The influence of different contract types on the effectiveness of owner-contractor relationships in construction projects

An exploratory research into the role of various aspects of different contract types on the nature of relationships

Thesis submitted in partial fulfilment of
the requirement for the degree of
Master of Science in Management of Technology

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General Information

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"The main lesson of the Romans lies in their self-confidence: everything they reached, they reached by taking their destiny into their own hands and by persistently struggling for what their goals are".

Niccolò Machiavelli (1469 -1527)
Discorsi sopra la prima deca di Tito Livio (1531)

Dedicated to Mark

Preface

This thesis is a tribute to our son Mark, who died in 2005 from a motorcycle accident at the age of 28. On the day of his accident our world collapsed. My wife Fia, our daughter Wendy and I have tried to overcome this loss each in our own way and with our own difficulties. I found some relief in setting a new goal and achieving the Management of Technology program at the TU-Delft as a dual learner. Although the program is finally completed with this thesis, the road towards it has provided me the supporting structure to gradually accept what happened.

The final stage in this process was to perform the research worded in this paper. I thank my supervisors ir. Prap Suprapto and dr. ir. Marian Bosch-Rekveldt for their academic support, great suggestions, critical feedback and guidance. Without them this thesis would not have become this successful.

Finally I would like to thank my wife Fia for accepting the burden of my limited attention.

Wim Moree
Delft, March 2013

Executive Summary

The nature of working relationship between owner and contractor in engineering and construction projects is considered to have a major effect on the project performance. Deterioration of the relationship between project parties may increase the likelihood of poor performance, while poor performance can be effectively reduced by improving some aspects of the relationship. As our research aims to improve project performance, we focus on factors that may influence working relationship effectiveness between owner and contractor.

Literature suggests that different types of contract, being one of these factors, tend to influence relationships between owner and contractor. However, it is still unclear how a particular type of contract influences this relationship. The aim of this study is to clarify the role of different contract types on the effectiveness of owner-contractor relationships in industrial construction projects. Therefore, the main research question for this study is defined as: *How do different types of contract influence the effectiveness of owner-contractor relationship in industrial construction projects, relative to other factors?*

To answer this question a Q-study was performed which revealed the subjective perceptions of the project managers on the relative influence of various contract aspects and of other influencing factors of owner-contractor relationships. Q-study is based on Q methodology that was originally developed for psychology purposes to examine human subjectivity. In this Q-study, we asked 8 project managers to sort out to which extent they agreed or disagreed on 11 scales (+5 to -5) regarding 55 predefined statements about the improvement of owner-contractor relationship.

The influence of contract types on the relationships for project-specific situations was investigated by a project evaluation study. In this study, the relationship quality of four different projects performed under different contract types (lump-sum, unit rates and alliancing contracting) was evaluated. For each project, semi-structured interviews with the owner and contractor project managers were held, structured by a relationship maturity assessment matrix.

On the basis of Q-factor analysis, three distinct perspectives were revealed, namely: *(1) Strong leadership and management, (2) Effective team integration, (3) Strong capabilities and structure*. Project managers who share perspective 1 believe that it is important that both owner and contractor senior management show consistent and passionate leadership. Above all, they believe mutual trust in the project team is mostly important. Perspective 2 shows a preference for relational competences such as: trust, team integration and joint attitude. Project managers who share this view believe that besides trust among team members, sharing a common vision and a set of objectives among all the people in the project team is mostly important to improve the relationship. Project managers who share perspective 3 believe that it is important for the relationship that the contractor has strong capabilities in project management. They also believe that it is important that the contract clearly specifies the roles and responsibilities of the parties and that the contract specifies targeted performance and its criteria.

Across all three perspectives the project managers believe that contractual aspects are relatively less or not relevant to contribute to the improvement of the owner-contractor relationship. Only those

project managers who share perspective 3 believe that the following contract aspects contribute to the improvement of the relationship: (*1) clear specification of roles and responsibilities of the parties and (2) the specification of targeted performance and its key criteria in the contract.* These contract aspects support the structure of the project management and the reduction of ambiguity about the project deliverables.

Among all perspectives, the project managers do believe that *contract type does not have considerable influence* on the owner-contractor relationship effectiveness. This is supported by the findings from the project-specific evaluation, which do not demonstrate that *different contract types* used in the investigated projects *have a distinct influence* on the owner-contractor relationship effectiveness.

The research results show that contract type is not **the** tool to influence relationship effectiveness, nor do other contract aspects as a matter of fact. The only contract aspects, which are identified as instrumental to improve the relationship, are contact aspects related to project structure specifying roles and responsibilities, and contract aspects about targeted criteria for performance. Therefore, extra attention to these contract aspects during front end development of the project may contribute to the relationship effectiveness and consequently to the project performance.

Due to the explorative nature of this study, it would be hypothetical to conclude that different contract types used in projects do not influence the owner-contractor relationship effectiveness. A survey research could be performed to further investigate the influence of different contract types on relationship effectiveness and consequently on project performance.

Table of Content

1 Introduction

1.1 Research Background, Problem, Purpose and Objective

Success and failure of industrial construction projects are not only intriguing to study for their effects on the environment where the projects are performed, but also for the possible causes that influence project performance. Improving project performance for organizations adds to their sustainable competitive advantage and to the motivation of the people involved. To realize improvement, insight in and knowledge about the factors that influence project performance are essential. Project performance has been subject to management research over the past decades and various influencing factors can be found in management literature. Suprapto (2011) qualifies several of them, naming leading scholars like Morris et al. (2010), Smith & Pryke (2008a) and Turner (2009). Relationships between owners and contractors have been recognized as one of these factors and contract types applied to execute the realization of projects as another.

The relationship between owner and contractor is considered to have important influence on project performance. According to Meng (2011), deterioration of the relationship between project parties increases the likelihood of poor performance, while poor performance can be effectively reduced by improving some relationship aspects. The influence may vary depending on whether parties have a relationship just for one project or whether they have built up a longer term relationship during the execution of consecutive projects. Athanasopoulou (2006) notes that the development of successful, long term, mutually beneficial relationships has attracted the attention of researchers for the past decades. Within this research stream, the issue of relationship quality, also called relationship effectiveness, has emerged as very important. Relationships are recognized to have a significant influence on project performance (Meng, 2011) and subjected to further study into which factors influence these relationships and how. One of these factors is the contract type applied to execute the project of the relationships on hand.

Literature suggests that different contract types tend to influence relationships between owner and contractor and therefore lead to different results, particularly in terms of project performance, cost and schedule (Griffiths, 1989; In ‘t Veld & Peeters, 1989). With regard to this, two opposite types of contractual relationships can be distinguished: *Adversarial relationships* and *collaborative relationships* (Cox & Ireland, 2006; Parker & Hartley, 1997).

Adversarial relationships are supposed to result from a traditional contracting and procurement approach, which is typically based on competitive bidding and lump-sum contracting (Berends, 2007; Thompson & Sanders, 1998). Competitive bidding and lump-sum contracting is generally assumed to lead to short-term, opportunistic behaviour and is adversarial in the relationship between owner and contractor (Humphrey et al, 2003; Lyer et al, 2008; Yang et al., 2010).

Collaborative relationships are believed to arise from relation-based contracting such as partnering and alliancing in projects. They are characterized by long term commitment, based on high levels of mutual trust, involvement, transparency and open book dealings.

It is still unclear however, how a particular contract type, like lump-sum, unit rate, reimbursable, incentive based or partnering/alliancing effects the nature of working relationships. So far, there are contradictory views on the effectiveness of incentive based and alliancing contracts on owner-contractor working relationships compared to lump-sum and unit rates contracts (Berends, 2007; Bresnen, 2007; Merrow, 2011). On the one hand, literature suggests that more collaborative contract types in terms of partnering objectives – for which alliance type of contracting is recognized as a more collaborative type than lump-sum based type – tend to a more effective relationship (Bayliss et al., 2004; Larson, 1995). On the other hand, it is suggested that this is not the case (Ng et al., 2002; Bresnen, 2007). Merrow (2011: 292) supports this view by stating: *"Designers of alliances also thought that they would get the best features of lump-sum contract with none of the draw backs. .... So what do we actually get with alliance contracts? We actually end up with the worst features of lump-sum contracts combined with the worst features of reimbursable contracts"*.

More in-depth support on how and why this would be the case is lacking and it seems unclear if and how contract types influence the relationship. Therefore, further research to reveal and explain the effects of contract types on owner contractor relationship is required. This study is meant to form a building stone in this research. Consequently, the aim of this study is to reveal and explain the influence of different types of contract on the relationship effectiveness between owners and contractors in construction projects within the context of other influencing factors.

Summarizing, the objective of this research can be formulated as:

To investigate what owner-contractor relationship effectiveness actually comprises of and how it is influenced by different types of contract. The subsidiary objective can be described as: to investigate the influence of other factors relative to contract type on the effectiveness of owner-contractor relationship.

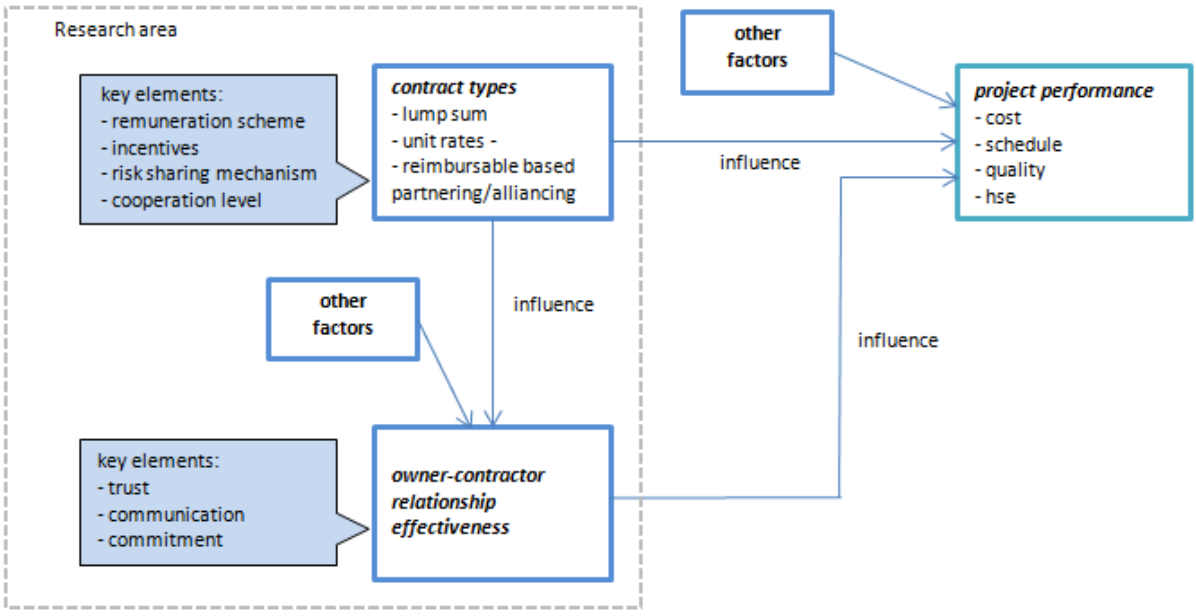

Figure 1.1 – Research area of this study in larger context (adapted from Suprapto, 2011)

The above mentioned considerations are reflected in a research area outline as presented in Figure 1.1. This diagram shows the scope of the research within a larger context, illustrating the overall relation with project performance.

1.2 Research Questions

From an introductory literature study, it can be summarized that there may be a prevalence influence between contract types and owner-contractor relationship effectiveness (Griffiths, 1989; In 't Veld & Peeters, 1989). Since the influence of a contract type on owner-contractor relationship may also be effected by other factors relative to these other factors, we should also investigate the effects of other variables on owner-contractor relationship effectiveness.

Therefore, we formulate the main research question as:

> *How do different types of contract influence the effectiveness of owner-contractor relationship in industrial construction projects, relative to other factors?*

To answer the main research question, the following sub-questions can be addressed:

1. *What are the different viewpoints of project managers towards multidimensional aspects of owner-contractor relationship in construction projects?*
2. *What aspects are common or not between these different viewpoints towards owner-contractor relationship?*
3. *How do the project managers perceive the influence of contract aspects relative to the other aspects within these viewpoints?*
4. *What do different project managers perceive of the owner-contractor relationship effectiveness in industrial construction projects under different types of contracts?*

To create the theoretical background for the operationalization of the research the following questions should be addressed:

- *What is owner-contractor relationship effectiveness and how can it be assessed?*
- *What are the relevant key elements to characterize owner-contractor effectiveness?*
- *What are the relevant key elements to characterize contract types?*
- *Which other factors than contract type can be identified that influence owner-contractor relationship effectiveness?*

1.3 Research Approach

A critical factor in this research is that the data should be obtained from directly involved actors each having their own likes and dislikes leading to subjective measurement of the relationship effectiveness factors, such that even if for a same position different persons could be interviewed, they would generate different profiles. Stephenson (1935) argued that if each individual would have

his specific likes and dislikes, their profiles would not correlate; if however, significant clusters of correlation exist, they could be factorized, described as common viewpoints and individuals could be measured with respect to them. This is achieved by using the Q-methodology, which provides the foundation of systematic study of subjectivity (Brown, 1993; 2002). This methodology was originally developed for psychology purposes to examine human subjectivity (Stephenson, 1953; 1965; Brown, 1980; McKeown & Thomas, 1988). According to Van Exel & De Graaf (2005) it forms a suitable and powerful methodology for exploring and explaining patterns in subjectivities, generating new ideas and hypotheses and identifying consensus and contrasts in views, opinions and preferences.

To answer the first three sub-research questions a Q-study was performed to reveal the subjective perceptions of the project managers on the relative influence of various contract aspects and of other influencing factors of owner-contractor relationships.

To gather information on the influence of contract types on the relationships, a multiple-project exploratory evaluation approach was chosen. Multiple projects were investigated, each with a different essential contract type, such as lump-sum, unit-rates and alliancing contracting. This is envisioned in the multiple-project element of the research. In a limited number of selected projects, semi-structured interviews were held with project managers on owner and contractor sides. To prepare for the project evaluation research, the key elements, factors and characteristics of contract types and of relationships were explored by means of literature study. By a quick scan interview with experts in the field, possible blind spots formed by missing variables in the concourse of elements based on literature study were filled.

To answer the last sub-research question, the influence of contract types on the relationships for project-specific situations was investigated by a project evaluation study. In this study the relationship effectiveness of specific projects performed under different contract types was evaluated.

1.4 Research Units and Attributes

This report uses the following conventions. Research units are the objects on which a research is conducted. They are defined in the research aim (Van der Velde et al., 2007: 15). For this research these units are: contract type and relationship effectiveness. These units or objects have certain attributes that are variable. Such attributes of the objects are the variables in the research. When conducting research, we attempt to establish relationships between these variables. The attributes of contract type and relationship effectiveness are identified by literature research and expert consulting. These attributes will form the basis for the operationalization of the research.

1.5 Report Structure

After this chapter, in which the background, problem definition and objective of the study are described, the research report is structured as follows.

Chapter 2 reviews the available literature relevant to the research objective, elaborating on the research units *relationship effectiveness* and *contract type*. The section on relationship effectiveness formulates a definition of effectiveness. The chapter describes a relationship assessment framework and its adaption for this research. It also formulates a view on the subjectiveness of the assessment of relationship effectiveness by directly involved actors.

Chapter 3 gives an overview of the strategy and design of the proposed research. It explains why the Q-study methodology combined with project evaluation research is the most suitable research strategy and describes the operationalization of the research. It also describes the selection of the projects to be evaluated, the data collection and analyses methods to be applied for the research. Finally it describes the preparation of the Q-sort and the project evaluation research protocol.

Chapter 4 presents and analyses the results of the Q-study among the project managers of the evaluated projects. The analysis reveals their viewpoints on the perception of multidimensional aspects of owner-contractor relationship in construction projects and the perception of contract aspects relative to the other aspects within these views. Their perceptions form the answers to research sub-questions 1 to 3.

Chapter 5 presents the four investigated projects and the assessment results of the research objects contract type and owner-contractor relationship effectiveness. For each project a separate section is dedicated in which the results obtained from the project evaluations are discussed. The closing section contains a cross-project analysis. This chapter answers research sub-question 4.

Chapter 6 discusses the link between the results of the Q-study and the project evaluation study related to findings in literature. It also discusses the validity of the research and its limitations for the Q-study as well as the project evaluation study. Chapter 6 concludes with the managerial implications and the scientific contribution of the research.

The final chapter, Chapter 7, contains the conclusions of the research. It presents and discusses answers to the research questions, describing the main research findings, and an overall conclusion. Next recommendations are provided and suggestions for further research are presented.

2 Theoretical Background

This chapter describes the analysis of available literature relevant for the operationalization of the research, elaborating on the research units of the study: relationship effectiveness and contract type. In the section on relationship effectiveness a definition of effectiveness is formulated. Furthermore this section elaborates on insights that provide the key influencing factors to explore the complex of owner-contractor relationship effectiveness variables of the research. It also describes a relationship maturity assessment framework developed by Meng et al. (2011) and the adaption of the framework for this research. Moreover it formulates a view on the subjectiveness of the assessment of relationship effectiveness by directly involved actors. In the section on contract type, the main contract types and characteristics relevant for the research are described.

2.1 Owner-Contractor Relationship Effectiveness

The theoretical views in this subsection form the basis to characterize and operationalize the research object owner-contractor relationship effectiveness and its attributes. In this perspective, owner-contractor relationship can be defined as the up-stream client-main contractor relationship in a construction chain (Cox & Ireland, 2006) which links the project parties together as relations in a construction supply chain (Love et al., 2004).

2.1.1 Effectiveness as a Notion On It Self

An action or process is effective if its efforts and offers actually contribute to the realization of the intended purpose. Effectiveness is the degree to which objectives are achieved and the extent to which targeted problems are solved (In 't Veld, 2002). Related to human behaviour effectiveness is considered as the product of content or quality and the acceptance thereof. This is known as the law of Maier and is represented by the acronym E = Q x A (Maier, 1970; Remmerswaal, 2006).

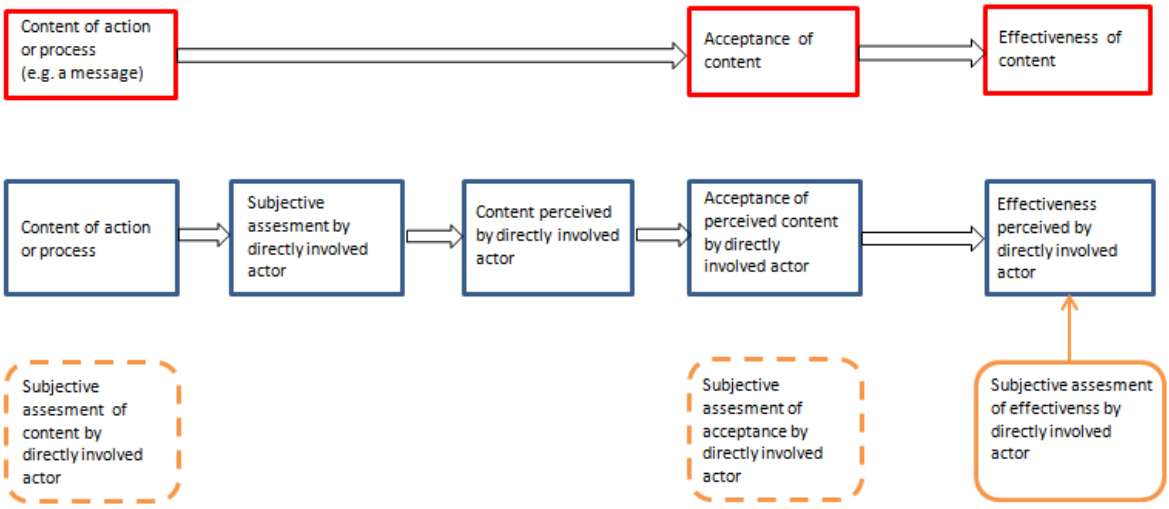

Figure 2.1 – Subjective assessment of effectiveness by directly involved actor

Acceptance of the content of an action or process depends on the subjective assessment of the content by the involved actor and his actual perception. The assessment of effectiveness by an actor who is involved in an action or process can therefore be regarded as the perception of the combination of his content assessment and his own acceptance assessment.

Thus perception of directly involved actors can be used as a measure for the relative assessment of the effectiveness of the content of an action or process by this directly involved actor. This means that the actor does not assesses the content (or quality) of an action or process itself but in combination with his acceptance of that content, thus assessing the effectiveness that he himself perceived from that content.

2.1.2 Relationship Effectiveness

Derived from the above definition of effectiveness, effectiveness of a relationship is the degree to which the relationship objectives are achieved and the extent to which targeted problems are solved. If the objective of the relationship is defined as reaching the highest level of partnership between parties, the effectiveness of the relationship is the degree to which the level of partnership is achieved. This can be regarded as the internal effectiveness of the relationship.

If the objective of the relationship is defined as the contribution of the relationship to (improve) project performance, the effectiveness of the relationship is the degree to which the partnership contributes to the project performance. This can be regarded as the external effectiveness of the relationship.

This study focuses on the investigation of the influence of contract types on owner-contractor relationship itself; not on the effect of different levels of partner relationships on project performance. Therefore, for this study we focus on the internal effectiveness of partner relationship. This internal effectiveness is investigated and assessed by using statements from actors involved, which are obviously subjective because each individual has his specific likes and dislikes. In the project evaluation study the actors are the project managers of the investigated projects. As already mentioned in the introduction, because their individual likes and dislikes, their profiles will not correlate. If however, significant clusters of correlation exist, they can be factorized, described as common viewpoints and individuals could be measured with respect to them (Stephenson, 1935). To achieve this, the Q-methodology is used to provide the foundation of systematic study of subjectivity (Brown, 1993; 2002). In this methodology, a relevant number of statements that the respondents can make on the subject at hand are identified. This collection is called the Q-set. The Q-set is used to structure the interviews about the influencing factors on owner-contractor relationship to frame the subjective views of the respondents. These relevant aspects are derived mainly from literature study, supplemented by aspects derived from expert consulting.

2.1.3 Definition of Relationship Effectiveness

In a literature study by Pinelopi Athanasopoulou (2006) on relationship quality, the author elaborates on the practice that the concepts quality, successfulness and effectiveness are often used as interchangeable. The author notes that the development of successful, long term, mutually beneficial relationships has attracted the attention of researchers for the past decades. Within this research

stream, the issue of relationship quality (RQ) has emerged as very important[1]. She states that when such quality is good, the relationship is successful and vice versa. With this argument Athanasopoulou supports the practice of the use of the concepts quality and successful as interchangeable.

Following this line of reasoning we will consider a relationship effective when it is successful and therefore when the quality of the relationship is good. Based on this interpretation of a relationship being effective when it is successful, we will consider the concepts relationship quality and relationship effectiveness in this study as interchangeable.

Existing empirical studies have evaluated the quality or performance of collaborative actions on the outcomes of the collaborative actions (Dietrich et al., 2010). In a similar trend, extensive research has been conducted to identify the factors that improve collaboration between different actors (Dodgson, 1993; Hoegl et al., 2004; Jap, 1999; Mohr & Spekman, 1994). Dietrich et al. (2010) observe that these studies provide valuable information for managers who try to understand how to design efficient collaborative relationships. However, they do not discuss the actual quality of collaboration; merely its consequential effects.

Based on this observation, they define the quality of collaboration not through its expected consequences, but on the basis of the fluency (smoothness) of interactional activities between the collaborative actors. In other words, they distinguish the quality of collaboration from its effectual elements identified in the previous research.

Based on the same reasoning, we define the effectiveness of relationship collaboration not through its expected consequences, but on the basis of the ease of interactional activities between the collaborative actors, the owner and the contractor.

