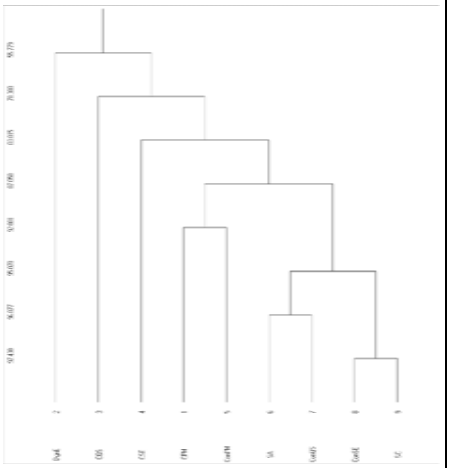
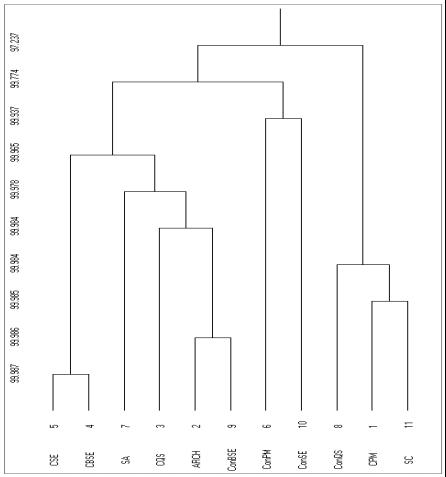
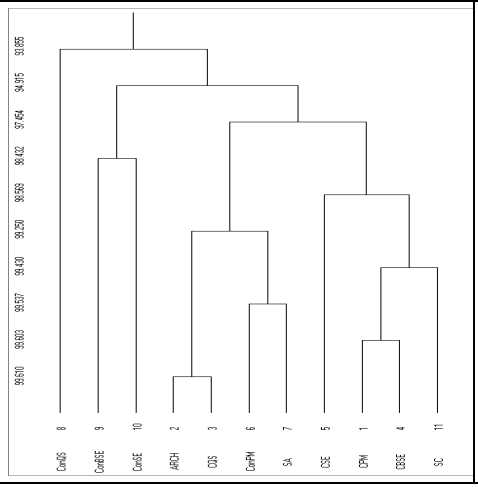
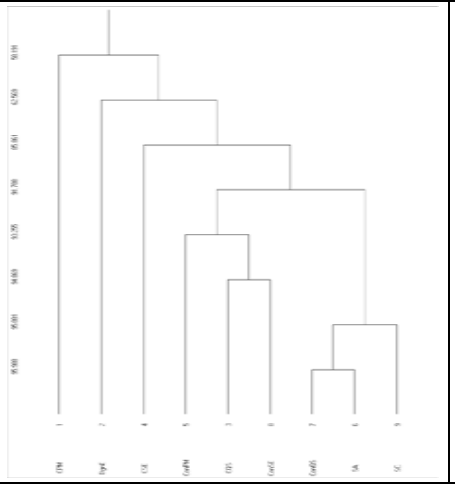
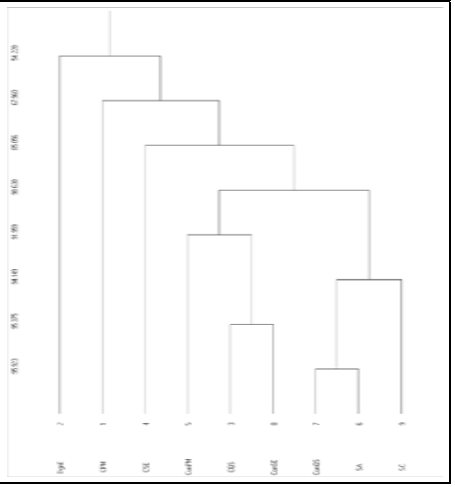
Appendix D Clique- Dendrogram	Case Two- Construction Phase		Case Three- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Formal communication				
Informal communication				

