APPLICATION OF SOCIAL NETWORK ANALYSIS: AN APPROACH TOWARDS CLIENT SATISFACTION

Ahmed El-Sheikh

This thesis is submitted in partial fulfilment of the requirements for a degree of Master of Science in Built Environment from the University of London.

Bartlett School of Graduate Studies

University College London

September 2006

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

Acknowledgement

'I am part of you all'

Since the sacred blow of creation till today, life offered a guaranteed continuous challenge, which perfectly superimposed a *sine* curve leading to where I am today. With such continuous challenge, it became impossible, for me, to list one event as a dramatic turning point for success.

A 'unit' acquires its value in '*unity*' as a flower in a bouquet, and a carved stone in a '*château*.' My success today is merely an accumulation of all events prior to this right moment.

My gratitude is not limited to a person, or an event. It exceeds all 'singles' to reach the 'whole' as I am, solely a '*part*' of the '*all*.'

Ahmed A. El-Sheikh

Special Thanks

In no particular order, I would like to thank:

A Shaibah and M Rizk for their financial support
Elaine Sivyer for her sincere effort on proof reading.
Harry Swales of Capita Symonds and his project team for their contribution.
M Frow, B Kiddle and P Walker for their support and directions on personal development

Many thanks to Dr S Pryke of The Bartlett School, UCL for his time and contribution to run the SNA data and develop SNA diagrams.

Abstract

Project success is the ultimate goal of any project coalition. Success is a result of collective actions at all levels of any one project throughout the entire project life cycle. One principal aspect of success is the project network typology. The aim of this research is to examine and correlate high density communication networks and client satisfaction. The study is carried out through the simultaneous analysis of project success factors and project networks. The correlation is established to highlight the significance of project networks. Gap analysis and Social Network Analysis (SNA) are reviewed as tools for delivering client needs and analysing project coalitions respectively. It has been concluded that there is no standard panacea for effective project management and project success. SNA is a useful tool to help project coalitions investigate communication patterns. Two SNA case study analyses were conducted. Time and cost were identified as the major project success factors. SNA was applied to examine the discussion and information exchange networks in relation to scope of work, cost-related and schedule-related communication. Socio-grams were developed and assessed. It is also concluded that communication patterns in Design and Build projects mirror the contractual arrangements, whilst high density information exchange networks do not necessarily reflect efficient network configuration or lead to a better delivery of project objectives. SNA is an effective tool. However, it is more beneficial when combined with other tools. A combination of SNA and gap analysis provides a useful monitoring mechanism and allows project coalitions to deliver project objectives and establish better levels of client satisfaction.

Keywords: *project success, client satisfaction, project management, gap analysis, management tools, social network analysis, project coalitions.*

Word count: 13,516

Table of Contents

Table of Figures

List of Tables

List of Abbreviations

3Cs	Client, Consultant and Contractor
APM	Association for Project Management
APM	Association for Project Management
CIOB	Chartered Institute of Buildings
JPEG	JPEG/JFIF is the format most used for storing and transmitting photographs
PMBOK	Project Management Body of Knowledge
QS	Quantity Surveyor
RIBA	Royal Institute of British Architects
RICS	Royal Institute of Chartered Surveyors
SCM	Supply Chain Management
SNA	Social Network Analysis
WBS	Work Breakdown Structure

Chapter 1

Introduction

The construction industry moved from the master builder model to trade fragmentation[1], with significant impact on management concepts and management tools[2] (Winch, 2002). The publication of the Latham Report (1994) and the Egan Report (1998) are modern calls for the collaboration and restructuring of the construction industry[3]. A number of studies on blame culture developed and *new procurement*[4] systems were introduced (Latham, 1998; Pryke, 2004a). As a result, project success is studied in a new light and project success measures and success factors have become the foci of research, with links to client satisfaction. Management of projects has developed a holistic dimension and gains from research in fields other than engineering, whilst project key players now realise the need to see beyond the boundaries of any single project (see Smyth, 2000; Winch, 2000; and Walker, 2002). Following this holistic viewpoint, there is a continuous growth in awareness of social changes and their impact on the construction industry. The construction industry had been influenced by continuous technical and social development (Pryke, 2006b). However, as opposed to technical changes, social changes are difficult to monitor and record and are therefore overlooked in most projects. Consequently, the need for a new approach and tools has emerged.

Previous research[5] has identified the need for a collaborative working environment. The Latham Report (1994) was based on the simple concept of teamwork. The construction industry could achieve a higher rate of customers satisfaction through developing effective teamwork and project set-up.

---

[1] See Winch (2002) for more details on the development of the construction industry in the UK.

[2] Total Marketing (TM), Relay Management (RM), Total Quality Management (TQM) and the win-win approach are several to mention (Smyth, 2000). Management tools moved from linear models to an organic structure. Work Breakdown Structure (WBS) and Critical Path Analysis (CPA) are substituted by organic network structures and the application of Social Network Analysis (Pryke, 2006). See Pryke (2004b) for further analysis on linear management models.

[3] Though restructuring was adopted as an engineering management tool, it was a *closed* approach and did not consider the dynamic nature of projects. The breadth in management aspects and project disciplines required a more organic approach.

[4] Refer to Pryke (2004a) for more discussion on *new procurement*.

[5] See Latham (1994) and Egan (1998).

Following Latham (1994), this research is based on the same concept of collaborative project set-up and the need to improve project network, in opposition to the current fragmentation commonly experienced in the construction industry. However, project networks tend to reflect technical and social aspects in project management, and new management tools are needed to capture the nature of project networks. Social Network Analysis (SNA) was introduced to the industry to help analyse project coalitions and reflect aspects of projects other than time, cost and quality. Improvement in project network is linked to client satisfaction.

Projects are seen (within this research) as a continuous flow of information governed by project networks and the ties between project coalitions. In order to achieve project success and a higher rate of client satisfaction, it is important to study the pattern of information exchange within any project network.
This research examines the information exchange density and derives lessons from the analyses of two case studies. Due to the nature of the construction industry, mentioned later, it is acceptable to say that the results and recommendations are valid for the samples examined at the time of the study, and further research can be can be conducted for deeper analysis.

The following chapter reviews the research context. It refers to the post-war era and the nature of construction industry. The development in management tools is briefly reviewed. Chapter Three provides the research framework. Project success is briefly examined with reference to project success measures, and work by Cleland *et al* (1988), Morris and Pinto (2004) and Belassi *et al* (1996) is reviewed. Gap analysis and Social Network Analysis (SNA) are reviewed in relation to client satisfaction. Research methodology is covered in Chapter Four. The research findings and discussion are covered in Chapters Five and Six respectively. Conclusions are drawn in Chapter Seven and a potential framework for future research is presented. Data gathering samples and finding are included in the appendices.

Chapter 2

Research Context

Overview

The construction industry touches many aspects of our lives (Turner, 1993). As a dynamic industry it is equally influenced by technical and social developments throughout the world (Pryke, 2004b), and thus operates in a *hybrid*[6] environment to deliver certain objectives[7]. While technical changes can be grouped around the themes of energy and communication, it is very difficult to record social changes in a similarly structured manner (*ibid*). The construction industry, as a benefit delivery based industry (Walker, 2002; Winch, 2002), developed strong links to the environment and society. However, there is a lack of research on the impact of social changes on construction. Recent approaches have emerged to include social aspects so that a collaborative working environment can be established[8]. Addressing the nature of construction projects and development in the construction industry can assist in the understanding of non-technical aspects related to project coalitions. For this reason, the following section examines development in the UK construction industry and establishes links to the research question.

The built environment has been the focus of continuous development at both technical and managerial levels. The UK construction industry moved from serving the Church and Crown to reforming the local environment (Winch, 2002), moving from the form of 'master builder' to groups of individuals referred to, in this research, as 'project coalitions'[9]. The post-war industrial era generated a new culture which shaped the market and the management style for years to come. The two mainstreams (the market and management style) developed in parallel and had a

[6] The nature of the construction environment is linked to the concept of management of change. The reader is referred to work by Turner (1993) on change management. For the purposes of this research the hybrid environment refers to continuous change in technical and social aspects of the construction industry.
[7] Project objectives normally mirror business, organisational or governmental objectives.
[8] The Latham and Egan Reports in 1994 and 1998 respectively, addressed the problem and need to develop a collaborative working environment.
[9] The innovation in procurement provides a different configuration of contractual relationships, which has a great impact on the interests and behaviour of project members and their performance.

continuous mutual impact on the construction industry. Changes in market views are addressed in this research solely to identify the position of the client in construction

The post-war market views focused on mass production and the market mix of product, promotion, place and price (Gummesson, 2002). The client was not considered a valuable player in the marketing process, which was reflected in the management concepts and leadership styles (Smyth, 2000). The management and leadership styles were influenced and an autocratic leadership style was adopted, with more emphasis on quantitative management techniques. Project management focused on project implementation, with less interest on the 'pre-sanction' stage (Walker, 2002; Morris and Pinto, 2004). Projects were shaped along assembly lines. The client was essentially out of the picture and only modest efforts were attributed to examining client needs. Project quality was therefore adversely affected.

The rise of complex projects required more collaborative arrangements and customer needs gained a strong presence in the marketing mix. The emphasis on the client role was clearly addressed through new concepts. The Latham (1994) and Egan (1998) Reports suggested a win-win approach and highlighted the need to consider the client role[10]. The management process and the culture of fragmentation were questioned and the client became the centre of interest. There was a need for close relationships among the client, design team and the constructors. This shift led to the concept of 'added value' (Winch, 2002). Research on collaboration was developed in relation to project success and the need for new management tools emerged.

Project Success

The nature of construction projects, in opposition to manufacturing, led to a plethora of studies on project success. Cleland and King (1972 and 1983), cited in Pryke (2005), reviewed the nature of construction projects and identified the need to manage project *interdependence*, *complexity* and *change*. Interface management was introduced by Cleland *et al* (1998) as a conceptual tool to manage complex projects and focus on areas of transfer. Walker (2002) proposed systems thinking to help gain total project orientation.

[10] Although research addressed the need to consider the client role, the client's responsibility is not defined and no consensus on the subject has been reached.

Both approaches attempted to employ the efforts of project coalition towards project success; however it was difficult to agree a standard form of measuring project success with the number of parties normally involved in complex projects (Cleland *et al*, 1998; Morris and Pinto, 2004).

Project success is seen through different lenses. Equal emphasis is given to the project network and the client as a significant member in project coalition. Since the project coalition involves a number of *actors* and can reflect a complex arrangement, a holistic view is crucial for project success.

Management Tools

Management tools have been subject to continuous development since the rise of the Industrial Revolution. A scientific approach was developed following Taylor and Fayol, to manage military projects and the space programme in the USA (Lavender, 1996). Soon this approach was rejected and more homogeneous approaches were introduced (Morris and Pinto, 2004).

However, it was difficult to deal with the wholeness of projects due to increased management interface and information exchange (Walker, 2002). Project fragmentation became unavoidable, even under the single point of accountability. It became more difficult to reach common ground and agree a common perception of project success (Winch, 2002). A number of tools were developed to help project managers identify key success factors and design efficient project setups (Morris and Pinto, 2004). The linear models[11], developed from scientific management, failed to provide an overall view of projects or to consider the client as a key player in project success (Winch *et al*, 1998). Pryke (2004) pointed out that project elements could not be seen in isolation under the *new procurement* routes and that there was a need to consider the wholeness of projects.

Social Network Analysis (SNA) was introduced to the construction industry as a tool for analysing project coalitions under, but not limited to, *new procurement.* SNA gained increasing importance in recent research dealing with the multi-faceted nature of the construction industry. Therefore the following points are considered:

[11] Existing analytical approaches currently used are based on *task dependency, structural analysis,* or *process mapping* (Pryke, 2004) and focus on dyadic relationships for the analysis, none of which provides a quantitative comparative that considers the project *information exchange.*

1. The Client is the centre of interest in projects and client satisfaction is the main success measure for any project.
2. Project network involves a number of actors and success cannot be achieved without a win-win approach.
3. A rigorous methodology is essential to correlate success measures and project networks.

Through application of SNA, this research will provide an insight into providing an environment for project success and client satisfaction in construction projects in the UK and will reinforce the concept of added value.

The main research question is:

Will a high density information exchange network lead to client satisfaction and project success?

In order to answer this question, this research will investigate project success, gap analysis and Social Network Analysis and correlate success factors and project networks[12].

The following may be constraints to this research:

1. Members of project coalitions have different agendas and success is viewed from different viewpoints.
2. Covert objectives are the main obstacles to open communication.
3. Although their impact is significant, cultural changes are very slow. Blame culture represents a continuous constraint to the improvement of communication, specifically in the construction industry
4. Deep-rooted adoption of linear models in traditional management is behind a lack of awareness of SNA and its application[13].

The primary premises of this research can be categorised into two areas:

1. Improvement of the quality of communication will lead to client satisfaction.
2. This improvement will give rise to a more collaborative environment among the project coalition.

The secondary premises of this research are:

1. Gaining an understanding of project success views and the client role.
2. This understanding will give rise to a more collaborative environment among the project coalition.
3. Application of management tools requires further analytical thinking.

Summary

This chapter reviewed the development of management views and the position of the client, and addressed the need for a collaborative environment for the success of projects. Therefore, within the context of this research, the client is considered as the centre of project interest, with client satisfaction being a major success measure for any project.

Project networks involve a number of actors and success cannot be achieved without a collaborative environment. Such an approach is essential for success and a rigorous methodology is needed to correlate success and project networks.

The following chapter investigates project success, gap analysis and Social Network Analysis.

---

[12] Investigation of project success is conducted through the analysis of success measures and factors. Although some projects may share some of the measures and factors, it is worth thinking of these factors as specific and unique. The same applies to networks. Therefore the correlation established herein is unique and correct only for the chosen samples at the time of the study. However, lessons can be learnt to improve performance in similar scenarios.

[13] Refer to Pryke (2004) for advantages and limitations in the application of SNA.

Chapter 3

Theoretical Framework

Introduction

The last few decades witnessed the development of several schools of thought in project management. The scientific management approach showed limitations in dealing with management aspects other than the implementation of projects. Other approaches were introduced to deal with human and social aspects in project management (Morris and Pinto, 2004). Despite such differences, research in project management had one thing in common - the desire to succeed.

Chapter Two tackled the problem of fragmentation currently experienced in management practice. This research accepts the fact that fragmentation of projects is essential to deal with the high number of project actors. However, it is difficult for project coalitions to reach a common ground and agree upon terms of project *success* (Winch, 2002). A number of tools were developed to help project managers identify key success factors and design efficient project set-ups (Morris, 2004).

This chapter firstly provides a brief review of the concept of project success. Project success is seen as an added value, and thus linked to *client satisfaction*. Secondly, and due to the increase in project size and complexity, gap analysis and the service quality model are covered as a potential tools to improve project quality. The client is considered as a significant key player and this research adheres to Winch's approach on involvement of the client (Winch *et al*, 1998). Nevertheless, gap analysis is a linear model and showed limitations in practice. Social Network Analysis is introduced as a tool to help study project coalitions and initiate project success.

Project success and client satisfaction

> *'You did well, Bernardo, in lying to us about the expense involved in the work'*
> ***Words of Pope Pius II,*** cited in Winch, 1998.

The words of Pope Pius II are quoted in many management research papers. The simple statement declared by the famous Eighteenth Century client to reward his

architect triggered the start of modern research on client satisfaction and the success of projects (Winch, 2002). Unknowingly, Pope Pius had opened the door for researchers in project management in the years to follow. Although the project was ten times over budget, it was still seen as successful (*ibid*). Similar situations have been recorded in contemporary project management practice.

The following is a review on project success and its relation to client satisfaction.

Review of Project Success

The study of project success was introduced in 1969 by Rubin and Seeling (Belassi *et al*, 1996). They considered technical performance as a success measure and related success to the project manager's experience (*ibid*). Modern project management, developed for defence projects and the space programme, focused on the *iron triangle* of time, cost and quality as the combined criteria for project success (Morris and Pinto, 2004). Once projects required a higher level of interaction and technical support, it became difficult to consider time, budget and quality as the sole criteria for success (Winch, 2002; Morris and Pinto, 2004). Baker, Murphy and Fisher (1983), mentioned in Belassi *et al*, (1996), adopted the concept of perceived performance, instead of time, cost and quality, to measure project success. Several studies followed and different approaches were adopted (see, for example, Cleland *et al*, 1988; Belassi *et al*, 1996; Morris and Pinto, 2004).

One approach to studying project success is to focus on factors leading to project success and success measures.

Cleland *et al* (1988) reviewed over 400 projects in a study of project success factors. They concluded that factors contributing to project success includes:

- Coordination and relations
- Adequacy of project structure and control
- Project uniqueness, importance and public exposure
- Success criteria salience and consensus
- Competitive budgetary pressure
- Initial over-optimism, conceptual difficulty
- Internal capabilities build up

See Cleland *et al*, 1988: 916 for more details.

Pinto and Slevin developed a similar approach to studying success measures, dealing with project success factors at strategic and tactical levels (Belassi, 1996).

Success Measure Factors	
Strategic success measures	**Tactical success measures**
Project mission Top management support Project scheduling Client acceptance	Client consultation Personnel selection Technical tasks Monitoring and feedback Communication Troubleshooting

Table 1: Success measures factors by Pinto and Slevin. Developed from Belassi, 1996.

Morris and Pinto (2004) focused on the root of the problem and studied project success factors. Through the identification of success factors, project coalitions can direct the project energy more efficiently.

Success Measure Factors
Goal commitment of project team
Accurate initial cost estimates
Adequate project team capability
Adequate funding to completion
Adequate planning and control techniques
Minimal start-up difficulties
Task (vs. social) orientation
Absence of bureaucracy
On-site project manager
Clearly established success criteria

Table 2: Success measure factors. Developed from Morris and Pinto, 2004: 101-102.

Criteria for Success

Developing a research on project success, Turner (2004) focused on conditions for success, as listed below. However, while he concluded that the presence of these conditions help reach project success, they are not a guaranteed remedy for success (*ibid*).

The necessary conditions for project success are identified as follows (Turner, 2004):

- The success criteria should be agreed with stakeholders prior to the beginning of the project.
- A collaborative working environment should be maintained.
- The project manager, with the client, should be empowered to give guidance on how to achieve the project results.
- The owner should take interest in the performance of the project.

The review summarised in the tables above shows that the pre-agreed success criteria are necessary for project success. Nonetheless, it is difficult to agree common success measures at any one stage of the project life cycle, especially in multi-layered project network and complex environments.

Project Success Levels

In developing a conceptual model of project management, Turner classified project management activities into integrative, strategic and tactical levels (Turner, 1998). Although project success did not form part of his model, with hindsight one can conclude that success factors and measures can be linked to management levels, leading to a more detailed examination of project success. The link between project management levels and research in success factors has not been explored to a great enough extent.

Cooke-Davis (Morris and Pinto, 2004) refers to three levels of project success through rendering three questions, which can be linked to Turner's model of strategic, integrative and operational levels of management.

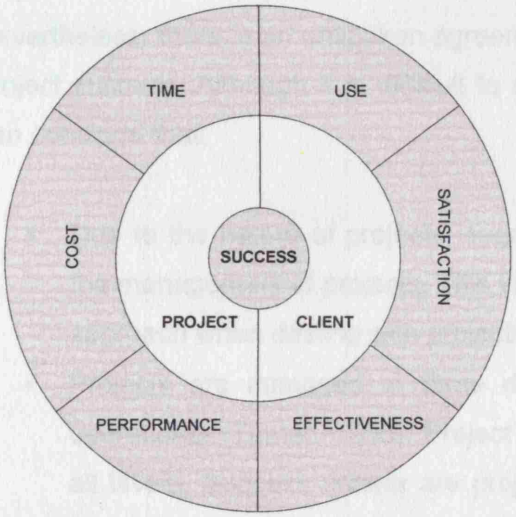
These questions are:

1. *How to ensure that the project is done right?*
2. *How to ensure that the right project is done?*
3. *How to ensure that the right projects are done, time after time?*

Client Satisfaction

In an attempt to establish a new framework of project success analysis, Belassi (1996) revealed that client consultation and client satisfaction scored the highest ranking as critical success factors in the construction industry. He also showed that client coordination and client satisfaction are repeatedly shown as significant success factors in a number of studies in project success. See Belassi (1996) for more details.