This results in the following definition of effectiveness:

> *Effectiveness of relationship is the degree of collaboration within the relationship, measured by the level of maturity of the relevant interactional activities taking place between the collaborative actors of the owner and the contractor.*

According to Dietrich et al. (2010) previous research on inter-organizational relationships has introduced similar ideas through the concepts *relationship quality* (Walter et al., 2003) and *relationship atmosphere* (Ritter & Gemünden, 2003). Westphal et al. (2007) use the concept *collaboration performance* in assessing the performance of virtual organizations. In addition, Hoegl & Gemünden (2001) and later Hoegl et al. (2004) used the concept teamwork quality to refer the quality of a team's interactions. Therefore they derive the concept to assess relationships by their interactional activities from Hoegl & Gemünden (2001) and utilize similar ideology and conceptual framework to introduce the concept *collaboration quality*. This assessment concept is based on the following five elements: communication, coordination, mutual support, aligned efforts and cohesion.

[1] The dimensions of relationship quality include: trust, commitment and satisfaction (Athanasopoulou, 2006).

For this study, however, the assessment of the owner-contractor relationships by their interactional activities will be based on a more elaborate assessment concept as described in the following sections.

2.1.4 Key Influencing Relationship Factors

Existing studies on construction supply chains have contributed to the identification of key influencing factors on supply chain relationship. Meng (2010) has made a comprehensive review of this literature and, based on this review, has developed an assessment framework for construction supply chain relationships. This comprehensive review shows that the identification of key relationship indicators involves the following three categories:

- Key factors critical to partnering success.
- Key factors leading to traditional adversarial relationship.
- Key factors impeding partnering success.

Meng has summarized 20 relevant studies and has identified the 18 key influencing factors presented in Table 2.1, which he considers to be key relationship indicators (Meng, 2010, Table 1). With this designation, Meng to some extend blurs the difference between the influencing character of the key factors with the effect on the relationship. In fact he uses the different effects of the influencing key factors to assess relationship quality.

These 18 key influencing relationship factors as identified by Meng in the sequence of the observed frequencies in his research are:

1. Trust (mutual trust or suspicion/mistrust)
2. Objectives (common or self-objectives)
3. Teamwork or fragmentation
4. Risk allocation (sharing risks or not)
5. Continuous improvement or not
6. Communication (open and effective or ineffective)
7. Business attitude (win-win or win-lose)
8. Problem solving/conflict resolution
9. Procurement/competitive tendering/contract
10. Senior management commitment or not
11. Share information and learning or withhold information
12. Focus (long term or short term)
13. Flexibility to change or resistance to change
14. Lack of partnering experience
15. Incentives
16. Performance assessment
17. Transparency
18. Monitoring

Table 1
Key relationship indicators of construction supply chains.

Perspective	Type of key factors	Author	Trust (mutual trust or suspicion/ mistrust)	Objectives (common or self objectives)	Teamwork or fragmentation	Risk allocation/ sharing risks or not	Continuous improvement or not	Communication (open and effective or ineffective)	Business attitude (win–win or win–lose)	Problem solving/ conflict resolution	Procurement/ competitive tendering/ contract	Senior management commitment or not	Share information and learning or withhold information	Focus (long-term or short-term)	Flexibility to change or resistance to change	Lack of partnering experience	Incentives	Performance assessment	Transparency	Monitoring
Positive perspective	Key factors critical to partnering success	Black et al. (2000)	√	√	√		√	√				√			√					
		Chen and Chen (2007)	√	√	√		√	√					√							
		Cox and Thompson (1997)	√			√					√						√			
		Kwan and Ofori (2001)	√	√		√						√	√							
		Lu and Yan (2007)	√	√			√	√		√		√					√			
		Naoum (2003)	√	√	√		√		√	√	√			√						
		Packham et al. (2003)	√		√				√											
		Palaneeswaran et al. (2003)	√			√		√	√					√					√	
		Pheng (1999)	√	√			√	√			√	√	√					√		
		Wilson et al. (1995)	√	√	√					√										
Negative perspective	Key factors leading to adversarial relationship	Bennett and Peace (2006)		√	√					√	√									
		Bower (2003)	√	√		√	√	√	√	√				√						
		Dainty et al. (2001)	√		√		√		√		√									
		Larson (1997)	√			√							√							√
		Pryke (2009)	√	√	√	√	√		√	√					√					
		Bresnen and	√	√		√														
	Key factors impeding partnering success	Marshall (2000a)																		
		Burnes and Coram (1999)				√					√					√				
		Chan et al. (2003)				√			√			√				√				
		Harper and Bernold (2005)	√	√				√							√					
		Ng et al. (2002)	√		√			√	√	√		√								
		Total	17	12	9	9	8	8	8	7	6	6	4	3	3	2	2	1	1	1

Table 2.1 – Key Relationship Indicators of Construction Supply Chain (Meng, 2010: Table 1)

Meng used the identified key influencing factors to develop an assessment framework for construction supply chain relationships, which framework is described in detail in the following section. Of these factors, the following key aspects of contracts (contract related factors) are identified:

- Risk allocation (sharing risk or not) [key factor 4]
- Governance/management [included in key factor 5]
- Problem solving/conflict resolution [key factor 8]
- Remuneration scheme [included in the key factor 9]
- Incentives [key factor 15]
- Performance assessment [key factor 16]
- Roles & responsibilities [included in key factor 17]
- Technical requirements/specifications [included in key factor 18]

These aspects are inter alia mentioned in other literature of Meng (2011), Meng et al (2011), ECI (2003), In 't Veld & Peeters (1989) and Suprapto (2011).

2.1.5 Assessment of Relationship Effectiveness

The effectiveness of relationships involves much more than their quality or health. Effectiveness of partnership relation refers to the degree that the efforts of the partners contribute to excellent partnering (Futrell et al.), or in terms of Meng to reach the highest level of relationship maturity (Meng et al., 2011). For this, the level of relationship maturity is defined by the degree in which the criteria for supply chain relationship are fulfilled.

Supply chain relationship maturity model

From an extensive study on established models for measuring relationships in construction, Meng has recognized obvious deficiencies in these models (Meng, 2010: 695). Based on a review of the literature and expert group discussion, he has developed a new assessment framework, called '*Maturity Model for Supply Chain Relationship in Construction*'. This model appears to be the most appropriate model so far for the assessment of relationship effectiveness in this study, as it focuses on construction supply chain relationships, while established models are mostly geared to manufacturing, retailing, purchasing and supply. More specifically Meng's model focuses on the relationship between customer and the supplier – in our research referred to as owner and contractor – rather than the entire supply chain.

The model follows the principle of the capability maturity model (CMM), which was originally proposed by the Software Engineering Institute (SEI) in 1991 for software development (Paulk et al., 1993). CMM provides a general approach for the assessment of the ability of an organization to manage its business processes. In general it consists of a number of key process areas and a number of maturity levels. In this approach, key process areas are clusters of related activities which purpose is to achieve a set of goals. Maturity levels are collections of key process areas, which define the major characteristics of key business processes of an organization.

The key elements of this model include:

- *Assessment criteria*: The assessment criteria are divided into eight main-criteria. Each main-criterion splits up into three sub-criteria. The main-criteria represent the main aspects of supply chain relationship, whereas the sub-criteria describe different aspects of each main-criterion.
- *Maturity levels*: In this model, four maturity levels are developed. They are progressing level by level from the very traditional end of the relationship continuum to the highly collaborative end.
- *Framework matrix*: In the framework matrix, detailed descriptions are provided for each assessment criterion for the four different maturity levels.

Assessment criteria

For the development of the maturity model, Meng has categorized the identified key influencing factors mentioned above into eight main categories, which he refers to as 'main-criteria'. For this categorization he focused on the owner-contractor relation link in the construction supply chain and ranked these influencing criteria by development in time of the cooperation between parties, starting with procurement and ending with contentious improvement. Meng splits up each main influencing criterion into three sub-criteria. The influencing criteria as categorized and subdivided by Meng (2010: 700) are presented in Table 2.2.

Main-criteria	Sub-criteria
Procurement	Selection criteria (lowest price, cost and quality, multi-criteria) Form of tender (single & 2-stage, direct negotiation, public tendering) Contract type
Objectives	Objectives alignment Benefits Continuity of work
Trust	Type of trust Confidence in others behaviour Monitoring others work
Collaboration	Working relationship Culture Mutual help
Communication	Information exchange Sharing learning Cost data transparency
Problem solving	Early warning Effectiveness Avoidance of recurrence
Risk allocation	Risk sharing Allocation principle Balance of risk and reward
Contentious improvement	Joint effort Performance measurement and feed back Incentives

Table 2.2 – Main & sub-criteria defined by Meng for development of the maturity model (Meng et al., 2011)

These criteria are used by Meng as key relationship indicators for the development and evaluation of a framework to assess the effectiveness and maturity levels of construction supply chain relationships. In this framework, relationship maturity level is determined by the overall assessment of the measured perception of respondents of the predefined key indicators for relationship effectiveness. From the results, relationship effectiveness can be ranked by maturity level per key indicator. Subsequently an overall maturity level for each relationship can be stated, based on the combination of the individual levels per key indicator. However, this overall maturity level merely provides a general classifying view. It does not provide the in-depth insight view required to explain the influence of contract types on the relationship effectiveness. For this in-depth insight the contribution of Q-study on the subjective views of the respondents, which does not form part of the maturity model, is applied.

Application on the research at hand

To judge the applicability of these criteria as assessment criteria for our research, we have to measure these criteria against the definition of effectiveness of relationship collaboration. For this research we have defined the effectiveness of relationship collaboration on the basis of the ease of interactional activities taking place between the collaborative actors. The interactional aspect implicitly refers to the course of the relationship, which is considered to be the relationship period during project execution. Therefore the assessment should be aimed to check which of the criteria of Meng relate to interactional activities. These are the criteria for which we can answer the question: *'Is this an interactional activity, taking place in the course of the relationship?'*[2] This question can be answered positively for all the criteria except for the main-criterion *'procurement'* and its sub-criteria.

This can be explained by the fact the Meng criteria derive from a concourse of *key influencing factors* that are to be considered *causes* resulting in the interactional activities. All of these factors are also regarded by Meng as *key relationship indicators*, which indicate *effects* of these causative influencing factors. For our research however these factors are not evidentially regarded causative, but subject to our definition of effectiveness of relationship collaboration. Considering this measure, 'procurement' is not regarded as a key relationship indicator for our research that indicates an effect, rather than a cause. Alternatively, we will not incorporate the main-criterion 'procurement' and its sub-criteria as criteria for the assessment of relationship effectiveness in our research.

Maturity levels

Although the general capability maturity model includes five maturity levels (Paulk et al. 1993), literature review and expert group discussion performed by Meng (Meng et al., 2011) helped to identify that four maturity levels suffice to reflect the full spectrum of supply chain relationships in construction industry. Therefore, four maturity levels are used in the maturity model of Meng to describe the relationship progression from confrontation, limited cooperation, and short-term collaboration, to close and long-term collaboration. These levels are referred to as: *Price competition, Quality competition, Project partnering and Strategic partnering/alliance*.

[2] This question is operationalized by the leading question: *'How does the relationship, in the course of the relationship, as interactional activity: ……'*. The question can be answered for the criteria: *' - share risks, - solve problems,- communicate, -support improvement, - collaborate, - handle trust, - share objectives'*. It cannot be answered for: *' - handle procurement'*.

Levels 1 and 2 represent traditional relationships and levels 3 and 4 represent collaborative relationships. Quality competition, on level 2 can be regarded as the transition from traditional to collaborative relationship. The four maturity levels are presented in Figure 2.2.

On level 1, the relationship is characterized by self-interest and mistrust. Here, mutual objectives are absent. Partners are focussed on achieving their own objectives and maximizing their own profits, regardless of the impact on others. Trust within the relationships is limited to each party's commitment to the formal contract. Price competition is common practice in the project and the win-lose attitude results in adversarial or arms-length relationships.

On level 2 partners also just focus on their own objectives and interests, while mutual objectives are not established. However, an attitude towards a win for one party and a partial win for another would enable some degree of cooperation between the partners. Instead of competition focussing on price, quality competition becomes common practice. Although partners basically rely on the formal contract, the mutual trust is largely built on the mutual understanding of each other's capabilities to perform their tasks.

On level 3 the alignment of objectives is achieved in a single project. The interests of partners are best served by focussing on the overall success of the project. Partners work together collaboratively as an integrated project team to achieve mutual project objectives. Mutual trust during the project is based on goodwill trust. A win-win attitude is characteristic for the project partnering relationship.

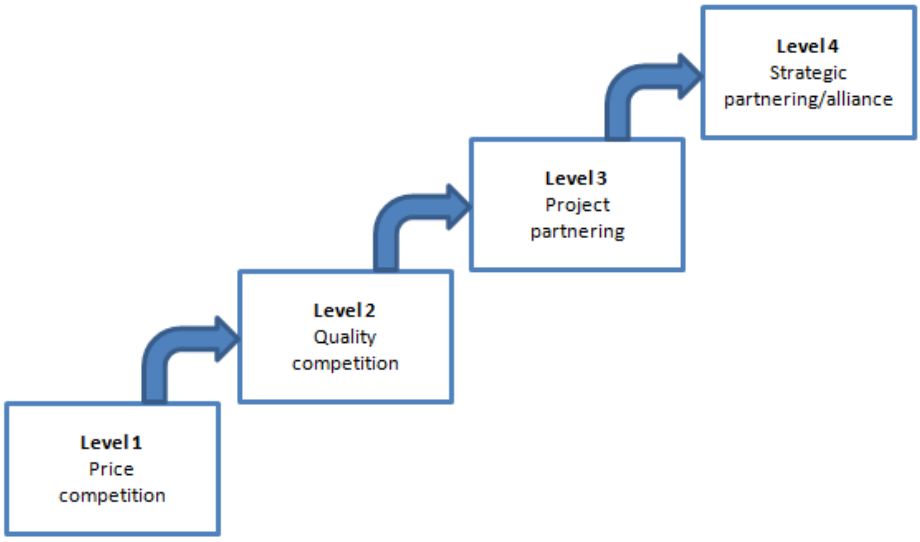

Figure 2.2 – Construction supply chain maturity levels (Meng et al., 2011)

On level 4, objectives are aligned over a series of projects, which focuses on the long-term relationship. Close partner collaboration in the whole supply chain is ensured by fair gain sharing. As everyone expects to achieve their best value, a high degree of trust exists. Continuous improvement is made a common interest by learning from performance measurement feedback and adopting innovative technology and management approaches. This relationship is called strategic partnering or strategic alliance.

Table 2. New Maturity Model in a Matrix Format

Main criteria	Subcriteria	Level 1	Level 2	Level 3	Level 4
Procurement	Selection criteria	The lowest price	Cost and quality	Multicriteria from short-term perspective	Multicriteria from long-term perspective
	Procurement route	Single-stage tendering	Two-stage tendering	Negotiation or tendering	Direct negotiation
	Form of contract	JCT	JCT/NEC	NEC/PPC 2000/JCT CE	NEC/TPC 2005/JCT CE/ Bespoke contract
Objectives	Objectives alignment	Only self objectives	Mainly self objectives	Mutual objectives in a project	Mutual objectives in the long-term
	Benefits	Win-lose	Win-partial win	Win-win in a single project	Win-win in the long-term
	Continuity of work	No continuity of work	Prospect of future work through tendering	Preferred suppliers	Guarantee for future work
Trust	Type of trust	Contractual trust	Competence trust	Short-term goodwill trust	Long-term goodwill trust
	Confidence in others' behavior	Little confidence	Some confidence	Much confidence	Full confidence
	Monitoring others' work	Checking and double checking	Checking somewhat reduced	Checking greatly reduced	Checking almost unnecessary
Collaboration	Working relationship	Confrontation or arms length	Limited cooperation	Collaboration	Close collaboration
	Culture	Mutual blame	Self defense	Abandon of blame culture	Problem solving focused culture
	Mutual help	No support for the weaker	Support only with the issues related to self-interest	Often support for a weak partner	Always support for a weak partner
Communication	Information exchange	Little information is exchanged openly	Some information is exchanged openly	Much information is exchanged openly	Most information is exchanged openly
	Sharing learning	No sharing learning and innovation	Little sharing learning and innovation	Sharing learning and innovation	Continuous sharing learning and innovation
	Cost data transparency	No cost transparency	Little cost transparency	Open book costing between two parties	Open book costing throughout the whole chain
Problem solving	Early warning	No risk identification, no early warning	Informal risk identification, no early warning	Early warning between two parties	Early warning throughout the whole chain
	Effectiveness	Problems often lead to disputes	Problems sometimes lead to disputes	Many problems are timely resolved at the lowest level	Most problems are timely resolved at the lowest level
	Avoidance of recurrence	Problems often recur	Sometimes problems recur	Few problems are repeated	Rare problems are repeated
Risk allocation	Risk sharing	No risk sharing	Limited risk sharing	Risk sharing greatly increased	Common practice for risk sharing
	Allocation principle	Risk is always allocated to the weak party	Risk is often allocated to the weak party	Risk is allocated to the party best able to manage it in a project	Risk is allocated to the party best able to manage it in the long-term
	Balance of risk and reward	No rewards for the party taking the risk	Some rewards for the party taking the risk	Often appropriate rewards for the party taking the risk	Always appropriate rewards for the party taking the risk
Continuous improvement	Joint effort	No joint effort for improvement	Limited joint effort for improvement	Joint effort for better ways of working	Continuous effort for better ways of working
	Performance measurement and feedback	No common measures; No formal feedback	Limited common measures; irregular but formal feedback	Common measures; regular and formal feedback in a project	Common measures; formal, regular, and continuous feedback
	Incentives	No incentive	Informal incentive	Single incentive	Multiple incentives

Table 2.3 – Meng Maturity Assessment Matrix (Meng et al., 2011: Table 2)

Framework matrix

The Meng maturity model is presented in a matrix format in Table 2.3. Besides main-criteria, sub-criteria and maturity levels, detailed descriptions are provided of the main characteristics of supply chain relationship in specific detailed areas and on a specific maturity level. For each sub-criterion a statement is given for each level of maturity, reflecting the maturity of the influence on the relationship as presumed by Meng.

2.2 Contract Types and Owner-Contractor Relationship

The theoretical views in this section form the basis to characterize and operationalize the research object contract type and its attributes.

As stated earlier, different types of contracts tend to lead to different kinds of relationship between owners and contractors (Griffiths, 1989; In 't Veld & Peeters, 1989). Where two opposite types of contractual relationships between owners and contractors can be distinguished: *Adversarial relationships* and *collaborative relationships* (Cox & Ireland, 2006; Parker & Hartley, 1997). Therefore the different forms of contracting, for which different contracting types and compositions of contracts are applied, are assumed to lead to different relationship behaviour between owners and contractors. This different behaviour is assumed to have different influence on the quality and effectiveness of these relationships. Hence different contracting types and compositions of contracts are assumed to have different influence on the relationship effectiveness. Therefore, in a more broad sense, our research focuses on the influence of various aspects in different contracting types such as remuneration principle (lump-sum/fixed price, unit rates, reimbursable, cost plus), governance mechanism, incentive and risk sharing scheme (Suprapto, 2011).

To operationalize the research object contract type and identify the contract aspects that form its attributes, various views on contract types are described and analysed in this section.

2.2.1 Contracts and Key Aspects

A contract can be considered as an agreement between two parties, where one party commits itself to deliver (clearly specified) goods, software or services to a second party, within a certain delivery time and for an agreed price (In 't Veld & Peeters, 1989). The party delivering goods is called 'the contractor' and the ordering party is generally called 'the client'. In this study, the client is called 'the owner' which emphasizes his final proprietary position with regards to the delivered goods opposite to the position of the contractor who transfers the title of the goods as part of the supply chain delivery process. Both parties will try to support their interests by negotiating contract conditions that will protect their final goals best. One of the main considerations in this respect is the choice of contract type.

Literature categorizes contracts and their key aspects such as remuneration scheme, incentives and risk sharing mechanism as used in the up-stream owner-contractor relationship in a construction chain in a broad range of ways. The type and scope of a contract is chosen by the owner, depending on the nature of the works, availability of its own management resources, availability of contractors, project value drivers, required competences and project lead time.

Generally spoken, a contract specifies roles, responsibilities, remuneration scheme, payment terms and phases, incentive scheme, distribution of risk, and dispute resolution, and conflict settlement (Lowe, 2007; Peeters, 1987; Smith, 2002; Walker & Hampson, 2003).

2.2.2 Remuneration View

A common way to categorize types of contract is by one of these roles: the remuneration scheme negotiated during the procurement phase, which scheme forms the core of the contract. Based on this, In 't Veld & Peters (1989) distinguish traditionally two extreme types of contracts:

Cost-reimbursement contracts

In these contracts the owner is required to reimburse all allowable, allocatable and reasonable costs demonstrably made by the contractor.

Fixed-price contracts

In these contracts, the contractor is obliged to deliver a final product for a specified price as contractually agreed. In the construction industry, these types of contract are also called '*lump-sum contracts*'. Within these contracts the differences are generally established by the method of fee determination. Based on this, In 't Veld & Peeters (1989) describe the following contract forms, which are most commonly used in the industry.

Cost reimbursable contract types:

CPPT Cost plus percentage fee contract
CPFF Cost plus fixed fee contract
CPIF Cost plus incentive fee contract

Fixed price contract types:

FFP Firm fixed price contract
FPI Fixed price incentive contract

According to them, the most common incentives are cost incentives, performance incentives, and delivery incentives.

2.2.3 Procurement Approach View

A more elaborate categorization is given by the UK Joint Contracts Tribunal (JCT, 2008). This tribunal distinguishes three main procurement approaches: traditional procurement (sometimes called conventional procurement), design and build procurement, and management procurement. Within these approaches the JCT (2008) defines and describes the following contract types:

Traditional or conventional procurement

Lump-sum contracts – where the contract sum is determined before construction is started. The contractor undertakes a defined amount of work in return to an agreed sum. Contracts 'with quantities' are priced on the basis of drawings and a firm bill of quantities. Contracts 'without quantities' are priced on the basis of drawings and a document such as a specification or work schedule.

Measured contracts – where the contract sum is not finalised until after completion, but is assessed on reimbursement to a previously agreed basis. This type of contract matches a situation where the contractor's work cannot be measured accurately before tenders are invited. Design will be fairly complete and an accurate picture of the quality required will be available to the tenderer. Contracts of this type will probably be of least risk to the owner as they are based on drawings and approximate quantities.
Cost reimbursable contracts – where the sum is calculated on the basis of prime (actual) costs of labour, plant and materials, plus an amount for overheads and profit. This contract type is sometimes referred to as a '*cost-plus contract*' or a '*prime cost contract*'. The amount or fee added to cover overheads and profit may be a fixed sum, a percentage, or some other reimbursable basis.

Design and build procurement

Package deal or turnkey contracts – where the owner settles on a complete package, usually based on a standard specification drawn up by a commercial firm. Such arrangements sometimes result in a specially drafted contract, but will usually be based on the contractors' standard terms (JCT, 2008).
Design and build contracts – where project documents will be written with the contractors' design obligations relating to the whole of the works in mind. These contracts differ fundamentally from traditional 'work and materials contracts' in that they expressly provide for contractors' design obligations.
Contractors' design for specific elements only contracts
Strictly, these are not design and build contracts, but traditional 'work and materials contracts' which include for limited design provisions relating to an identified portion of the work.

Management procurement

Management contracts – where the management contractor undertakes to manage the execution of the work through works contractors contractually bound to him. The contract will usually include both the pre-construction and the construction phase. Documentation will start with project drawings, a project specification and cost plan. This information allows the conversion into documents on which competitive tenders can be obtained for the work packages.
Construction management contracts – where the construction managing contractor undertakes to manage the execution of the work through trade contractors but the owner is involved in managing the project, and the contracts with the trade contractors are concluded with the owner directly.
Design – manage – construct contracts
Although this and other variants of management procurement contracts exist, they are invariably on the basis of specially drafted forms to suit the particular situations.