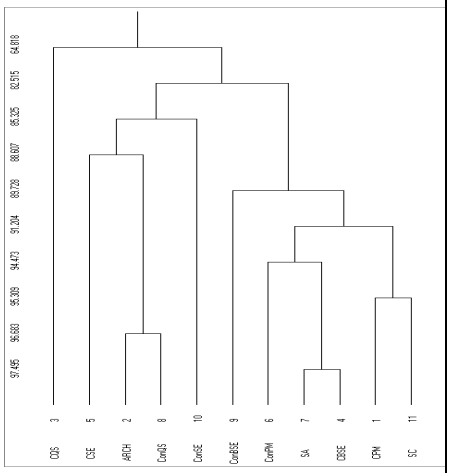
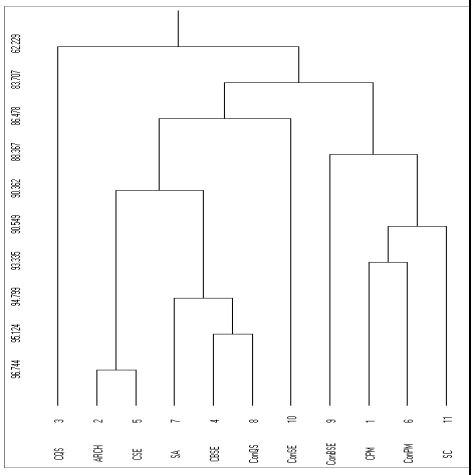
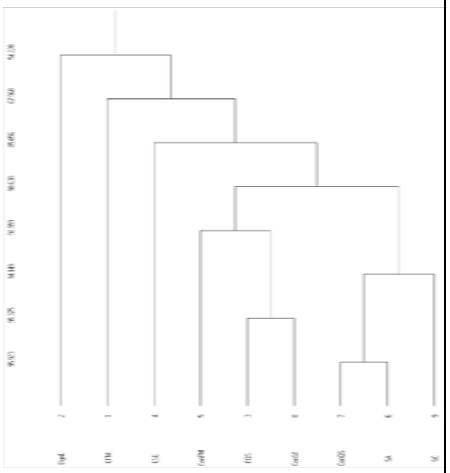
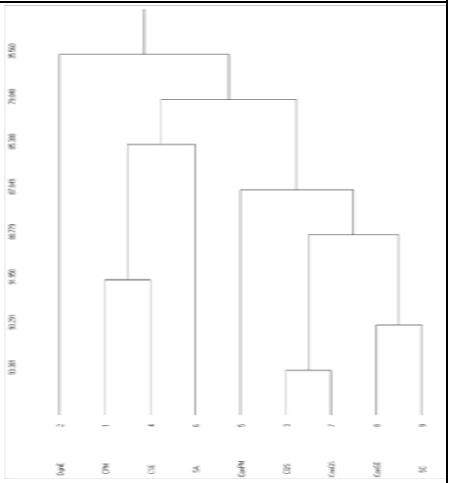
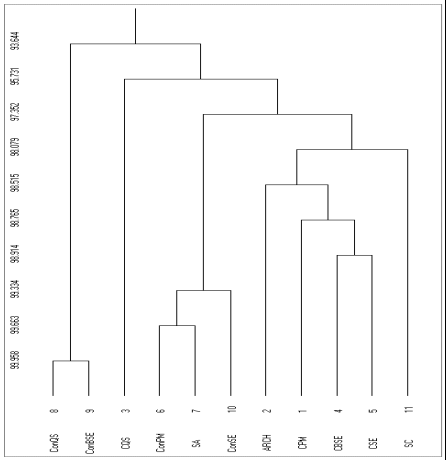
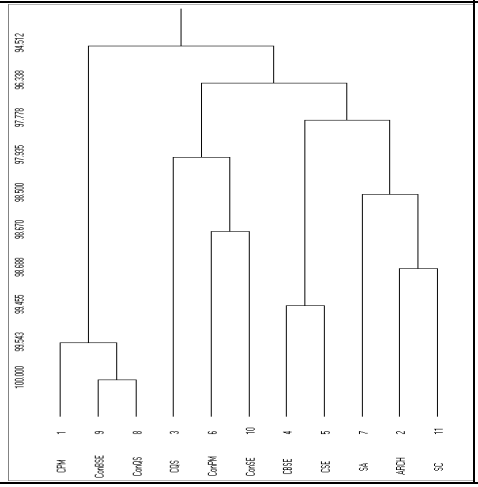
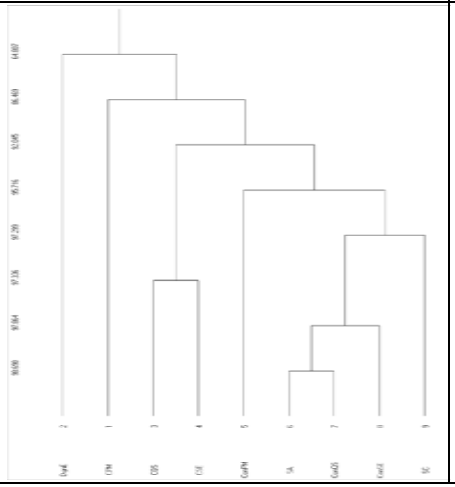
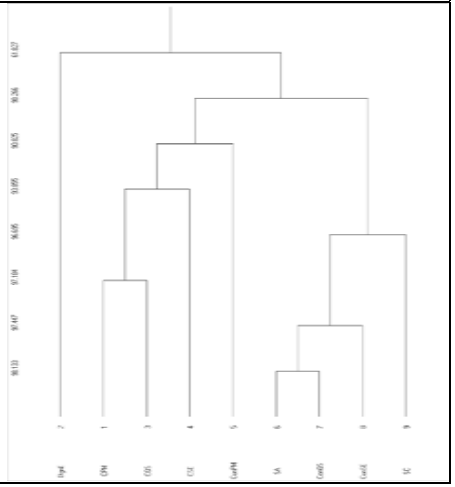
Appendix D Clique- Dendrogram	Case Two- Construction Phase		Case Three- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Problem Sovling				
Working Relation				