In their analysis of success in project management, Pinto and Slevin (Morris and Pinto, 2004), linked success elements to the *client* and the *project*.



Traditional success elements related to the project reflect the scientific management view and focus on the long-believed 'iron triangle'. On the other hand, elements related to the client are driven by the concept of benefit-delivery and added value, and are mirrored in project purpose, project effectiveness and client satisfaction (Morris and Pinto, 2004).

Figure 1: Success elements in projects. Source: Pinto and Slevin in Morris and Pinto (2004): 102.

Cooke-Davis (ibid) concluded that little has been said about the 'benefits' of projects in relation to project success and addressed the need for an effective benefit delivery framework resulting in a more structured client satisfaction framework.
Winch (2002) considers that projects are carried out to add values at strategic as well as operational management levels. The concept of benefit delivery is referred to as *added value* and is adopted in research on project success to bridge the gap between the client and project coalition (see Winch, 2002 for more details on the added value concept).

In summary, extensive research has been conducted on the success and failure of projects. Views on project success vary extensively among project actors. Nevertheless, there is an unspoken agreement on the impact of client satisfaction on project success. Although it is difficult to review all aspects of project success, we can conclude that:

- Due to the nature of projects, segmentation of projects is employed to help the management of projects. This view does not negate the need for a holistic approach when dealing with projects (Morris and Pinto, 2004).
- Projects are managed at three different levels: integrative, strategic and operational (Turner, 1996). Project success factors should be considered at all levels. Success criteria are project specific and it is difficult to establish absolute success and failure factors (Morris and Pinto, 2004).
- Client involvement and client satisfaction are common elements leading to the success of projects (Belassi, 1996).
- Turner developed the necessary conditions for project success (Turner, 2004) and Winch (2002) adopted the concept of added value.
- The existence of effective benefit delivery is a major factor for project success (Cooke-Davis, 2002).

The following section addresses two models linked to benefit delivery and how client satisfaction can be attained. The two models are gap analysis developed by Winch (2000), and the service quality model developed by Zeithaml (1990).

Gap analysis

The growth in market involved an increase in the number of complex projects. Projects grew to include a high number of participants from different trades and it became difficult to deal with projects as one-off undertakings. The concept of segmentation in the construction industry (as mentioned earlier) was introduced to enable effective control actions and delivery of milestones (Morris and Pinto, 2004). However, projects were segmented at their strategic levels and viewed through their life cycles as a means of segmentation. This segmentation is illustrated through current procurement routes and management tools.

In order to gain a coordinated overall view of projects, Winch (1998) adopted the added value concept and concentrated his research on gap analysis. On the other hand, Walker (2002) studied systems thinking and developed a conceptual model in management process.

G*ap analysis* is seen as an analytical tool towards the realisation of client satisfaction. The two approaches share the overall objective of project success.

Fragmentation of Projects and Gap Analysis

Winch *et al* (1988) mentioned that projects were previously the centre of interest as a reflection of capital and were based on the concept of the master builder, as a universal concept. Projects were managed by architects who acquired social and technical knowledge[14] (Winch, 2002). The concept of the master-builder succeeded in delivering the client needs and meeting the technical challenges. It was accepted as a management model for centuries. However, the environment of project management changed and was different after the war.

The post-war era experienced a lack of expertise and an inability to link social and technical skills. Fast-paced technical development led to multi-faceted projects which required high levels of co-ordination, and the fragmentation of projects was expected to help deal with different aspects of projects. Despite initial success in project operations, problems transpired when two or more elements interfaced - which was, and still is, a guaranteed scenario (Morris and Pinto, 2004).

[14] See Winch, 2002 for a more detailed comparative study on the development of the construction industry. The implications of such developments in the management of projects are a potential area for future research.

The need to gain an overall coordinated view of projects became visible to project managers. Berggren *et al.*, cited in Morris and Pinto (2004) classified coordination as the first problem of organisational fragmentation and recorded the need for developing a project strategic view. They highlighted the importance of managing project fragmentation and as a result a holistic view is now integrated at the strategic level of projects. Two approaches to realize this holistic view became visible:

- Process-based management which focuses on how things are done.
- Interface management which concentrates on the areas of transfer during the project life cycle.

Project Life Cycle

Traditional management views projects in the light of production theory (Lavender, 1996; Smyth, 2000), where activities are arranged in assembly lines to match the product set-up. As a result, projects are reduced to a number of processes and seen in the light of their life cycle[15] (Lavender, 1996; Smyth, 2000; Gummesson, 2002).
Turner (1993) mentioned that the project life cycle reflects the transient nature of projects, and project managers need to change their management emphasis. However, Morris argues that the focus on the project life cycle led to more segmentation in the management of projects and limited management to the traditional iron triangle (Morris and Pinto, 2004). He criticised current management models for being dominated by a concern for tools and techniques. Transitional periods, seen either during the project life cycle or between activities, need to be managed to deliver a holistic project orientation (*ibid*).

[15] Morris argues that despite the need to defragment a project for managerial purposes, there is no right single approach in dealing with projects. The divide is utilised for research purposes and experience is crucial for successful project management (Morris and Pinto, 2004).

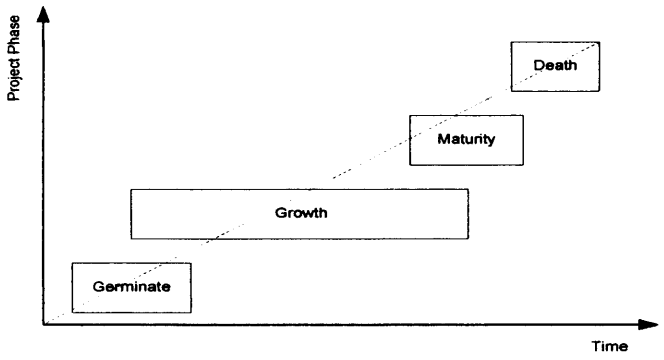


Figure 2: Project life cycle and interface management.

Error! Reference source not found., cited from Turner (1993), combines a problem solving model, project life cycle and project management activities. Though it is not shown in his illustration, project management activities are repeated during each stage of the project life cycle.

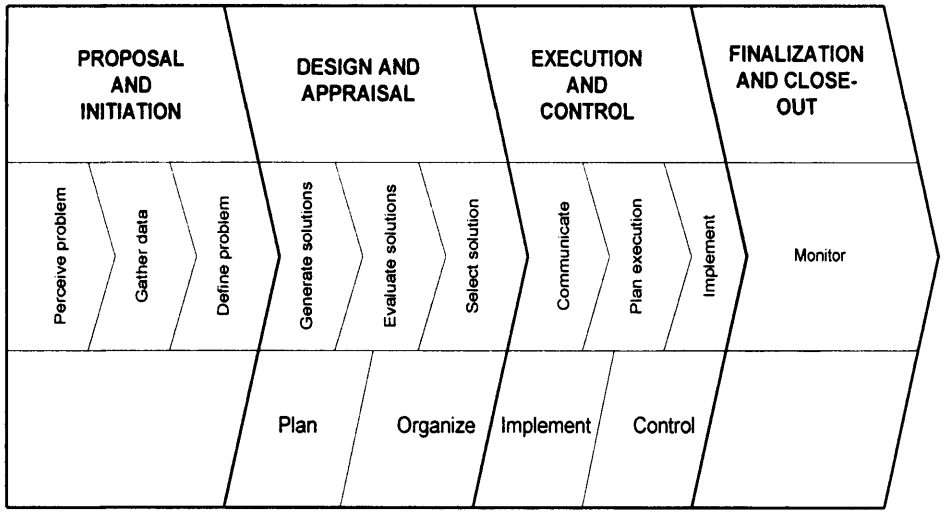


Figure 3: Relating three views of the life cycle[16]. Source: Turner, 1993: 24.

In a recent revision of PMBOK[17] by Morris, mentioned in Morris and Pinto (2004), the transient nature of project life cycles is controlled through the concept of gate management, where project milestones are studied outside the iron triangle and the strategic validity of deliverables is continuously checked. Considering the project life

[16] See Turner (1993) for more details.
[17] Project Management Body of Knowledge developed by Association for Project Management.

cycle and the transient nature of projects, Winch *et al* (1998) proposed gap analysis as a model to manage projects, with a focus on the overlap between project stages.

They addressed the need to keep the client in the focus of the whole process in order to maintain project added values. Five principal gaps affecting project success were identified to minimise client surprises in order to achieve project success[18]. **Error! Reference source not found.** shows the Gap Analysis model as proposed by Winch *et al* (1998)[19].

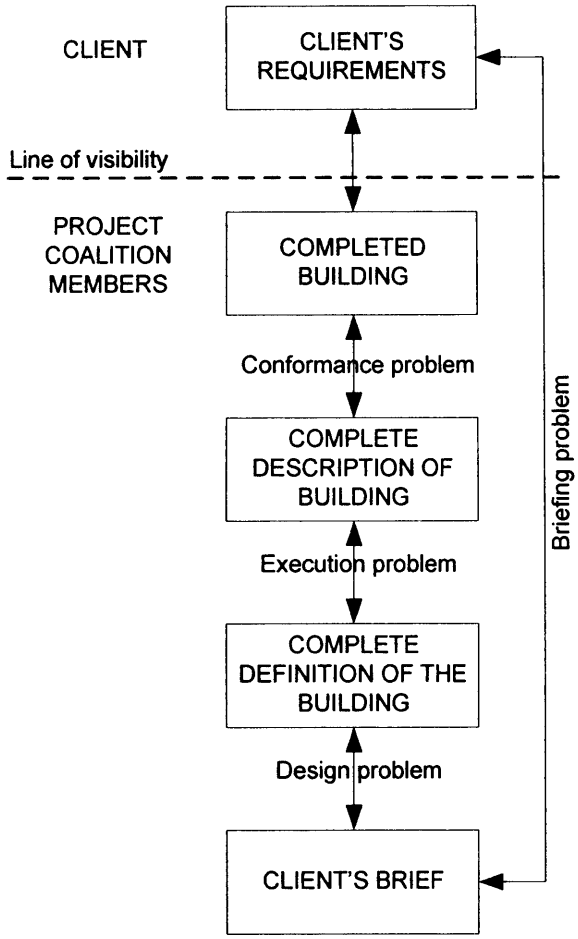
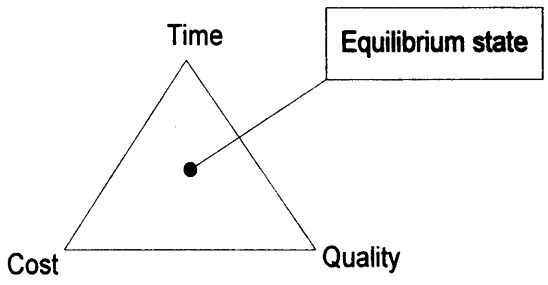


Figure 4: Gap analysis approach. Source: Winch *et al*, 1998: 196.

[18] Following the concept of interface management, Winch *et al* (1998) adapted the gap analysis for better delivery of client needs. The gap analysis was developed from the service quality model SERVQUAL by Zeithaml *et al* (1990) and is referred to later in this research.

[19] The gap analysis as proposed by Winch *et al* (1998) does not address the process of setting the project objectives, and thus is put in use during the project implementation. For further details on the application of gap analysis and total project quality, see Winch, 1998: 198-205.
Winch (2002) views projects as a continuous chain of activities, to deliver value. He thus follows an economy-based view towards projects and considers continuous measure of project NPV. The benefit delivery concept is revealed as *added value* (*ibid*).



Winch *et al* (1998) identified the following four aspects of quality:

1. Quality of conception
2. Quality of specification
3. Quality of realization
4. Quality of conformance

Figure 5: Traditional management view.

Gap Analysis, Service Quality and Client Satisfaction

Project life cycle analysis shows the need for a wider perspective towards quality in order to facilitate project key success factors other than from the traditional view of time, cost and quality (Winch *et al*, 1998; Morris and Pinto, 2004).

Principal Gaps in Management Model	
Gap 1	Between consumer expectations and management's perceptions of consumer expectations.
Gap 2	Between management's perceptions of consumer expectations and management's translation of those perceptions into service quality specifications.
Gap 3	Between service quality specifications and actual service delivery.
Gap 4	Between actual service delivery and external communications to the consumer about service.
Gap 5	Between actual service delivery and consumer's perception of the service.

Table 3: Principal gaps in management model. Developed from Winch *et al* (1998).

Morris argues that despite the importance of monitoring the project schedule and budget against quality, it is immature simplification to limit management of projects to the execution stage only. Management of projects starts as early as the conception of projects, referred to as the pre-sanction stage (Morris and Pinto, 2004). Winch *et al* (1998) noted that the traditional management model concentrates on measures of time, cost and quality, and gives primacy to the application of management tools rather than management concepts. Such focus obstructs the understanding of project management in a number of ways; for instance, project management is orientated towards the needs of the procedures rather than the client needs.

Although scientific management focused on project execution and the implementation stage (Morris and Pinto, 2004), it can be argued that such orientation stems from the consideration of the client needs. However, under scientific management, the management interest is limited to the operational levels (Turner, 1996). Little research has put the client as the focus of interest at integrative and strategic levels (Winch, 2002)[20] [21].
Zeithaml *et al* (1990) developed extensive research on service delivery and identified four factors that may affect clients' expectations and ten dimensions of service quality, with a focus on communication (Zeithaml *et al*, 1990).

Both models developed by Zeithaml *et al* and Winch *et al* relate client satisfaction to client expectations and put the client in the focus of all project operations (see Zeithaml *et al*, 1990 and Winch *et al*, 1998 for more details). For the purposes of this research, this review adheres to the model developed by Winch *et al*.

From the above, it has been noticed that the complexity of projects in their ad-hoc structure and transient nature requires a high level of coordination. Organisational segmentation can lead to the problem of coordination and absence of customer (Turner, 1996; Morris and Pinto, 2004). Zeithaml *et al* (1990) and Winch *et al* (1998) proposed *SERVQUAL* and gap analysis, respectively, to overcome these problems, and mainly focused on client satisfaction. Both models addressed the significance of communication, but did not provide a communication model as part of their research.
Complex projects continuously evolve to reflect organic networks and new tools are required for the analysis of projects. A new approach to client satisfaction is employed and information exchange network is considered. Social Network Analysis is covered next as an effective tool for this purpose.

Social Network Analysis

The previous sections have shown different levels of success and previous research has concluded that client involvement and client satisfaction are among significant project success measures. In order to reach client satisfaction in the complex environment of project management, Winch introduced gap analysis as an analytical tool to reduce client surprise and uncertainty (Winch *et al*, 1998). However, gap

[20] See Turner (1996) for more details on management levels and management activities.
[21] Winch *et al* focused on the client needs and based their model on *SERVQUAL* - a service quality model developed by Zeithaml *et al* (Winch *et al*, 1998).

analysis, like other linear models, has limitations in dealing with projects as multi-dimensional networks (Pryke, 2004b)[22]. Social Network Analysis (SNA), based on *Graph Theory* and derived from disciplines other than project management, was introduced to the industry to help analyse project coalitions and reflect aspects of projects other than time, cost and quality. This section will, succinctly, review research in SNA in relation to project success and client satisfaction.

What is Social Network Analysis?

Social network analysis has gained increasing importance in recent research dealing with the multi-faceted nature of the construction industry. Otte and Rousseau (2002) cited that SNA "is not a formal theory but rather a broad strategy for investigating social structure".

Wetherall *et al* summarise this idea in their following definition of Social Network Analysis (Wetherall *et al*, 1994, cited in Otte and Rousseau, 2002):

Most broadly, social network analysis (1) conceptualises social structure as a network with ties connecting members and channelling resources, (2) focuses on the characteristics of ties rather than on characteristics of individual members, and (3) views communities as 'personal communities', that is, as networks of individual relations that people foster, maintain, and use in the course of their daily lives (Otte and Rousseau, 2002).

Definition of SNA by Pryke:

SNA is a body of theory and methodology for the analysis of systems based on the conceptualisation of systems as networks of relationships. The network comprises actors or nodes linked by some form or relationship (ties). SNA enables the observer to systematically specify the relationships between actors within a group. The output of the analysis can be expressed mathematically and graphically (2006)[23].

[22] Pryke provided an extensive analysis of linear management models and introduced SNA as an analytical tool with non-hierarchal manner.
[23] Following the definition of SNA, it is introduced as in the theoretical framework of this research and revisited as an integral part of the methodology later in chapter 4.

Pryke's definition shows that SNA is a tool for investigating social structure. Since social structures are hardly predictable, SNA benefits from research in related disciplines to give structure to an individual actor's behaviour within the network. Sociometric and anthropological elements are the most important two to mention in relation to psychological behaviour. Loosemore (1998) addressed the psychological aspects of SNA and focused on the nature of links (ties) between team members (actors).
On the other hand, Otte and Rousseau (2002) focused on the importance of SNA to emphasise individualistic acts of network members.

Two points should be taken into consideration when dealing with SNA:

1. Any project network is seen as a smaller representation of community and thus is dynamic.
2. The type and quality of links between members should be taken into consideration when dealing with social network analysis.

Otte and Rousseau (2002) noted that the network behaviour, as well as of the individuals within, is mutually influenced through the value of ideas originating in SNA in relation to the numerous aspects of the network (mainly social, psychological and anthropological). They noted that the project coalition, as a whole, recorded a resultant value greater than the sum of the values recorded by its members as individuals (*ibid*).

Consequently, SNA enables project coalitions to consider the concept of added value at strategic and operational levels.

Development of Social Network Analysis

During the last decade, the construction industry has faced significant changes with regard to the *management of projects* and *procurement systems* (Pryke, 2004b). The publication of the Latham Report (Latham, 1994) and the Egan Report (DETR, 1998) prompted new procurement systems. Partnership, supply chain management and the use of work or technology clusters are a few to mention (Pryke, 2006). The new procurement systems generated new challenges to all parties involved in any project network and focused namely on collaboration. The traditional management approach focused on linear analytical tools, which were initiated by the scientific management school of thought (Morris and Pinto, 2004).

In his analysis of construction project coalitions, Pryke (2004b) reviewed and categorised the management models under:

- Task dependency
- Structural analysis
- Process mapping

He also proposed SNA as a tool to overcome the problems of linear models and addressed the social aspects of SNA (*ibid*).

Morris, mentioned in Cleland *et al* (1988), critically analysed task dependency tools, initially introduced to match the concepts of scientific management[24] which led to an autocratic culture and greater dependency on the organisational structure as a means to effective project management. The organisational theory focused on the hierarchical link between project levels, and projects were seen as linear structures where members were expressed in terms of their linked *roles*. Work Breakdown Structure (WBS) was developed and used to monitor project progress and the PSO[25] triangle was thrown out of balance (Turner, 1996). Walker (2002) studied the nature of projects and highlighted the need to move from this traditional view and adopt new models.

Research took another turn and focused on process management with greater consideration of the issue of analysis and visualisation of construction processes (Pryke, 2006). The graphic rendering of process management derived its roots from Business Process Redesign (BPR). The outcome results were represented in the form of flow charts and did not show roles or actors (Ould, 1995; Winch and Carr, 2001; and Pryke, 2006). Winch and Carr (2001) argue that although the business approach of BPR might show information exchange, it does not reflect *where the project is* or *why it has developed in a certain way*.