Partnering procurement

Framework Agreements – where owners who carry out work regularly want to try and capture the benefits of long term relationships with contractors. These are umbrella type of contracts defining general principles and conditions and therefore named 'agreements'. They are used in conjunction with the appropriate contractual arrangements for particular projects as defined in work package contracts. JCT (2008) notes that partnering is not a specific procurement approach. The concept can therefore be incorporated into most contractual arrangements.

2.2.4 Contracting Approach View

Another categorization is chosen by Merrow (2011), who classifies contract types by contracting approaches. He defines and describes the following four basic types of contract for mega projects.

EPC Lump-sum (Fixed-Price) contracting

These contracts are the most common form of mega project contracts. They involve a single contractor who is responsible for engineering, procurement and construction for the entire project or of a portion of the project under a single contract.

Reimbursable EPC and EPCm

Under this form, a single contractor is responsible for the entire project under a contract that reimburses the contractor based on the quantity of services and materials provided. The key characteristic of reimbursable EPC is that the engineering and procurement contractor also controls construction and fabrication. Reimbursable EPC can also be operated with multi-prime arrangement, much like multi-prime EPC lump-sum contracts[3]. A hybrid of this model is EPCm – engineering, procurement and construction management. Here, the engineering and procurement contractors hire the construction and fabrication contractors and manage their work.

Alliance contracts

Alliance contracting is a particular form of reimbursable incentivized contracting that was pioneered in the petroleum industry in the UK North See in the 1990s. Alliance refers to the grouping of (almost) all contractors working on a mega project under a single compensation scheme. The scheme involves some form of bonuses or gain share – usually in the form of splitting under runs among the owner and the contractors – in the event that the project performs better than targets, usually on cost. In the event of an overrun, some alliance schemes make the contractors share a portion of this overrun up to a certain cap. Merrow (2011) notes that alliance contracts are an extreme form of incentivized reimbursable scheme. The basic form is EPC reimbursable, where the same group of contractors stays on the job throughout. The twist is that all contractors share in the incentive scheme, usually proportionately to their slice of the project's estimated cost.

Mixed contracts

Mixed contracting is a strategy that involves reimbursable engineering and procurement, including – in some cases – the procurement of some lump-sum package items. This stage is followed by lump-sum contracts for construction or fabrication by contractors that are independent of the engineering and procurement contractors.

2.2.5 Contract Types

In each view the remuneration principle plays a prominent role. *Therefore, for this study the remuneration view is used as a basis for contract type categorization.* With this the categorizing of the research object contract type can be considered equal to the various forms of remuneration. This is in line with the view that, conceptually, contracting strategy is defined as a process of choosing various forms in the continuum between traditional lump-sum and cost reimbursement.

[3] Multi-prime is a delivery method that includes more than one prime contractor on a particular project. The owner will have separate contracts with each prime contractor. The prime contractor is responsible for the coordination and delivery of the work covered by its particular scope of work, but is not responsible for the entire project.

Contract Type	Key Characteristics
Lump-sum	The contractor bids on a contract based upon specifications provided by the owner against competition, agreeing to execute a project at a fixed price.
Negotiated fixed-price	The contractor is selected first, than the price is negotiated with the owner. Generally used when the contractor commence work before a final price is agreed upon
Unit price contract	The contractor is paid a set amount for every 'unit' of work performed. If the contractor performs well under this contract, he can benefit from cost saving; however, if the project does not proceed as originally planned, the contractor cannot recover cost overruns except for certain limited situations.
Guaranteed maximum price	This contract is performed in a manner similar to a cost reimbursable contract, except that the total fee plus the total cost cannot exceed an agreed guaranteed maximum price (GMP).
Cost reimbursable	The owner reimburses all cost in performing a project and pays contractor a *pre-determined fee* or a *percentage fee* of the cost incurred. The contractors' profit may be in the form of a fee, a simple mark-up applied to labour costs incurred, or a combination of the two. The fee may be an *incentive fee* based upon achieving certain performance indicators, milestones or targets; it may be a *fixed amount* in the contract, or it may be based upon a *percentage of the cost* incurred.
Converted lump-sum	A hybrid form of reimbursable and lump-sum contract with a single contract for development and implementation. Initially during development phase (FED), a reimbursable contract will be used; after the certainties of scope and cost are known, the contract is converted to lump-sum for the implementation phase (detail engineering, procurement and construction works).

Table 2.4 – Key characteristics of various types of contracts (adapted from Suprapto, 2011)

Contract type attributes

Based on the above mentioned views, the following contract types characterized by the remuneration principle are identified for this research as the attributes for the research object contract type:

1. Lump-sum contracts
2. Unit rate contracts
3. Alliance contracts

Of these contract types, the lump-sum and alliance types form the extreme types representing the low end and the high end of the continuum; while the unit rate type is considered to represent an intermediate.

2.2.6 Other Aspects of Contracts

As we are interested in influence of contract types on owner-contractor relationship effectiveness, placed in the larger context of contracting, other contract aspects that may also influence the relationship effectiveness are incorporated in this research. To this end, the following contract related key aspects that are retrieved from the results of the comprehensive literature study of Meng (2010) as described in section 2.1.4 are used:

- Risk allocation (sharing risk or not)
- Governance/management
- Problem solving/conflict resolution
- Incentives
- Performance assessment
- Roles & responsibilities
- Technical requirements/specifications

As the contract type is characterized by the remuneration principle, contract type as a contract aspect is considered to correspond with the remuneration principle that is identified in section 2.1.4 as a key contract aspect.

2.3 Conceptual Research Framework

Based on the performed literature study a conceptual framework for this study is used as presented in the diagram in Figure 2.3.

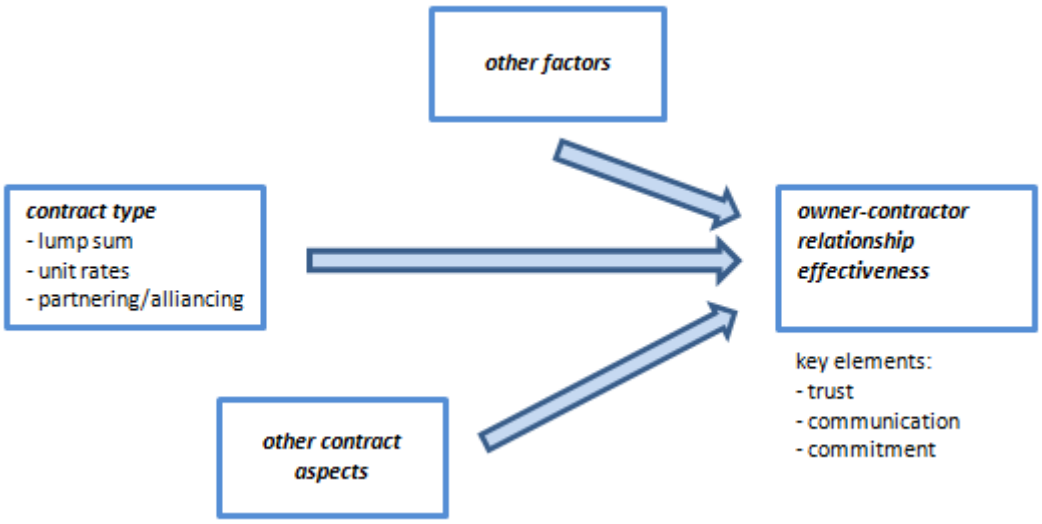

Figure 2.3 - Conceptual framework

The figure shows that in addition to the relation between contract types and owner-contractor relationship, one should consider other contract aspects and other non-contract related factors influencing the effectiveness of owner-contractor relationships.

It should be noted however that our main interest concerns the generation of in-depth knowledge and information. We are not aiming to test a conceptual model or hypothesis. We want to explore patterns of influences and of beliefs, attitudes and opinions towards owner-contractor relationships.

3 Research Design

This chapter is about the strategy and design of the proposed research. It discusses the selection of the Q-study methodology combined with project evaluation research as the most suitable research strategy and the operationalization of the research. It also describes the selection of the projects to be evaluated and the data collection and analyses methods that will be applied for the research. Finally the preparation of the Q-sort and the project evaluation research protocol are described.

3.1 Research Strategy

The aim of the research is to study the influence of different contract types on the effectiveness of owner-contractor relationships as a phenomenon within its entire, natural environment. We want to explore patterns of influences and of beliefs, attitudes and opinions towards owner-contractor relationships and we are looking for explanations. We do not strive to gather data to perform a statistical analysis, nor do we aim to test hypothesis.

This can be achieved by means of Q-methodology which provides the foundation of systematic study of subjectivity (Brown, 1993; 2002). According to Van Exel & De Graaf (Van Exel & De Graaf, 2005) it forms a suitable and powerful methodology for exploring and explaining patterns in subjectivities, generating new ideas and hypotheses and identifying consensus and contrasts in views, opinions and preferences. Therefore, to investigate the subjective viewpoints and perspectives of the respondent-interviewees, a Q-study of the projects supported by project evaluation can be considered as a most suitable research strategy for this study.

The execution of the research strategy is influenced by the fact that information can be collected from the organizations involved in the research. With this, reliability and validity are major issues. Reliability can be defined as the overall precision and accuracy to measure the concept. This measurement must be systematic, not coincidental. Reliability is practically always defined in terms of repeatability (Van der Velde et al., 2007). For the Q-study this implies that, if the study would be performed (again) by another researcher using the same measuring instrument on the same involved persons, he would discover a comparable data complex. Validity can be defined as the accuracy to actually measure what you want to measure. Reliability is a precondition for validity. A Q-study has suitable characteristics to deliver reliable and valid results, if adequate protocols are used.

3.2 Research Approach

To gather data for this research, a multiple project evaluation approach was followed. For this, we selected four completed industrial construction projects in the Netherlands. The research is based on the literature review described in Chapter 2 that identifies key elements and dimensions to describe and measure the variables subject to the research. From this, measuring tools and instruments like questionnaires - including Q-statements - and interview protocols were developed. With these instruments the selected projects were studied and investigated. Thus, multiple in-depth project evaluation research was performed where multiple projects were studied; exploring owner and

contractor perspectives, following a multiple projects embedded design, in which each project represents a completed project. (Yin, 2009).

The embedded design relates to the different dimensions contract type, relation and other factors to be analysed within one case. The use of multiple project evaluation in an embedded design assumes to provide a more general view on the dimensions subject to the study (Yin, 2009). Per case, semi-structured interviews were held with project managers on both the owner side and the contractor side. The information obtained was then used to explore the various dimensions of the contracts and the dimensions and key factors of the project relationships and to perform project qualitative analysis to explain the relations and influences.

Finally the results were described and analysed, tested against literature findings and conclusions were drawn. For the analyses of the project data and information a comparative cross-project analysis was used (Yin, 2009). With a cross-project analysis, a comparison of the project results across different projects is made to deepen the understanding of the results (Miles & Huberman, 1994). The Q-factor analysis of the research data forms an important building stone of this analysis for explaining subjective respondent views. The cross-project analysis aims to answer the research question. Figure 3.1 presents the described research approach.

3.2.1 Project Selection

Completed industry/infrastructure construction projects in the Netherlands were chosen as subject of analysis to concur with other resent research on relationships in engineering and construction projects at TU-Delft (Suprapto, 2011).

Further limitations in terms of projects rate are the time and budget boundaries of the master science thesis project framework in which this study is performed. On the other hand, to perform a comparative cross-project analysis on the influence of the three defined typical contract types on owner-contractor relationships, at least three projects needed to be selected; one for each type. To allow comparison with findings of other studies on project management and project performance in construction projects (e.g. Bosch-Rekveldt, 2011), projects of over 5 million Euros were selected.

For each contract type a representative project was selected and pre-examined to ensure the availability of information sources and their free access as well as the willingness of the involved project managers to cooperate which resulted in three suitable projects. A fourth project that was quite comparable with the selected project for the lump-sum contract type in terms of procurement route, type of project, technical complexity, and owner and contractor participation was added to the research scope because the evaluation of this project might contribute to the cross-project analysis of the study.

For this study the following four Dutch construction/installation projects were selected. Thus, the minimum requirement of three contract types to investigate was met and the research was reasonably kept within the boundaries of the master science project.

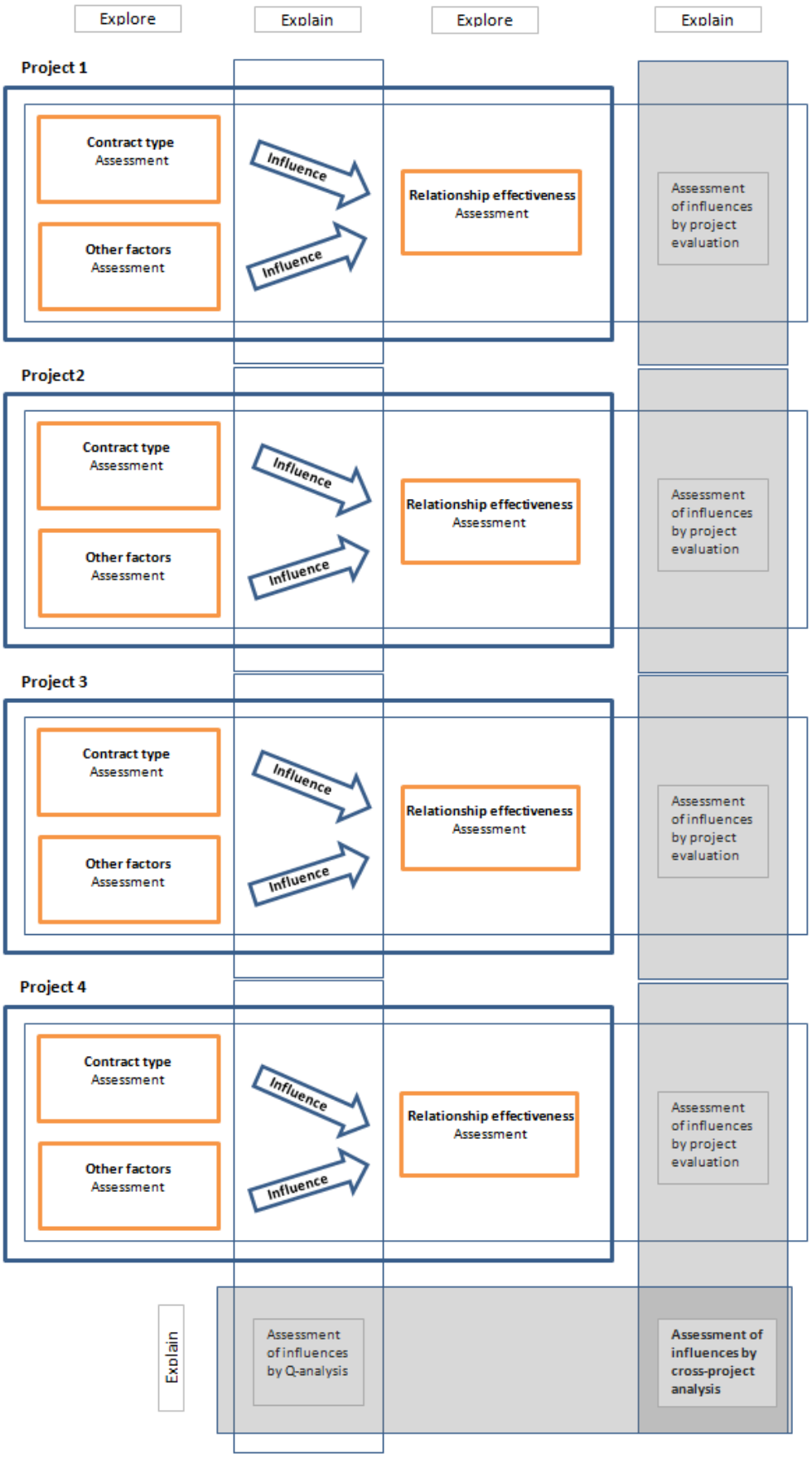

Figure 3.1 – Research outline diagram

1. Lump-sum EPC-contract based rail infra project agreed between a public tram line operator and a public metro line operator as the owner and an industrial contractor (being an intercompany rail & infra electrical/ installation project consortium) for the installation of the rectifier substations for a new sub-urban light rail line. Initial Lump-sum price 10 M€.
2. Lump-sum EPC-contract based rail infra project agreed between a public metro line operator as the owner and an industrial contractor (being an intercompany rail & infra electrical/ installation project consortium) for the revamp of the rectifier substations for a sub-urban metro line. Initial Lump-sum price 12 M€.
3. Unit rates contract based project agreed between international oil and gas company and an industrial electrical/installation contractor for the construction and installation works of 2 consecutive refinery turnarounds. Initial unit rates based provisional budget price 23 M€.
4. Alliance incentive based reimbursable EPC-contract project agreed between an industrial waste-energy company and an industrial contractor (being a project joint venture between a mechanical contactor and an electrical/installation contractor) for the refurbishment of waste incinerator furnaces. Initial project budget price 30 M€.

For each project the project managers from both sides acted as the information sources to investigate the relationship, its particulars and the influence of the used contract type and to perform the Q-study. The empirical data were collected by means of semi-structured interviews with the involved project managers of each project. The data collection was structured by prepared questions and questionnaires based on theoretical analyses.

For the contractor involvement, project managers of the identified contractors were approached as respondent. For the owner involvement, project managers of the different owners were approached as respondent. In line with a Q-methodology based statement questionnaire, the respondents were asked to ranking various predefined Q-statements about owner-contractor relationship. Than they were asked to comment on them. Prior to this, the project managers were asked to grant access to their project files so that the contracts and their characteristics could be studied.

3.2.2 Q-Methodology

As noted before, the assessment of the effectiveness of owner-contractor relationships and its elements depends on the subjective assessment of the involved actor. To deal with subjectivity in our research, Q-analysis was used to analyse the Q-study results. With Q-analysis, correlations between the research units across the variables are analysed. The question is which research units are strongly similar to each other in view of the ranking pattern on the variables. The basis for this analysis is a correlation matrix between the research units (Van der Velde et al., 2007: 159). In our research these research units are formed by the respondents, the project managers on owner and contractor sides of the investigated projects.

Q-study starts with the development of a set of statements called the concourse. The concourse is the collection of possible statements that respondents can be made about the subject at hand. The concourse is thus assumed to contain all relevant aspects of all the discourse (Van Exel and De Graaf, 2005: 4). Typically, in a Q-study, respondents are presented with a sample of these statements,

called the Q-sample or Q-set. In our research these would be statements about the elements of the research subjects and the relations between the subjects under investigation. Respondents, called the P-set, are asked to rank-order the statements from their individual perspective, according to preference, judgment or feeling about them. This P-set would in our research be the persons that are interviewed; the project managers from both sides. This is called Q-sorting.

By Q-sorting people give their subjective meaning to the statements, thus revealing their personal viewpoint (Smith, 2001) or personal profile (Brouwer, 1999). These individual rankings on views are subsequent subject to factor analysis. Correlation between personal profiles based on this analysis may than reveal the existence of similar viewpoints or segments of subjectivity (Brown, 1993). By correlating people, Q-factor analysis provides insight into similarities and differences in viewpoints on a particular subject. A crucial basis of Q-methodology is that subjectivity is communicable, because only when subjectivity is communicated, when it is operational expressed, it can be systematically analysed just as any other behaviour (Stephenson, 1953; 1968).

Q-analysis as part of the Q-methodology does not need large numbers of subjects as R-analysis does, because it can reveal characteristics independent of distribution of that characteristic relative to other characteristics (Smith, 2001; Van Exel & De Graaf, 2005: 2). It only requires sufficient subjects to establish the existence of a factor for purposes of comparing one factor with another (Militello & Benham, 2010: 624).

As Q-sort studies are designed to sample from a concourse of perspectives, rather than from a population of people, representativeness does not depend on large samples of respondents (Anderson et al., 1997, Ten Klooster et al. 2008: 513). For this, the diversity of the respondents is more important than the number of respondents. All the method requires is sufficient respondents to identify these perspectives as factors to make it possible to compare among factors (Brown, 1980). Most Q-sort studies result in less than seven factors, and often not more than two or three. *For purposes of identification of factors only four or five respondents are required to produce stable factors* (McKeown & Thomas, 1988; Ten Klooster et al. 2008: 513).

Q-sort design

According to Ten Klooster et al. (2008), the Q-sort method typically involves the ranking of a set of statements in a near-normal distribution, ranging from strongly agree to strongly disagree as shown in Figure 3.2. The Q-sort method is a forced-choice research approach. All statements must be ranked and each position can only be used once. A major difference between the Q-sort method and more conventional research approaches involves the data analysis. The data matrix is inverted where the respondents are the variables and the statements are the projects. Instead of the statements, respondents are correlated (Ten Klooster et al., 2008: 512).

When designing a Q-sort study, we must decide on the number of statements and the shape of the (forced) distribution. The number of statements to incorporate in the Q-set should match the complexity of the research topic (Amin, 2000). All possible aspects of the research units, which are the objects on which the research is conducted, must be represented. *To realize this, it is rarely necessary to use 60 statements or more in a Q-set* (Ten Klooster et al., 2008: 512)

Despite extensive research on the application of different distribution shapes, no specific guidelines in this respect are available. The applied range and the distribution shape are usually arbitrarily designed to accommodate the number of items used in the study (Ten Klooster et al., 2008). *Typically Q-samples consist of 20–50 statements.*

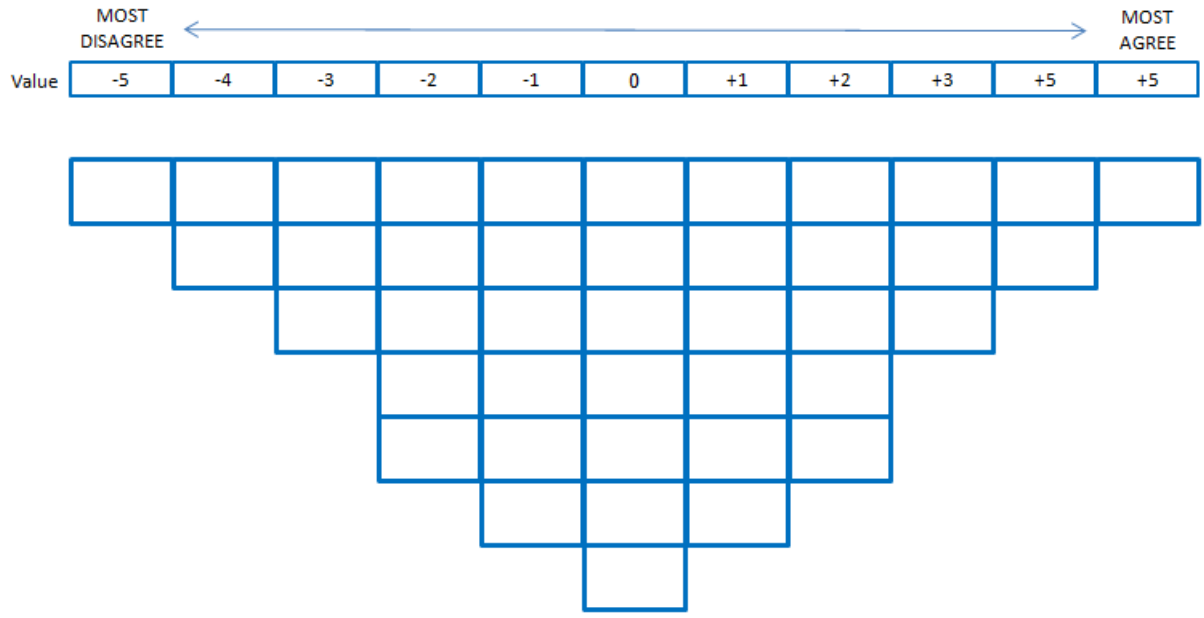

Figure 3.2 – Q-Sort distribution

These statements must be ranked using 7–11 piles making up the range between the extremes from strongly agree to strongly disagree (Mrtek, Tafesse & Wigger, 1996). The number of statements per pile varies, but usually assumes a near-normal distribution, with one or two items to be forced maximum in the extremes, gradually increasing to more statements in the middle piles.