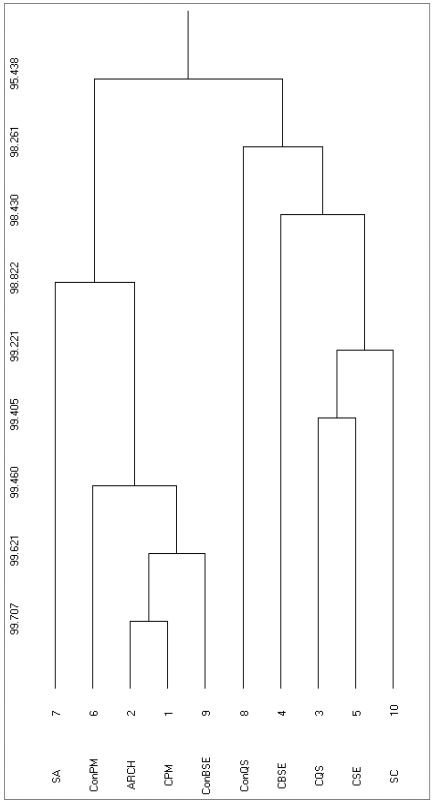
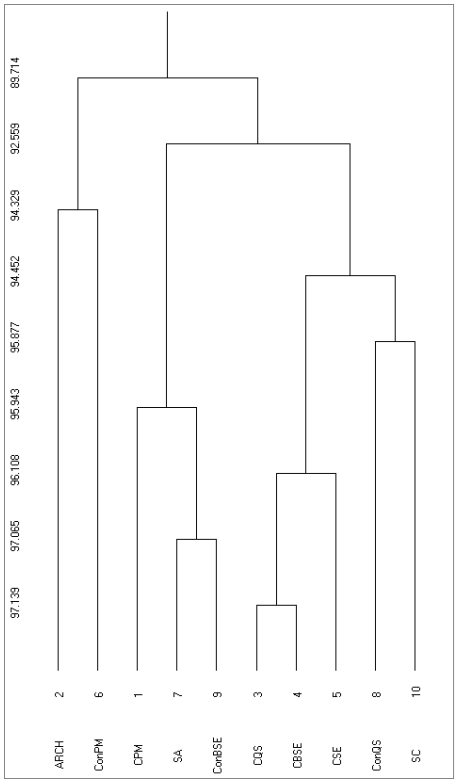
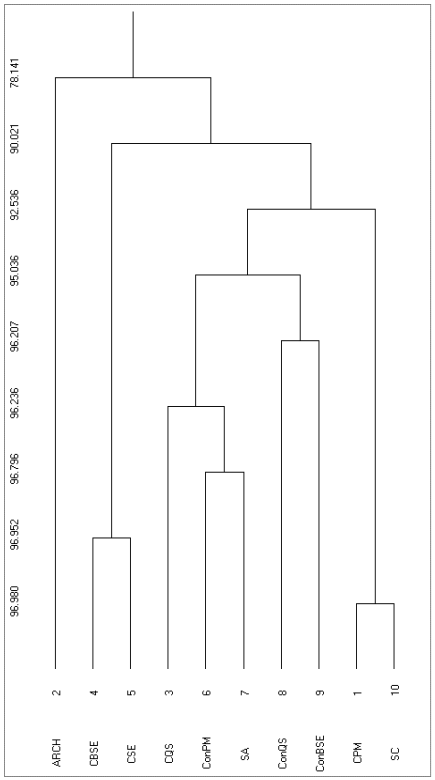
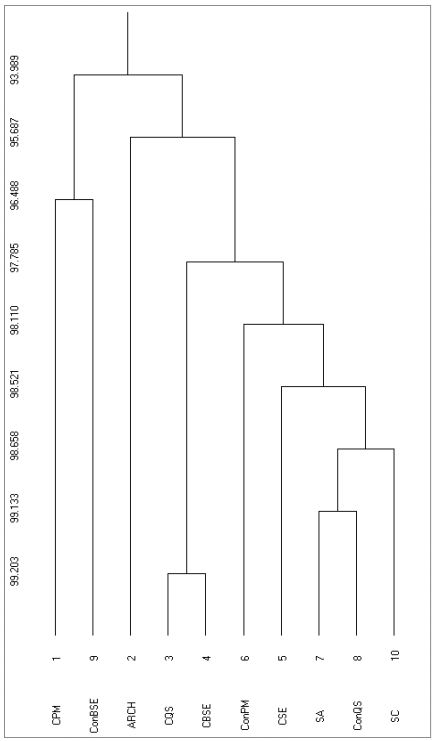
Appendix D Clique- Dendrogram	Validation Case Study			
	Formal Communication	Informal Communication	Problem Solving	Working Relation
				