None of the previous approaches were alone capable of reflecting the project network in a way that considers projects as a whole.

[24] Critical Path Analysis (CPA), Critical Path Method (CPM) and PERT Network Plans are among the tools which are task orientated and view projects as an accumulation of tasks.
[25] Turner (1996) used PSO to indicate the need to achieve balance among three components of any project: people, system and organisation.

Cleland *et al* (1988) pointed out the need to link project actors in the light of project tasks and management processes. Walker (1984), cited in Pryke (2006), addressed the need to deal with roles, relationships and decision-making grouping. Pryke, cited below, linked project networks to project governance.

In order to understand the ways in which the construction process is evolving, we need to be able to examine, comparatively, a number of aspects of project governance associated with both the design and production processes. It is suggested that we need to examine the dynamic between contractual relationships, performance incentives and information exchange activities (Pryke, 2006).

Loosemore (1998) introduced the basic foundations behind the development of social network analysis[26] and addressed the need to note that:

- People are interdependent rather than dependent.
- People are embedded in complex and dynamic social networks.
- Relationships are important in determining behaviour.
- Change is a constant factor which should be taken into consideration.

Social Network Analysis and Client Satisfaction

The application of SNA is relatively new in the construction industry. Nevertheless, it is strongly linked to recent research in new procurement, collaboration, integration and communication.

Regardless of the strong mathematical concepts behind SNA, it is the social aspects and the graphical presentation that have led to its increased application in construction. Loosemore (1998) addressed the mathematical theory and background of SNA, and pointed out that it does not negate the embedded potential to reach a balance between *qualitative* and *quantitative* aspects in project management.[27] Such a note by Loosemore recalls the fact that there is no single solution when dealing with projects (Morris and Pinto, 2004).

[26] See Pryke (2006) for more details on the development of SNA.
[27] Due to space restrictions, the reader is advised to refer to the bibliography for a more in-depth review of SNA language and numerical and graphical representation.

Pryke (2006) identified the need to understand the construction process and examine aspects of project governance. SNA is applied to examine the dynamic interface between contractual relationships, performance incentives and information exchange activities. SNA can help deliver project added value and meet client requirements efficiently through:

- addressing problems at early stages, through mathematical and graphical representation (Pryke, 2004b) and thus minimising any client surprises.
- developing an information exchange network (Pryke, 2006) and reducing any gaps during project transfer (Winch *et al*, 1988).

Other benefits of SNA are listed below (Pryke, 2006).

- SNA represents an interdependent tool. The behaviour of project coalitions is depicted in a holistic and non-hierarchical manner.
- SNA provides analysis at an appropriate level of detail.
- SNA represents information gathered about project coalitions in a uniform manner.
- SNA allows the quantification of differences in governance systems between projects.
- SNA has a high level of compatibility with the construction industry in being a non-linear, complex iterative and interactive process.
- SNA provides non-hierarchical representation.
- SNA provides mature recognition of non-dyadic forms in a link to new procurement.

Summary

In conclusion, project management is an added value orientated practice which considers the client at the centre of its interest (Winch *et al* 1998; Winch 2000). Recent research showed the pros and cons of different approaches and problem-solving models currently used in construction. Despite the differences in approaches and management school of thoughts, it is obvious that there is no single right solution to any management problem (Morris and Pinto, 2004). However, social network analysis, based on sociometrical, psychological and anthropological aspects, shows the potential to introduce a near-optimum tool for the analysis of project success (Loosemore, 1998).

This chapter has presented an overview of three areas in relation to the concept of added value. Project success, gap analysis and the application of SNA have been introduced to the reader in an attempt to understand project success from different perspectives.

The complex and iterative nature of construction, in addition to the involvement of a relatively high number of key players, requires rigorous and dynamic management tools to match. Such a task would have been easier in the controlled environments of manufacturing or production. The social aspects in construction, seen as a mutual exchange of interest, serving the community and being served by community members, have required a new management approach.

Client satisfaction has been adopted as the main success measure. Project success has been presented in this context and linked to gap analysis as a tool to minimise client surprise. SNA has been introduced to highlight the significance of balancing both technical and social aspects in construction and to overcome the limited presentation techniques of traditional management tools

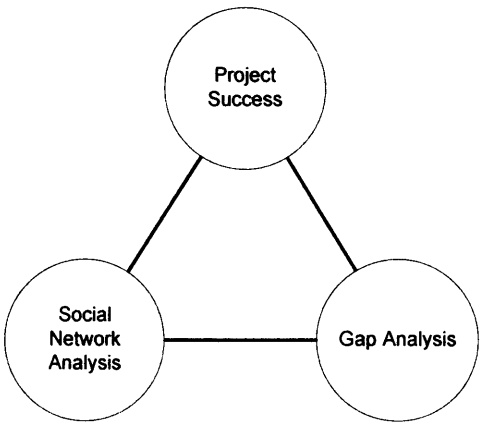


Figure 6: Theoretical Framework

Research methodology is covered in the following chapter.

Chapter 4

Research Methodology

In order to deal with the analytical issues identified in the previous chapters, it was necessary to identify a methodology which would enable an independent and non-hierarchical analysis and facilitate the presentation of project parameters. SNA was introduced previously as part of the theoretical framework for this research. However, following the definitions by Wetherall *et al* (1994) and Pryke (2006), SNA is considered a body of theory and a tool. Thus it is revisited in this section as part of the research methodology.

This research has ascertained that SNA evolved from branches of knowledge other than engineering and construction - sociology, social psychology and anthropology being a few to mention. At the same time, SNA is based on the graph theory and reflects a strong mathematical background. However, Loosemore (1998) pointed out that the mathematical background of SNA does not negate the potential to reach a balance between *qualitative* and *quantitative* aspects of project management.

Pryke (2004a) states, "it is clear from the nature of this type of analysis [SNA] that identification of the population boundaries and inclusion of the whole population in the data gathering exercise are fundamentally important issues". Borgatti, Everett and Freeman (1992), cited in Pryke (2004a), question the validity of networks and argue that the omission of a single actor in the network can invalidate the analysis, even when the sampling is statistically accepted and administratively convenient. However, SNA, as addressed in this research, relates to construction projects which are closely defined in opposition to other types of wider social networks. Construction projects are seen within their limited life spans which dictate the network sampling. This approach is referred to as the nominal approach developed by Lauman, Marsden and Prensky (1989), cited in Wasserman and Faust (1994). Therefore and for the purposes of this research, this approach to define the network boundaries and contain the analysis population is deemed to be acceptable.

Data gathering is being conducted to answer three fundamental questions in relation to the theoretical framework comprising project success factors, information exchange and gap analysis, as identified in Chapter Three (see figure 7).

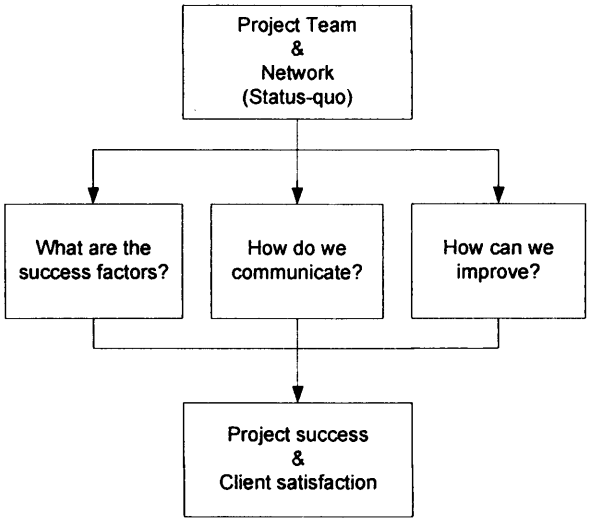


Figure 7: Fundamental questions of research

Data gathering

In order to ensure the reliability of the data analysis, it was important to contain the project variables during the selection process. Two similar case study analyses were carried out. The data gathering and data analysis for both samples were conducted simultaneously, independently and in an identical manner. A brief outline of the case studies is included later in this section.

A modified questionnaire survey was conducted to identify the project success factors, type and level of communication, and project gaps in conformance and realization. Project coalitions were identified and boundaries drawn around the sample networks. Members of each project team were asked to complete and return the questionnaires via e-mail. However, most of the data used for the analysis were gathered on phone. The data were considered accurate and acceptable for the purposes of this research.

The questionnaire included questions on the following:

- project success factors;
- type, importance and frequency of communication; and
- problems of conformance and realization[28].

[28] See Winch *et al* (1998) for the application of gap analysis in construction projects.

Project Success Factors

The question of project success factors was developed from Cleland *et al* (1988). It is accepted that each organisation has its own way of measuring and expressing project success. However, in spite of such differences, there seem to be unspoken rules regarding project success at the implementation stage.

Project success factors were identified through the open-ended question: ' *What are the Key Project Indicators?*'[29]. The list was limited to the three most important items.

The answers were challenged through informal discussions in order to examine the project coalitions' understanding of project success factors.

The participants were asked to identify the impact of the project KPIs and identify project actor(s) associated with each KPIs. This was included in case further analysis is required in future to the centrality levels of actors strongly linked to project success / failure. However, the question was commonly misinterpreted as a means of performance appraisal.

Social Network Analysis

In order to examine the communication patterns in any project environment, it is necessary to define the nature of the communication, as aspects of communication can generate thousands of different network configurations.

The research question (identified in Chapter Two) aims to study the density of information exchange in projects. Construction projects are seen as smaller representations of social settings. As a result, it is important to consider different patterns of communication to mirror the non-hierarchical nature of networks. The participants completing the questionnaire survey were asked to consider four types of communication: *instruction, advice, information exchange* and *discussion.*

The communications among the project coalitions were classified under three categories: *scope of work, cost-related* and *schedule-related* (identified as *SW, CR* and *SR* respectively). The participants were asked to record sent and received communications as per the above classifications, and subjectively evaluate their related levels of frequency and importance.

[29] KPIs are introduced to the project coalitions as items that can indicate project success. Benchmarking and measuring mechanisms were not considered at this stage.

They were asked to answer two questions:

- *From whom do you receive information?*
- *To whom do you send information?*

The gathered information was filtered and the communications categorised as high or low priority according to their importance and frequency. The analysis focused on two types of communication: *information exchange* and *discussion*. The former mirrors the nature of the implementation stage; the latter reflects the non-hierarchical communication patterns in networks. The data were used to produce a node list for each member of the network[30]. The node lists were used as raw data to produce a graphic presentation of the networks. UCINET 6 was used for this purpose and network diagrams were produced in JPEG format.

Criteria	Importance of communication	Frequency of communication
Low	1 – Not important 3 – Less important	3 – Monthly 4 – Fortnightly
High	5 – Important 7 – Very important 9 – Extremely important	5 – Weekly 8 – Daily 9 – Several times a day

Table 4: Classification criteria.

Indices for Social Network Analysis
(http://en.wikipedia.org/wiki/Social_network, accessed 3rd September 2006)

Centrality
The count of the number of ties to other actors in the network. See also

Centralization
The difference between the n of links for each node divided by the maximum possible sum of the differences. A centralized network will have many of its links dispersed

[30] The node list is a text representation of actors connected to each other in any specific network.

around one or a few nodes, while a decentralized network is one in which there is little variation between the n of links each node possesses.

Density

Individual-level density is the degree to which a respondent's ties know one another/ the proportion of ties among an individual's nominees. Network or global-level density is the proportion of ties in a network relative to the total number possible (sparse versus dense networks).

Although project coalitions were asked to identify sent and received information, the data exhibited a high level of personal bias regarding the importance of information. Data on received communication were used for the analysis to eliminate the need to examine imbedded personal bias.

Gap analysis

Gap analysis was used to map the communication patterns among the members of each project coalition. The two projects were at the implementation / execution stage (RIBA K); as a result, this research focused on the execution problem. The key participants (management consultants, architects, quantity surveyors and contractors) were asked to identify any constraints that may hinder successful project delivery. The question was structured as an open-ended question to eliminate any constraints to their answers. The answers were populated around the theme of communication and information exchange.

About the Case Studies

In order to be able to compare project variables, it is essential that the samples show similarities in project type, complexity, procurement route and project stage. The RIBA plan of work and checklist are used to define the project stage. See Appendix A for the RIBA plan of work. The two projects are based on Design and Build contracts and are currently at the implementation stage (RIBA – K stage).

Project	Total budget	Programme	Area
Petchy Academy	£34,214,999	78 Weeks	10,000 m^2
Westminster Academy	£30,950,082	117 Weeks	11.300 m^2

Table 5: Project characteristics.

The samples were selected from the Academy Programme initiated by the Department for Education and Skills (DfES), on the basis that project objectives were communicated and mature networks developed within the project coalitions. The concept of a limited project life span was adopted and both project networks were populated based on a nominal approach. Data gathering was carried out through a revised questionnaire[31] to investigate project KPIs and success factors, and information exchange. Project teams were asked to identify the type, importance and frequency of sent and received information with reference to the agreed scope of work, project schedule and project cost.

This chapter provided an insight on the research methodology and a description of research samples. The research methodology developed a means to examine project success factors, different communication patterns and current problems of execution. The data gathering was conducted through a questionnaire survey and phone interviews with key personnel in an informal manner. The following chapter presents the research findings.

[31] The SNA questionnaire used for this study is based on the data gathering questionnaire developed by Dr S Pryke of The Bartlett School, UCL, as part of his extensive research on SNA.

Chapter 5

Research Findings

"The unexamined life is not worth living"
Socrates (470-399)

Project Success

The team members of project coalitions were asked to identify the project KPIs and perceived success factors. The feed back shows that the current project stage dictates the project success factors.

Project coalitions identified cost and schedule as primary success factors and an indication of project success. None of the team members classified client satisfaction as an independent factor contributing to project success. There was a common understanding that client satisfaction can be materialised through delivery on time and to budget. The findings show that there is a common perception among project members on project success factors at the current project stage for the two projects, with slight difference in order. The findings show that there is a common perception among project members regarding project success factors at the current project stage for both projects. However, there were slight differences in order: Team members of Project B highlighted the significance of project budget in preference to project schedule whereas team members of Project A considered project schedule is more important.

Benefits to the organisation or project stakeholders were not considered by any of the project team. None of the project coalitions considered the concept of repetitive business or repetitive client. No consideration was given beyond the current stage of the project. All actors agreed on the following as factors:

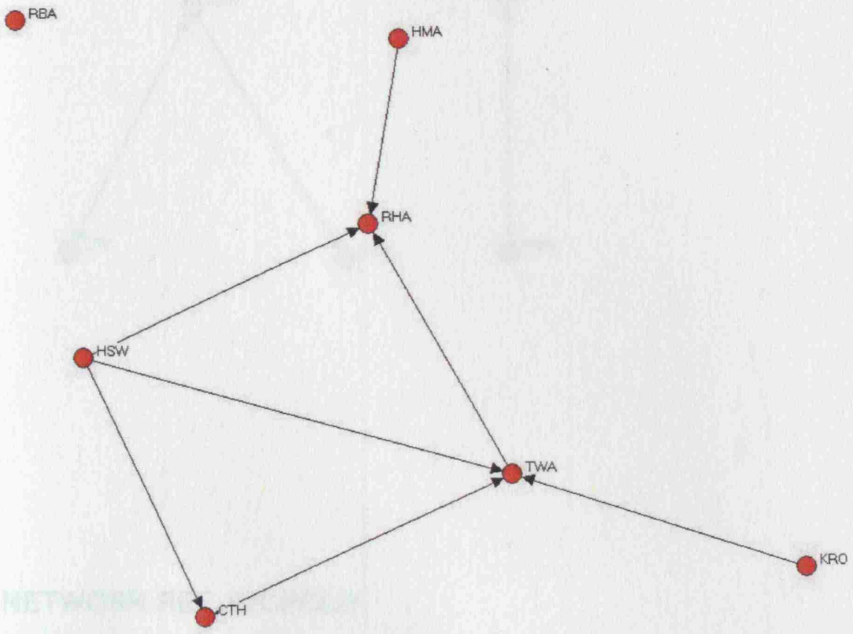
- Accuracy of approved budget
- Minimum changes during construction
- Effective contract administration
- Co-ordination among project team
- Good communication

The following secondary factors were also identified:

- Finalised scope of work
- Quality of drawings
- Clarity of instructions

Social Network Analysis

Project A



N

ETWORK REF. 01CRCHI

Type of Communication	Area of Communication	Level of Communication
Information	Cost related	High priority

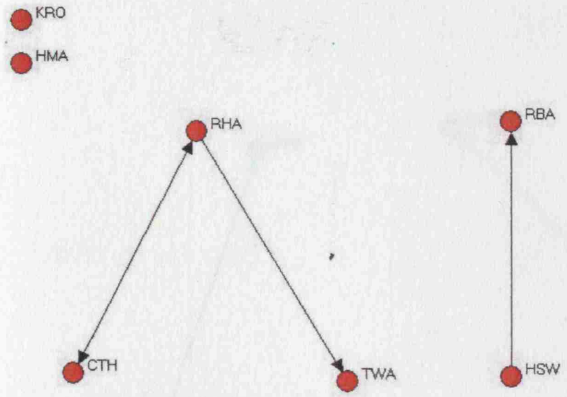
NOTES:

- One isolate (RBA - Structural Engineer)
- KRO and HMA initiate one directional information flow
- TWA is an active central node and acts as a bridge between KRO and HMA
- RHA is a central receiving actor
- Directional flow of project information
- Project coalition reflect slow centrality network

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01CRCLO

Type of Communication	Area of Communication	Level of Communication
Information	Cost related	Low priority

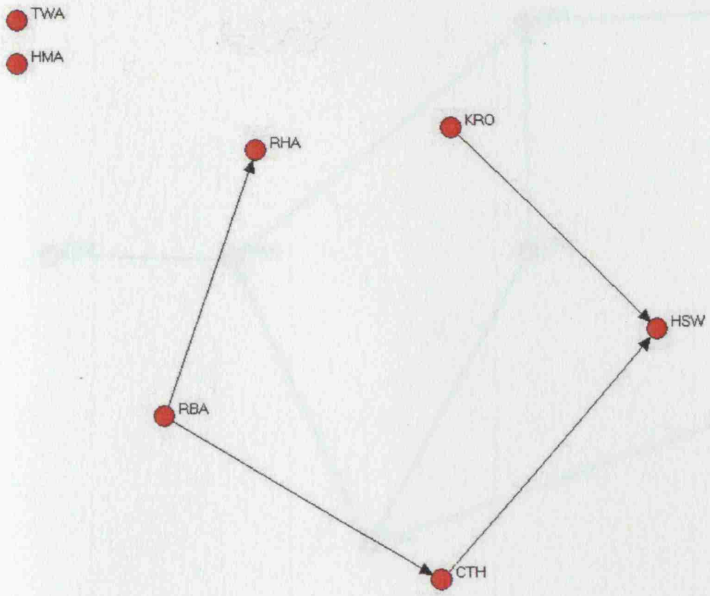
NOTES:

- Three sub-groups
- KRO and HMA are isolates in this network
- Incomplete triad between RHA (Architect), CTH (Contractor) and TWA (Quantity Surveyor)
- A directional flow between HSW and RBA and in isolation to the network
- Isolated, low centrality network

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01CRDHI

Type of Communication	Area of Communication	Level of Communication
Discussion	Cost related	High priority