Q-sort procedure

The Q-sort procedure comprises of four steps. Ten Klooster et al. (2008: 512) describe these steps as follows.

The first step is the collection of relevant ideas, beliefs and opinions on the research object. Such collection is called the concourse. It can be based on various sources, such as interviews, content analysis or previous research.
The second step is the selection and formulation of a set of meaningful statements, which results in the Q-sample. If the statements are on a product or brand, ideally the final selection consists is an equal number of positive and negative statements (Schlinger, 1996). Up to here, the procedure resembles the development of attitude questionnaire items. The resulting statements are randomly numbered and printed on separate cards.
The third step involves respondents having to express their views on the research topic by placing all cards in the pre-structured Q-sort distribution. The end result is called Q-sort.
The fourth step is the data analysis. A correlation matrix is made of all Q-sorts, indicating the degree of correspondence between respondents. The correlation matrix is submitted to a by-person factor analysis to explore attitudinal groupings. Factor scores are computed for each of the items in the resulting clusters of respondents, which lead to one representative Q-sort per group.

Also, confounding respondents (loading significantly on more than one factor) and non-significant respondents (not loading on any of the factors) are identified. The final task is to interpret and explain similarities and differences among the factors.

3.3 Data Collection and Analysis

3.3.1 Data Collection

The data sources and collection methods used and the involved respondents are summarized in the matrix given in Table 3.1.

Required data	Objective	Data source	Data collection	Respondents
General project data	Describe project			Per project 1/2/3/4
Organizations	Describe project environment	Company information; Project Managers	Document review; Interview	PM 1/2/3/4 - owner PM 1/2/3/4 - contractor
Project data	Describe project characteristics	Project files; Project Managers	Document review; Interview	PM 1/2/3/4 - owner PM 1/2/3/4 - contractor
Project manager back ground	Describe characteristics, management style and attitude of Project Manager	Project Managers	Structured interview, open questions	PM 1/2/3/4 - owner PM 1/2/3/4 - contractor
Contract data	Identify and describe contract attributes (aspects of contract)	Project files	Document review	
Owner-contractor relationship data	Measure and assess attributes of relationship (indicators)	Project Managers	Questionnaire	PM 1/2/3/4 - owner PM 1/2/3/4 - contractor
	Explore and describe views of project managers on relationship	Project Managers	Q-set and Q-sort; Structured open interview	PM 1/2/3/4 - owner PM 1/2/3/4 - contractor
Influence contract aspects on relationship indicators data	Explore and describe views of project managers on influence	Project Managers	Q-set and Q-sort; Structured open interview	PM 1/2/3/4 - owner PM 1/2/3/4 - contractor

PM = project manager

Table 3.1 – Data collection sources and methods

For each of the 4 projects, per individual project the following data was collected:

- Data regarding the project in general to correctly and comprehensively describe the project and its environment conditions, focussing on characteristics of organizations, the project and the project manager.

- Data regarding the applied contract to describe its attributes.
- Data regarding the owner- contractor relationship to describe its attributes.
- Data regarding the relationship between contract attributes and owner-contractor relationship attributes to describe influences.

3.3.2 Data Analysis

Assessing aspects of contracts and contract types

For the object contract type in each project we have identified the aspects of the applied contract by assessing the contract documents used for the project. Based on these aspects a footprint was made of the contract that positions the contract in a typology diagram. These diagrams show how the contracts differ from the identified typical contract types. Furthermore, they form a basis for the comparison between the contracts used in the various projects to identify similarities and differences.

Assessing aspects of relationship effectiveness and relationship level

The assessment of the aspects of the object relationship effectiveness was carried out by means of a matrix questionnaire, based on the Meng Maturity Assessment Matrix as described in the previous chapter. To this end, the Meng matrix was slightly adjusted by deleting the main-criterion 'procurement' and its sub-criteria, based on the reasoning given in the previous chapter under 'Assessment of Relationship Effectiveness' under the heading 'assessment criteria'. The resulting Effectiveness Assessment Matrix Questionnaire is shown in Appendix A.

For each project the questionnaire was filled in by both project managers, who indicated per criterion which statement was felt to be most applicable on the relationship he was part of. Therefore, by filling in the questionnaire, the project managers expressed their perception of the level of maturity on an extensive number of main and sub-criteria. Based on the ranking of these aspects on a maturity level scale of 1 to 4 ranging from low to high, a footprint of the relationship effectiveness was obtained that positions the relationship effectiveness in a maturity typology structure. These matrices give insight into the perceptions of the project managers on the relationship effectiveness in the various projects. Also, these matrices allow for the comparison between the assessments of the project managers within the projects and between the projects to identify similarities and differences.

Cross-project analysis by comparing footprints of contract type and relationship effectiveness

By comparing the combinations of the applied contracts and the footprints of relationship effectiveness within each project, we identified similarities and differences on aspect level of the object relationship effectiveness. By then comparing these combinations between the projects, we recognized variations in the aspects of the assessed relationships effectiveness for the different identified contract types per project.

However, the resulting cross-project analysis does not reveal similarities and differences in viewpoints of the involved project managers between the various assessments of relationship effectiveness. Nor does it reveal similarities and differences in viewpoints on the influence of the

various aspects of the applied contracts and the aspects of relationship effectiveness. Furthermore, the assessments of the project managers of the aspects of the relationship effectiveness are by its nature subjective, because the ranking is based on personal perception. The assessments reflect their individual points of view, influenced by their specific likes and dislikes (Van Exel & De Graaf, 2005) and introduce personal bias.

Assessing views on relationship effectiveness and relationship level using Q-methodology

To cope with this, Q-methodology was used to collect, sort and analyse data based on the statements ranked by the project managers. From this similar and differing views were developed. For this the Q-sample statements and data from the completed Q-sorts were entered into the PQ Method 2.33 software programme, which is designed to analyse Q-methodology studies (Schmolck, 2012).

To identify groups of similarly completed Q-sorts, referred to as factors, factor analysis was performed on the entered Q-sort data. As each completed Q-sort represents an individual point of view on the study topic, a group of similarly completed Q-sorts, or a factor, represents a shared viewpoint on the study topic. Therefore, more than one factor indicates the presence of multiple viewpoints on the study topic (Chinnis et al., 2000: 198).

To realize this, principal component analysis and the resulting correlation matrices were used to find the associations among the different Q-sorts (Militello & Benham, 2010: 626; Brown, 1980). Subsequently factor analysis was applied, where the emergent factors were rotated to a simple structure using the Varimax method. This rotation provided z-scores for each statement on each factor. For this the number of factors was determined by examining the 'elbow' in a scree plot of eigenvalues. Consequently a model sort in the form of a factor array was created for each factor in the pattern. With this we were able to identify how each participant correlates to each of the model sorts.

3.4 Q-Sort Preparation

For the Q-sort, a Q-sample called the Q-set was used, developed by Suprapto in 2012[4] that was generated by means of a set of statements called the concourse. This Q-set is shown in Table 3.2.

According to Militello et al. (2010) a Q-sample can be generated either as readymade (structured) or naturalistically (unstructured) (McKeown & Thomas, 1988). An example of a readymade Q-sample is an acknowledged set of published standards of which the descriptions are used as Q-set statements. In that case the concourse is more an imaginary stage from which these standards are implicitly supposed to be developed. A naturalistic Q-sample originates from a naturalistic concourse development, where the concourse statements are generated from communicated subjectivity of a given topic (Militello et al., 2010: 624).

[4] Suprapto, M., PhD Researcher at Delft Centre for Project Management, Section Technology Strategy & Entrepreneurship, Faculty of Technology Policy and Management, Delft University of Technology.

Category	**Statement**	Nr
Owner attitude	Owner's senior management displays consistent and passionate leadership	55
	Owner's senior management provides necessary resources and support to the project team	1
	The owner believes that the contractor will make efforts to deliver their commitments	4
	The owner recognizes contractor’s commercial interest	53
Contractor attitude	Contractor's senior management displays consistent and passionate leadership	8
	Contractor's senior management provides necessary resources and support to the project team	36
	The contractor has confidence that owner is reliable and trustworthy	3
	The contractor internalizes the owner's long-term goals as their own goals	42
Joint attitude	Owner and contractor acknowledge and respect cultural differences (organizational and people)	6
	Owner and contractor establish open and honest communication throughout the project lifecycle	44
	Owner and contractor focus their efforts on delivering current project objectives since no future projects can be guaranteed	19
	Owner's and contractor's senior management are proactively involved in handling escalated conflicts/ disputes	47
	When problems occur, owner and contractor do not blame each other but focus on solutions and mutual interests	28
Owner capability	The owner assigns its people sufficiently and with appropriate skills, knowledge, and experience	45
	The owner has necessary technical capabilities such as technological, business, and operation	49
	The owner has strong capability in project management	50
	The owner has strong financial capacity	10
Contractor capability	The contractor has high reputation and credibility in the marketplace	29
	The contractor has highly skilled and experienced people	54
	The contractor has strong capability in project management	18
	The contractor has strong technical capability such as engineering, procurement, and construction	48
Contract aspects	The contract clearly specifies roles and responsibilities of the parties	20
	The contract includes a structured approach to problem solving and dispute resolution	24
	The contract includes explicit incentive schemes	21
	The contract is used as the basis for managing all activities of the project	5
	The contract specifies remuneration scheme fairly and transparently	22
	The contract specifies targeted performance and its key criteria	35
	The contract specifies the statement of work as clearly as possible	14
	The risks are clearly specified in the contract	9
Team Integration	A single project team is formed from owner and contractor's key personnel	33
	All people in the project team work without organizational and hierarchical boundaries	27
	Owner and contractor build on positive experience from previous relationship	26
	The contractor aligns sub-contractors and suppliers to the project goals	23
	The owner aligns its internal functions such as business and operation	25
	The project team regularly exercises team building/alignment activities	31
	The tasks are distributed between owner and contractor rather than duplicated	17

Category	Statement	Nr
Way of working	Owner and contractor have compatible systems and procedures	16
	Owner and contractor jointly develop key measures and evaluate the project performance	7
	Owner and contractor jointly develop procedures for conflicts/disputes handling	52
	Owner and contractor jointly identify and manage the project risks	40
	The contractor is involved early during front end development of the project	12
	The contractor offers competitive solutions for a well-performing owner	41
	The owner puts sufficient effort and resources on front end development	13
	The owner rewards a well-performing contractor with a better chance of securing the next project	34
	The people's performance and behaviour are recognized (financially and/or non-financially)	37
Team effectiveness	All people accept joint responsibilities for the team's achievement	15
	All people in the project team are personally engaged towards the project goals and outcome	51
	All people in the project team feel free to share information and knowledge across organizational boundaries	32
	All people in the project team participate actively	31
	All people in the project team share a common vision and set of objectives	2
	All people in the project team trust each other	43
	As long as people perform well, social activities/events have to be restricted	30
	No contentious issues and conflicting opinions in the project team are allowed	38
	The project team embraces divergent views as creative inspiration to problem solving	46
	The project team regularly evaluates each other's roles and performance and jointly acts for improvement	11
	The project team's primary concern is to execute the project excellently	39

Table 3.2 – Structured Final Q-set (adapted from Suprapto, 2012)

The Q-set developed by Suprapto is mainly based on a naturalistic approach to Q-studies into owner-contractor relationships in engineering projects. Opinion statements were collected by Suprapto, regarding (I) *relational attitudes* of the owner, the contractor, and jointly such as commitment, orientation, and trust; (ii) *capabilities* of the owner and the contractor, (iii) *team integration* such as alignment, team building, and shared objectives, (iv) *way of working* such as systems and procedures, procedures for conflict resolution, and performance measurement, (v) *team effectiveness* such as team's trust, and information sharing, and participation, and (vi) *contract aspects* such as responsibilities, remuneration, and incentive scheme.

Statements were extracted from 9 interviews with project directors and project managers, popular articles from websites and blogs of professional community (e.g.: IQPC, IACCM, PMI, APM), popular literature (e.g.: ACA, 1999; CII, 2011; KPMG, 2010; Merrow, 2011), and scientific literature (e.g.: Ahola, 2009; Bosch-Rekveldt, 2011: Brenner, 2007; Chan et al., 2012; Meng 2011, Smyth & Pryke, 2008). The respondents were asked to reflect on owner-contractor relationship and share their views.

The raw material was edited by Suprapto and then categorised. Composite statements were split to address a single issue but broad and clear enough to be interpreted in slightly different ways by different people; similar statements were grouped and taken together. After 6 iterative discussions, Suprapto compiled 115 statements. All statements were arbitrarily assigned to one of the six categories: relational attitudes, capabilities, contract, team integration, way of working, and team effectiveness.

Finally, within each category a broadly representative selection was made, leading to a set of 55 statements to form the Q set. Each statement was randomly assigned a number and printed on a card. These statements are presented in Table 3.2. Thus a Q-set of 55 statements was generated to be used for the Q-sort. This Q-set is shown in Appendix B. The 55 statements were individually printed on 3 x 6 cm note cards, resulting in 55 cards.

Next, a Q-sort distribution board with 55 positions approximating a near-normal distribution ranging from 'most agree' to 'most disagree' was developed, containing as many cells as there are Q-sample statements (Appendix C). Subsequently an A1-poster format template was prepared on which the developed Q-sort distribution diagram was printed to help facilitate the Q-sort process.

Statements to operationalize for the influence of contract aspects

The following statements are included to investigate the relative influence of contract aspects:

Contract aspect	Statement	Nr.
Risk allocation	The risks are clearly specified in the contract	9
Governance/management	The contract is used as the basis for managing all activities of the project	5
Problem solving/conflict resolution	The contract includes a structured approach to problem solving and dispute resolution	24
Remuneration scheme	The contract specifies remuneration scheme fairly and transparently	22
Incentives	The contract includes explicit incentive schemes	21
Performance assessment	The contract specifies targeted performance and its key criteria	35
Roles & responsibilities	The contract clearly specifies roles and responsibilities of the parties	20
Technical requirements/ specifications	The contract specifies the statement of work as clearly as possible	14

Note that in this research contract type is considered to correspond with the remuneration principle identified in section 2.1.4 as a key contract aspect.

3.5 Project Evaluation Protocol

A project evaluation protocol was used to structure the research and interviews per individual project and increase the validity of the study. The interviews were held on the basis of a set of interview guidelines (Appendix D).

To reduce participants' bias, everyone received the same brief information about the objectives of the interviews and the Q-sort. The participants were introduced to the maturity level matrix

questionnaire interview by a written instruction to-the questionnaire survey as presented in Appendix E. For the introduction and the execution of the Q-sort process a written instruction as presented in Appendix F was used.

Before the interviews, project documentation such as contractual documents, minutes of meetings, progress reports and close out reports were studied by the interviewer to become familiar with the project and the setting in which it was executed. The written information was also used to complement and interpret the interview results and the results of the Q-analysis. Before the interviews, the project documentation was studied to identify the general project characteristics. Also, prior to the interview, the contract documents were studied to assess the aspects of contract and contract type.

The first part of the interviews was meant to verify and complete the assessment of the contract documents.

The second part of the interviews was meant to assess the aspects of the relationship effectiveness and relationship level. For this a matrix type questionnaire was used, based on the Meng maturity level matrix as described in the literature review (Appendix E). The purpose of this matrix questionnaire is twofold. On the one hand, to obtain data to assess the mentioned relationship effectiveness aspects in each specific project by ranking relationship indicators in the matrix on relationship maturity level. This ranking was done by circling the appropriate matrix cell per effectiveness sub-criteria. On the other hand, it to prepare for the subsequent Q-sort process as described as the fourth part by making the respondent familiar with the characteristics of the relationship indicator criteria for the different maturity levels to illustrate the background of the statements of the Q-sample. Besides completing the matrix questionnaire, comments on individual questionnaire items were registered on the questionnaire form.

The third part of the interviews involved the Q-sort process. During this process, the participants were asked to rank a Q-set of 55 statements; each printed on a card, in two stages on a large board with an empty Q-sort near-normal distribution, the Q-sort distribution board. The cards were presented to the respondent in random order and the respondents were asked to rank the statements, indicating to what extent they would agree or disagree with them.

At the start, the interviewer explained the sorting task to the respondent, guided by a written instruction. The respondents had to read the cards and divide them into three piles. One pile for the statements he agreed with, one pile for the statements he disagreed with and one pile for the statements he felt uncertain or neutral about. After that, the respondents had to place the cards from the ‘agree’-pile on the positions on the Q-sort distribution board, followed by the ‘disagree’-pile and consequently by the ‘neutral’-pile. They were free to move the cards until all the positions were filled and they were fully satisfied with the resulting distribution. The results of the Q-sorts were registered on an A4 Q-sort template.

Also, after completion of the Q-sort, the respondents were requested to comment on the decisions they made in performing the Q-sorts by asking*: ‘Please explain why you agree most/disagree most, with the statement you have placed below the +5/+4/+3 - -5/-4/-3 column’*. These comments helped

us to better understand the respondents' considerations on their sorting process. About this information Brown (1980: 200) states that it provides the investigator with an opportunity to clarify points which may be obscure to him. Their answers and comments were also recorded on the Q-sort instruction form, used for the interview.

To further ensure protocol and content validity, the protocol and the Q-sample were entirely tested on a trial project, prior to the used on the selected projects. This included testing of the prepared assessment matrix, questionnaires, the Q-set statements, the Q-sort template and the instruction forms. For this trial project an industrial infrastructure project was used of which the involved project manager from the contractor side acted as the respondent. Based on the experience gained during this process and on the remarks and additions of the respondent, the protocol was amended and the documents and Q-sort process was added and improved. It was also recognized that this Dutch native project manager experienced some problems in understanding the English wordings on the effectiveness assessment matrix and the Q-statements on the cards. Therefore a Dutch and an English version were prepared for the research interviews and used depending on the preference of the respondents.

4 Q-study Results & Analysis

In this chapter the results of the Q-study among the project managers of the 4 studied projects on both the owner side and on the contractor side are presented and analysed. The analysis reveals how the project managers perceive multidimensional aspects of owner-contractor relationship in construction projects and how they perceive contract aspects relative to the other aspects within these views.

4.1 Q-Sorting

The selected projects represent executed works performed under the different contract types: *lump sum contracts (project 1 and 2), unit rate contract (project 3) and reimbursable/alliance contract (project 4)*. For each of the 4 projects subject to this study, Q-sort based interviews were held among the project managers to reveal the viewpoints of the project managers on how they perceive multidimensional aspects of owner-contractor relationship in construction projects in general. The most relevant of these factors are included in the set of Q-statements which was used for the Q-sort interviews. These factors are divided in contract aspects, falling in the category 'Contract', and other factors falling in the categories *'Attitude' (owner, contractor and joint attitude), 'Capability' (owner and contractor), 'Team integration', Way of working' and 'Team Effectiveness'*, as described in Chapter 3.

The project managers were asked to sort the Q-statements by answering for each statement the pronunciation: *'I believe in order to improve owner-contractor relationship that it is important that .....'* . It was explicitly stated to answer in a general context and not in the context of the project subject to the project evaluation.

The resulting Q-sorts were presented in distribution diagrams. In these distribution diagrams the statements belonging to the afore mentioned different categories are indicated by different colours, allowing to assess the relative influences per category as indicated by the project managers. The complete results for the 4 projects are presented in the Q-sort distribution diagrams for the project managers of the 4 studied projects in Appendix G.

4.2 Q-Factor Analysis

After completion of the Q-study interviews, the Q-sorts were factor analysed be means of software package PQ Method version 2.33 (Schmolck, 2012) to statistically cluster the data of the project managers. First, the set of Q-statements that were used for the Q-study interviews were entered as input to the program in the same order of 1 to 55 as it was generated. Next the Q-sort data of all the project managers was entered. Then a factor analysis on the data was performed by executing the PQ-Method program. Factor analysis is the statistical concept for clustering the project managers. Initially, eight subjective clusters (factors) were generated. These subjective clusters are groups of similar completed Q-sorts, each representing a shared point of view or shared perspective.

This initial step delivers unrotated factor loadings as intermediate output i.e. a standard deviation score based on how each project manager ranked the statements. An iterative analysis was performed to identify the number of clusters that exist. For this, the factors were rotated by the program until a strong significance was attained for all the eight project managers on either of the 8 factors clusters where a factor is at least defined by 2 significant loadings of one sorter. A factor loading in this step is considered statistically significant at 0.01 significance level if it is above +0.3473 or lower than -0.3473[5]. The Varimax rotation option was performed, which is the commonly used rotation method among Q-method users (McKeown & Thomas, 1988; Sekaran & Bougie, 2009).

The factor loadings obtained by each project manager were cross-checked for this significance and if one was found to be not significant, factor rotation was performed on less factors. From this process it appeared that the rotation with only 3 factors showed significance for all the project managers. The thus recognized 3 subjective clusters among the eight project managers explain 64% of the variance, while the other 5 clusters explain for the remaining 36%.

The outputs of the described PQ-Method program processing are*: (1) rotation factor loading matrix, (2) perspectives denoted by loadings, (3) correlation matrix, and (4) consensus and distinguishing statements.*

4.3 Project Wise Factor Loadings of the Project Managers

The factor loadings for each project manager are presented in Table 4.1. Factor loading represents the extent to which each project manager is inclined towards that particular perspective. In fact, factor loadings are correlation coefficients: they indicate the extent to which each Q-sort is similar or dissimilar to the composite factor array, the model Q-sort for that type. The project manager's factor loadings are cross-checked for significance values higher than +0.3473 or lower than -0.3473. If more than one perspective scores significant, then the perspective with the highest score is marked as the defining sort of that project manager. Note that perspective 1 and perspective 2 have two project managers each and perspective 3 has four project managers with defining sorts.

Q-sort by project		Perspective 1	Perspective 2	Perspective 3
Project 1 Lump Sum A	**Owner PM 1**	0.7546X	0.4794	-0.0156
	Contractor PM 1	0.1211	0.8077X	0.2084
Project 2 Lump Sum B	**Owner PM 2**	0.0734	0.8304X	-0.0677
	Contractor PM 2	0.3592	0.1491	0.5800X
Project 3 Unit Rates	**Owner PM 3**	0.8494X	-0.0082	0.2218
	Contractor PM 3	-0.2707	0.1523	0.6841X
Project 4 Alliance/ Reimbursable	**Owner PM 4**	0.1140	-0.0434	0.7089X
	Contractor PM 4	0.2245	-0.0113	0.7042X

Table 4.1 – Factor loadings with X indicating the defining sorts per perspective

[5] Statistical significance at the 0.01 level (99% confidence level for not due to chance) exists if the value, irrespective of the sign, is at least 2.576 times the standard error for which in this case the expression 1/SQRT(N) applies, where N is the number of statements (in this case N=55) and SQRT is the square root (McKeown & Thomas, 1988; Sekaran & Bougie, 2009).

For each perspective a composite factor array, which represents a model Q-sort for that perspective was generated by the PQ-Method program processing that shows the sequential listing of statements that characterize the particular perspectives, ranging from most agree to most disagree statements. From the model Q-sorts, a model Q-sort distribution diagram was composed for each perspective, showing the distribution of the earlier mentioned influencing factors for the owner-contractor relationship, distinguished by their categories as described subsequently.

4.3.1 Perspective 1: Strong Leadership & Management

It can be concluded from the model Q-sort statements of this perspective that there is a dominance for strong managerial and leadership aspects. This perspective is shared by 2 owner project managers (the project managers of projects 1 and 3) who believe that strong leadership and management may improve the owner-contractor relationship.