Appendix E : Regular Equivalence - Dendrogram	Case One -Design Phase		Case One- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Formal communication				
Informal communication				

Appendix E : Regular Equivalence - Dendrogram	Case One -Design Phase		Case One- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Problem Solving				
Working Relation				

Appendix E : Regular Equivalence - Dendrogram	Case Two- Construction Phase		Case Three- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Formal communication				
Informal communication				

Appendix E: Regular Equivalence - Dendrogram	Case Two- Construction Phase		Case Three- Construction Phase	
	Partnering	Non-partnering	Partnering	Non-partnering
Problem Solving				
Working Relation				

Appendix E: Regular Equivalence - Dendrogram	Validation Case Study			
	Formal Communication	Informal Communication	Problem Solving	Working Relation
				

APPENDIX F- PREMILINARY STUDIES' REPORTS

Tseung Kwan O Extension Contract 607 (Station and Tunnel)

Interview with:

Interviewee	Position	Date
Mr. Dan Lam	Site agent of Leighton China State JV	29/7/2002
Mr. Malcolm Plummer	Project Manager of Leighton China State JV	21/8/2003
Mr. Brian Septon	Senior Construction Engineer of MTRC	21/8/2003

Background of the Case

The client (MTRC) introduced partnering to TKE project after the contract was awarded. It consisted of 34 major contracts: 13 civil contracts and 21 building services and E&M contracts. The project was started in Nov, 1998 and was finished in Aug, 2002. For the TKE station and tunnel contract, it was awarded to the Leighton China State JV. The project was risky and complex involving many interfaces between different contract, construction and design, and external parties.

Reasons to Adopt Partnering

- Uncertainty and risk

The primary reason to use partnering was to minimize uncertainty and risk from the project. Partnering improved communication; identified potential problems to eliminate risk. Trust building was important to make partnering a success. To start off, one party must take risk first and make an assumption that partners were going to be honest. Trust was brought up over time and largely depended on other parties' reaction. Trust building and risk taking was reciprocal. Building trust through the project eliminated uncertainty. Without partnering, project team relationship would not be so good.

- High resource dependency

MTRC invested huge capital in the TKE project. MTRC also used partnering in other small projects.

- Technological innovation

This project was designed not to introduce too much new technology because it was risky. The only objective of the client was to complete the project successfully.

- Social network structure

MTRC had prior relationship with most of the contractors because most of them had worked for the MTRC before. MTRC always wanted to improve efficiency through better relationship, no matter relationship was bad or good upon start off. Present relationship can be utilized in future projects. Contractors may have advantage in establishing relationship even though contract is awarded on competitive tendering basis.