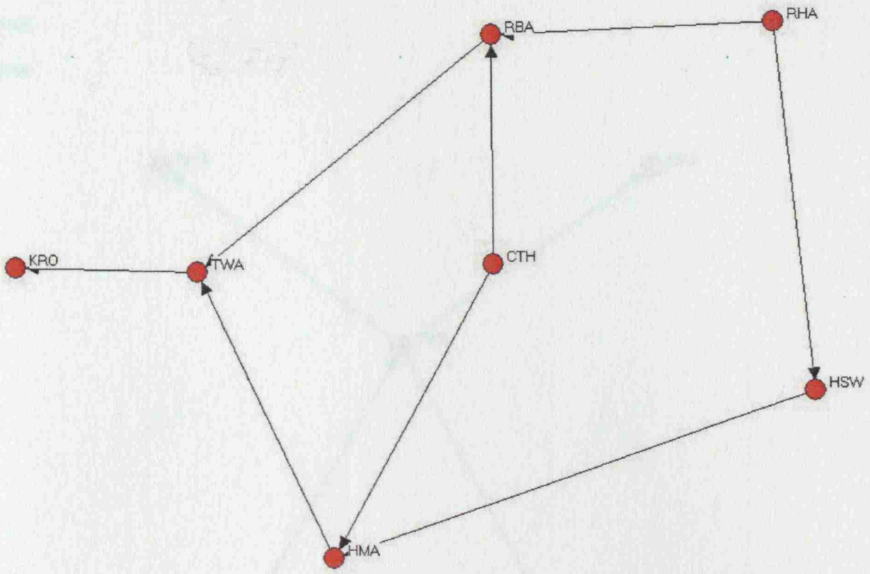
NOTES:

- TWA and HMA are isolates in this network
- CTH is acting as a bridge between RBA and HSW
- Very low centrality network
- Linear directional flow of information

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01CRDLO

Type of Communication	Area of Communication	Level of Communication
Discussion	Cost related	Low priority

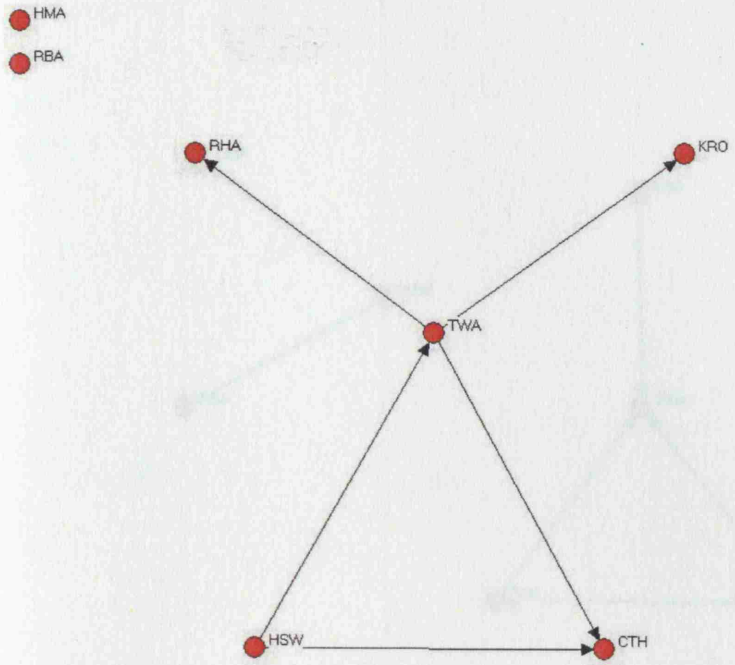
NOTES:

- Relatively high centrality network
- CTH is acting as a central hub of information (See 01CRDHI)
- CTH (Contractor) is not engaged in cost related discussion with TWA (Quantity Surveyor)

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SRCHI

Type of Communication	Area of Communication	Level of Communication
Information	Schedule related	High priority

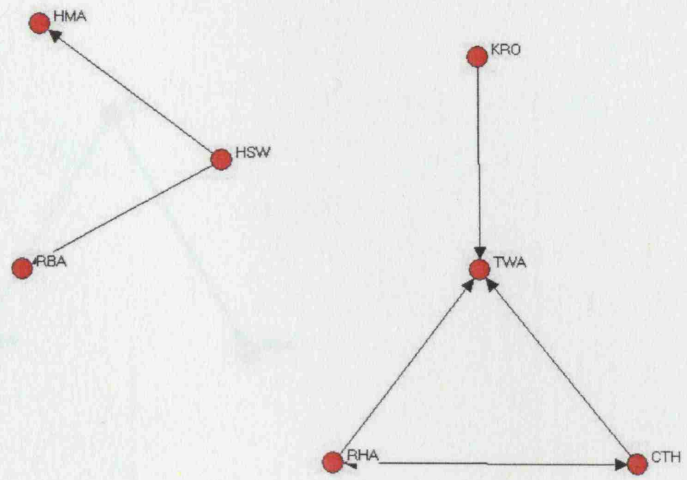
NOTES:

- Low centrality network
- The structural and service engineers are isolated
- TWA (Quantity Surveyor) is a central node forming a triad with CTH and HSW and has a linear communication link to KRO.
- The network is shaped by the roles of the project coalition

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SRCLO

Type of Communication	Area of Communication	Level of Communication
Information	Schedule related	Low priority

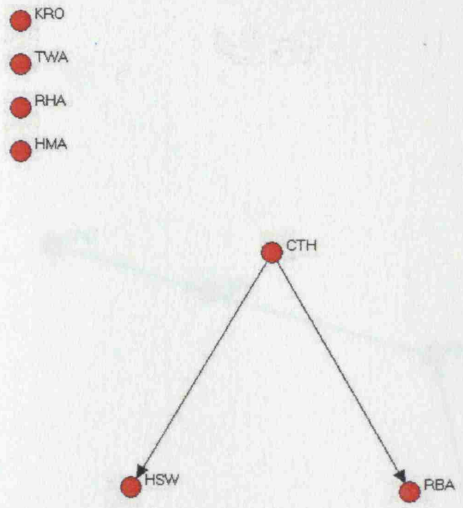
NOTES:

- The network is formed around two sub-groups
- The first sub-group shows the one-way directional flow of information from HSW to HMA and RBA, forming an incomplete triad
- The second sub-group shows that TWA is an actor with relatively high centrality forming a triad with CTH and RHA

KEY:

HSW	Construction Project Manager
KRO	Employee Agent
TWA	Quantity Surveyor
CTH	Contractor
RHA	Architect
HMA	Service Engineer
RBA	Structural Engineer

Project A



NETWORK REF. 01SRDHI

Type of Communication	Area of Communication	Level of Communication
Discussion	Schedule related	High priority

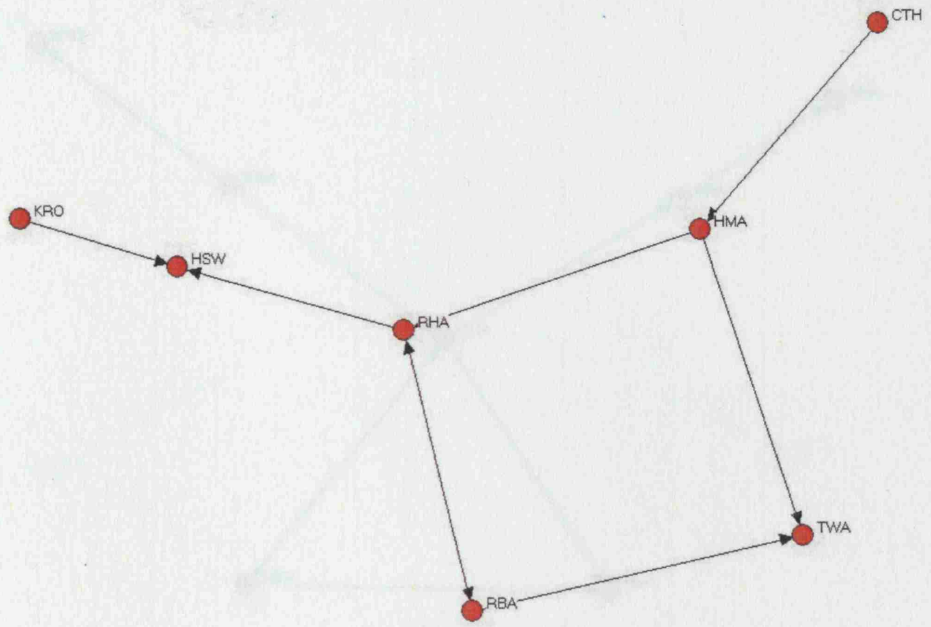
NOTES:

- KRO, KRO, RHA and HMA are isolates in this network
- CTH has directional links with RBA and HSW, forming an incomplete triad
- Very low density and centrality
- Poor discussion amongst the project team

KEY:

HSW	Construction Project Manager
KRO	Employee Agent
TWA	Quantity Surveyor
CTH	Contractor
RHA	Architect
HMA	Service Engineer
RBA	Structural Engineer

Project A



NETWORK REF. 01SRDLO

Type of Communication	Area of Communication	Level of Communication
Discussion	Schedule related	Low priority

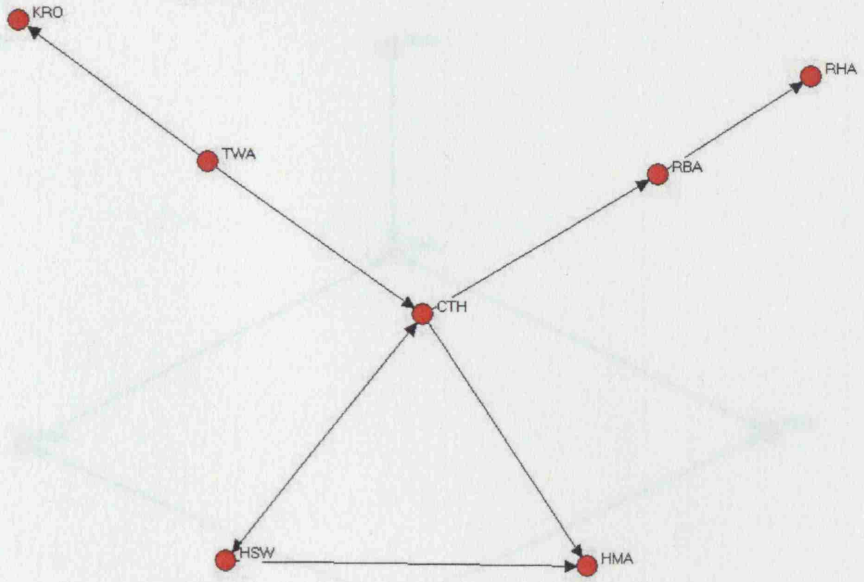
NOTES:

- Low density network
- RHA and HMA have relatively high centrality
- HSW and TWA are acting as a recipients in this network
- This network reflects mid-level intensity of schedule related discussion

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SWCHI

Type of Communication	Area of Communication	Level of Communication
Information	Scope of work	High priority

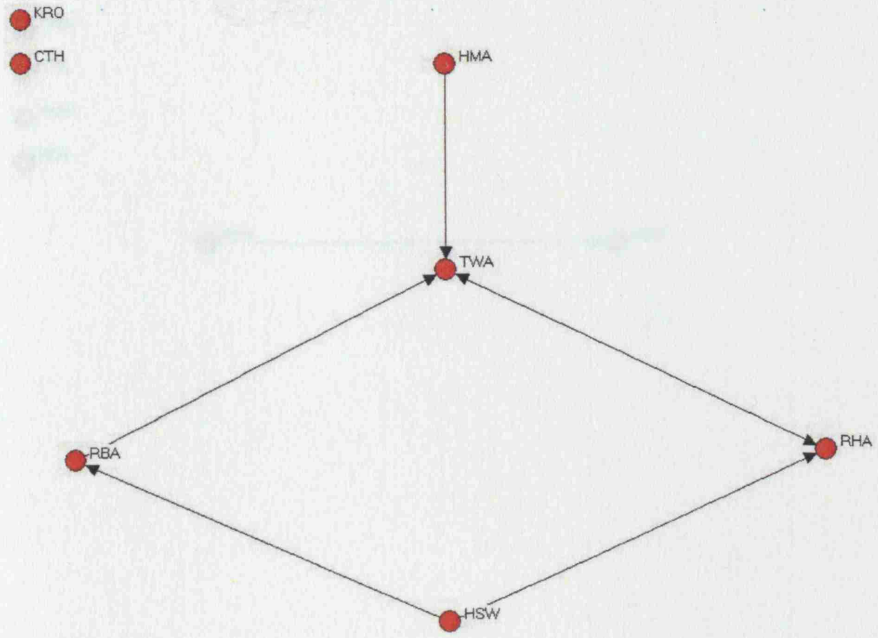
NOTES:

- TWA initiates the information flow
- CTH, HMA and HSW form an active triad linked to the rest of the network through CTH
- CTH has the highest centrality level in this network
- RBA is a bridge between CTH and RHA

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SWCLO

Type of Communication	Area of Communication	Level of Communication
Information	Scope of work	Low priority

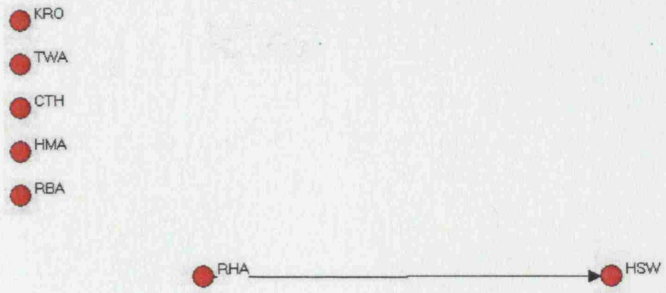
NOTES:

- Low density, low centrality
- TWA has a relatively high centrality in this network and acts as a receiving node
- RHA has a bi-directional communication link with TWA
- KRO and CTH are isolates in this network

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SWDHI

Type of Communication	Area of Communication	Level of Communication
Discussion	Scope of work	High priority

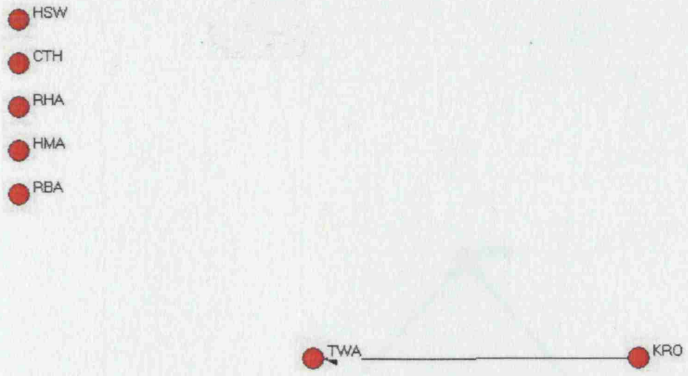
NOTES:

- Very low density
- Very low centrality
- Hardly performing as a network
- Five isolates
- Single link between HSW and HSW
- The discussion is contained and not shared

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SWDLO

Type of Communication	Area of Communication	Level of Communication
Discussion	Scope of work	Low priority

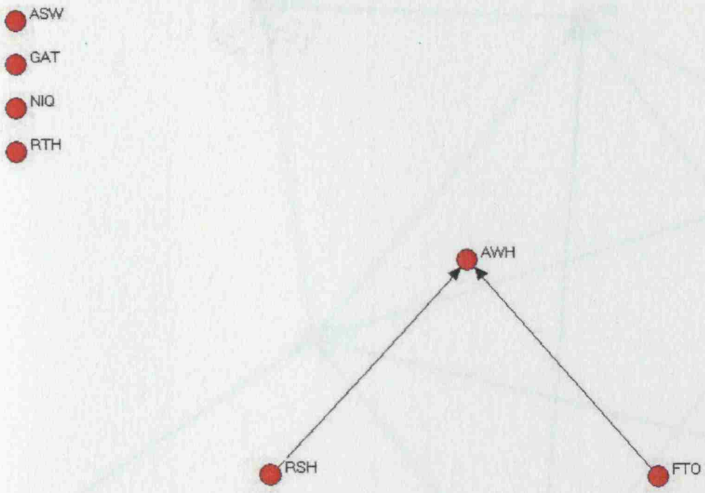
NOTES:

- Very low density
- Very low centrality
- Hardly performing as a network
- Five isolates
- Single link between KRO and TWA
- The discussion is contained and not shared

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project B



NETWORK REF. 02CRCLO

Type of Communication	Area of Communication	Level of Communication
Information	Cost related	Low priority

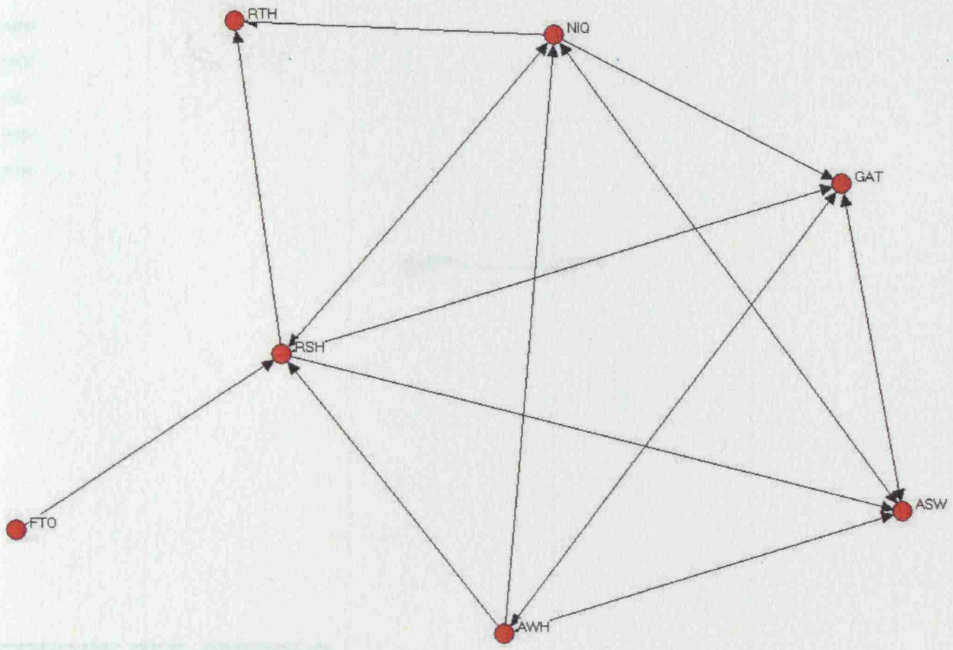
NOTES:

- Four isolates
- FTO and RSH send information to AWH in an incomplete triad
- Low frequency – unimportant cost related information is contained by AWH and not shared
- Information flow stops at AWH and is not communicated further
- Very low density, low centrality network

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B



NETWORK REF. 02CRDLO

Type of Communication	Area of Communication	Level of Communication
Discussion	Cost related	Low priority

NOTES:

- Relatively active network
- FTO initiates cost related discussion
- FTO has the lowest centrality in this network
- RSH, RTH and NIQ form a triad connected to the rest of the network
- Excluding RTH and FTO, all network actors have the same centrality level

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B

NETWORK REF. 02SRCLO

Type of communication	Area of Communication	Level of Communication
Information	Schedule related	Low priority