Table 4.2 provides a summary of the model Q-sort statements of this perspective, indicating the distribution of categories of influencing factors as addressed by these statements. The Q-sort values for the statements are given in parentheses.

Most agree statements	**8 - Contractor attitude (5)** **55 - Owner attitude (4)** **43 - Team effectiveness (4)**
Agree statements	**47 - Joint attitude (3)** **15 - Team effectiveness (3)** **12 - Way of working (3)** **1 - Owner attitude (3)**
Most disagree statements	**30 (negative statement) - Team effectiveness (-5)** **21 - Contract aspects (-4)** **10 - Owner capability (-4)**
Disagree statements	**35 - Contract aspects (-3)** **16 - Way of working (-3)** **33 - Team integration (-3)** **52 - Way of working (-3)**
Most distinguishing statements	**8 - Contractor attitude** **55 - Owner attitude** **25 - Team integration**

Table 4.2 – Perspective 1 composed Q-sort result: most agree, most disagree and most distinguishing statements by category of influencing factors

Appendix H (1) presents the top 3 most agree statements and 4 agree statements as well as the bottom 3 most disagree statements and 4 disagree statements from the PQ-Method program processing for this perspective. The statements are followed by key remarks centred on these statements as worded by the project managers during the Q-sort interviews about their individual most agree and most disagree statements.

The table in the appendix also presents the 3 most distinguishing statements of the perspective, i.e. statements that this view has the least in common with perspectives 2 and 3. From this data it can be comprehended that the project managers with this view believe that it is important for the owner-

contractor relationship that both owner and contractor senior management show consistent and passionate leadership (8) and (55) - (Q-sort values of +5 and +4). They also believe that trust among each other in the project is most important (43) - (Q-sort value of +4).

They mostly disagree that as long as the project team performs well, social activities and alignment activities have to be restricted (30) - (Q-sort value of -5). By mostly disagreeing with this negative formulated aspect of team effectiveness, these project managers believe that these activities should not be restricted and that this aspect of team effectiveness is also most important.

The explicit inclusion of incentives schemes in the contract (21) and strong financial capacity of the owner (10) are regarded by the project managers as most unimportant for the improvement of the relationship) - (Q-sort values of -4).

Relative influence of contract aspects in perspective 1

Figure 4.1 presents the composed Q-sort distribution diagram for perspective 1, showing the distribution of influencing aspects by category; i.e. the relative influence of the contract aspects addressed by the Q-statements on this perspective. To facilitate reading the report in black-white printed version, a cut-out of the distribution of contract aspect from the full model Q-sort distribution is presented in Figure 4.2.

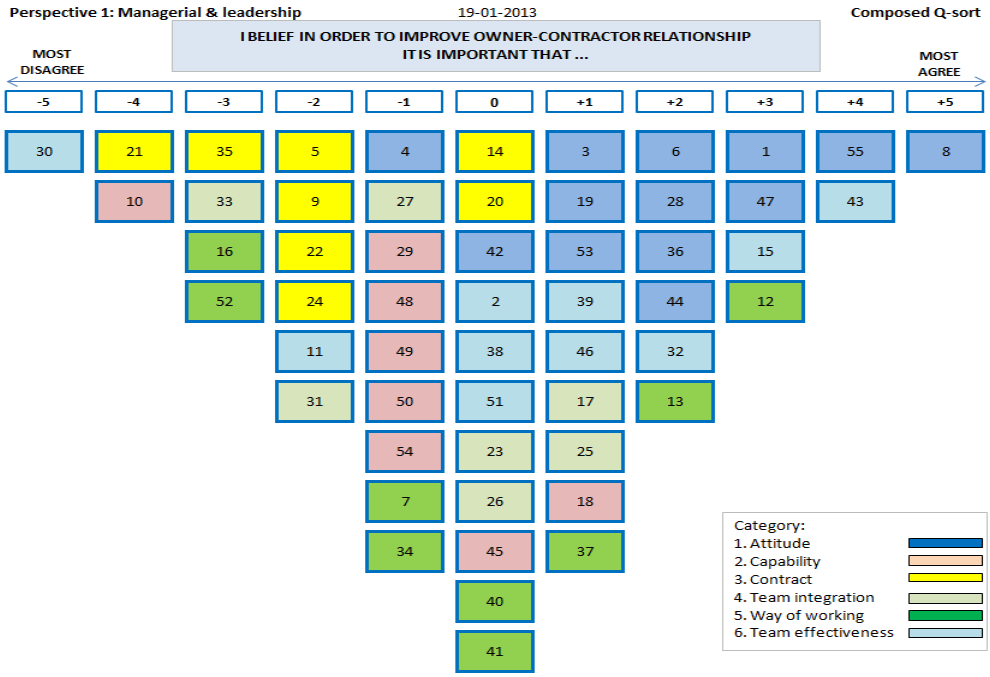

Figure 4.1 – Composed Q-sort distribution for perspective 1, showing the distinguished categories of influencing factors

The diagrams show the dominance in this perspective for influencing factors of the categories: *owner/contractor attitude and team effectiveness.* The diagrams also show that the project managers who share this perspective mostly disagree that 2 of the 8 assessed contract aspects help to improve owner-contractor relationship (Q-sort values of -3 and -4). Of the other 6 aspects they believe they are not relevant or have no influence on the owner-contractor relationship effectiveness (Q-sort values of 0 to -2).

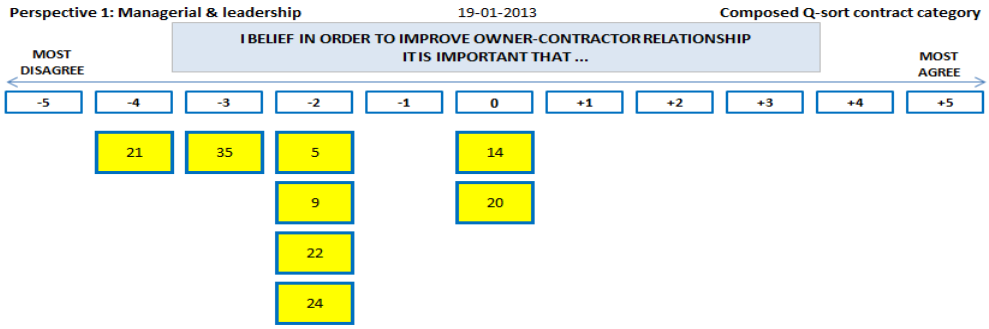

Figure 4.2 – Composed Q-sort distribution of contract aspects for perspective 1

The contract aspects which they disagree with most to improve the relationship are: *explicit incentive schemes (21) and the specification of targeted performance and its key criteria in the contract (35)* - (Q-sort values of -4 and -3).

The contract *aspect remuneration principle* - which, as argued in section 2.2.6, is considered to correspond with contract type - is operationalized by the statement *'The contract specifies remuneration scheme fairly and transparently' (22)*. The project managers who share this view believe that this contract aspect is not relevant or has no influence on the relationship (Q-sort value of -2).

4.3.2 Perspective 2: Effective Team Integration

It can be concluded from the model Q-sort statements of this perspective that there is a dominance for relational competences such as: *trust, team integration and joint attitude.* This perspective is shared by 1 contractor and 1 owner project manager (the contractor project manager of project 1 and the owner project manager of project 2) who believe that effective team integration may improve the owner-contractor relationship.

Most agree statements	**2 - Team effectiveness (5)** **43 - Team effectiveness (4)** **40 - Way of working (4)**
Agree statements	**28 - Joint attitude (3)** **53 - Owner attitude (3)** **42- Contractor attitude (3)** **51 - Team Effectiveness (3)**
Most disagree statements	**38 (negative statement) - Team effectiveness (-5)** **35 - Contract aspects (-4)** **10 - Owner capability (-4)**
Disagree statements	**21 - Contract aspects (-3)** **22 - Contract aspects (-3)** **25 - Team integration (-3)** **29 - Contractor capability (-3)**
Most distinguishing statements	**2 - Team effectiveness** **53 - Owner attitude** **42 - Contractor attitude**

Table 4.3 – Perspective 2 composed Q-sort result: most agree and most disagree and most distinguishing statements by category of influencing factors

Table 4.3 provides a summary of the model Q-sort statements of this perspective, indicating the distribution of categories of influencing factors as addressed by these statements. Appendix H (2) contains a table with the top 3 most agree statements and 4 agree statements as well as the bottom 3 most disagree statements and 4 disagree statements are presented. The statements are followed by key remarks centred on these statements. The table in the appendix also presents the 3 most distinguishing statements of the perspective, i.e. statements that this view has the least in common with perspectives 1 and 3.

From this data it can be understood that the project managers who share this perspective believe that sharing a common vision and set of objectives among all the people in the project team (2) and trust among team members (43) are most important to improve the owner-contractor relationship (Q-sort values of -+5 and +4). Besides that, they also believe that jointly identifying and managing of project risks by owner and contractor (40) are important for the relationship (Q-sort value of +4).

They mostly disagree that no contentious issues and no conflicting opinions are allowed within the project team (38) - (Q-sort value of -5). By mostly disagreeing with this, also these project managers believe that allowing these issues and opinions is most important. The specification in the contract of targeted performance (35) and strong financial capacity of the owner (10) are regarded by the project managers who share this perspective as most unimportant for the improvement of the relationship (Q-sort values of -4).

Relative influence of contract aspects in perspective 2

In Figure 4.3 the composed Q-sort distribution diagram for perspective 2 is presented showing the distribution of influencing aspects by category, thus showing the relative influence on the perspective. A cut-out of the distribution of contract aspects is presented in Figure 4.4.

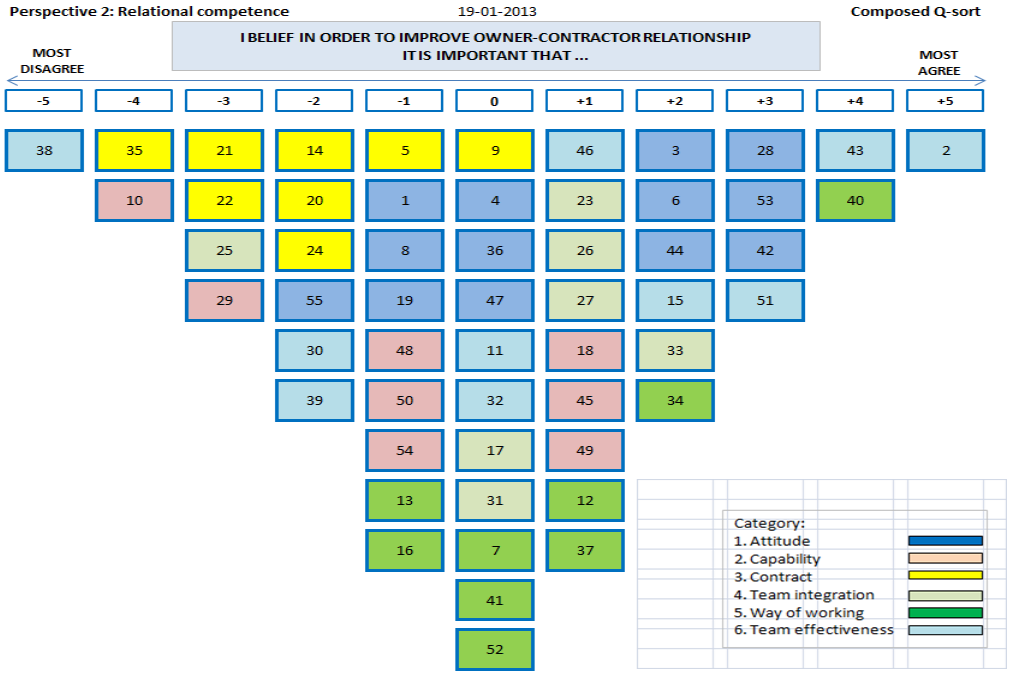

Figure 4.3 – Composed Q-sort distribution for perspective 2, showing the distinguished categories of influencing factors

The diagrams show the dominance on this perspective for influencing factors of the categories: *team effectiveness and owner/contractor attitude,* which it has in common with perspective 1. The diagrams also show that the project managers mostly disagree that 3 of the 8 assessed contract aspects help to improve owner-contractor relationship (Q-sort values of -3 to -4). They believe 5 aspects are not relevant or have no influence on the owner-contractor relationship effectiveness (Q-sort values of 0 to -2).

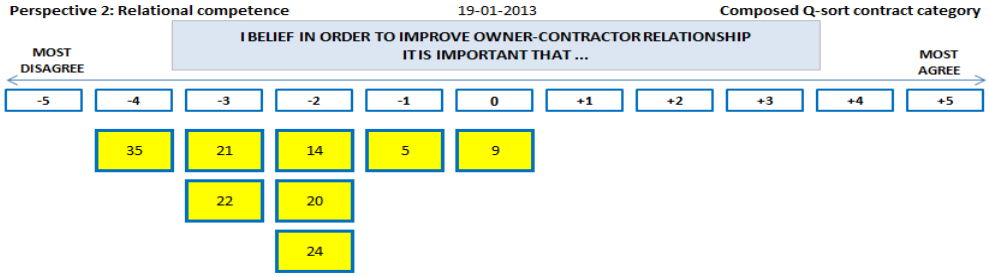

Figure 4.4 – Composed Q-sort distribution of contract aspects for perspective 2

The contract aspects they disagree with most to improve the relationship are: *the specification of targeted performance and its key criteria (35) and explicit incentive schemes in the contract (21)* - (Q-sort values of -4 and -3). These are the same contract aspects as in perspective 1.

The project managers who share this view believe that the contract aspect *remuneration principle (22*) - which is considered to correspond with contract type - is not relevant or has no influence on the relationship (Q-sort value of -3).

4.3.3 Perspective 3: Strong Capabilities & Structure

From the model Q-sort statements of this perspective it can be concluded that this perspective shows dominance for hard aspects such as: *owner/contractor capability and contact aspects regarding the specification of performance, roles and responsibilities in the contract.* This perspective is shared by 1 owner project manager and 3 contractor project managers (the owner project managers of project 4 and the contractor project managers of project 2, 3 and 4) who believe that strong capabilities and structure may improve the owner-contractor relationship.

Table 4.4 provides a summary of the model Q-sort statements of this perspective, indicating the distribution of categories of influencing factors as addressed by these statements.

Most agree statements	**18 - Contractor capability (5)** **20 - Contract aspects (4)** **35 - Contract aspects (4)**
Agree statements	**45 - Owner capability (3)** **43 - Team effectiveness (3)** **39 - Team effectiveness (3)** **48 - Contractor capability (3)**
Most disagree statements	**27 - Team integration (-5)** **38 (negative statement) - Team effectiveness (-4)** **16 - Way of working (-4)**

Disagree statements	**21 - Contract aspects (-3)** **50 - Owner capability (-3)** **41 - Way of working (-3)** **4 - Owner attitude (-3)**
Most distinguishing statements	**18 - Contractor capability** **20 - Contract aspects** **35 - Contract aspects**

Table 4.4 – Perspective 3 composed Q-sort result: most agree and most disagree and most distinguishing statements by category of influencing factors

The table in Appendix H (3) shows the top 3 most agree statements and 4 agree statements, and the bottom 3 most disagree statements and 4 disagree statements. The statements are followed by key remarks centred on these statements. The table in the appendix also presents the 3 most distinguishing statements of the perspective, i.e. statements that this view has the least in common with perspectives 1 and 2.

From this data it can be learned that the project managers who share this view believe that it is important for the owner-contractor relationship that the contractor has strong capabilities in project management (18) - (Q-sort value of +5). They also believe that it is important for the relationship that the contract clearly specifies the roles and responsibilities of the parties (20) and that the contract specifies targeted performance and its criteria (35) - (Q-sort values of +4).

The project managers who share this perspective also consider it most unimportant everyone in the project team should work without organizational and hierarchical boundaries (27) and that owner and contractor have compatible systems and procedures (16) - (Q-sort values of -5 and -4). They also mostly disagree that no contentious issues and no conflicting opinions are allowed within the project team (38) - (Q-sort value of -4). By mostly disagreeing with this, also these project managers believe that allowing these issues and opinions is most important.

Relative influence of contract aspects in perspective 3

Figure 4.5 shows the composed Q-sort distribution diagram for perspective 2. It presents the distribution of influencing aspects by category, thus showing the relative influence on the perspective. A cut-out of the distribution of contract aspects is presented in Figure 4.6.

The diagrams show the dominance in this perspective for influencing factors of the categories: *contractor/owner capability, contract aspects and team effectiveness.* This distinguishes this perspective in this respect from both perspectives 1 and 2. The diagrams also show that the project managers mostly disagree that *explicit incentive schemes in the contract (21)* help to improve owner-contractor relationship (Q-sort value of -3).

They believe that 5 contract aspects are not relevant or have no influence on the owner-contractor relationship effectiveness (Q-sort values of +2 to -1). In contrast to the other perspectives, the project managers sharing this perspective believe that 2 aspects of contracts help to improve the relationship. That are the contract aspects: *clear specification of roles and responsibilities of the parties (20) and the specification of targeted performance and its key criteria in the contract (35)* - (Q-

sort values of +4). Note that, contrary to this perspective, the latter contract aspect (35) is identified in both the other perspectives as an aspect of which project managers mostly disagree to improve the relationship.

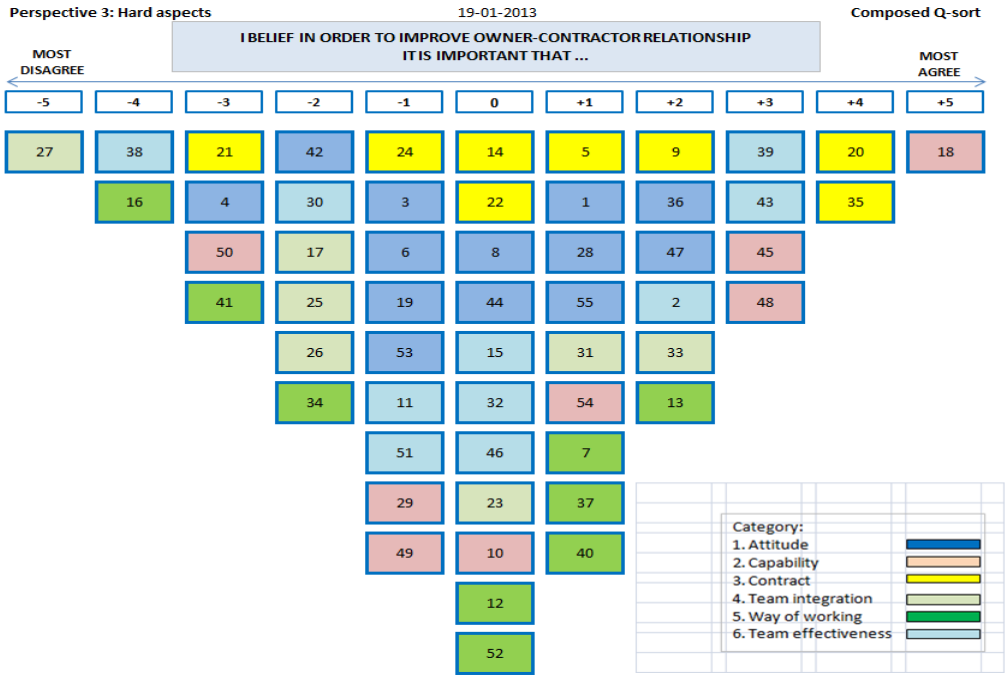

Figure 4.5 – Composed Q-sort distribution for perspective 3, showing the distinguished categories of influencing factors

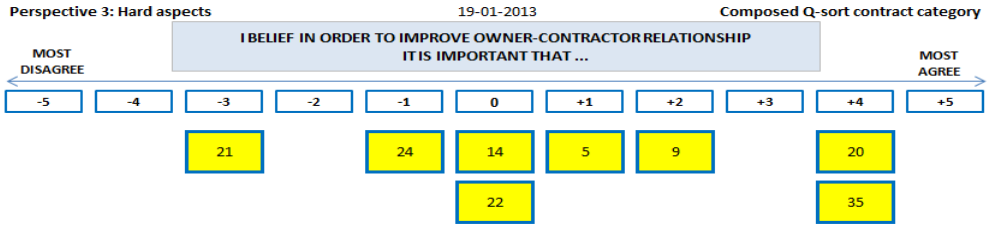

Figure 4.6 – Composed Q-sort distribution of contract aspects for perspective 3

Of the contract aspect *remuneration principle (22)* - which is considered to correspond with contract type - the project managers who share this view believe that this aspect is not relevant or has no influence on the owner-contractor relationship (Q-sort value of 0).

4.4 Correlation Between Perspectives

The correlation scores between perspectives obtained from the PQ-Method program processing are presented in Table 4.5. For the values > 0.266 the correlation is statistically significant at the 0.05 level of significance. It can be observed that the perspectives do not negatively correlate. This means that the perspectives do not represent opposite oriented views. Perspective 1 correlates considerable with perspective 2 and slightly lower with perspective 3, both significant on 0.05

significance level. This means that the project managers who share perspective 1 are fairly willing to accept characteristics of perspectives 2 and 3. Perspective 2 does not score much correlation with perspective 3 i.e. not statistically significant on 0.05 level. Never-the-less, it may be concluded that the positive correlation indicates that the project managers have the ability to appreciate the views of other perspectives.

Perspectives	Perspective 1	Perspective 2	Perspective 3
Perspective 1	1.0000	0.2902	0.2739
Perspective 2	0.2902	1.0000	0.1559
Perspective 3	0.2739	0.1559	1.0000

Table 4.5 – Correlation between perspectives

4.5 Correlation Between Project Managers

Table 4.6 is a duplication of Table 4.1 in which the characterizing of the perspectives are added to provide insight in the correlation between project managers.

Q-sort by project		Perspective 1	Perspective 2	Perspective 3
		Strong leadership & management	Effective team integration	Strong capabilities & structure
Project 1 Lump Sum A	**Owner PM 1**	0.7546X	0.4794	-0.0156
	Contractor PM 1	0.1211	0.8077X	0.2084
Project 2 Lump Sum B	**Owner PM 2**	0.0734	0.8304X	-0.0677
	Contractor PM 2	0.3592	0.1491	0.5800X
Project 3 Unit Rates	**Owner PM 3**	0.8494X	-0.0082	0.2218
	Contractor PM 3	-0.2707	0.1523	0.6841X
Project 4 Alliance/ Reimbursable	**Owner PM 4**	0.1140	-0.0434	0.7089X
	Contractor PM 4	0.2245	-0.0113	0.7042X

Table 4.6 – Characterization of perspectives and factor loadings with X indicating the defining project managers

Perspective 1 is shared by 2 owner project managers who believe that strong leadership and management may improve the owner-contractor relationship
Perspective 2 is shared by 1 contractor and 1 owner project who believe that effective team integration may improve the relationship.
Perspective 3 is shared by 1 owner project manager and 3 contractor project managers who believe that strong capabilities and structure may improve the relationship.

This could indicate that owner project managers prefer a relationship management style, while the contractor project manager focus on the hard aspects of management to control projects.

4.6 Relative Influence of Contract Aspects Among All Perspectives

Among all perspectives contract aspects are believed to be irrelevant to or non-contributing to the improvement of the owner-contractor relationship. Only one perspective (3) reveals that project managers who share this view believe that just 2 of the assessed 8 contract aspects contribute to the improvement of the owner-contractor relationship, which are: (*1) clear specification of roles and responsibilities of the parties and (2) the specification of targeted performance and its key criteria in the contract.* These are aspects regarding structure as a hard aspect of the cooperation between owner and contractor. With this the results of this research do not reveal a dominance of the influence of contract aspects on owner-contractor relationship, relative to other assessed influencing aspects.