Small projects of MTRC undergoing or in coming future:
Kowloon Tong interchange
Tsi Sha Tsui improvement work
Yau Tong Station
Disneyland railway

- Asset capability

Some subcontractors did not have the ability to form partnering. Their management was not well developed. MTRC wanted to develop relationship with subcontractors but it was difficult because MTRC and subcontractors had no direct relationship. Supply chain partnering would be much more difficult than forming partnering between client and contractors. However, the interviewee thought that supply chain partnering should be pushed to go ahead to capture substantial gains. MTRC was responsible for the project management and it had more direct involvement than the conventional approach.

- Others

Ultimate reason to adopt partnering was to complete project successfully and to reduce cost. Cost was reduced in this project. Besides partnering, there were many other reasons. For example, economic climate was much better when the contract was awarded. Construction cost was reduced with economic down turn and the project run very smoothly.

Factors Leading to Successful Partnering:

(1)The client's commitment to use partnering.
Success came from real commitment of the project team.
MTRC did research upfront to see what was partnering and the cost involved.
Additional cost of partnering must be smaller than cost savings of the contract.
The client's commitment was the key to drive forward.

MTRC's top management committed to use partnering. Supplementary agreement was signed to cover the risk factors for potential claims. All parties knew the risk and were willing to share risk, for example, the building surveyor forgot to leave hole to the structure. With partnering, there was no problem because it was recoverable under supplementary agreement. It would be more difficult for contractor to initiate to use partnering.

(2)Project nature.
Complex project was found to be more suitable to use partnering. In this project, the client could not control daily project details. Designated contractors belonged to the client but not the main contractor. For multi-discipline complex project, the client had to take a leading role. If the nominated contractor did not support partnering, the contractor could do nothing. But if the client initiates to use partnering, the nominated contractor had to follow.

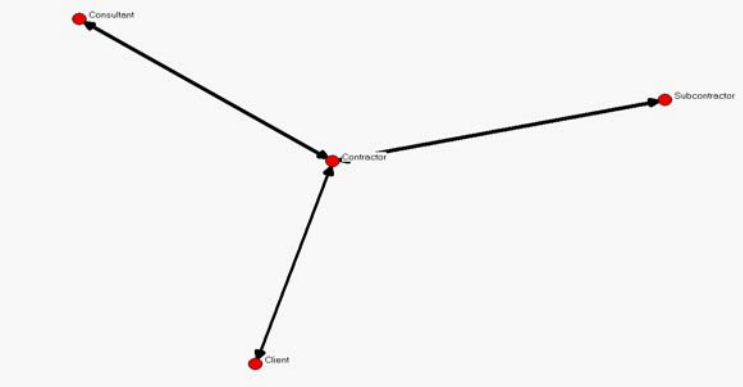
Preliminary Social Network Analysis

Do you agree partnering improves working relationship of this contract through:	Design phase	Construction phase	Completion phase
Level of trust			
• With client	4	4	4
• With consultant	3	4	5
• With designated /nominated subcontractors	3	4	5
Communication			
• With client	5	5	5
• With consultant	4	3	3
• With designated/ nominated subcontractors	3	5	4

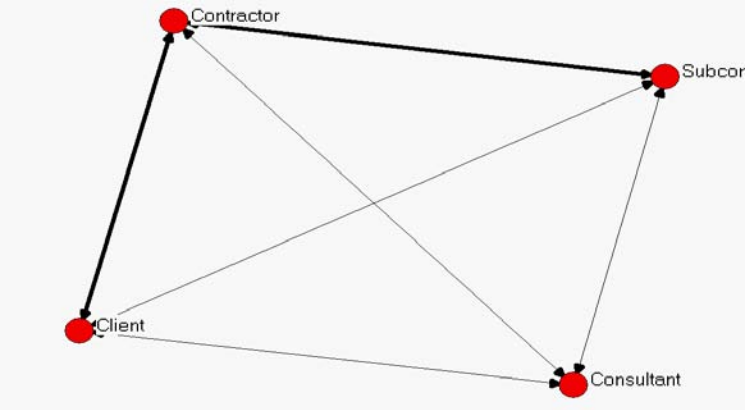
Effect of partnering on working relationship (1= Strongly disagree, 5= Strongly agree)