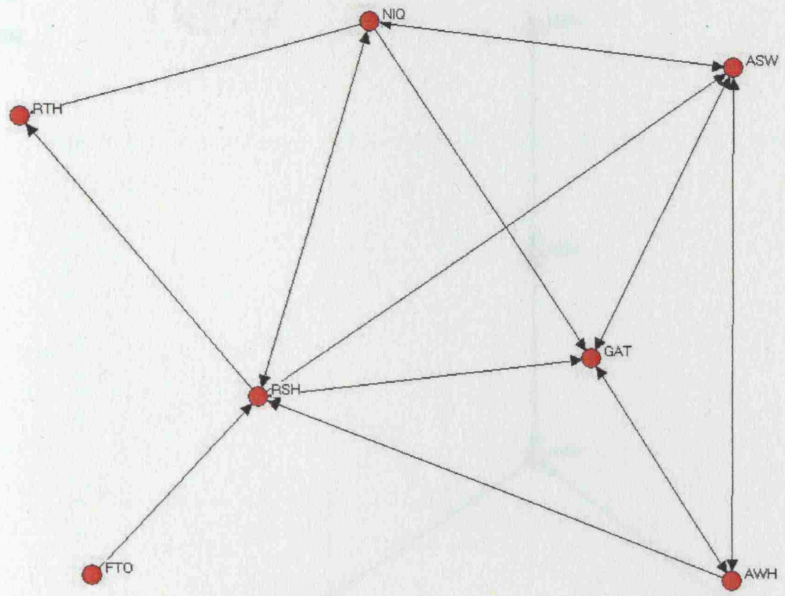
NOTES:

- ASW, GAT, NIQ, RSH and RTH are isolates in this network
- One directional flow of schedule related information between FTO and AWH
- The project coalition is not acting as a network
- Very poor interest in sharing information on project schedule
- Very low density and centrality

Key:

ASW Architect
AWH Construction Project Manager
FTO Client Representative
GAT Quantity Surveyor
NIQ Structural Engineer
RSH Contractor
RTH M/E Engineer

Project B



NETWORK REF. 02SRDLO

Type of Communication	Area of Communication	Level of Communication
Discussion	Schedule related	Low priority

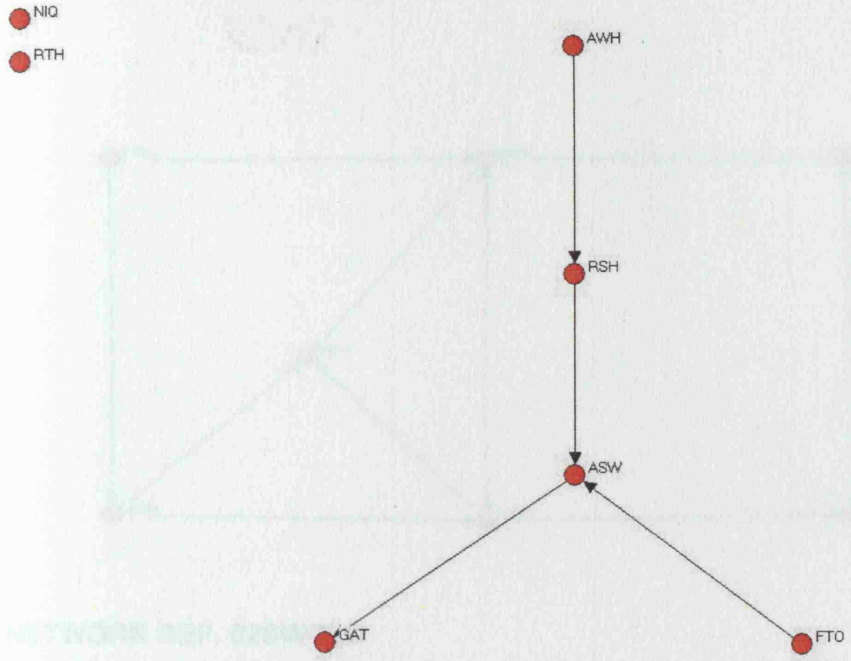
NOTES:

- Active network of schedule related low / low discussion
- Relatively high density
- Relatively high centrality
- FTO initiates the discussion
- RSH, NIQ and RTH form a triad connected to the rest of the network through NIQ and RSH, who has the highest centrality in this network
- GAT is an active central node
- ASW (Architect), AWH (Management Consultant) and RSH (Contractor) form a triad with equal links to GAT (Project quantity surveyor).

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B



NETWORK REF. 02SWCHI

Type of Communication	Area of Communication	Level of Communication
Information	Scope of work	High priority

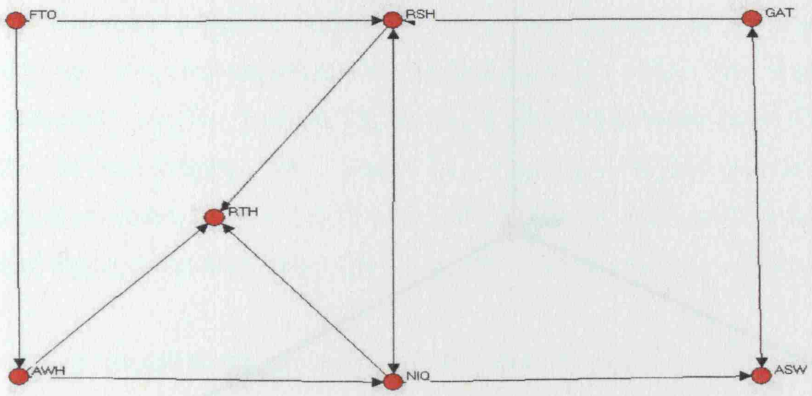
NOTES:

- Low density
- Low centrality
- NIQ and RTH are isolates
- Directional flow of high / high information
- Reflects high contractual arrangement with the primacy given to contract administration

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B



NETWORK REF. 02SWCLO

Type of Communication	Area of Communication	Level of Communication
Information	Scope of work	Low priority

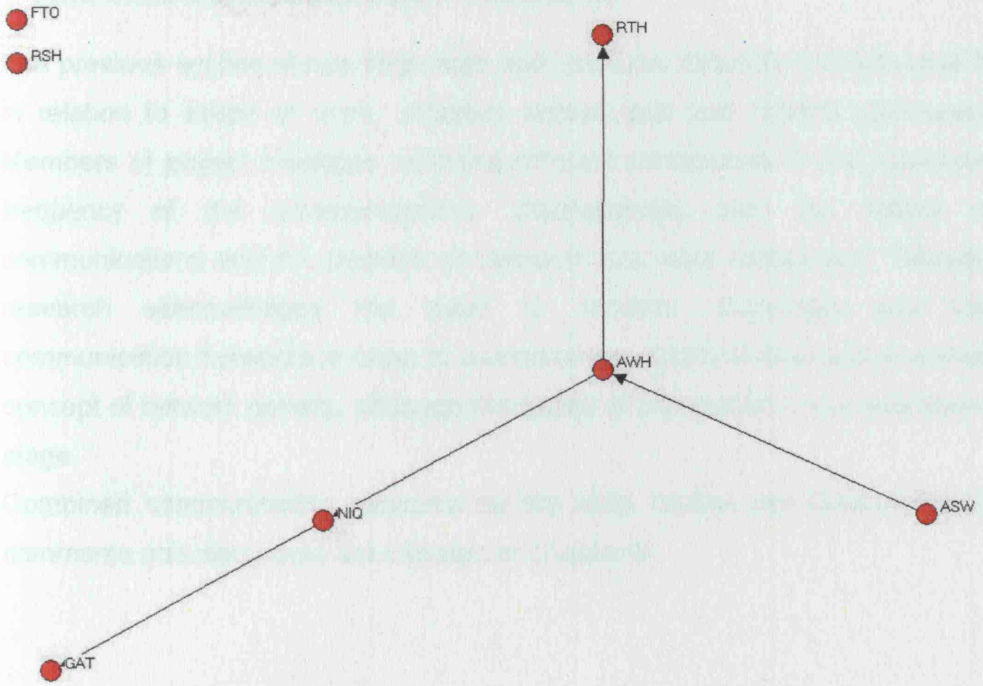
NOTES:

- Low density network
- The contractor has high centrality in this network
- The client initiates the flow of information
- GAT (quantity surveyor) reflects the approach of contract administration being connected to ASW (Architect) and RSH (Contractor)
- ASW acts as a bridge between NIQ and GAT
- RTH is an active receiving node
- Information flow stops at RTH

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B



NETWORK REF. 02SWDLO

Type of Communication	Area of Communication	Level of Communication
Discussion	Scope of work	Low priority

NOTES:

- Low centrality, low density network
- The network reflects poor discussion of scope of work
- AWH acts as a central node in this network
- NIQ is a bridge between AWH and GAT
- The client and contractor are isolates and take no part in the discussion, which reflects a high contractual approach

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

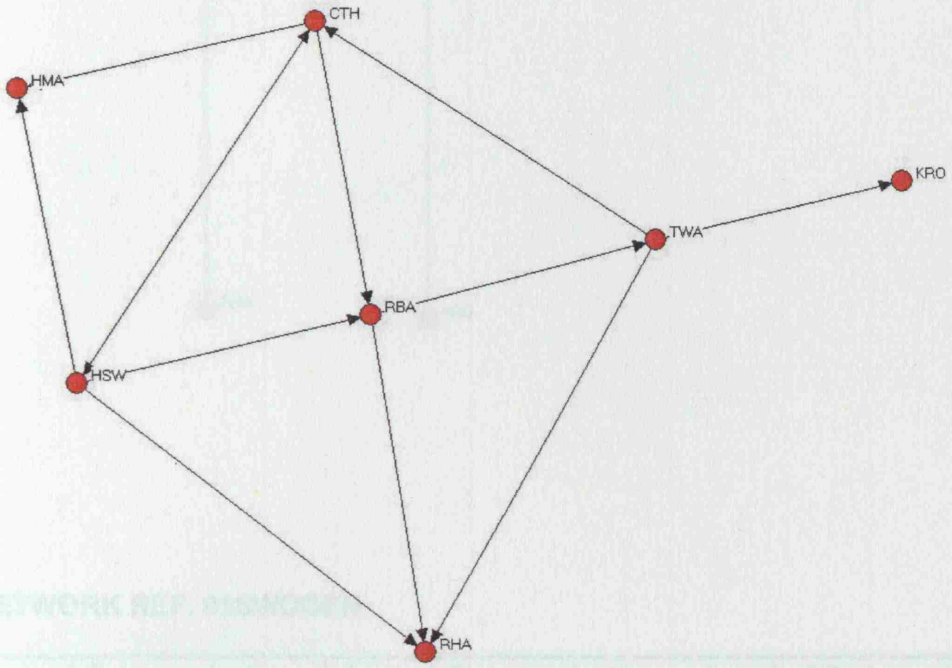
Combined communication networks

The previous section shows High-High and Low-Low networks for both case studies in relation to scope of work, schedule related and cost related communications. Members of project coalitions exhibited different perceptions of the importance and frequency of the communications. Discrepancies over the nature of the communications and the problem of personal bias were recognised. Therefore this research acknowledges the need to combine High-High and Low-Low communication networks in order to overcome any personal bias and re-consider the concept of network density, although the quality of information is not examined at this stage.

Combined communication networks for the case studies are illustrated next, and comments and discussion are included in Chapter 6.

Project A. Combined Networks

Project A



NETWORK REF. 01SWCGEN

Type of Communication	Area of Communication	Level of Communication
Information exchange	Scope of work	Combined priority

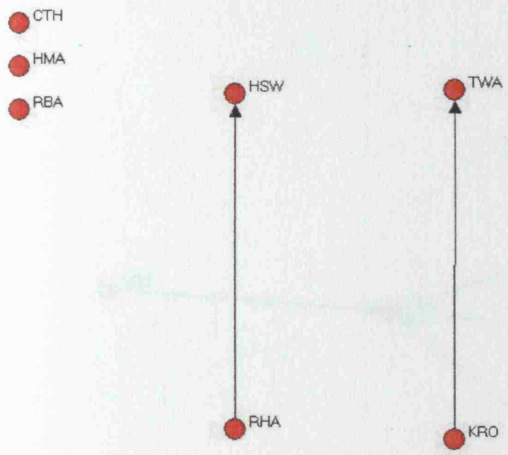
NOTES:

- Relatively high density network.
- CTH, TW, RHA and HSW from an integral quadrant of the network
- HMA forms a triad with CTH and HSW
- RBA is a bridge between CTH and RHA; and between HSW and TWA
- KRO is linked to the network through a single directional tie with TWA

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SWDGEN

Type of Communication	Area of Communication	Level of Communication
Discussion	Scope of work	Combined priority

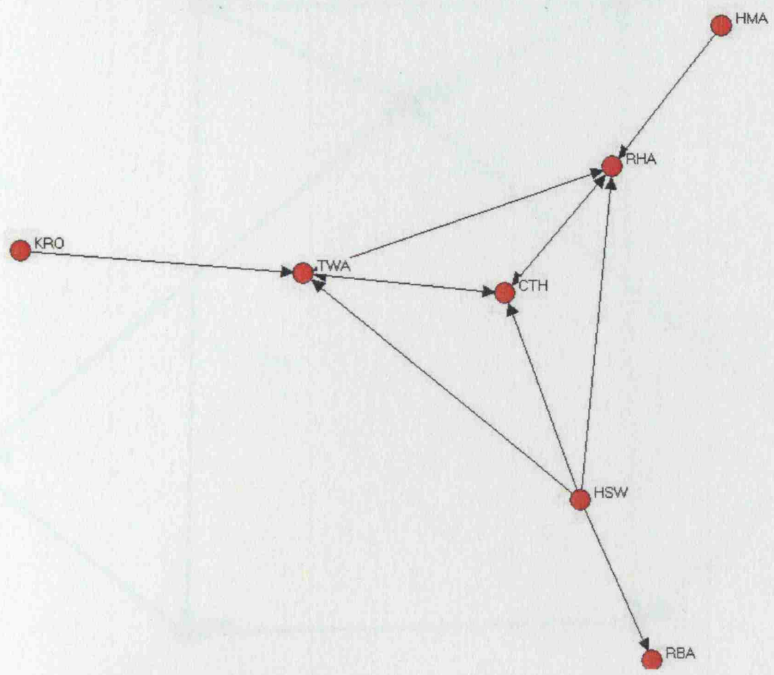
NOTES:

- Low centrality, low density network
- Three isolates
- Two separate sub-groups in dyadic relationships

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01CRCGEN

Type of Communication	Area of Communication	Level of Communication
Information exchange	Cost related	Combined priority

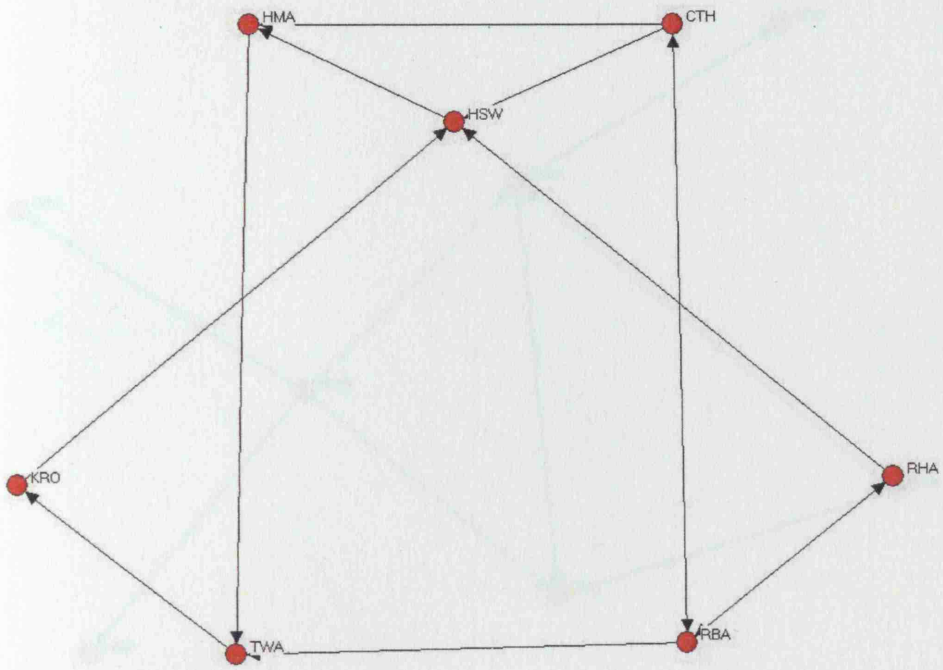
NOTES:

- RHA, HSW and TWA form a triad, with CTH in the centre of the network
- RBA, KRO and HMA form extended arms to the network in three different directions
- Centre-focused formation of cost related information exchange

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01CRDGEN

Type of Communication	Area of Communication	Level of Communication
Discussion	Cost related	Combined priority

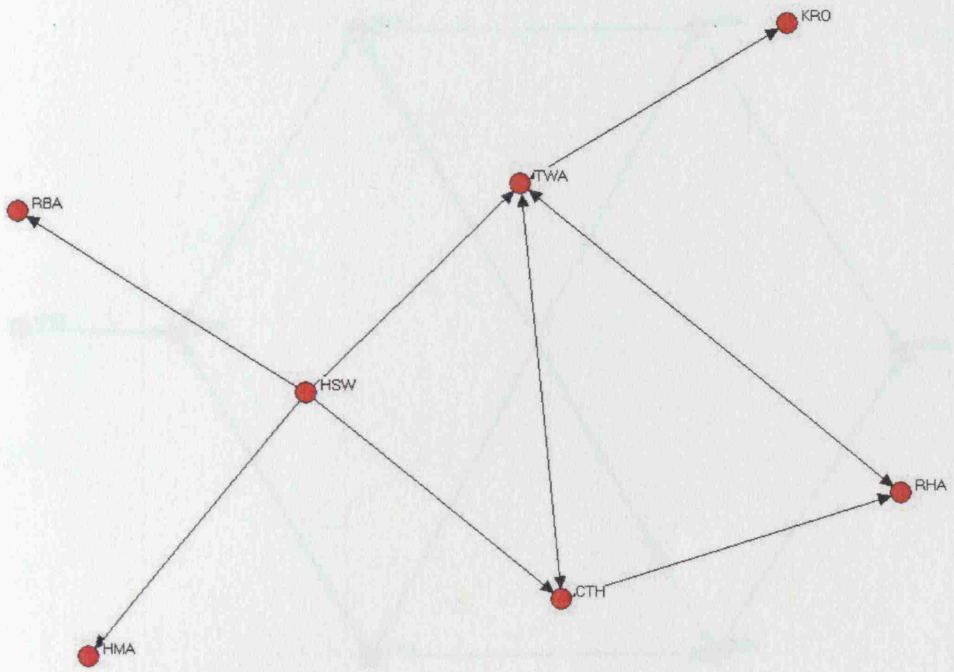
NOTES:

- Medium density and centrality network
- HSW is a central actor in this network
- CTH, RBA, TWA and HMA form the central quadrant of the network
- RHA is a bridge between RBA and HSW
- KRO is a bridge between TWA and HSW

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project A



NETWORK REF. 01SRCGEN

Type of Communication	Area of Communication	Level of Communication
Information exchange	Schedule related	Combined priority

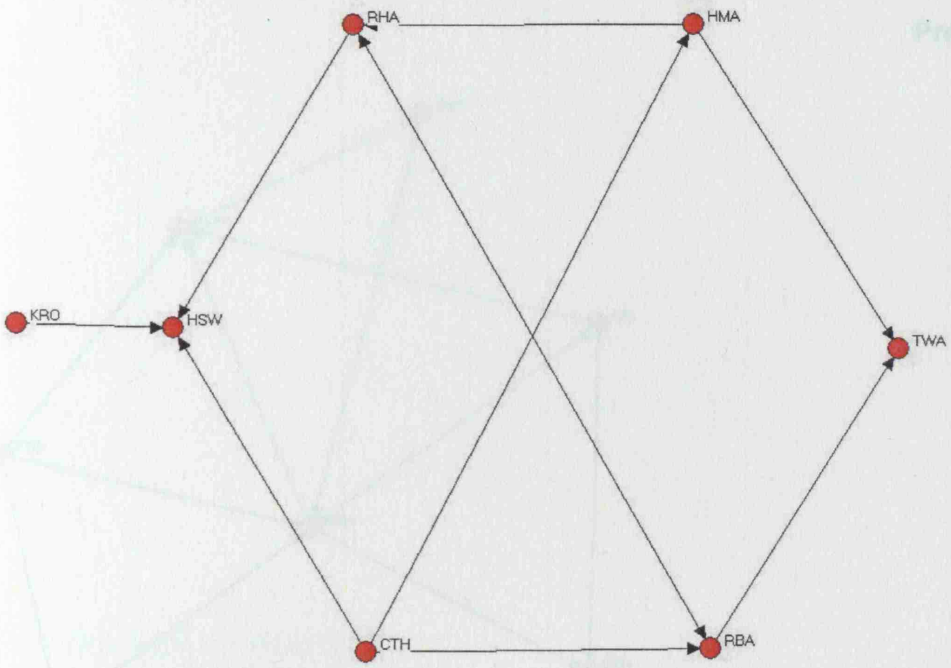
NOTES:

- Medium density network
- HSW is an active node sending information to TWA, CTH, HMA and RBA
- TWA is a receiving node receiving information from HSW, RHA and CTH
- TWA is in a triad with RHA and CTH

KEY:

HSW	Construction Project Manager
KRO	Employee Agent
TWA	Quantity Surveyor
CTH	Contractor
RHA	Architect
HMA	Service Engineer
RBA	Structural Engineer

Project A



NETWORK REF. 01SRDGEN

Type of Communication	Area of Communication	Level of Communication
Discussion	Schedule related	Combined priority

NOTES:

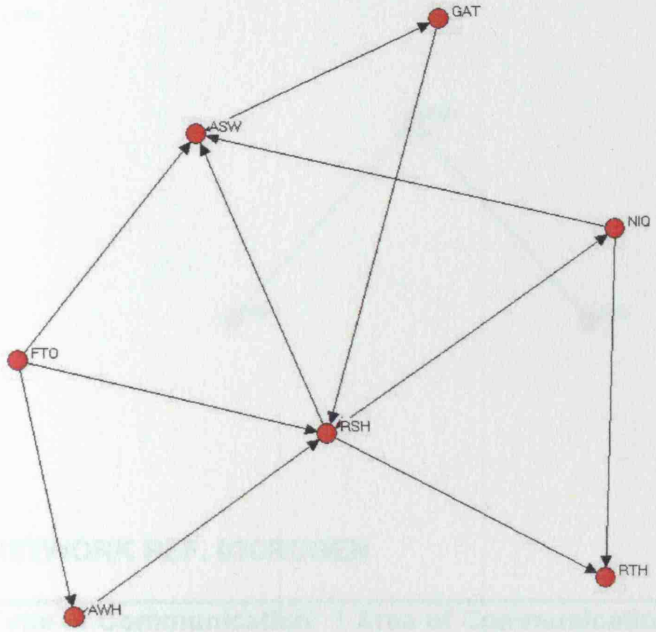
- This is a very balanced formation of discussion
- All actors have the same centrality level except for TWA
- KRO acts as an initiator in this network

KEY:

HSW Construction Project Manager
KRO Employee Agent
TWA Quantity Surveyor
CTH Contractor
RHA Architect
HMA Service Engineer
RBA Structural Engineer

Project B. Combined Networks

Project B



NETWORK REF. 02SWCGEN

Type of Communication	Area of Communication	Level of Communication
Information exchange	Scope of work	Combined priority

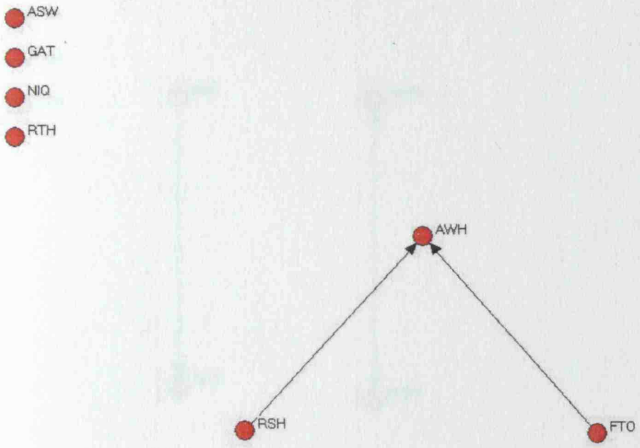
NOTES:

- Relatively high density
- RSH has the highest centrality level and is a central actor in the network
- The network formation is near balanced with near perfect distribution around RSH
- FTO initiates the flow of information as an active sender to ASW, AWH and RSH

Key:

ASW Architect
AWH Construction Project Manager
FTO Client Representative
GAT Quantity Surveyor
NIQ Structural Engineer
RSH Contractor
RTH M/E Engineer

Project B



NETWORK REF. 02CRCGEN

Type of Communication	Area of Communication	Level of Communication
Information exchange	Cost related	Combined priority

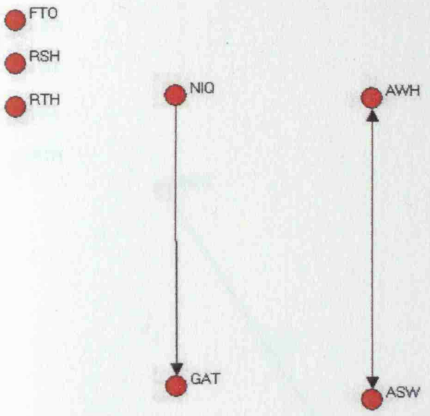
NOTES:

- No cost related high-high information exchange has been recorded
- The figure 02CRCGEN, above reflects the low-low information exchange network
- Four isolates
- FTO and RSH send information to AWH in an incomplete triad
- Low frequency– unimportant cost related information is contained by AWH and not shared
- Information flow stops at AWH and is not communicated further
- Very low density, low centrality network

Key:

ASW Architect
AWH Construction Project Manager
FTO Client Representative
GAT Quantity Surveyor
NIQ Structural Engineer
RSH Contractor
RTH M/E Engineer

Project B



NETWORK REF. 02SWDGEN

Type of Communication	Area of Communication	Level of Communication
Discussion	Scope of work	Combined priority

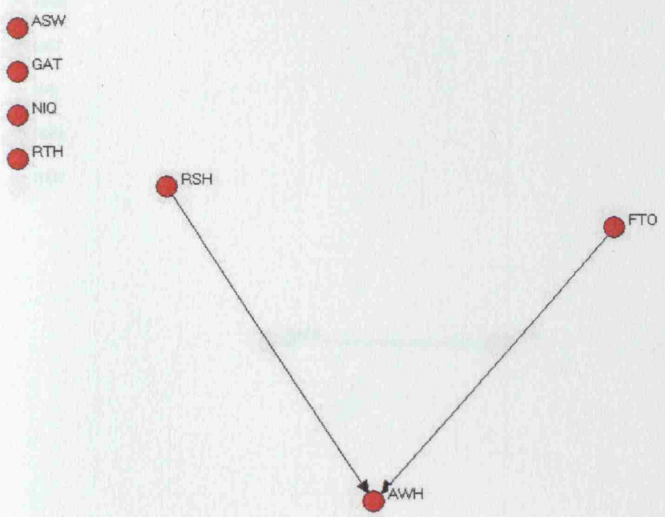
NOTES:

- Two separate sub-groups
- Three isolates
- Low centrality, low density network

Key:

ASW Architect
AWH Construction Project Manager
FTO Client Representative
GAT Quantity Surveyor
NIQ Structural Engineer
RSH Contractor
RTH M/E Engineer

Project B



NETWORK REF. 02CRDGEN

Type of Communication	Area of Communication	Level of Communication
Discussion	Cost related	Combined priority

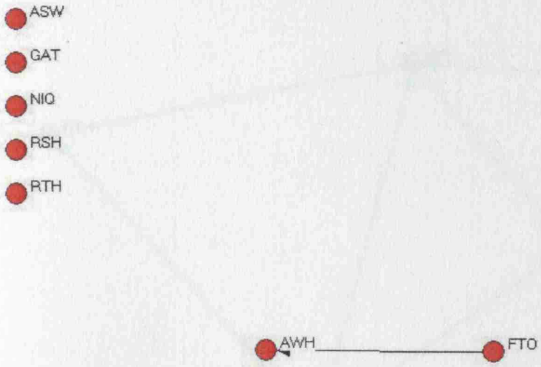
NOTES:

- Four isolates
- Low centrality, low density network
- Incomplete triad between AWH, FTO and RSH

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B



NETWORK REF. 02SRCGEN

Type of Communication	Area of Communication	Level of Communication
Information exchange	Schedule related	Combined priority

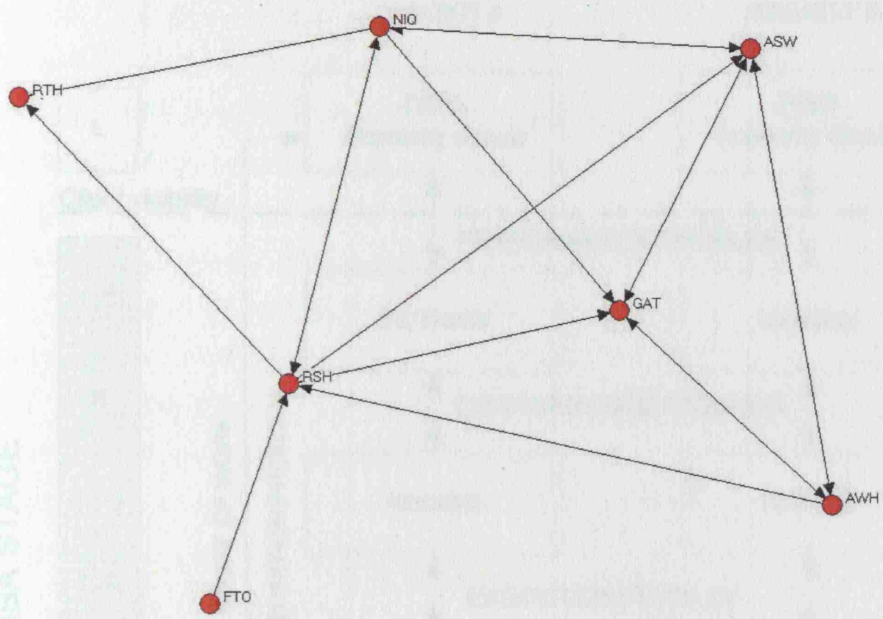
NOTES:

- Very low density
- Five isolates
- Single flow of information from FTO to AWH

Key:

ASW	Architect
AWH	Construction Project Manager
FTO	Client Representative
GAT	Quantity Surveyor
NIQ	Structural Engineer
RSH	Contractor
RTH	M/E Engineer

Project B



NETWORK REF. 02SRDGEN

Type of Communication	Area of Communication	Level of Communication
Discussion	Schedule related	Combined priority

NOTES:

- Relatively active network of relatively high density
- GAT and RSH are central nodes in this network
- Perfect triad between ASW, AWH and RSH, with GAT in the centre
- FTO has the lowest centrality with a single link to RSH

Key:

ASW Architect
AWH Construction Project Manager
FTO Client Representative
GAT Quantity Surveyor
NIQ Structural Engineer
RSH Contractor
RTH M/E Engineer.

Gap analysis

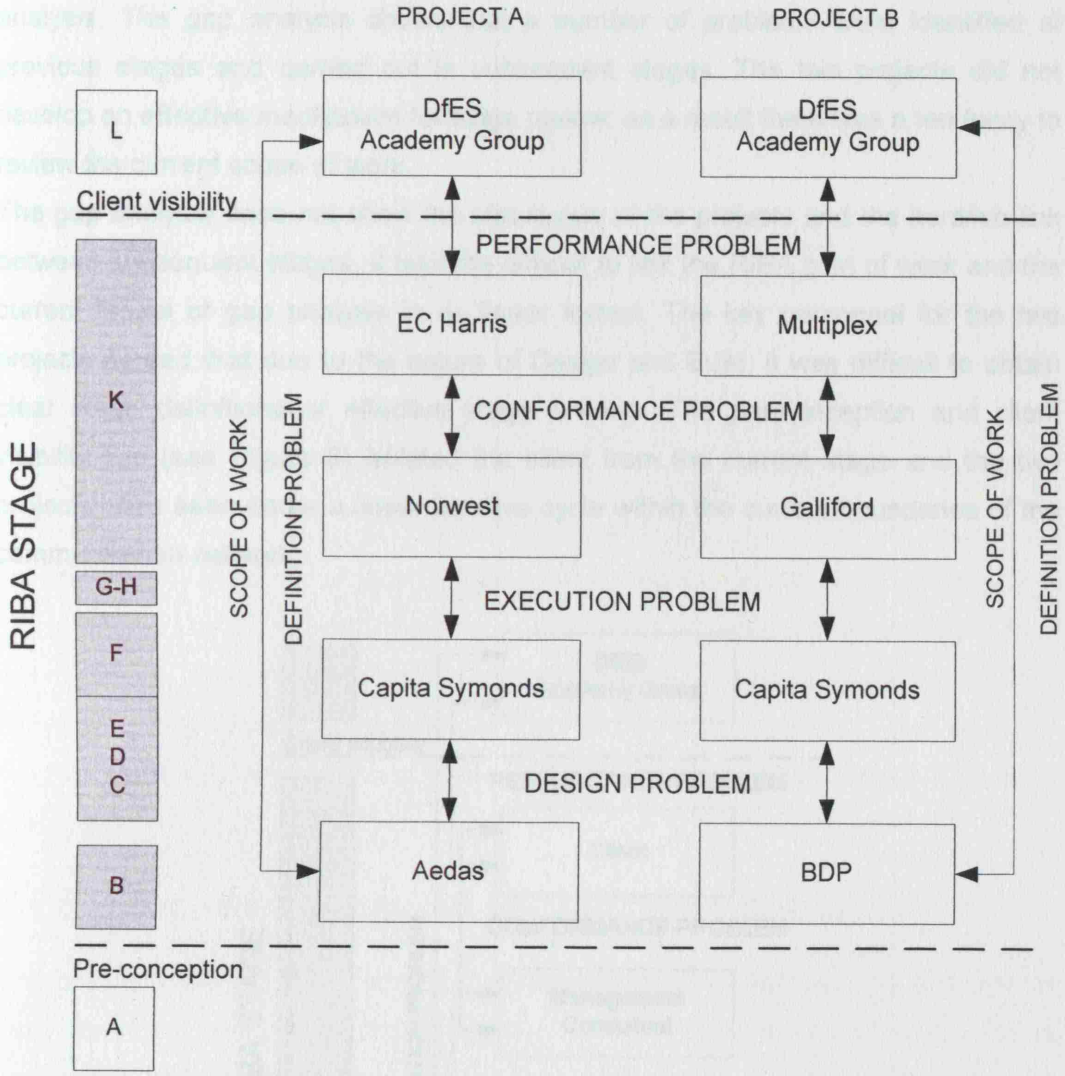


Figure 8: Gap analysis for the case studies

The project managers were asked to identify the gap analysis of their projects following the model developed by Winch *et al.* (1998). The gap model for each project was identified and linked to the RIBA plan of work as shown above.

This research addressed the execution stage (RIBA-Stage K) and concentrated on the discussion and information exchange communication patterns in relation to scope of work, project cost and project schedule. The high priorities of the two projects emerged as being project cost and schedule. The gap analysis shows that the two projects are seen as chains of events, following the RIBA plan of work, in opposition to the organic nature of information exchange. Due to the nature of the current

procurement route (Design and Build), four parties are interlinked. The architect, contractor, management consultant and the client form the central part of the gap analysis. The gap analysis shows that a number of problems were identified at previous stages and carried out in subsequent stages. The two projects did not develop an effective mechanism for stage review; as a result there was a tendency to review the current scope of work.

The gap analysis does not show the status quo of the projects and the iterative link between subsequent stages. It became difficult to link the RIBA plan of work and the current model of gap analysis in its linear format. The key personnel for the two projects agreed that due to the nature of Design and Build, it was difficult to obtain clear stage definitions or effective stage reviews. The pre-conception and client visibility line (see Figure 8) isolated the client from the current stage and the two projects were seen under a linear iterative cycle within the current boundaries of the communication network.

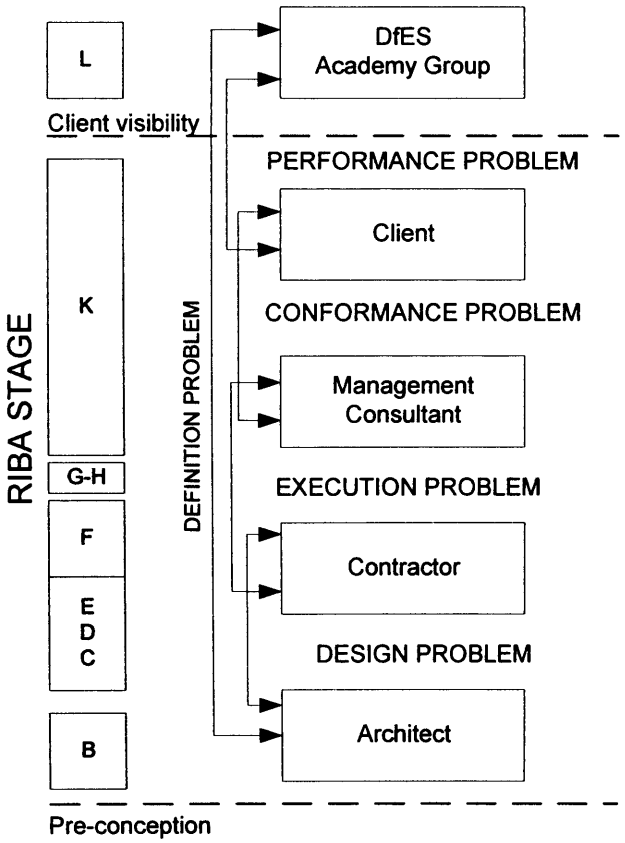


Figure 9: Gap analysis and projects' status quo

Chapter 6

Discussion

"Any piece of knowledge I acquire today has a value at this moment exactly proportioned to my skill to deal with it. Tomorrow, when I know more, I recall that piece of knowledge and use it better"

Mark Van Doren (1894–1972)

This research conceptualised the two case studies as networks of actors connected through links. The nature and type of links mutually influence how project coalitions operate. This was measured and represented graphically under the categories identified in the previous chapter. It was essential for the benefit of the discussion to consider the roles of individual members of the project coalitions in opposition to their organisations. The research findings are discussed and aspects of project success factors, communication networks and gap analysis are covered. The research findings are linked to the RIBA plan of work, which is an essential component of the discussion.

Project success factors and the RIBA plan of work

The two case studies demonstrated the principal considerations of time and cost as being the main measures of project success. The ultimate goal of management tools was overlooked and the project coalitions focused on the contractual relationship as a means to effective project control. This interest is reinforced by the adoption of the RIBA plan of work. This section briefly analyses the RIBA plan of work and its impact on the construction industry[32].

Construction projects involve a high number of project actors and stakeholders. The impact of the construction industry on the built environment is extended to include social aspects as well as technical ones. The industrial revolution facilitated significant development in the technical aspects of the construction industry. Social

[32] The RIBA plan of work is used to identify the project stage for the two case studies used for this research, and therefore management models developed by other professional bodies do not form part of the discussion.

aspects did not develop at the same pace and were overlooked. The construction industry in the UK is currently influenced by professional bodies - RIBA, RICS, APM and CIOB being a few to mention. RIBA deals with all professional aspects of the architectural practice and tends to have a major impact on the construction industry. Projects are governed by procedures developed by RIBA and introduced in their plans of work. (See appendix A for an outline of the RIBA plan of work). However, the RIBA plan of work tends to lack a comprehensive view on the management of projects. The deficiency in the current management of projects tends to be a result of the noticeable absence of management education in architectural programmes.