Among all perspectives the project managers believe that the contract aspect *remuneration principle* - which, as argued in section 2.2.6, is considered to correspond with contract type - is not relevant or has no influence on the owner-contractor relationship effectiveness.

4.7 Agree and Disagree Consensus Statements

Table 4.7 presents the most significant consensus statements obtained from the PQ-Method program processing, ranked by score. These are statements that do not distinguish between any pair of perspectives and consist of agree as well as disagree statements. In the table the Q-sort values per consensus statement are given to indicate its position in the Q-sort distribution for each perspective, thus showing the ranking of agreement or disagreement on the scale from -5 to +5.

Agree consensus statements	**Category**	**Factor Q-sort values**		
		1	**2**	**3**
43: All people in the project team trust each other	Team effectiveness	4	4	3
44: Owner and contractor establish open and honest communication throughout the project lifecycle	Joint attitude	2	2	0
37: The people's performance and behaviour are recognized (financially and/or non-financially	Way of working	1	1	1
32: All people in the project team feel free to share information and knowledge across organizational boundaries	Team effectiveness	2	0	0
Disagree consensus statements	**Category**			
21: The contract includes explicit incentive schemes	Contract aspects	-4	-4	-4
24: The contract includes a structured approach to problem solving and dispute resolution	Contract aspects	-2	-2	-1
29: The contractor has high reputation and credibility in the marketplace	Contractor capability	-1	-3	-1
50: The owner has strong capability in project management	Owner capability	-1	-1	-3

Table 4.7 – Consensus statements among all perspectives

The results show that the notion that trust among all people in project is important for the owner-contractor relationship appears strong in all views. Also the notion that it is not important for the relationship that the contract includes explicit incentive schemes is strong among all views. The agree consensus statements among the different perspectives show a dominance for relational competences and behaviour, while the disagree statements show a dominance for hard aspects of cooperating.

5 Project Evaluation Results & Analysis

This chapter presents the 4 investigated projects and the results of the assessments of the research objects contract type and owner-contractor relationship effectiveness. Each project is captured in a separate section. The closing section provides a cross-project analysis.

Maturity model interviews: Relationship aspects

For each project individual structured interviews based on the Maturity Model as described in Chapter 3 were performed involving the project managers on owner and contractor side. The perception of the project managers of the effectiveness of the owner-contractor relationship during the project are presented in a matrix based on this model, containing the results of the project manager assessments. The effectiveness is assessed by means of 7 main-criteria, each measured by 3 sub-criteria on a maturity level scale of 1 to 4 ranging from low to high.

Per project the results are presented in a matrix showing the maturity levels perceived by the project managers on both sides for each sub-criterion. Thus the individual views of the project managers are presented such that they can be compared as foot prints. From the sub-criteria, combined maturity levels are calculated by arithmetic means for each of the 7 main-criteria, presented in a summary part of the matrix and in a separate spider diagram.

Added to the matrix are the results of the perception of the project managers on the project performance, measured on the sub-criteria: *quality, time, budget and HSE (health, safety and environment).* The results for the 4 projects are presented in the Effectiveness Assessment Maturity Model Data Matrix for the 4 Studied Projects in Appendix I. For the purpose of analyzing the data by project, summarizing matrices with the results combined on main-criteria level are generated that are presented in the respective sections in which the project data are discussed.

5.1 Project 1: Lump Sum Project A - Engineering, Procurement and Construction of Rectifier Substations for a Light Rail Line

5.1.1 Project Description

This project involved the engineering, procurement, construction and installation of the rectifier station part of the electrification of a new sub-urban light rail line between Rotterdam and The Hague in the Netherlands. The project included the delivery of 14 rectifier substations placed in shelters as a total package.

Owner of the project was a combination of the transportation departments of the city of Rotterdam and the city of The Hague who operate the public sub-urban transport system in and around Rotterdam and The Hague respectively.

The contractor was an intercompany joint venture between a French and a Dutch subsidiary of an international company that designs, installs and maintains systems in industry, infrastructures and the service sector. The contribution of the French partner involved the engineering part and the procurement of mayor equipment, while the Dutch partner was concerned with the project management and the construction & installation part of the project and the procurement of

materials. The Dutch partner of the contractor had successfully cooperated with one of the departments of the owner in various small, medium and large projects over the past years.

The project contract was awarded based on the European public procurement procedure consisting of a two stage tendering route. During the first stage contractors were selected on technical and economical qualifications. The second stage involved the actual tendering where the contractor was asked to offer a lump-sum price, based on aspects like technical and functional requirements, overall life cycle costs (LCC) estimate and a project execution plan. For the selection of the contractor, the principle of the most economically advantageous tender was applied.

The initial contract lump-sum price was 10 M€. The project execution started end 2005 and the delivery of the project took place around mid 2007.

5.1.2 Maturity Model Interview Results

The maturity model interview results for this project, combined on main-criteria level are presented in the maturity model data matrix as shown in Table 5.1.

Maturity Model data matrix Project 1: Lump Sum infra project A					PM Owner				PM Contractor			
Owner - Contractor relationship					Maturity Level 1 = price competition 2 = quality competition 3 = project partnering 4 = strategic partnering/alliance							
Effectiveness main criteria					1	2	3	4	1	2	3	4
Objectives							3				3	
Trust							3			2		
Collaboration								4				4
Communication						2					3	
Problem solving							3			2		
Risk allocation							3				3	
Continuous improvement							3			2		
Maturity level overall average					3,0				2,7			
Project performance					Performance Level							
Performance criteria					1	2	3	4	1	2	3	4
Performance Level 1,2,3,4: poor, reasonable, moderate, good	Quality						3				3	
	Time							4				4
	Budget							4				4
	HSE							4				4
Performance level average					3,8				3,8			

Table 5.1 – Team effectiveness assessment by project managers for project

The matrix shows that the owner project manager assesses the effectiveness of the relationship at maturity level 3, which can be interpreted as 'Project partnering'. The contractor project manager assesses the effectiveness approximate to level 3, which can be interpreted as 'Evolving to Project partnering'. The overall maturity level from owner project manager's point of view has a calculated average value of 3.0 and from the contractor project manager's point of view it has a calculated

value of 2.7. This shows that the project managers in this project have a slightly different view on the perceived effectiveness with a more optimistic view of the owner project manager.

With respect to project performance, both project managers consider the overall performance approximate to good with an average calculated value of 3.8 on a scale of 1 to 4.

The spider diagram in Figure 5.1 shows the results of the assessments of the project managers on the different relationship effectiveness main-criteria compared by their maturity levels.

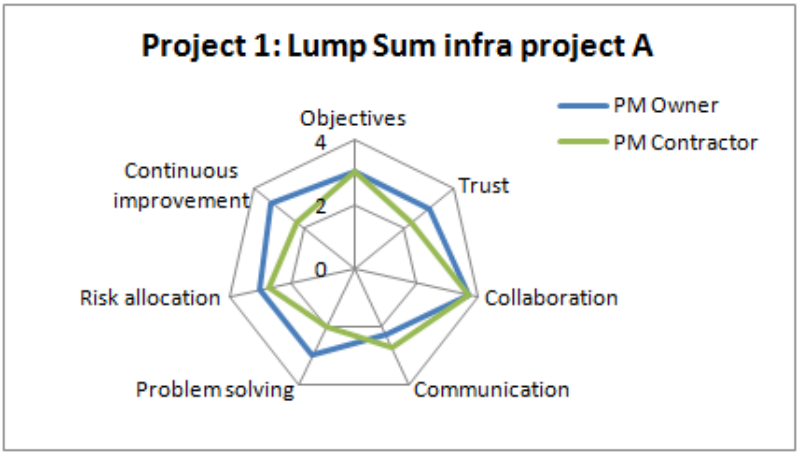

Figure 5.1 – Relative maturity levels per main-criteria for project 1 perceived by project managers

5.2 Project 2: Lump Sum Project B - Engineering, Procurement and Construction of the Revamp of Rectifier Substations of a Metro Line

5.2.1 Project Description

This project is comparable with project 1 in terms of procurement route, type of project, technical complexity, technical and financial magnitude, type of contract, contract conditions and owner and contractor participation.

The purpose of this project was to perform the engineering, procurement, construction and installation to revamp the electrification of a sub-urban metro line in the Rotterdam sub-urban region in The Netherlands. The project included the revamp of 8 rectifier substations on the existing metro line and the supply of 4 new substations in the extension of the metro line through the centre of the city of Rotterdam. This also included the electrical installation of a tunnel that was part of the line extension.

Owner of the project was the transportation department of the city of Rotterdam that was also one of the partners in the owner combination of project 1. The contractor was the same intercompany joint venture between a French and a Dutch subsidiary of an international company that executed the project of project 1 with the same split up of scope activities. But both the project manager of the owner and the contractor were different persons, and also the staff composition of both the project teams was different.

The project contract was also awarded based on the European public procurement procedure consisting of a two stage tendering route, using comparable selection criteria as for the project of project 1. The general contract conditions were almost identical to the general contract conditions of the contract of project 1.

The initial contract lump-sum price was 12 M€. The project execution started end 2006 and stretched to early 2010.

5.2.2 Maturity Model Interview Results

The maturity model interview results for this project, combined on main-criteria level are presented in the maturity model data matrix as shown in Table 5.2.

Maturity Model data matrix Project 2: Lump Sum infra project B		PM Owner				PM Contractor			
Owner - Contractor relationship		Maturity Level 1 = price competition 2 = quality competition 3 = project partnering 4 = strategic partnering/alliance							
Effectiveness main criteria		1	2	3	4	1	2	3	4
Objectives		1						3	
Trust		1					2		
Collaboration			2					3	
Communication			2					3	
Problem solving		1					2		
Risk allocation			2				2		
Continuous improvement			2				2		
Maturity level overall average		1,5				2,5			
Project performance		Performance Level							
Performance criteria		1	2	3	4	1	2	3	4
Performance Level 1,2,3,4: poor, reasonable, moderate, good	Quality		2				2		
	Time	1				1			
	Budget	1				1			
	HSE		2					3	
Performance level average		1,5				1,8			

Table 5.2 – Team effectiveness assessment by project managers for project 2

The matrix shows that the owner project manager assesses the effectiveness of the relationship between maturity levels 1 and 2, which can be interpreted as between 'Price competition' and 'Quality competition'. The contractor project manager assesses the effectiveness between levels 2 and 3, which can be interpreted as between 'Quality competition' and 'Project partnering'.

The overall maturity level from owner project manager's point of view has a calculated average value of 1.5 where from the contractor project manager's point of view it has a calculated value of 2.5. This shows that the project managers in this project have a considerable different view on the perceived effectiveness with a more pessimistic view of the owner project manager. This is in contrast to the project managers in project 1, who have a slightly different view on the relationship effectiveness.

With respect to the project performance, the owner project manager considers the overall performance as between poor and reasonable with an average calculated value of 1.5 on a scale of 1 to 4. The contractor project manager assesses the overall performance approximate to reasonable with an overall value at 1.8. With this the difference in perception of the contract managers on the quality level is considerably less than about the relationship effectiveness.

The spider diagram in Figure 5.2 shows the results of the assessments of the project managers on the different relationship effectiveness main-criteria compared by their maturity levels.

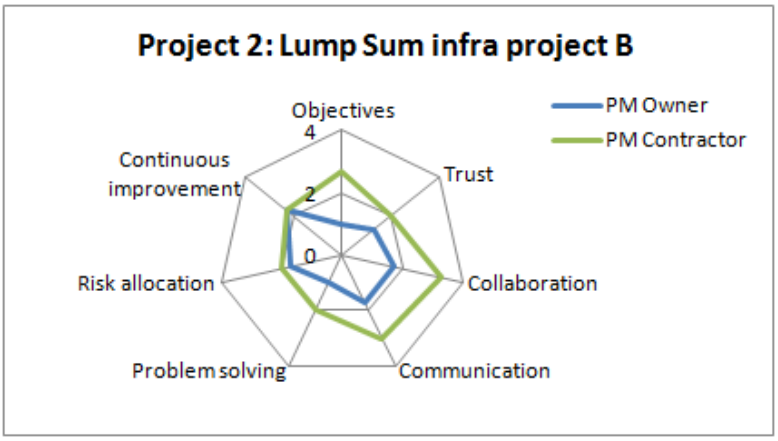

Figure 5.2 – Relative maturity levels per main-criteria for project 2 perceived by project managers

5.3 Project 3: Unit Rates Turnaround Project – Construction and Installation Works for Two Consecutive Refinery Turnarounds

5.3.1 Project Description

This project involved the mechanical and electrical activities for two consecutive turnarounds for an existing refinery plant in an industrial business area in the Western part of The Netherlands. The plant turnaround procedure is a continuous process from one major scheduled maintenance outage to the next to plan, prepare and execute major maintenance work and process modifications to stretch existing plant capacity by replacing current equipment and placing additional equipment.

Owner of the project was the plant owner who is a Dutch subsidiary of a multinational oil and gas company. The contractor was a Dutch subsidiary of an internationally operating company that designs, installs and maintains systems in industry, infrastructures and the service sector. The contractor had not executed similar works for the owner before.

The project contract was awarded based on a well-structured open private tendering procedure consisting of a two stage tendering route, using multiple criteria from short term perspective and contract negotiation after pre-selection. The structured and extensive contract was based on a standard used by the international engineering company that supported the owner.

The total value of the consecutive works was 6 M€ and was remunerated based on unit rates using an enterprise cost engineering tool called Cleopatra. The project started June 2007 and continued to the final completion of the second turnaround in September 2009.

5.3.2 Maturity Model Interview Results

The maturity model interview results for this project, combined on main-criteria level are presented in the maturity model data matrix as shown in Table 5.3.

The matrix shows that the owner project manager assesses the effectiveness of the relationship between maturity levels 2 and 3, which can be interpreted as between 'Quality competition' and 'Project partnering'. The contractor project manager assesses the effectiveness just above level 3, which can be interpreted as 'Evolved Project partnering'. The overall maturity level from owner project manager's point of view has a calculated average value of 2.6 and from the contractor project manager's point of view it has a calculated value of 3.3. This shows that the project managers involved have a fairly different view on the perceived effectiveness with a more optimistic view of the contractor project manager.

Maturity Model data matrix **Project 3: Unit Rates turnaround project**					PM Owner				PM Contractor			
Owner - Contractor relationship					Maturity Level							
					1 = price competition			2 = quality competition				
					3 = project partnering			4 = strategic partnering/alliance				
Effectiveness main criteria					1	2	3	4	1	2	3	4
Objectives						2						4
Trust							3					4
Collaboration							3					4
Communication							3				3	
Problem solving							3				3	
Risk allocation						2					3	
Continuous improvement							3				3	
Maturity level overall average					2,6				3,3			
Project performance					Performance Level							
Performance criteria					1	2	3	4	1	2	3	4
Performance Level 1,2,3,4: poor, reasonable, moderate, good								4				4
								4				4
							3					4
								4				4
	Quality											
	Time											
	Budget											
	HSE											
Performance level average					3,8				4,0			

Table 5.3 – Team effectiveness assessment by project managers for project 3

With respect to project performance, the owner project manager considers the overall performance approximate to good with an average calculated value of 3.8 on a scale of 1 to 4. The contractor project manager assesses the overall performance good with a value of 4.0. Therefore the difference in perception on the quality level is quite less distinct than on the relationship effectiveness.

The spider diagram in Figure 5.3 shows the results of the assessments of the project managers on the different relationship effectiveness main-criteria compared by their maturity levels.

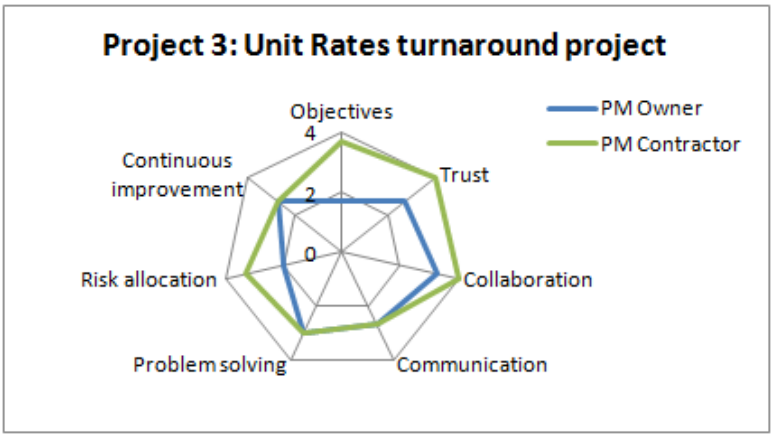

Figure 5.3 – Relative maturity levels per main-criteria for project 3 perceived by project managers

5.4 Project 4: Reimbursable Alliance Project - Engineering, Procurement and Construction for the Refurbishment of Waste Incineration Furnaces.

5.4.1 Project Description

This project involved the engineering, procurement, construction and installation for the refurbishment of 4 existing waste to energy incinerator furnaces in an industrial business area in the Western part of The Netherlands. The project formed part of consecutive turnaround programs and was intended to meet future environment requirements for the operation.

Owner of the project was the operating company of a waste energy plant who is a subsidiary of an international operating Dutch waste-energy company that has active operations in Western Europe across the entire waste chain of collecting and processing waste into raw materials and energy.

The contractor was a joint venture of a mechanical construction contractor and an electrical installation contractor. The mechanical contractor was part of a major European construction-services business with its headquarters based in the Netherlands. The electrical installation contractor being the Dutch subsidiary of French based international company that designs, installs and maintains systems in industry, infrastructures and the service sector. Both parties had independently and successfully cooperated with the project owner in various small, medium and large projects over the past years.

A project alliance was formed between the project owner and the contractors joined venture in order to achieve different key performance indicators (KPI) within the timeframe given per turnaround. Alliance team consisting of these 3 parties was committed to execute two turnarounds per year.

The project contract was awarded by the owner to the contractor's joint venture based on direct negotiation and multi criteria from long term perspective.

The total value of the consecutive works was 34 M€ and was remunerated on a reimbursable basis using an entire open book accounting. The project started mid 2006 and stretched to the final completion end 2008.

5.4.2 Maturity Model Interview Results

The maturity model interview results for this project, combined on main-criteria level are presented in the maturity model data matrix as shown in Table 5.4.

The matrix shows that the owner project manager assesses the effectiveness of the relationship between maturity level 3 and 4, which can be interpreted as between 'Project partnering' and 'Strategic partnering/alliance'. The contractor project manager assesses the effectiveness just above level 3, which can be interpreted as 'Evolved Project partnering'. The overall maturity level from owner project manager's point of view has a calculated average value of 3.5 and from the contractor project manager's point of view it has a calculated value of 3.2. This shows that the project managers in this project have a similar assessment on the perceived effectiveness with a slightly more optimistic view of the owner project manager.

Maturity Model data matrix **Project 4: Reimbursable alliance project**	PM Owner				PM Contractor			
Owner - Contractor relationship	Maturity Level 1 = price competition 2 = quality competition 3 = project partnering 4 = strategic partnering/alliance							
Effectiveness main criteria	1	2	3	4	1	2	3	4
Objectives				4				4
Trust		2					3	
Collaboration				4			3	
Communication				4			3	
Problem solving			3					4
Risk allocation				4			3	
Continuous improvement				4			3	
Maturity level overall average	3,5				3,2			
Project performance	Performance Level							
Performance criteria	1	2	3	4	1	2	3	4
Performance Level 1,2,3,4: poor, reasonable, moderate, good — Quality				4				4
Time				4				4
Budget				4				4
HSE				4				4
Performance level average	4,0				4,0			

Table 5.4 – Team effectiveness assessment by project managers for project 4

With respect to the project performance, both the owner and contractor project manager consider the overall performance good with an average calculated value of 4.0 on a scale of 1 to 4. They have no difference in perception on the quality level.

The spider diagram in figure 4.4.1 shows the results of the assessments of the project managers on the different relationship effectiveness main-criteria compared with their maturity levels.

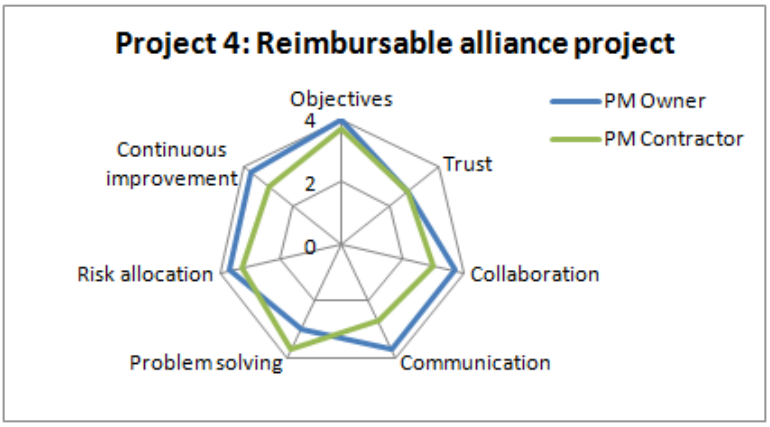

Figure 5.4 – Relative maturity levels per main-criteria for project 4 perceived by project managers

5.5 Cross-project Analysis

5.5.1 Contract Type and Relationship Effectiveness

To compare the results of the various projects the results of the individual maturity model matrixes per project were combined in a one page maturity model project data matrix overview which is part of Appendix I. In this overview the deviation per sub-criteria between the assessments of the project managers on owner and contractor side per project are presented. A summary of this overview on main-criteria level is presented in Table 5.5.

Maturity Model Project Data Matrix Summary		---- Project 1 ---- Lump Sum infra project A			--- Project 2 --- Lump Sum infra project B			--- Project 3 --- Unit Rates turnaround			--- Project 4 --- Reimbursable alliance project		
		PM Owner	Δ	PM Contr	PM Owner	Δ	PM Contr	PM Owner	Δ	PM Contr	PM Owner	Δ	PM Contr
Main criteria	Sub-criteria	Maturity Level			Maturity Level			Maturity Level			Maturity Level		
Maturity levels non-weighted average													
Objectives		3	0	3	1	1,7	2,7	1,7	2	3,7	4	0,3	3,7
Trust		3	0,7	2,3	1,3	0,7	2	2,7	1,3	4	2,7	0	2,7
Collaboration		3,7	0	3,7	1,7	1,6	3,3	3,3	0,7	4	3,7	0,7	3
Communication		2,3	0,4	2,7	1,7	1,3	3	2,7	0	2,7	3,7	1	2,7
Problem solving		3	1	2	1	1	2	3	0	3	3	0,7	3,7
Risk allocation		3	0,3	2,7	1,7	0,3	2	2	1,3	3,3	3,7	0,4	3,3
Continuous improvement		3,3	1	2,3	2,3	0	2,3	2,7	0	2,7	3,7	0,7	3
Maturity level overall non-weighted average		3	0,5	2,7	1,5	0,9	2,5	2,6	0,8	3,3	3,5	0,5	3,2
Performance	Quality	3		3	2		2	4		4	4		4
(1,2,3,4: poor,	Time	4		4	1		1	4		4	4		4
reasonable,	Budget	4		4	1		1	3		4	4		4
moderate, good)	HSE	4		4	2		3	4		4	4		4
Performance non-weighted average		3,8		3,8	1,5		1,8	3,8		4	4		4

Table 5.5 – Overview of relationship effectiveness assessment for the 4 studied projects

In this overview also the calculated deviation between the assessments of the project managers on both sides per project are presented. The table shows that on the overall maturity level the deviation

between the assessments does not exceed the difference of one level, where the project managers of project 2 and 3 are the most dissimilar in their perception.

Table 5.6 presents a summary of the calculated results of effectiveness and performance per studied project, thus providing an insight on their relation to the contract types used for the evaluated projects.