Do you agree partnering improves working relationship of this contract through:	Design phase	Construction phase	Completion phase
Level of trust			
• With contractor	N.A.	5	5
• With consultant	N.A.	3	3
• With sub-contractors	N.A.	2	2
Communication			
• With contractor	N.A.	4	4
• With consultant	N.A.	3	3
• With sub-contractors	N.A.	3	3

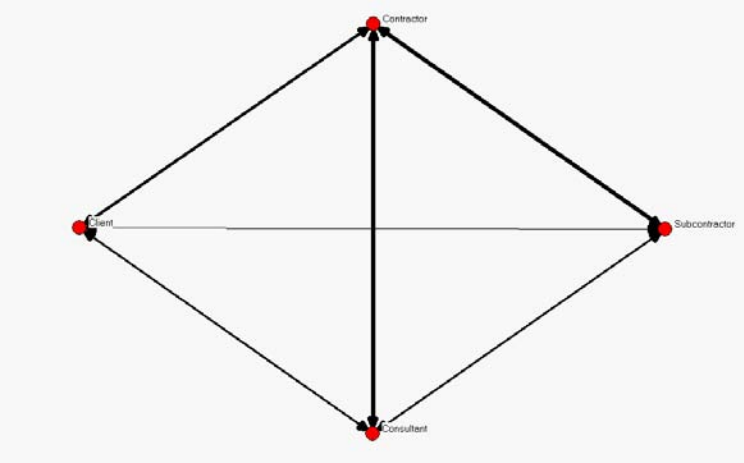
Design Phase- Communication



Construction Phase-Communication



Completion Stage- Communication



Methodological Improvements:

It was commented by the interviewees that questionnaire Part IIA and IIB were too brief and should be elaborated with full sentence for clarity.

MTRC is a committed client to use partnering. Its future projects are potential projects for in-depth case study investigation. Interviewees also provided a review about current partnering application in Hong Kong's construction industry and suggested several partnering projects available for investigation.

Although the literature suggested that social network data could be collected in interview, it was recommended by the interviewees that questionnaire would be more appropriate. Interviewees found it difficult to give a relative score on other partners by one-by-one question asking by the researcher. Follow up interviews could cross check the accuracy and consistency of the findings.

Non-partnering project relationship benchmark would need to be set up to compare with chosen partnering case study. One question should be asked for one type of relationship. Separate question should be set on working relationship and communication.

It was also found from preliminary testing of social network analysis that data should be in square matrix because some measures of network analysis needed square matrix. Missing data would distort the construction of network. Utmost effort was needed to ensure complete network data were collected.

It was learned from the preliminary study that it was important to identify the right person to participate in this research. Although different project had different jobs' title, key persons could be identified from an organization chart.

It was also found that data collection of communication should be divided into formal and informal communication. Interviewees commented that partnering changed communication behaviour from more formal to more informal.

Preliminary Questionnaire Survey

(a) Please read each question carefully before giving your opinions/answers.
(b) Please give your opinions/answers to each question by ticking (✓) in the appropriate boxes.

Part I: Personal Profile

Q1. Name: _____

Q2. Age:

20-29	30-39	40-49	50-59	Above 60
☐	☐	☐	☐	☐

Q3. What is your highest level of education?

- Certificate/Higher certificate/Diploma/Higher diploma ☐
- Bachelor's degree ☐
- Master's degree ☐
- Doctoral degree ☐
- Others please specify: _____

Q4. How would you classify your working organization in the following?

- Academic ☐
- Public client ☐
- Private client ☐
- Consultant ☐
- Main contractor ☐
- Sub-contractor ☐

Q5. How long have you been working in the construction-related industry?

- Less than 3 years ☐
- 3 to 8 years ☐
- 8 to 15 years ☐
- 15 to 20 years ☐
- More than 20 years ☐

Q6. How could your position be best described in the management structure of your organization?

Senior management level	☐
Middle management level	☐
Junior management level	☐

Q7. Do you have experience in “partnering” type project?

Yes	☐
No	☐

If yes, how many projects have you been involved? _____

Q8. Do you have experience in the following?

	Yes	No
Joint venture project	☐	☐
Business partners	☐	☐
Partnering workshop	☐	☐

You have completed Part I of the Questionnaire. Please proceed to Part II. Thank you!

Part IIA Strategic alliance formation

To what extend do you agree the followings lead to alliance formation?