According the RIBA plan of work, projects are divided into stages and seen as a chain of subsequent stages. There have been calls for collaborative working and the need for a holistic view has been highlighted. Although life cycle fragmentation may be used to manage different stages of projects, the professional bodies need to move away from isolated management views and develop a comprehensive holistic view with the client being taken into consideration. There is a need to gather all professional bodies under one party and develop a common and comprehensive management model.

Project Success Factors

It has been noted that the traditional management model concentrates on measures of time, cost and quality, and gives primacy to the application of management tools in that context. Consequently, project managers focused on hard aspects of project procedures, rather than client needs. The concept of collaboration was introduced to the industry through the Latham (1994) and Egan (1998) reports. However, neither of the two reports provided a structured model on how to initiate and maintain a collaborative environment. It became essential to consider all project actors when dealing with elements and factors of project success. However, current management practice shows otherwise. Project success factors are seen through different lenses and project actors developed uncoordinated views on project success factors. The problem is reinforced through the application of current management models and specifically the RIBA plan of work. There is a need to integrate more than one management model and adopt a wider view on project success factors with the client in focus. Appreciation of project success factors by project coalitions will gradually

enable a collaborative working environment and, ultimately, delivery of project success.

Social Network Analysis

Overview

The discussion above briefly tackled the impact of RIBA plan of work on communication patterns and addressed the project success factors within the time and space constraints. Although it is acceptable for the purpose of this research, the discussion provided herein is not exhaustive and further research needs to be conducted. The following discussion continues with application of social network analysis in the context of this research. It was essential to interpret and discuss the sociograms for the case studies in specific. Therefore, the discussion is valid for the time and context it was written in. However, it is beneficial to extend the research analysis and examine some of the outcomes in more details. A brief discussion of SNA is developed below:

- Social Network Analysis is a useful tool to investigate the communication patterns in construction projects in opposition to linear management tools. Though SNA can be used as an independent exercise to examine different aspect of project networks, it is essential to consider the procurement routes, project processes and procedures. This can be achieved through rigorous combination of different tools. The involvement of all project actors and the client is fundamental for the success of the analysis.
- The role of architect, quantity surveyor and management consultant are being defined by the contractual arrangements under Design and Build which defines and constraints communication patterns. The primacy given to contractual arrangement led to a dominant role of quantity surveyor. As projects are going through the construction phase, the contractor is highly interested in maximising their profit through revised scope of work .
- Design and Build is a flexible procurement route. However, unless a collaborative working environment is well developed, the project goal may not gain the interest of project key actors. The involvement of management consultant is constrained by the procurement route applied and their roles tend to be advisory.

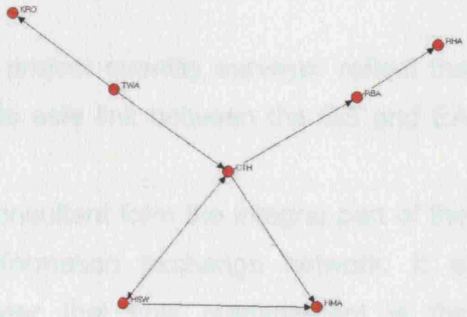
- The SNA sociograms of discussion and information exchange show high reliance on the contractual relationship as project control measure. This primacy given to the contractual arrangements is reflected through linear communication links. Nodes are linked sequentially with one tie each side to form a low density chain tend to emphasise the hierarchy in communication commonly mirror the organisational chart.
- Linear chain of communication with high emphasis on the contractual relationship reflect the role of quantity surveyor system in the UK construction industry, leading to prominence of what is referred to in this research as contract administration syndrome.
- This research highlighted the need to identify the quality of communication in relation to ties. Poor quality information requires repetitive communication links which show high density network. There is a need to examine high density networks in more details to explore the quality of information through links.
- Social Network Analysis as a management tool has an early stage acceptance in the UK. There is high potential of growth and benefits can help reforming the constructing industry. However, SNA, in similarity to all management tools, records limitations. Although the graphic representation of centrality may show actors linked through ties. This does not necessarily imply collaborative environment as actors follow curtain project procedures. The links do not mirror collaboration. This research identifies the concept of connectivity as a collaborative connection which reflects the team work to deliver the client needs, in opposition to centrality which is a mathematical and graphical representation of information exchange.
- There is a plethora of literature on theory and application of SNA. However, little research has been developed on interpretation of SNA diagrams. SNA diagrams should be seen in the light of project context. The project stage, nature and culture should be take into consideration when dealing with SNA diagrams. In that context, it is essential to relate SNA and project-based management to examine, revisit and amend project procedures. Gap analysis is a useful tool to bridge different aspects in management of projects.
- A high degree of personal bias has been recorded where information is viewed more important by senders than receivers. This research used the receiving communication records to monitor project network. Rigorous analysis is required

to capture the level of personal bias in relation to the contractual arrangements and different procurement routes.

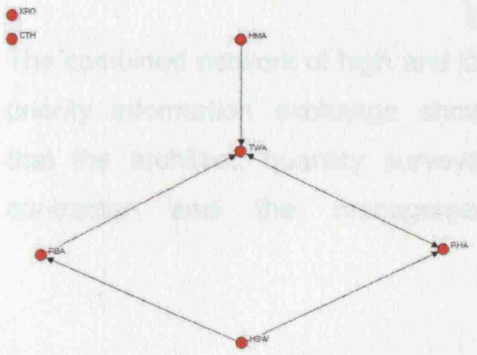
Project A

Scope of work information exchange network

The high priority network (01SWCHI) confirmed the dominance of RIBA plan of work. The Architect is a recipient in this network and information is contained at that point. It coincides with the contractor's interest to review the scope of work a means to control project cost. On the other hand, the high centrality of the contractor shows a change in project governance under Design and Build. As a result, there is an active information exchange between the contractor and the management consultant.



The contractor is not taking part in low-low information network exchange (01SWCLO). Such isolation reflects a lack of interest in information exchange in absence of performance incentives (contractual reward in this scenario).



reflected on the combined network (01SWCGEN).

The contractual relationship dominance is shown by the quantity surveyor gaining relative high centrality on this network and is

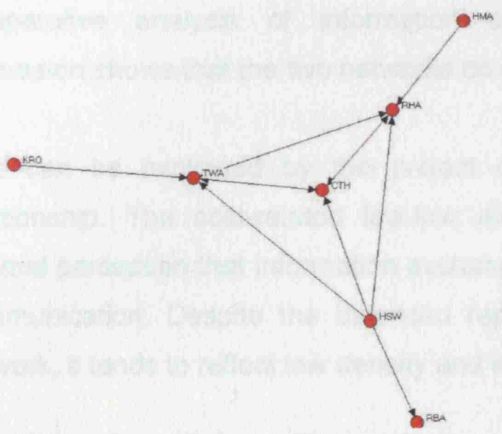
Scope of work discussion network

The combined discussion network (01SWDGEN) is basically a representation of high and low priority discussion networks as sub groups with no links across. This representation reflects the dominance of contractual relationship and lack of discussion among the project team in absence of team spirit.

Although contractually linked to the contractor, the architect forms a discussion link with the management consultant; and both the contractor and the client are isolates in this network, which is an indicator of lack of team spirit.

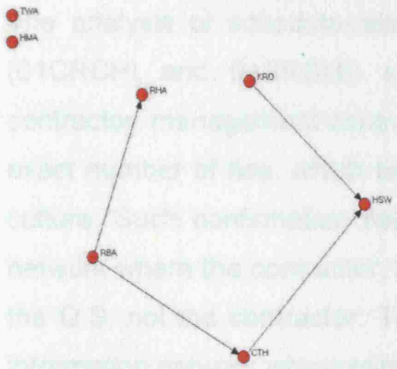
Cost related information exchange network

The high centrality and the active role of the project quantity surveyor reflect the dominant culture of contract administration. This sole link between the QS and EA confirms the project culture.

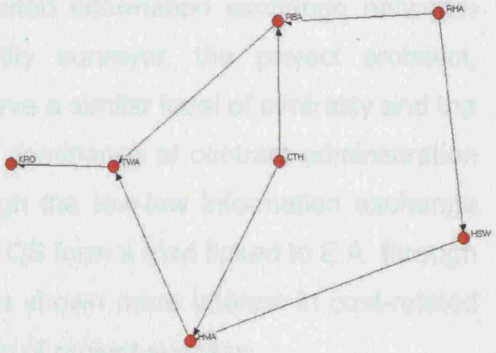


The combined network of high and low priority information exchange shows that the architect, quantity surveyor, contractor and the management consultant form the integral part of the information exchange network. It is clear that cost management is the main interest of the project team. The academy programme is characterised by strict budget approval mechanism with limited risk allowance.

Cost related discussion network



Network Ref 01CRDHI

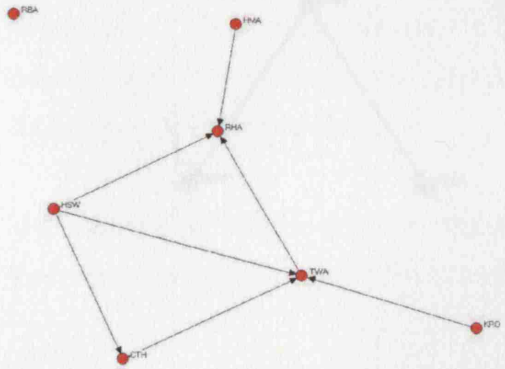


Network Ref 01CRDLO

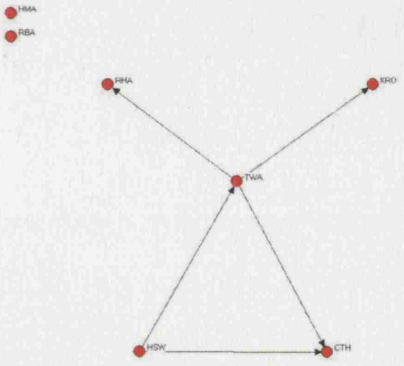
The high priority discussion network shows very low level of interest among the project team to engage in non-directional cost related communication. The comparative analysis of information cost-related information exchange and discussion shows that the two networks do not show similar characteristics.

This can be explained by the project culture of primacy given to contractual relationship. The cost-related low-low discussion network (01CRDLO) reflect a general perception that information exchange supersede the need for non-directional communication. Despite the balanced representation of the combined discussion network, it tends to reflect low density and is subject to further development.

Schedule related information exchange network



Network Ref 01CRCHI

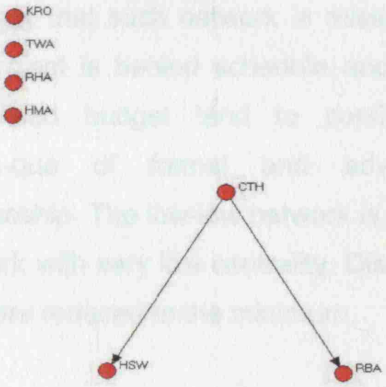


Network Ref01SRCHI

The analysis of schedule-related and cost-related information exchange networks (01CRCHI and 01SRCHI) shows the quantity surveyor, the project architect, contractor, management consultant and E.A. have a similar level of centrality and the exact number of ties; which tends to show the dominance of contract administration culture. Such confirmation reveals itself through the low-low information exchange network where the contractor, the architect and QS form a triad linked to E.A. through the Q.S. not the contractor. The contractor has shown more interest in cost-related information network which mirrors his perception of project success.

Schedule related discussion network

The schedule related high priority discussion (01SRDHI) is very limited to two links between the contractor and the structural engineer; and the contractor and the management consultant in an identical manner to the cost related high priority discussion network (01CRDHI). The rest of the project coalition shows no interest in the discussion network. The low density discussion network and linear information exchange network are perceived to be a sign of high risk project environment and blame culture as a result. The low piority discussion network (01SRDLO) show low density communication level. The linear link between the E.A. the management consultant and the project architect

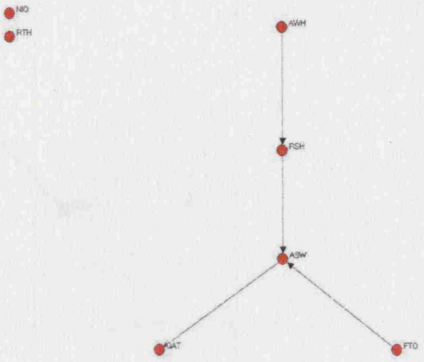


Network Ref 01SRDHI

Project B

Scope of work information exchange network

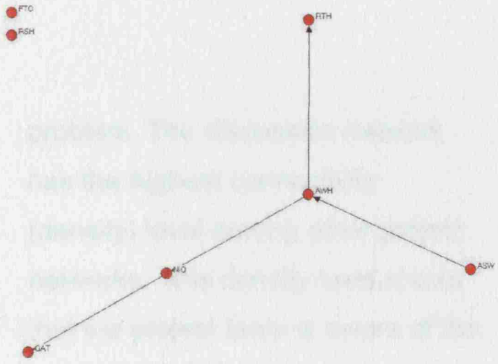
The high priority network (02SWCHI) tends to show a hierarchical flow of information based on formal project structure. The linear flow mirror the project interest on linear management models with a side influence from the client.



The low-low information exchange network reflects the current interest to review the scope of work. M/E scope of work is shown to be a major concern of the project team. This concern is reflected through a high centrality of the M/E engineer and the project Q.S. Refer to 02SWCLO

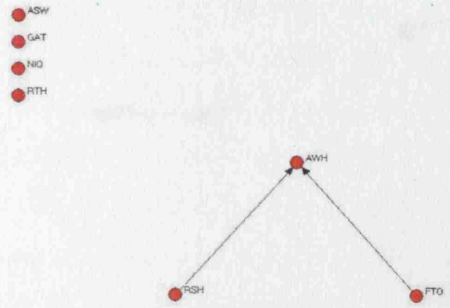
Scope of work discussion network

No high priority discussion network has been recorded for project B scope of work. The fact that such network is missing and the project is behind schedule and above authorised budget tend to confirm the status-quo of formal and adversarial relationship. The low-low network is a linear network with very low centrality. Discussion links are reduced to the minimum.



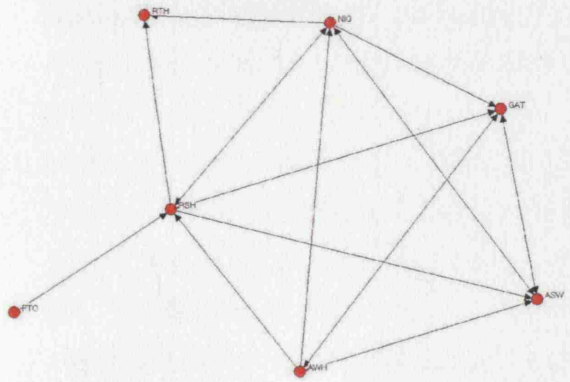
The management consultant has the highest centrality in this network which shows a moderate attempt to address the problem.

Cost related information exchange network



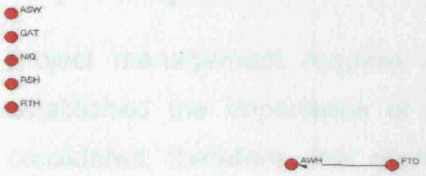
The cost related low-low information exchange tends to link the client and the contractor to project management consultant, which reflects the rigid project structure and the primacy of the project contractual relationship. Though high priority network was identified, the application (UCINET 6) was unable to process the data and no comparison can be established. However, it is predicted that the network may reflect formal links and feature a central quad of management consultant, the quantity surveyor., the client and contractor. The M/E engineer may be linked to the contractor and Q.S.

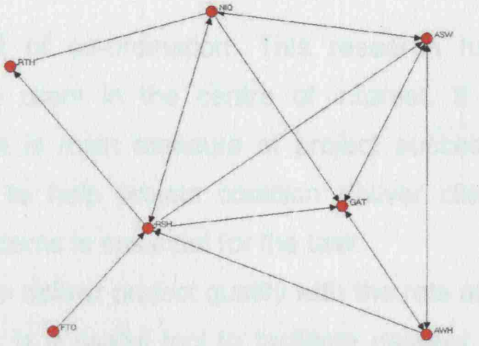
Cost related discussion network



The low-low cost related network scored high centrality and density. The analysis of project budget shows a figure of 2% an authorised spending. This network formation confirms the problem. The discussion network has the highest connectivity (density) level among other project networks. This density level shows that the project team is aware of the problem and it is forms a hot issue of their discussion. However, the project coalition did not show constructive actions towards the problem. No high priority network or similar information exchange (in terms of density and connectivity) networks have been recorded.

Schedule related information and discussion exchange network





NETWORK REF. 02SRCLO NETWORK REF. 02SRDLO

The information exchange network is minimised to a single flow from the client to management consultant, while the discussion network shows higher density level. The comparison of cost and schedule related information exchange against the discussion networks reveals the magnitude of problems associated with project budget and its impact on the network formation. It is shown that the project coalition is active on the discussion side for both issues.

Gap Analysis

Project management requires a high level of co-ordination. This research has established the importance of keeping the client in the centre of interest. It is considered, therefore, that client satisfaction is main measure of project success. Different approaches has been developed to help project coalition deliver client needs. The monitoring of communication patterns is essential for the task.

Gap analysis has been introduced as a tool to deliver project quality with the role and position of client taken into consideration. It is a useful tool to facilitate delivery of client expectations. However, gap analysis is represented in a linear manner, in opposition to the organic structure of networks; and multi-faceted nature of projects.

The dynamic nature of projects requires flexible models to accommodate the evolvement of projects during their life cycle. Gap analysis, in absence of all other management views, does not provide a communication model despite the concept of information exchange being introduced. However, as a linear model, gap analysis can be used in conjunction with other model to facilitate delivering project objectives; and therefore, this research does not eliminate the role of linear models already introduced by scientific management.

- Projects reflect a number of organic networks and new tools are required for the analysis of projects. Social network analysis has been introduced, as a tool, to highlight the significance to balance both technical and social aspects in construction and to overcome the limited presentation techniques of traditional management tools. The analysis of two case studies provided an insight of the communication patterns and reveal a closer outlook of project networks. SNA provides a rigorous insight of project coalition. The behaviour and performance of project coalition can be linked to project objectives and client needs. Problems can be identified. Gap analysis assists project coalitions to monitor project delivery mechanism. Project review measures can be designed and put in place during the project life cycle. Gap analysis is a useful tool to maintain project quality and minimise client surprises.
- To reach beneficial levels of client satisfaction, it is essential to monitor project network and readjust the performance of project coalition in accordance to project criteria. A cross directional link between SNA and gap analysis is crucial for project success.

Summary

The analysis provided in this report is considered valid for the samples and only at this stage of project life cycle. It is essential for project coalitions to identify project objectives at early stage of project life cycle. Identification of project objectives will lead the project team to review relative success factors, which enables project coalitions to direct their resources to achieve pre stated objectives. Consequentially, project processes and procedures are re-drawn for the same purpose. The two case study analysis showed that time and cost are primary project objectives at this stage. Project success factors were identifies as 'deliver the project on time and within budget'. Adoption of RIBA plan of work is useful as a guidance on management of projects. The fragmentation of projects to a chain of stages is useful for project control. However, it is essential to manage the link between different project stages.

Social network analysis was used to examine the communication pattern. Discussion and information exchange networks were controlled by the contractual relationship and recorded low density with relatively high centrality for contractor and quantity surveyor. The network configurations were analysed for this report and showed that high priority was given to contract administration.
Gap analysis is a useful tool to ensure the client is in the focus of interest of projects. Successful delivery of client needs and client satisfaction are considered major measures for project success.

Further research is required to examine:

- the level of personal bias in communication. Senders of information tend to give weight to their information more than recipients.
- the quality of communication as high density network may be reasoned to incomplete information.
- the concept of centrality in network is subject to analysis and investigation. There no single prototype to answer the question of centrality as it is subject to the project culture.
- similar analysis is required to examine the role of bridges in networks.