Effectiveness and Performance assessment		Project 1 Lump Sum A	Project 2 Lump Sum B	Project 3 Unit Rates	Project 4 Reimbursable
Effectiveness maturity level	Owner PM	3.0	1.5	2.6	3.5
	Contractor PM	2.7	2.5	3.3	3.2
Performance level	Owner PM	3.8	1.5	3.8	4.0
	Contractor	3.8	1.8	4.0	4.0

Table 5.6 – Cross-project comparison of team effectiveness assessment and performance level for the 4 studied projects

For projects 1, 3 and 4 it shows comparable calculated effectiveness levels of 3.0, 2.6 and 3.5 based on the owner project managers assessment and 2.7, 2.6, and 3.2 based on the contractor project managers' assessment. With this, the results do not demonstrate a distinct influence of different contract types used in the investigated projects on the owner-contractor relationship effectiveness perceived by the involved project managers.

Although projects 1 and 2 are comparable in terms of procurement route, type of project, technical complexity, technical and financial magnitude, type op contract, contract conditions and owner and contractor participation, both the project managers of project 2 assess the effectiveness at a lower level than the project managers of project 1. These different views do not alter the conclusion that the results of this research do not demonstrate a distinct influence of different contract types on the owner-contractor relationship effectiveness.

5.5.2 Project Performance and Relationship Effectiveness

Comparison of the project evaluation results of the effectiveness maturity level and the project performance level per investigated project shows a corresponding tendency of the levels. The project managers of both owner and contractor in case 2 not only assess the relationship effectiveness on a lower level than the project managers in case 1, 3 and 4, but also the project performance.

6 Discussion

This chapter discusses the link between the results of Q-sort study and the project evaluation, and relates it to findings in literature. It also discusses the validity of the research and its limitations for both the Q-study and the project evaluation. Finally, the managerial implications and the scientific contribution of the research are discussed.

6.1 Synthesis of Q-study Results and Project Evaluation Results

The analysis of the Q-study results in Chapter 4 show that among all perspectives contract aspects are believed to be irrelevant to or non-contributing to the improvement of the owner-contractor relationship. In only one of the perspectives project managers are of the opinion that just 2 of the assessed 8 contract aspects contribute to the improvement of the owner-contractor relationship. These are the aspects about *specifying roles, responsibilities* and about *targeted criteria for performance* which regard to the structure as a hard aspect of the cooperation between owner and contractor. Note that in contrast to this perspective, the contract aspect *specifying criteria for performance* is identified in both other perspectives as one that project managers disagree on most to improve the relationship. This supports the conclusion from the Q-study that this research does not reveal a dominance of the influence of contract aspects on owner-contractor relationship, relative to other assessed influencing aspects.

With respect to the outcome of the perceived influence of contract type, the Q-study results show that among all perspectives the project managers believe that the contract *aspect remuneration principle* - which, as argued in section 2.2.6, is considered to correspond with contract type - is not relevant or has no influence on owner-contractor relationship effectiveness. This indicates that the project managers do not believe that contract type is relevant to or has influence on the owner-contractor relationship effectiveness.

Analysis of the project evaluation results in Chapter 5 *does not demonstrate a distinct influence* of different contract types used in the investigated projects on the owner-contractor relationship effectiveness according to the involved project managers. This observation is supported by the results of the Q-study analysis in Chapter 4. This chapter indicates that all involved project managers - in a general context and not in the context of the project subject to the project evaluation – share the opinion that the contract type applied to a project *is not relevant to or has no influence* on the owner-contractor relationship effectiveness.

These results oppose suggestions in literature as described in the introduction chapter of this paper that different types of contract tend to influence relationships between owner and contractor and therefore lead to different results, particularly in terms of project performance, cost and schedule (Griffiths, 1989; In ‘t Veld & Peeters, 1989).

Comparison of the project evaluation results of the effectiveness maturity level and the project performance level per investigated project shows a corresponding tendency of the levels. The project managers of both owner and contractor in case 2 not only assess the relationship effectiveness on a lower level than the project managers in case 1, 3 and 4, but also the project performance.

This supports the findings described in literature about the influence of relationship effectiveness on project performance. With regard to this, Meng (2011) states that the deterioration of the relationship between project parties may increase the likelihood of poor performance, while poor performance can be effectively reduced by improving certain aspects of the relationship. The Meng statement suggests that the effectiveness influences the performance. However this does not exclude that the performance might be the influencing variable or that the variables are interactive, as is suggested in the project 3 project managers' quote.

Although projects 1 and 2 are quite comparable, both project managers of project 2 assess the effectiveness of their project on a much lower level than the project managers of project 1. This raises the question why the assessed effectiveness of such similar projects is so different. From the general project data it can be concluded that the big difference in both projects is that both the project manager of the owner and of the contractor are different persons and that the staff composition of both the project teams was different. It can therefore be presumed that the project manager as a person, his specific way of working and capabilities may be of key influence on the relationship effectiveness.

This is supported by some of the explaining statements of the contractor project manager in project 3 during the Q-sort activity. The project 3 contractor project manager, in his explanations to his most agree statements 18 and 39, assumes an interactive influence between project performance and relationship effectiveness. His line of reasoning is that good project execution leads to good project performance. This in its turn has a positive effect on the relationship and its effectiveness, which has a positive influence on good project execution. He also assumes the positive influence of strong project management capabilities on the team relationship as well as on the owner-contractor relationship.

The results of the interviews with the project managers and from their explaining statements lead to the conclusion that they believe that project management is a people process and that the people involved in the project are essential for success of failure of the project. This is consistent with the findings and conclusions of Bosch-Rekveldt (2011: 224) in a recent study on project complexity.

The observation of the contractor project manager of project 3 assuming an interactive influence of project performance and relationship effectiveness may be a basis for the explanation of the *Jemima* principle postulated by Merrow (2011: 48). This principle implies that: '*megaprojects are rarely mediocre; they tend to be either very, very good or they are horrid'*. Like the girl of the English nursery rhyme *'little girl with the pretty curl'* whose name was *Jemima*. Supported by the assumption of the project manager, this principle could be explained by a positive feedback influence on the project control mechanism of a project, thus amplifying a positive or negative development of performance during project execution. This underpins the dynamic character of the control mechanism of projects, which aspect is in our opinion underexposed in research on the influence of direct and indirect variable on project performance. Based on the idea of regarding project control mechanisms as dynamic control systems, a conceptual model could be designed using scientific knowledge from the field of control engineering to investigate the dynamic behaviour of project management with respect to project performance.

6.2 Validity and Limitations

The research is based on 2 building stones: *(1) Q-methodology and the Q-set of statements that has been used,* and *(2) project evaluation based on maturity level matrix interviews*. The Q-methodology part was meant to generate knowledge about factors that influence owner-contractor relationship effectiveness and the relative influence of contract aspects among them. The project evaluation part was meant to establish a possible relation between contract type and owner-contractor relationship effectiveness.

Q-sort validity and limitations

The Q-methodology part of the research relies on the credibility of the concourse and the robustness of the statements generated for the research. This research used the complete Q-set of statements as developed by Suprapto (2012), based on a naturalistic approach as described in Chapter 3. Therefore opinion statements on several pre-defined categories from literature study were extracted from 9 interviews with project directors and managers, popular websites and professional community blogs.

A limiting aspect to be considered is that the opinions of people outside the circle of project directors and project managers, such as secondary involved persons like financial controllers and operation managers (who form the natural final clients of the project deliverables) are not included in the developed concourse. This is partly compensated by using opinions from other involved persons as expressed in the consulted websites and the blogs. The influence of this limitation could be tested by future research where other people than the addressed project directors and managers are approached.

The Q-study was performed among eight project managers involved in four projects each evaluated for their owner-contractor effectiveness. In fact, 8 respondents can be considered sufficient to produce stable factors for the purpose of identification of factors (McKeown & Thomas, 1988; Ten Klooster et al. 2008: 513). But the exclusive selection of project manager as respondents also limits the research to the opinions of project managers, thus excluding the opinions of other professionals who are influencing actors of project owner-contractor relationships.

This Q-study has delivered three different perspectives among the respondents in the project construction industry. The results of this research have not yet been validated with additional Q-study outside the investigated projects. But a parallel Q-study, performed among project managers in the project engineering industry by Suprapto, using the same Q-set may be used to support the credibility of this research and vice versa.

The Q-study established the relative unimportance of contract aspects among the investigated influencing factors, but this is based on 4 projects and the views and believes of 8 project managers. To strengthen this claim, Q-study research on additional projects, involving different project managers may be conducted.

Project evaluation validity and limitations

For the project evaluation research, a matrix questionnaire based on literature findings was designed and used to assess the owner-contractor relationship effectiveness by maturity levels. The validity and reliability of the design for this evaluation can be assessed by the construct validity, the external

validity and reliability (Yin, 2009). According to Yin (2009: 40), construct validity means: *'identifying correct operational measures for the concepts being studied'*. External validity means: *'defining the domain to which a study's findings can be generalized'*, and reliability means*: 'demonstrating that the operations of a study - such as the data collection procedures - can be repeated, with the same results'*.

To establish construct validity, existing scales, statements and questions, based on literature research have been used to ensure that the maturity levels were measured as accurately as possible and comparable with past performed studies.

To ensure reliability, the research has been documented in detail. This enables other researchers to repeat the project evaluation which should lead to the same findings and conclusions (Yin, 2012). To this end, the raw data (matrix questionnaires with responses and interview remarks are available on request. Furthermore the matrix questionnaire was piloted and pre-tested. This enabled us to remove errors, ambiguity and vagueness in the questionnaire (Van der Velde et al, 2007). One of the measures taken was to translate the matrix questionnaire into Dutch to perform interviews with native Dutch speaking respondents. Finally the reliability was supported by promising the respondents to maintain their confidentiality in order to prevent biased answers.

With respect to the external validity, one could wonder whether the results are applicable to other projects with similar contract types. The external validity of this part of the research was supported by the selection of the projects to be evaluated.

A weakness in the research is the fact that some of the project managers interviewed were not involved in the entire project execution period from start to delivery. Their responses do not reflect the full period of the project execution. Other weaknesses are the influence of differences in time between closing-out of the individual projects and the assessment some years later related to the influence of memory fading of the individual project managers.

Even though this research is executed under these constraints and limited to only four projects executed under three different contract types, the results of the study may be considered of sufficient external validity for the conclusion that a distinct influence of different contract types used in the investigated projects on the owner-contractor relationship effectiveness perceived by the involved project managers *has not been demonstrated*.

However, to increase the external validity of this research part a survey research could be performed to further investigate the influence of different contract types on relationship effectiveness and consequently on project performance, using the Meng effectiveness assessment matrix as a thoroughly tested questionnaire.

6.3 Managerial Implications

The motivation for this study was basically to contribute to the generation of knowledge on how project performance is and can be influenced. After all, improving project performance means organizations can increase their sustainable competitive advantage and staff motivation. Insight into the factors that influence project performance is essential. The aim of this study was to form a building stone in the research on this subject by investigating the influence of contract types and other contract aspects on owner-contractor relationship effectiveness and thus on project performance.

The research results show 3 perspectives, identifying factors that can improve owner-contractor relationship effectiveness. These factors are: *(1) strong leadership & management, (2) effective team integration, and (3) strong capabilities & structure*. This can be used as a guideline for project management to influence and improve the project control process and consequently project performance.

The research results lead to the conclusion that the type of contract, materialized by the remuneration principle of the contract, is not the exquisite tool to influence relationship effectiveness. Neither are other contract conditions aspects considered as such. The only contract aspects that may improve the relationship are contract aspects related to project structure specifying roles and responsibilities, and contract aspects about targeted criteria for performance.

This teaches us that relationship effectiveness and consequently project performance can be enhanced by paying extra attention to defining these contract aspects during front end development of the project. Not to pay disproportionate attention to contract form and conditions not contributing to project management structure.

The developed effectiveness assessment matrix can be used by organizations to assess actual project relationships and identify priorities to improve owner-contractor relationships. Besides the fact that it is easy to handle and the results are easy to process, the personal interview condition may, due to the *Hawthorne-effect*,[6] support the involvement and motivation of the respondents as actors in the project management system.

6.4 Scientific Contributions

Originally, Q-methodology was used only in psychology and social science. Over the past years the method has also been applied in other fields of science to address multi-actor setting such as in emergency medicine (Chinnis at al., 2001), food technology (Ten Klooster et al., 2008) and the evaluation of collective leadership (Militello & Benham, 2010). However, this method to investigate viewpoints on owner-contractor relationships in construction has not been specifically quoted nor widely used. In this research, the successful application of Q-methodology to study subjective

[6] The Hawthorn-effect refers to the effect that that changes in participants' behaviour during the course of a study may be related only to the special social situation and social treatment they received (Kolb, Rubin & Osland, 1995).

viewpoints has been demonstrated by researching owner-contractor relationship. As a result stable conclusions could be drawn on dominant perspectives existing among project managers on the influencing factors on these relationships.

The Q-study was performed in combination with an evaluation of the projects in which the respondents were involved. This provided contingency information to support the study, therefore contributing to the validity and reliability of the research. As an instrument for the project evaluation an effectiveness assessment matrix was used, based on a maturity model for supply chain relationships in construction developed by Meng et al. (2011). The results from this research proved the value and applicability of this tool for the assessment of relationship effectiveness in construction industry.

The relevance of this study for TU-Delft lies in the fact that its outcome can be used to complement other research in the field of relationship behaviour and project performance in engineering and construction projects.

7 Conclusions & Recommendations

This final chapter presents the conclusions of this research. It provides answers to the research questions and describes its main findings, followed by an overall conclusion. Finally, recommendations are provided and suggestions for further research from Chapter 6 are summarized.

7.1 Main Findings

The purpose of this study was to generate an in-depth support for how and why particular contract types , such as lump-sum, unit rate, reimbursable, incentive based or partnering/alliancing influence the nature of working relationships. So far contradictory views exist on the effectiveness of incentive based and alliancing contracts on owner-contractor working relationships compared to lump-sum and unit rates contracts (Berends, 2007; Bresnen, 2007; Merrow, 2011). These views are that on the one hand literature suggests that more collaborative types of contract in terms of partnering objectives – for which alliance type of contracting is recognized as a more collaborative type than lump-sum based type – tend to a more effective relationship (Bayliss et al., 2004; Larson, 1995). On the other hand it is suggested that this is not the case (Ng et al., 2002; Bresnen, 2007). Since the influence of contract type on owner-contractor relationships may also be influenced by and relative to other factors, it was important to investigate the effects of other variables on owner-contractor relationship effectiveness too.

This led to the following main research question:

> *How do different types of contract influence the effectiveness of owner-contractor relationship in industrial construction projects, relative to other factors?*

To answer the main research question, the following sub-questions were addressed:

1. *What are the different viewpoints of project managers towards multidimensional aspects of owner-contractor relationship in construction projects?*
2. *What aspects are common or not between these different viewpoints towards owner-contractor relationship?*
3. *How do the project managers perceive the influence of contract aspects relative to the other aspects within these viewpoints?*
4. *What do different project managers perceive of the owner-contractor relationship effectiveness in industrial construction projects under different types of contracts?*

The answers to research sub-questions 1, 2 and 3 are provided in Chapter 4, where the results of the Q-study among the project managers of the evaluated projects are presented and analysed. Chapter 5 presents the results of the assessments of the contract type and owner-contractor relationship effectiveness. It describes and analyses the outcome of 4 investigated projects to provide answers to research sub-question 4.

The following sections elaborate on answering the sub-research questions RQ 1 to 4, thus contributing to the answer on the main research question.

RQ 1: What are the different viewpoints of project managers towards multidimensional aspects of owner-contractor relationship in construction projects?

The research among eight project managers involved in four projects under different contract types has revealed the following dominant subjective common viewpoints:

Perspective 1: Strong leadership & management
Perspective 2: Effective team integration
Perspective 3: Strong capabilities & structure

Perspective 1: Strong leadership & management

Project managers who share this view believe that strong leadership and management may improve the owner-contractor relationship. They believe that it is important for the owner-contractor relationship that both owner and contractor senior management show consistent and passionate leadership. They also believe that mutual trust in the project is most important.

They mostly disagree that as long as the project team performs well, social activities have to be restricted. By mostly disagreeing with this negative formulated aspect of team effectiveness, the project managers in fact believe that these activities should not be restricted and that this aspect of team effectiveness is also most important. The explicit inclusion of incentives schemes in the contract and strong financial capacity of the owner as an aspect of owner capability are regarded by the project managers as least important to the improvement of the relationship.

Perspective 2: Effective team integration

This perspective shows dominance for relational competences such as: *trust, team integration and joint attitude.* Project managers who share this view believe that sharing a common vision and a set of objectives among the project team members, as well as mutual trust among team members are most important to improve the owner-contractor relationship. They also believe that a joint identification and management of project risks by owner and contractor are important for the relationship.

They mostly disagree that no contentious issues or conflicting opinions are allowed within the project team. By mostly disagreeing with this, the project managers also believe that allowing these issues and opinions is very important. Specification in the contract of targeted performance and strong financial capacity of the owner as an aspect of owner capability are regarded by them as least important to the improvement of the relationship.

Perspective 3: Strong capabilities & structure

This perspective shows dominance for hard aspects such as: *owner/contractor capability and contact aspects regarding the specification of performance, roles and responsibilities in the contract.* Project managers who share this view believe that it is important for the owner-contractor relationship that

the contractor has strong capabilities in project management. They also believe that it the contract must clearly specify the roles and responsibilities of the parties as well as targeted performance and criteria.

They mostly disagree that no contentious issues and no conflicting opinions are allowed within the project team. By mostly disagreeing with this, also these project managers believe that allowing these issues and opinions is most important. These project managers also consider it as most unimportant that all people in the project team work without organizational and hierarchical boundaries.

RQ 2: What aspects are common or not between these different viewpoints towards owner-contractor relationship?

Correlation between perspectives

The research results lead to the observation that the perspectives do not correlate negatively. In other words, they do not represent opposite oriented views. The project managers who share perspective 1 are fairly willing to accept characteristics of perspectives 2 and 3, while the willingness of the project managers of perspectives 2 and 3 to accept each other's views is low. Never-the-less, the positive correlations indicate that they can appreciate the views of others.

Correlation between project managers

Perspective 1 is shared by 2 owner project managers who believe that strong leadership and management may improve the owner-contractor relationship. Perspective 2 is shared by 1 contractor and 1 owner project who believe that effective team integration may improve the relationship. Perspective 3 is shared by 1 owner project manager and 3 contractor project managers who believe that strong capabilities and structure may improve the relationship. This could be an indication that owner project managers have a preference for a relationship management style, while contractor project managers focus on the hard aspects of management to control projects.

Agree and disagree consensus statements

The idea that mutual trust in projects is important for the owner-contractor relationship is strongly expressed in all views. Also the notion that it is not important for the relationship that the contract includes explicit incentive schemes is strong within all views. The agree consensus statements in the various perspectives show a dominance for relational competences and behaviour, while the disagree statements show a dominance for hard aspects of cooperating.

RQ 3: How do the project managers perceive the influence of contract aspects relative to the other aspects within these viewpoints?

Relative influence of contract aspects in perspective 1

The dominant influencing factors of perspective 1 belong to the categories: *owner/contractor attitude* and *team effectiveness.* Project managers who share this view mostly disagree that 2 of the 8 assessed contract aspects help to improve owner-contractor relationship. Of the other 6 contract

aspects they believe these are not relevant or have no influence on the owner-contractor relationship effectiveness. The contract aspects which they mostly disagree with to improve the relationship are: *(1) explicit incentive schemes* and *(2) the specification of targeted performance and its key criteria in the contract.*

Relative Influence of contract aspects in perspective 2

Of perspective 2 the dominant influencing factors belong to the categories: *team effectiveness and owner/contractor attitude,* which it shares with perspective 1. Project managers who share this view mostly disagree that 3 contract aspects help to improve owner-contractor relationship. They believe that 5 contract aspects are not relevant or have no influence on the owner-contractor relationship effectiveness. The contract aspects which they mostly disagree with to improve the relationship are: *(1) the specification of targeted performance and its key criteria and (2) explicit incentive schemes in the contract.* These are the same contract aspects as of perspective 1. In addition to this they also mostly disagree that the contract aspect *fair and transparent specification of a remuneration scheme*, has influence on the relationship.

Relative influence of contract aspects in perspective 3

The dominant influencing factors of perspective 3 belong to the categories: *contractor/owner capability, contract aspects and team effectiveness.* This distinguishes it from perspectives 1 and 2. Contrary to the other perspectives, the project managers sharing this view believe that 2 contract aspects help to improve the relationship. That are the aspects: *(1) clear specification of roles and responsibilities of the parties and (2) the specification of targeted performance and its key criteria in the contract.* This latter contract aspect is in contrast identified in the other perspectives as an aspect on which project managers mostly disagree with to improve the relationship. Of the other 6 assessed contract aspects the project managers who share this view mostly disagree that *explicit incentive schemes in the contract* help to improve owner-contractor relationship. They believe that 5 contract aspects are irrelevant or have no influence on the owner-contractor relationship effectiveness.

Relative influence of contract aspects among all perspectives

Among all perspectives project managers believed that contract aspects are irrelevant or have no influence on the owner-contractor relationship effectiveness. Only one perspective (3) reveals that project managers who share this view believe that just 2 of the assessed 8 contract aspects contribute to the improvement of the owner-contractor relationship, being: (*1) clear specification of roles and responsibilities of the parties and (2) the specification of targeted performance and its key criteria in the contract.* With this the research results do not reveal a dominance of the influence of contract aspects on owner-contractor relationship, relative to other assessed influencing aspects.

Among all perspectives the project managers believe that the contract aspect *remuneration principle* is not relevant or has no influence on the owner-contractor relationship effectiveness. As the remuneration principle is considered to correspond with contract type, it indicates that they do not believe that contract type is relevant or has influence on the owner-contractor relationship.

RQ 4: What do different project managers perceive of the owner-contractor relationship effectiveness in industrial construction projects under different types of contracts?

Of the 4 different projects executed under different contract types, the owner-contractor relationship effectiveness perceived by the involved project managers of both sides were assessed. This assessment was made by means of structured interviews based on the Maturity Model described in Chapter 3.

The perception of the project managers of the effectiveness of the owner-contractor relationship during the project is presented further on in this paper. The effectiveness is assessed for 7 main-criteria, each measured by 3 sub-criteria on a maturity level scale of 1 to 4 ranging from low to high. In addition, the perception of the project managers on the project performance, measured on the sub-criteria: *quality, time, budget and HSE* was assessed.

Project 1: Lump Sum project A - Engineering, Procurement and Construction of rectifier substations for a light rail line

The owner project manager of this project assesses the effectiveness of the relationship on maturity level 3, which can be interpreted as 'Project partnering'. The contractor project manager assesses the effectiveness approximate to level 3, which can be interpreted as 'Evolving to Project partnering'. The project managers in this project have a slightly different view on the perceived effectiveness with a more optimistic view of the owner project manager.

With respect to the project performance, both project managers consider the overall performance approximate to good with an average calculated value of 3.8 on a scale of 1 to 4.

Project 2: Lump Sum project B - Engineering, Procurement and Construction of the revamp of rectifier substations of a metro line

The owner project manager of this project assesses the effectiveness of the relationship between maturity levels 1 and 2, which can be interpreted as between 'Price competition' and 'Quality competition'. The contractor project manager assesses the effectiveness between levels 2 and 3, which can be interpreted as between 'Quality competition' and 'Project partnering'. The project managers in this project have a considerably different view on the perceived effectiveness with a more pessimistic view of the owner project manager. This is in contrast with the project managers in project 1, who have a slightly different view on the relationship effectiveness.

With respect to the project performance, the owner project manager considers the overall performance as between poor and reasonable with an average calculated value of 1.5 on a scale of 1 to 4. The contractor project manager assesses the overall performance as approximate to reasonable with an overall value at 1.8. With this the difference in perception of the contract managers on the quality level is considerably less than on the relationship effectiveness.