	Strongly disagree→ Strongly agree				
	1	**2**	**3**	**4**	**5**
2.1 Inducements					
2.1.1 Transaction cost perspective					
(a) Share cost among partners					
2.1.2 Resource dependency perspective					
(a) Reduce uncertainty of interdependency					
2.1.3 Need based perspective (Project nature)					
(a) Share risk					
(b) Share resource capabilities					
(c) Acquire new skills or knowledge/ Technological innovation					
(d) Enhance competitive/ market power					
2.1.4 Social network perspective					
(a) Prior social ties					
2.1.5 Others					
(a) Isomorphic pressures					
(b) Legitimacy					
(c) Political economy					
2.2 Opportunities					
2.2.1 Asset capabilities					
(a) Technical capital					
(b) Commercial capital					
(c) Social capital					

Part IIB Opinions about partnering relationships

Do your think partnering brings about higher levels of the followings?

Do you agree partnering improves working relationship of the project through:	**Strongly Disagree**				**Strongly Agree**
	1	**2**	**3**	**4**	**5**
Commitment					
Asset specificity					
Hostages					
Reciprocal investment					
Dependency					
Level of trust					
Previous relations					
Shared values					
Risk taking					
Reputation					
Communication					
Quality					
Information sharing					
Participation					
Conflict resolution					
Joint problem solving					
Timely resolution					

End of the questionnaire

Thank you for your kind participation

Please return to Carol Hon (FAX: 2764 5131) or post to Department of Building & Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon (stamp envelop is enclosed)

Preliminary Semi-structured Interview Questions

1. Background of case study MTRC contract 607

- Duration
- Project team (Contact No.!!!)
- Project characteristics

2. Reasons to use partnering

- Uncertainty and risk
- High resource dependency
- Technological innovation
- Social network structure (prior ties)
- Asset capability
- Others

3. Partnering process

- Workshop and charter (Internal partnering workshops?)
- Parties involved (Any SC? SC not ready for partnering?)
- Monthly evaluation /Partnering performance monitoring system

4. Effect of partnering

Effect of partnering on working relationship (1= Strongly disagree, 5= Strongly agree)

Do you agree partnering improves working relationship of this contract through:	Design phase	Construction phase	Completion phase
Level of trust			
• With client			
• With consultant			
• With sub-contractors			
Communication			
• With client			
• With consultant			
• With sub-contractors			

Effect of partnering on project performance

- Time
- Cost
- Quality
- Safety

5. Why partnering in this project is a success/ failure?

- Project characteristics (Complex, high risk, adequate contract sum)
- Others

6. Obstacles of partnering implementation

- Lack of trust
- Lack of commitment
- Lowest bid tendering (Price too low->lack of trust, commitment)
- Project team (Frequently rotate)

7. Do you have any project experience on

- Successful partnering
- Unsuccessful partnering (label only)
- Not use partnering

8. What kinds of project should use partnering/ use it more successfully?

- Complex vs. simple projects

9. Others

- Future role and development of partnering

APPENDIX G: RELATED PUBLICATION OF THE THESIS

Hon, C.K.H. and Fan, L.C.N. (2004) Network structure of cooperative relationships of partnering and non-partnering projects in Hong Kong: Social network approach. *Proceedings of the CII-HK Conference 2004 on Construction Partnering: Our Partnering Journey- Where are We Now and Where are We Heading*, 9 Dec 2004, Hong Kong, China, 117-124.

Hon, C.K.H. and Fan, L.C.N. (2003) Interaction dynamics of cooperative alliance relationship in construction. *Proceedings of the Second-International Conference on Construction in the 21st Century: Sustainability and Innovation in Management and Technology*, 10-12 Dec 2003, Hong Kong, China, 251-256.

Hon, C.K.H. and Fan, L.C.N. (2003) A conceptual model of cooperative strategic alliance relationships. *Proceedings of the Third International Postgraduate Research Conference in the Built and Human Environment*, 3-4 Apr 2003, Lisbon, Portugal, 619-627.

Fan, L.C.N. and **Hon, C.K.H.** (2002) Strategic alliance formation in construction industry- Case studies- Hospital projects in Hong Kong. *Proceedings of The Conference on Re-engineering Construction-Enabling and Motivating Excellence*, 10 Apr 2002, Hong Kong, China, 87-91.