Chapter 7

Conclusion

"He is a poor pupil who does not go beyond his master"
Foster MS 3, fol. 66v

The construction industry has moved from the master builder model to trade fragmentation (Winch, 2002) with significant impact on management concepts and management tools. The publications of the Latham Report in 1994 and the Egan Report in 1998 were modern calls for collaboration and restructuring within the construction industry. A number of studies on blame culture in the UK construction industry developed and new procurement systems were introduced (Latham, 1998; Pryke, 2004). As a result, project success is studied in a new light and project success measures and success factors have become the foci of research, with links to client satisfaction. Management of projects has developed a holistic dimension and has gained from research in fields other than engineering. Project key players are now required to see beyond the boundaries of any single project (Smyth, 2000; Walker, 2002; Winch, 2002). In accordance with this holistic view, there is a continuous growth in awareness of social changes and their impact on the construction industry. The construction industry is influenced by continuous technical and social developments (Pryke, 2006b). However, social changes are difficult to monitor and record, and are therefore overlooked in most projects. Consequently, the need for a new approach and tools has emerged. Social Network Analysis (SNA) has been introduced to the industry to help analyse project coalitions and reflect aspects of projects other than time, cost and quality. Such analysis helps the understanding of project networks in relation to project success and client satisfaction.

This research highlighted the significance of information exchange for the success of projects. The primary research question was:

Will a high density information exchange network lead to client satisfaction and project success?

SNA has gained increasing importance in recent research dealing with the multi-faceted nature of the construction industry. Therefore and for the purposes of this research, the following points were considered:

- The client is the centre of interest in projects and client satisfaction is the main success measure for any project.
- Project networks involve a number of actors and success cannot be achieved without a win-win approach.
- A rigorous methodology is essential to correlate success measures and project networks.

Three areas were reviewed and investigated in order to answer the research question, namely: project success factors, gap analysis and SNA.

To answer the research question, it was necessary to identify a methodology which would enable an independent and non-hierarchical analysis and facilitate the presentation of project parameters. It was important to maintain a mathematical balance between qualitative and quantitative aspects of project management.
SNA was used for the analysis. A Nominalist approached was adopted in defining the network boundaries and a selection of project networks were linked to the current project stage. Key personnel were selected to form the networks to facilitate the analysis of the research question. This approach to define the network boundaries and contain the analysis population was deemed to be acceptable for the purposes of this research.
Two similar case study analyses were carried out. The data gathering and data analysis for both samples were conducted simultaneously, independently and in an identical manner. A modified questionnaire survey was used to identify the project success factors, type and level of communication, and project gaps in conformance and realization.

The questionnaire included questions on:

- project success factors;
- type, importance and frequency of communication; and
- problems of conformance and realization.

It was accepted that each organisation has its own way of measuring and expressing project success. However, in spite of such differences, there seem to be unspoken rules regarding project success at the implementation stage. Project success factors were identified through the following open-ended question: *'What are the Key Project Indicators?'*. In order to examine the communication patterns in any project environment, it is necessary to define the nature of the communication, as aspects of communication can generate thousands of different network configurations.
The research question aims to study the density of information exchange in projects. The participants completing the questionnaire survey were asked to consider four types of communication: instruction, advice, information exchange and discussion.
The communications among the project coalitions were classified under three categories: scope of work, cost-related and schedule-related (identified as SW, CR and SR respectively). The participants were asked to record sent and received communications, and record the related levels of frequency and importance.

The participants were asked to answer two questions:

- *From whom do you receive information?*
- *To whom do you send information?*

The gathered information was categorised as high or low priority according to its importance and frequency. The analysis focused on two types of communication: information exchange and discussion. The data were used to produce a node list for each member of the network. A graphic presentation of the networks was generated using UCINET 6. The data of received communication were used and problems associated with personal bias were eliminated. Gap analysis was used to map the communication patterns among the members of each project coalition. The two projects were at the same RIBA stage.
Project coalitions identified cost and schedule as primary success factors and as indicators of project success. None of the team members classified client satisfaction as an independent factor contributing to project success. There was a common understanding that client satisfaction can be materialised through the delivery of projects on time and to budget. There were slight differences in order of priorities: team members of Project B highlighted the significance of project budget in

preference to project schedule, whereas team members of Project A considered project schedule as being more important.
The concept of the repetitive client was not considered and no consideration was given beyond the current stage of the project.
SNA showed very low centrality and low density network configurations for both projects. The architect, quantity surveyor, client and management consultant formed central parts of the network formations. The low priority discussion networks recorded higher density than those of information exchange. On the other hand, low density was recorded for high priority information exchange. The communication patterns were governed by the roles of members of project coalitions and their contractual links. All network configurations recorded low connectivity.
The gap analysis shows that four parties are interlinked. The architect, client, contractor, management consultant and the two projects are seen as chains of events. A number of problems were identified at previous stages and carried out in subsequent stages. The two projects did not develop an effective mechanism for stage review and as a result there was a tendency to review the current scope of work. The pre-conception and client visibility lines (see Figure 8) isolated the client from the current stage and the two projects were comprising a linear iterative cycle within the current boundaries of the communication networks.

The construction industry in the UK is currently influenced by professional bodies; therefore projects are governed by procedures developed by RIBA and introduced into their plans of work. The RIBA plan of work tends to lack a comprehensive view of the management of projects. This research argued that deficiencies in the current management of projects tend to be a result of the noticeable absence of management education in architectural programmes. A comprehensive understanding of management tools and techniques is essential for project success.

This research provided a valuable insight into the communication patterns of both case studies. Time and cost were demonstrated as being the primary success factors during the implementation stage of the two projects. The need has been identified to reconsider the position of the client as an integral part of the project network. To achieve high levels of client satisfaction, it is essential to monitor project networks and re-adjust the performance of project coalitions in accordance with project criteria. A cross-directional link between SNA and gap analysis is crucial for project success.

Further research

Further research is required to examine:

- the level of personal bias in communication. Senders of information tend to give more weight to their information than the recipients.
- the quality of communication and the nature of ties.
- the concept of centrality in a network as being subject to analysis and investigation. There no single prototype to answer the question of centrality as it is subject to the project culture.
- the role of bridges in networks.

Final Word

'...I have finished the Chapel I have been painting. The pope is well satisfied'
Michelanglo to his father: 1512

Bibliography

Angus, G., P. D. Flett and J. A. Bowers (2005), "Developing A Value-Centred Proposal for Assessing Project Success", **International Journal of Project Management**, in press.

Arditi, D. and D. Lee (2003), "Assessing the Corporate Service Quality Performance Of Design-Build Contractors Using Quality Function Deployment", **Construction Management and Economics**, Volume 21, 175-185.

Belassi, W (1996), "A New Framework for Determining Critical Success/Failure Factors in Projects", **International Journal of Project Management**, Volume 14 (3) 141-151.

Belot, A. and C. Gaureau (2004), "Factors Influencing Project Success: the Impact of Human Resource Management", **International Journal of Project Management**, Volume 22 (1), 1-11.

CIOB (2002), **Code of Practice for Project Management of Construction and Development, 3rd Edition**, CIOB, Ascot, Berkshire.

Cleland, I. C. and W R King (1988), **Project Management Handbook**, Van Nostrand Reinhold, London.

Dietrich, P. and P. Lehotonen (2005), "Successful Management of Strategic Intentions through Multiple Projects-Reflections from Empirical Study", **International Journal of Project Management**, in press.

Drucker, J. and G. White (1996), **Managing People in Construction**, Institute of Personal and Development, London.

Egan Report, DETR (1998), **Rethinking Construction: The Report of the Construction Task Force to the Deputy Prime Minster** http://www.rethinkingconstruction.org/rc/report/

Frank, J. (1999), **Building Procurement Systems: A Client's Guide**, Addison Wesley Longman Ltd., Harlow Essex and CIOB, Ascot, Berkshire.

Gemünden, H. G., S. Salomo, and A. Krieger (2006), "The Influence of Project Autonomy on Project Success", **International Journal of Project Management**, in press.

Gummesson, E. (2002), **Total Marketing Relationship**, Butterworth-Heinemann, Oxford.

Huckin, T. N. and A. Olsen (1991), **Technical Writing and Professional Communication for Non-Native Speakers of English**, McGraw Hill, Singapore.

Latham, Sir M. (1994), **Constructing the Team: Joint Review of Procurement and Contractual Arrangements in the UK Construction Industry**, HMSO, London.

Lavender, S. (1996), **Management for the Construction Industry**, Addison Wesley Longman Ltd., Malaysia.

Leung, M., *et al* (2004), "Measuring Construction Project Participant Satisfaction", **Construction Management and Economics**, Volume 22 (2), 319-331.

Ling F. Y. Y. (2004), "How Project Managers Can Better Control the Performance of Design-Build Projects", **International Journal of Project Management**, Volume 22 (6), 477-488.

Loosemore, M. (1998), "Social Network Analysis: Using A Quantitative Tool within an Interpretative Context to Explore the Management of Construction Crises", **Engineering, Construction and Architectural Management**, Volume 5 (4), 315-326.

Morris, P. and G. Pinto (2004), **The Wiley Guide to Managing Projects**, Wiley, New York, 2004.

Otte, E. and R. Rousseau (2002), "Social Network Analysis: a Powerful Strategy, also for the Information Science", **Journal of Information Science**, Volume 28 (6), 441-453.

Ould, M.A. (1995), **Business Process Modelling and Analysis for Re-Engineering and Improvement**, John Wiley & Sons Ltd, West Sussex.

Pryke, S. D. (2004a), "Twenty – First Century Procurement Strategies: Analysing Networks of Inter-Firm Relationships", **RICS, Research Paper Series**, Volume 4 (27).

Pryke, S.D. (2004b), "Analysing Construction Project Coalitions: Exploring the Application of Social Network Analysis", **Construction Management and Economics**, Volume 22 (8), 787-797.

Pryke, S. D. (2004c), "Analytical Methods in Construction Procurement and Management: A Critical View", **Journal of Construction Procurement**, Volume (10) 1, 49-67.

Pryke, S. D. (2005), "Towards a Social Network Theory of Project Governance", **Construction Management and Economics**, Volume 23 (9), 927-939.

Pryke, S. D. and Smyth, H. (2006), **Relationship Approach to the Management of Projects**, Blackwell, London.

Schindler, S. and M. J. Eppler (2003), "Harvesting Project Knowledge: A Review of Project Learning Methods and Success Factors", **International Journal of Project Management**, Volume 21 (3), 219-228.

Shirazi, B. (1996), "Organisational Structure in the Construction Industry", **Construction Management and Economics**, Volume 14, 199-212.

Smyth, H. J. (2000), **Marketing and Selling Construction Services**, Blackwell Science, Oxford.

Turner, J. R. (1993), **Handbook of Project-Based Management**, McGraw-Hill Book Company Europe, Berkshire.

Turner, J. R. (2004), "Five Necessary Conditions for Project Success", **International Journal of Project Management**, Volume 22 (5), 349-350.

Walker, A. (2002), **Project Management in Construction**, Blackwell Science Ltd., Oxford.

Wasserman, S and K. Faust (1994), **Social Network Analysis: Methods and Applications,** Cambridge University Press, Cambridge.

Winch, G. *et al* (1998), "Towards Total Project Quality: A Gap Analysis Approach", **Construction Management and Economics**, Volume 16, 193-207.

Winch, G.W. (2002), **Managing Construction Projects**, Blackwell Science Ltd., Oxford.

Zeithaml, V. A. *et al* (1990), **Delivering Quality Service; Balancing Customer Perception and Expectations**, Collier Macmillan Publishers, London.

Appendix 'A'

RIBA Plan of Work

The RIBA Plan of Work Stages 1999
(http://www.ribafind.org/plan.asp)

The RIBA Plan of Work is a robust process protocol which describes the activities from appraising the clients requirements through to post construction. The stages are also used in the appointing documents to help identify the architects services.

A: Appraisal Identification of Client's requirements and possible constraints on development. Preparation of studies to enable the Client to decide whether to proceed and to select probable procurement method.

B: Strategic Briefing Preparation of Strategic Brief by, or on behalf of, the client confirming key requirements and constraints. Identification of procedures, organisational structure and range of consultants and others to be engaged for the project. [Identifies the strategic brief (as CIB Guide) which becomes the clear responsibility of the client]

C: Outline proposals. Commence development of strategic brief into full project brief. Preparation of outline proposals and estimate of cost. Review of procurement route.

D: Detailed proposals. Complete development of the project brief. Preparation of detailed proposals. Application for full development control approval.

E: Final proposals. Preparation of final proposals for the Project sufficient for co-ordination of all components and elements of the Project.

F: Production information F1: Preparation of production information in sufficient detail to enable a tender or tenders to be obtained. Application for statutory approvals. F2: Preparation of further production information required under the building contract. [Now in two parts, F1 - the production information sufficient to obtain tenders and F2 - the balance required under the building contract to complete the information for construction]

G: Tender documentation. Preparation and collation of tender documentation in sufficient detail to enable a tender or tenders to be obtained for the construction of the Project. [Solely concerned with the documentation required for tenders. Particularly useful with D+B or management contracts]

H: Tender action. Identification and evaluation of potential contractors and/or specialists for the construction of the project. Obtaining and appraising tenders and submission of recommendations to the client.

J: Mobilisation. Letting the building contract, appointing the contractor. Issuing of production information to the contractor. Arranging site handover to the contractor.

K: Construction to Practical Completion. Administration of the building contract up to and including practical completion. Provision to the contractor of further information as and when reasonably required.

L: After Practical completion. Administration of the building contract after practical completion. Making final inspections and settling the final account. [Clearly separated from the construction phase]

Appendix 'B'

Service Quality Model

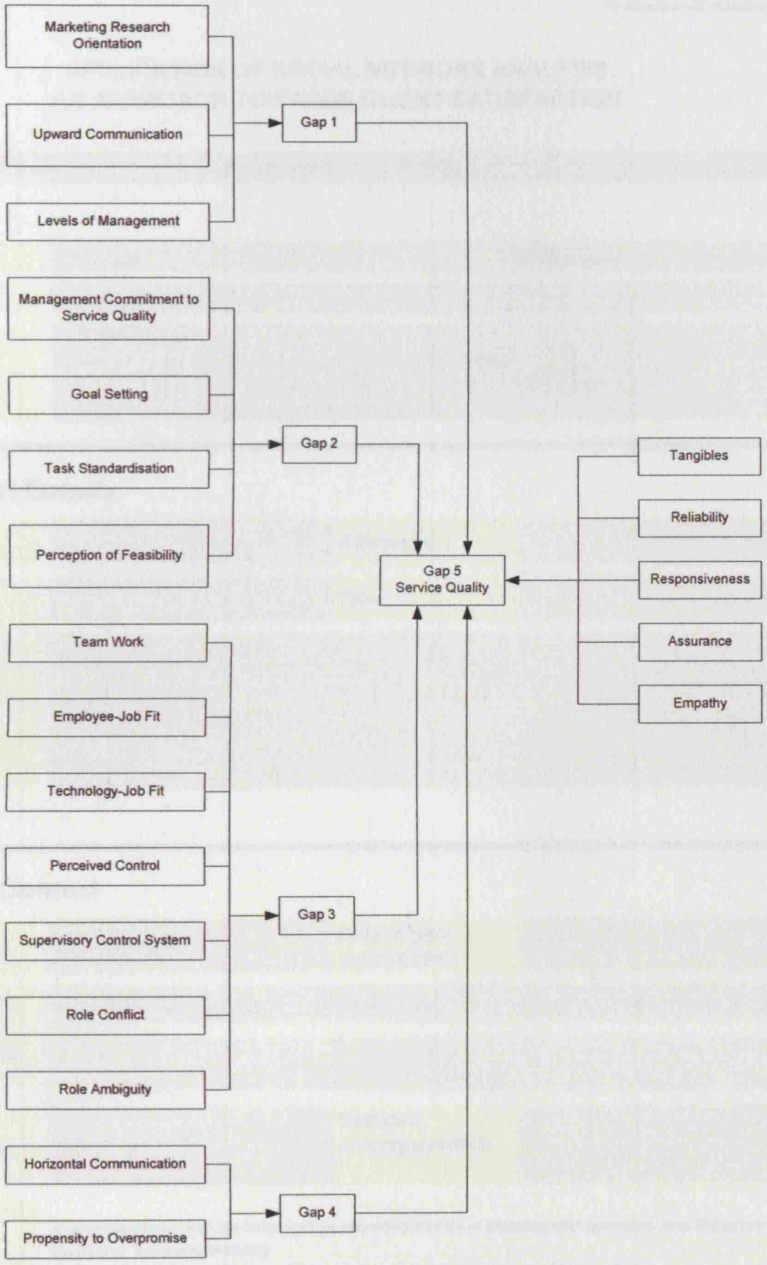


Figure 10 Service Quality Model. Source: Zeithaml, 1990

Appendix 'C'

Data Gathering Questionnaire

APPLICATION OF SOCIAL NETWORK ANALYSIS
AN APPROACH TOWARDS CLIENT SATISFACTION

Data Gathering Pack

Data pack No.	**DP001/01**	Date issued:
Issued by:	Ahmed El-Sheikh	
Contact Details	Faithful+Gould Euston Tower, 286 Euston Road, London. NW1 3AT Tel: E-mail	

1. Personal Details

Project Name		**Reference**	
Name		**Title**	
Contact Details	**E-mail:** **Phone 1:** **Phone 2:**		

2. Project Context

Organisation	Capita Symonds	**Role of your organisation**	CPM
Main Condition	Consultant ☐ Contractor ☐ Design Team ☐ Client ☐ Others ☐		
Identify if others			
Other supplementary agreements		**Relevant correspondence**	
Note	*It is understood that the information provided herein is shareholder sensitive and therefore is treated in full confidentiality* *The results of the analysis will be strictly used for the purpose of this study*		

3. Network Population

Actor Ref	Name	Role	Organisation	Contact Details

4. Key Project Indicators

4.1 Identify three key project indicators

	Key Project Indicators (KPI)
1	
2	
3	

4.2 Impact Identification

Psitive Impact of Exceptionally Good Performamce			
KPI 1		Actor Involved	
KPI 2		Actor Involved	
KPI 3		Actor Involved	

Negative Impact of Exceptionally Poor Performamce			
KPI 1		Actor Involved	
KPI 2		Actor Involved	
KPI 3		Actor Involved	

5. From Whom Do You Receive Information?

Team Member			Nature of Information Exchange								
			Agreed scope of work			Schedule related			Cost related		
Ref	Name	Role	Type	*I*	*f*	Type	*I*	*f*	Type	*I*	*f*

Type of communication
e.g. A = Instruction
B = Advice
C = Information
D = Discussion (non-directional communication)

Importance of communication I (1-9)
e.g. 1 = Not important
3 = Less important
5 = Important
7 =Very important
9 = Extremely important

Frequency of communication f (1-9)
e.g. 3 = Monthly
4 = Fortnighly
5 = Weekly
8 = Daily
9 = Several times a day

No distinction is made between various modes of communication

FAITHFUL GOULD

6. To Whom Do You Send Information?

Team Member			Nature of Information Exchange								
			Agreed scope of work			Schedule related			Cost related		
Ref	Name	Role	Type	*I*	*f*	Type	*I*	*f*	Type	*I*	*f*

Type of communication
e.g. A = Instruction
B = Advice
C = Information
D = Discussion (non-directional communication)

Importance of communication I (1-9)
e.g. 1 = Not important
3 = Less important
5 = Important
7 =Very important
9 = Extremely important

Frequency of communication f (1-9)
e.g. 3 = Monthly
4 = Fortnighly
5 = Weekly
8 = Daily
9 = Several times a day

No distinction is made between various modes of communication

FAITHFUL GOULD