Project 3: Unit Rates turnaround project – Construction and Installation works for two consecutive refinery turnarounds

The owner project manager of this project assesses the effectiveness of the relationship between maturity levels 2 and 3, which can be interpreted as between 'Quality competition' and 'Project

partnering'. The contractor project manager assesses the effectiveness just above level 3, which can be interpreted as 'Evolved Project partnering'. The project managers in this project have a fairly different view on the perceived effectiveness with a more optimistic view of the contractor project manager.

With respect to the project performance, the owner project manager considers the overall performance as approximate to good with an average calculated value of 3.8 on a scale of 1 to 4. The contractor project manager assesses the overall performance as good, with a value of 4.0. With this the difference in perception on the quality level is quite less significant than on the relationship effectiveness.

Project 4: Reimbursable alliance project - Engineering, Procurement and Construction for the refurbishment of waste incineration furnaces.

The owner project manager of this project assesses the effectiveness of the relationship between maturity levels 3 and 4, which can be interpreted as between 'Project partnering' and 'Strategic partnering/alliance'. The contractor project manager assesses the effectiveness just above level 3, which can be interpreted as 'Evolved Project partnering'. The project managers in this project have a similar assessment on the perceived effectiveness with a slightly more optimistic view of the owner project manager.

With respect to the project performance, both the owner and contractor project manager considers the overall performance as good with an average calculated value of 4.0 on a scale of 1 to 4. They have no difference in perception on the quality level.

7.2 Overall Conclusion

The project evaluation research *has not demonstrated* a distinct influence of different contract types used in the investigated projects on the owner-contractor relationship effectiveness perceived by the involved project managers. This observation is supported by the results of the Q-study indicating that the involved project managers - in a general context and not in the context of the project subject to the project evaluation – share the view that the contract type applied to a project is not relevant to or has no influence on the owner-contractor relationship effectiveness.

These results oppose suggestions in literature described in the introduction chapter of this paper that different types of contract tend to influence relationships between owner and contractor and therefore lead to different results, particularly in terms of project performance, cost and schedule (Griffiths, 1989; In 't Veld & Peeters, 1989).

7.3 Recommendations

The Q-study established the relative unimportance of contract aspects among the investigated influencing factors. This is however based on 4 projects and the views and believes of 8 project managers. To strengthen this claim, Q-study research may be conducted on additional projects, involving different project managers.

The research results show that contract type is not **the** tool to influence relationship effectiveness, nor do other contract aspects as a matter of fact. The only contract aspects which are identified as instrumental to improve the relationship are contact aspects related to project structure specifying roles and responsibilities, and contract aspects about targeted criteria for performance. Therefore, extra attention to these contract aspects during front end development of the project may contribute to the relationship effectiveness and consequently to the project performance.

Due to the explorative nature of this study it would be hypothetical to conclude that different contract types used in projects do not influence the owner-contractor relationship effectiveness. A survey research could be performed to further investigate the influence of different contract types on relationship effectiveness and consequently on project performance, using the Meng effectiveness assessment matrix as a thoroughly tested questionnaire.

In this study a potential interactive influence of project performance and relationship effectiveness has emerged, which may be a basis for the explanation of the observation by Merrow (2011) that mega projects are rarely mediocre but tend to be either very, very good or horrid. This observation may be explained by a positive feedback influence on the project control mechanism of a project as explained in section 6.1. Based on the idea that project control mechanisms are dynamic control systems, a conceptual model could be designed using scientific knowledge from the field of control engineering to investigate the dynamic behaviour of project management with respect to project performance.

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Appendix A – Effectiveness Assessment Matrix Questionnaire

Effectiveness Assessment Matrix Questionnaire (adapted from Meng, 2011)

ASSESSMENT CRITERIA		RELATIONSHIP ASSPECTS PER MATURITY LEVEL			
Main criteria	Sub-criteria	Level 1	Level 2	Level 3	Level 4
Objectives	Objectives alignment	Only self objectives	Mainly self objectives	Mutual objectives in project	Mutual objectives in the long-term
	Benefits	Win-lose	Win-partial win	Win-win in a single project	Win-win in the long-term
	Continuity of work	No continuity of work	Prospect of future work through tendering	Preferred suppliers	Guarantee for future work
Trust	Type of trust	Contractual trust	Competence trust	Short-term goodwill trust	Long-term goodwill trust
	Confidence in others' behaviour	Little confidence	Some confidence	Much confidence	Full confidence
	Monitoring others' work	Checking and double checking	Checking somewhat reduced	Checking greatly reduced	Checking almost unnecessary
Collaboration	Working relationship	Confrontation or arms length	Limited cooperation	Collaboration	Close collaboration
	Culture	Mutual blame culture	Self defence culture	Abandon of blame culture	Problem solving focused culture
	Mutual help	No support for the weaker	Support only with the issues related to self-interest	Often support for a weak partner	Always support for a weak partner
Communication	Information exchange	Little information is exchanged openly	Some information is exchanged openly	Much information is exchanged openly	Most information is exchanged openly
	Sharing learning	No sharing learning and innovation	Little sharing learning and innovation	Sharing learning and Innovation	Continuous sharing learning and innovation
	Cost data transparency	No cost transparency	Little cost transparency	Open book costing between two parties	Open book costing throughout the whole chain

Problem solving	Early warning	No risk identification, no early warning	Informal risk identification, no early warning	Early warning between two parties	Early warning throughout the whole chain
	Effectiveness	Problems often lead to disputes	Problems sometimes lead to disputes	Many problems are timely resolved at the lowest level	Most problems are timely resolved at the lowest level
	Avoidance of recurrence	Problems often recur	Sometimes problems recur	Few problems are repeated	Rare problems are repeated

Risk allocation	Risk sharing	No risk sharing	Limited risk sharing	Risk sharing greatly increased	Common practice for risk sharing
	Allocation principle	Risk is always allocated to the weak party	Risk is often allocated to the weak party	Risk is allocated to the party best able to manage it in a project	Risk is allocated to the party best able to manage it in the long-term
	Balance of risk and reward	No rewards for the party taking the risk	Some rewards for the party taking the risk	Often appropriate rewards for the party taking the risk	Always appropriate rewards for the party taking the risk

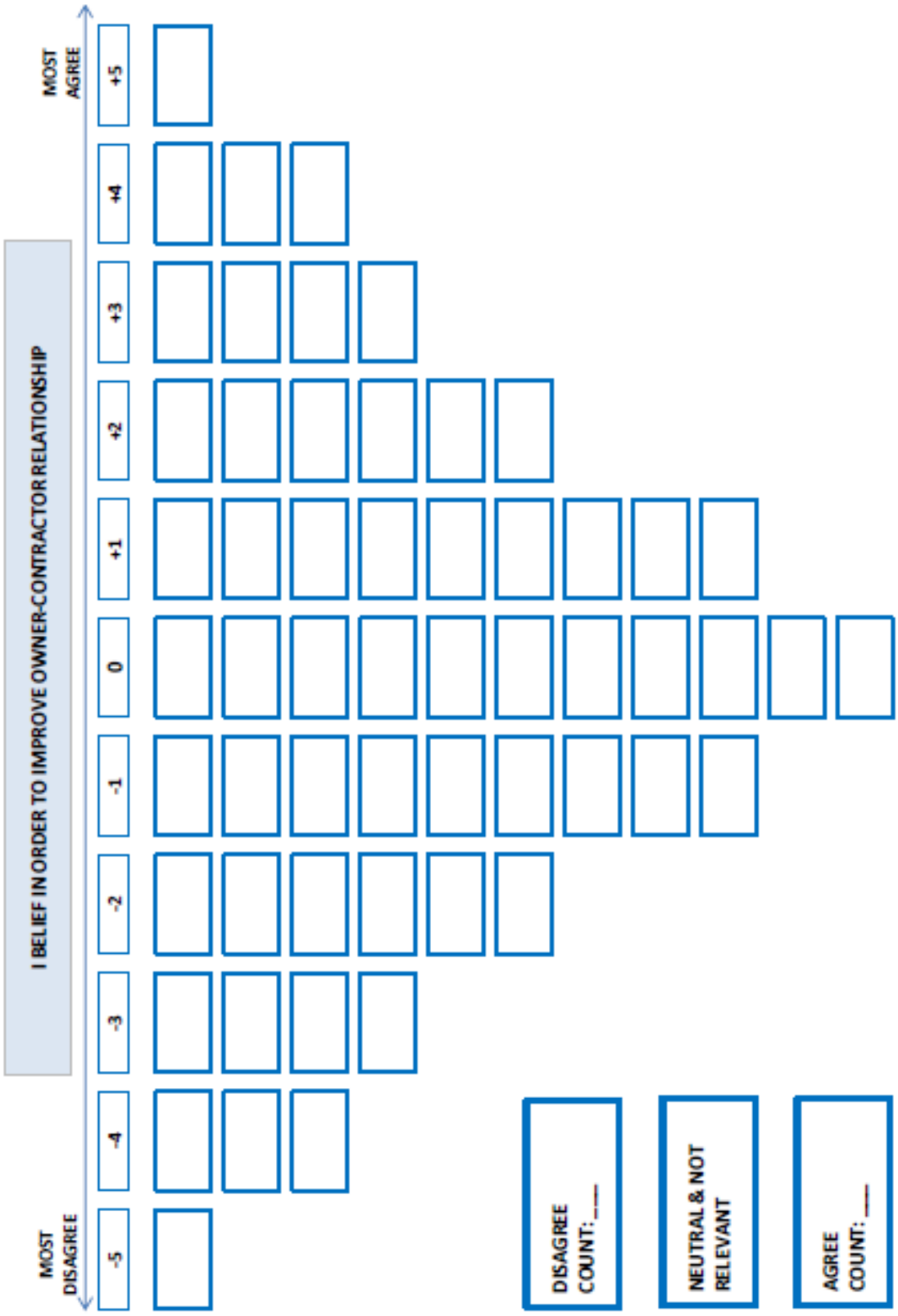
Continuous improvement	Joint effort	No joint effort for improvement	Limited joint effort for improvement	Joint effort for better ways of working	Continuous effort for better ways of working
	Performance measurement and feedback	No common measures; no formal feedback	Limited common measures; irregular but formal feedback	Common measures; regular and formal feedback in a project	Common measures; formal, regular, and continuous feedback
	Incentives	No incentive	Informal incentive	Single incentive	Multiple incentives

Appendix B – Q-Statements for Owner-Contractor Relationship Assessment

No	Statement
1	Owner's senior management provides necessary resources and support to the project team
2	All people in the project team share a common vision and set of objectives
3	The contractor has confidence that owner is reliable and trustworthy
4	The owner believes that the contractor will make efforts to deliver their commitments
5	The contract is used as the basis for managing all activities of the project
6	Owner and contractor acknowledge and respect cultural differences (organizational and people)
7	Owner and contractor jointly develop key measures and evaluate the project performance
8	Contractor's senior management displays consistent and passionate leadership
9	The risks are clearly specified in the contract
10	The owner has strong financial capacity
11	The project team regularly evaluates each other's roles and performance and jointly acts for improvement
12	The contractor is involved early during front end development of the project
13	The owner puts sufficient effort and resources on front end development
14	The contract specifies the statement of work as clearly as possible
15	All people accept joint responsibilities for the team's achievement
16	Owner and contractor have compatible systems and procedures
17	The tasks are distributed between owner and contractor rather than duplicated
18	The contractor has strong capability in project management
19	Owner and contractor focus their efforts on delivering current project objectives since no future projects can be guaranteed
20	The contract clearly specifies roles and responsibilities of the parties
21	The contract includes explicit incentive schemes
22	The contract specifies remuneration scheme fairly and transparently
23	The contractor aligns sub-contractors and suppliers to the project goals
24	The contract includes a structured approach to problem solving and dispute resolution
25	The owner aligns its internal functions such as business and operation
26	Owner and contractor build on positive experience from previous relationship
27	All people in the project team work without organizational and hierarchical boundaries
28	When problems occur, owner and contractor do not blame each other but focus on solutions and mutual interests
29	The contractor has high reputation and credibility in the marketplace
30	As long as people perform well, social activities/events have to be restricted
31	The project team regularly exercises team building/alignment activities
32	All people in the project team feel free to share information and knowledge across organizational boundaries
33	A single project team is formed from owner and contractor's key personnel
34	The owner rewards a well-performing contractor with a better chance of securing the next project
35	The contract specifies targeted performance and its key criteria
36	Contractor's senior management provides necessary resources and support to the project team
37	The people's performance and behaviour are recognized (financially and/or non-financially)
38	No contentious issues and conflicting opinions in the project team are allowed
39	The project team's primary concern is to execute the project excellently
40	Owner and contractor jointly identify and manage the project risks

No	Statement
41	The contractor offers competitive solutions for a well-performing owner
42	The contractor internalizes the owner's long-term goals as their own goals
43	All people in the project team trust each other
44	Owner and contractor establish open and honest communication throughout the project lifecycle
45	The owner assigns its people sufficiently and with appropriate skills, knowledge, and experience
46	The project team embraces divergent views as creative inspiration to problem solving
47	Owner's and contractor's senior management are proactively involved in handling escalated conflicts/ disputes
48	The contractor has strong technical capability such as engineering, procurement, and construction
49	The owner has necessary technical capabilities such as technological, business, and operation
50	The owner has strong capability in project management
51	All people in the project team are personally engaged towards the project goals and outcome
52	Owner and contractor jointly develop procedures for conflicts/disputes handling
53	The owner recognizes contractor's commercial interest
54	The contractor has highly skilled and experienced people
55	Owner's senior management displays consistent and passionate leadership

Appendix C – Q-sort Distribution Board for 55 Statements



Appendix D – Guideline for Interviewing Project Managers

INSTRUCTIONS FOR THE PROJECT MANAGER INTERVIEWING PROCESS

Phase 1
Objective: Acquire information about organization, project data and project manager background

1. Explain PM the purpose and objective of the research and the research plan
2. Ask PM for general information/description about his organization
3. Ask PM for general information/description of the project
4. Ask PM for access to his project file, especially the project contract documents
5. Interview PM about his background with following open questions (prepared by data collection from open sources like Linked In, Face book and personal web pages) asking about general characteristics like: (gender), age, education, experience (years in different positions, total years of working experience), and highest educational degree/level.

Phase 2
Objective: Acquire assessment of PM on contract & type, influences on relationship; assessment of relationship; assessment of views of PM on influences on relationship.

A. Assessment of PM on contract and influences on relationship
1. Explain classification of contract types
2. Explain relationship effectiveness

B. Assessment of relationship
3. Explain relationship maturity level classification
4. Ask PM to complete the relationship maturity level matrix
5. Ask PM to give additional remarks, if any, per key element of each relationship factor

C. Assessment of subjective viewpoints of PM on influences on relationship
6. Explain Q-sort protocol
7. Ask and assist PM to perform Q-sort protocol
8. Ask PM additional Q-sort protocol questions

Appendix E – Effectiveness Matrix Questionnaire Instructions Form

RESPONDENT NUMBER: ____

INSTRUCTIONS TO THE MATURITY LEVEL MATRIX QUESTIONNAIRE SURVEY

The purpose of this matrix questionnaire is twofold. Firsts to obtain data to assess the aspects of the effectiveness of owner-contractor relationship as experienced in this specific project by ranking relationship indicators in the matrix on relationship maturity level. Second to prepare for the subsequent Q-sort survey by making the respondent familiar with the characteristics of the relationship indicator criteria for the different maturity levels to illustrate the background of the statements of the Q-sample.

These instructions will guide you through the survey step by step. Please read each step to the end before you start carrying it out.

Instructions for matrix questionnaire

1. Read the main-criteria, the sub-criteria and the description of its characteristics under each of the four relationship maturity level.

2. Decide per sub-criterion which characteristic you judge the most appropriate for this project.

3. Circle the most appropriate characteristic per sub-criterion on the matrix form.

Specific comments on sub-criteria

To be entered by the interviewer.

Sub-criterion	Comment

Appendix F – Q-Sort Instruction Form

RESPONDENT NUMBER: ____

INSTRUCTIONS TO THE Q-SORT SURVEY

The purpose of this Q-sort survey is to obtain data to assess views on the effectiveness of owner-contractor relationship.

These instructions will guide you through the survey step by step. Please read each step to the end before you start carrying it out.

Instructions for Q-sort

1. Take the deck of cards and the score sheet and sit at a table. Lay down the score sheet in front of you. All 38 cards in the deck contain a statement on owner-contractor relationship aspects or key elements of contracts that may influence this relationship.
   We ask you to rank-order these statements from your own point of view related to the project under investigation.
   Our question to you is: *"To what extent do you agree with the following statements".* The numbers on the cards (from 1 to 57) have been assigned to the cards randomly and are only relevant for the administration of your response.

2. This study is about effectiveness of owner-contractor relationship.
   We are interested in your attitude and perceptions on the effectiveness of the various aspects of the relationship in general during the execution of projects like the project under investigation and how various aspects of the used contract type may influence this relationship.

3. Read the 57 statements carefully and split them up into three piles: a pile for statements you tend to disagree with, a pile for cards you tend to agree with, and a pile for cards you either agree or disagree with, or that are not relevant or applicable to you.
   Please use the three boxes "AGREE", "NEUTRAL OR NOT RELEVANT" and "DISAGREE" at the bottom left of the score sheet. Just to be clear, we are interested in your point of view. Therefore, there are no right or wrong answers.
   When you have finished laying down the cards in the three boxes on the score sheet, count the number of cards in each pile and write down this number in the corresponding box. Please check whether the numbers you entered in the three boxes add up to 57.

4. Take the cards from the "AGREE" pile and read them again. Select the one statement you most agree with and place the card in the last box on the right of the score sheet, below the "+5". Next, from the remaining cards in the deck, select the three statements you most agree with and place them in the three boxes below the "+4" (it does no matter which one goes on top or below). Follow this procedure for all remaining cards from the AGREE" pile placing them in the boxes below the "+3, +2", "+1" and "0".

5. Now take the cards from the "DISAGREE" pile and read them again. Just like before, select the one statement you most disagree with and place the card in the last box on the left of the score sheet, below the "-5". Follow this procedure for all cards from the "DISAGREE" pile as followed for the "AGREE" pile.

6. Finally, take the remaining cards and read them again. Arrange the cards in the remaining open boxes of the score sheet.

7. When you have placed all cards on the score sheet, please go over your distribution once more and shift cards if you want to.

8. When you are finished, please write down the number of the cards in the boxes you placed them on.

Questions about the extreme positions

MOST AGREE

1. Please explain why you agree most with the statement you have placed below the "+5".

card nr.: …	Statement:
	Explanation:

2. Please explain why you agree most with the three statements you have placed below the "+4".

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

3. Please explain why you agree most with the four statements you have placed below the "+3".

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

MOST DISAGREE

4. Please explain why you disagree most with the statement you have placed below the "-5".

card nr.: …	Statement:
	Explanation:

5. Please explain why you disagree most with the three statements you have placed below the "- 4".

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

6. Please explain why you disagree most with the four statements you have placed below the "- 3".

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

Questions about decisions made in performing the Q-sorts

1. With what statements did you have difficulty by placing? Please list the number of statements and describe your experienced dilemma.

card nr.: …	Statement:
	Explanation:

card nr.: …	Statement:
	Explanation:

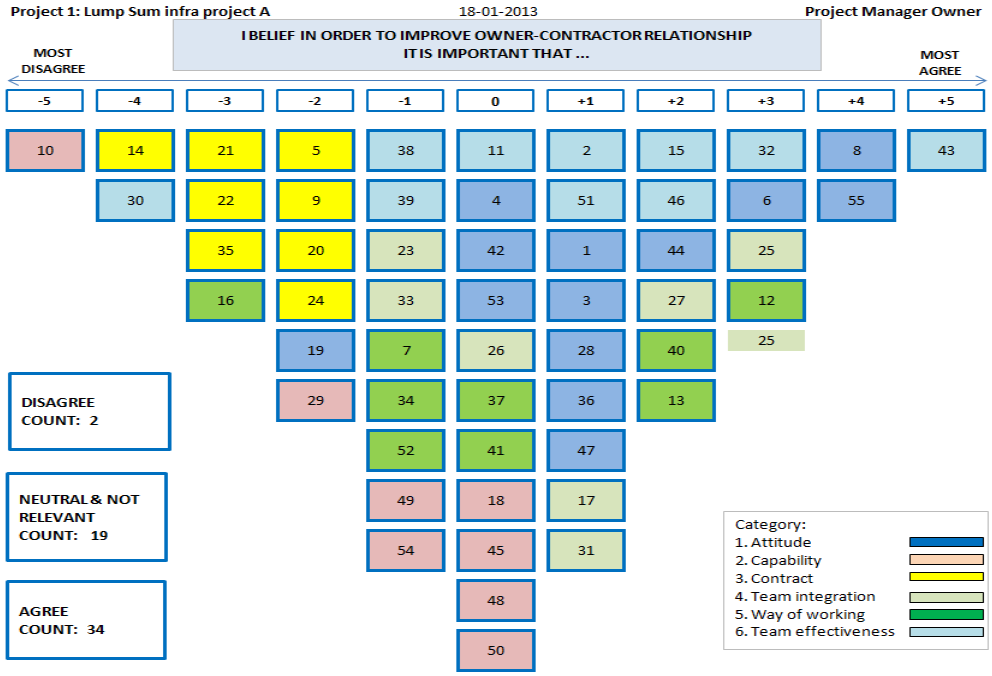
card nr.: …	Statement:
	Explanation:

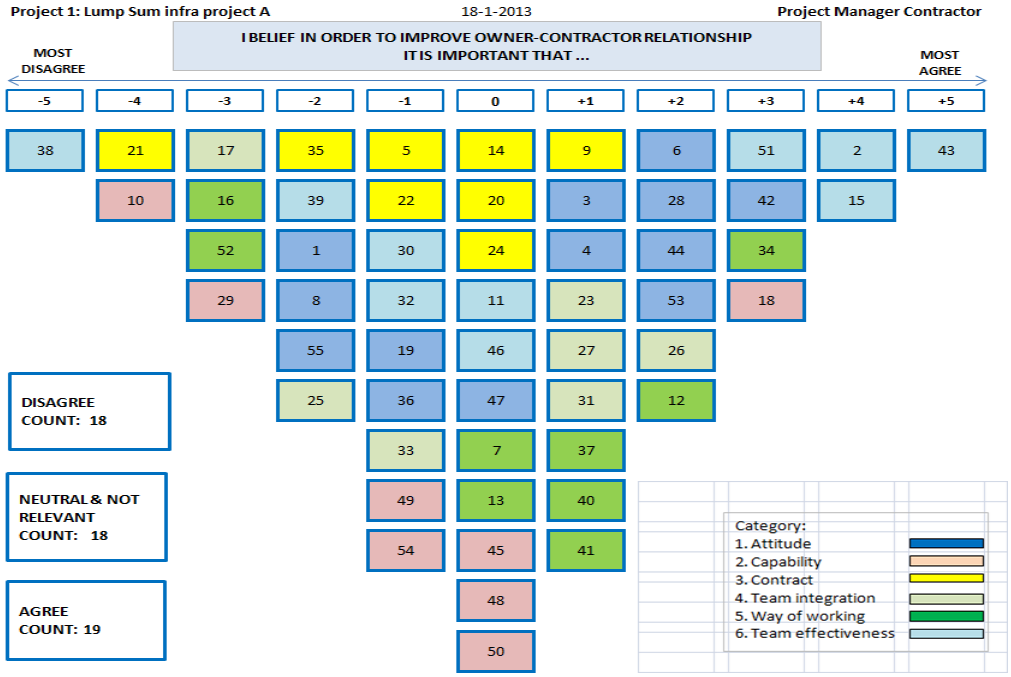
2. What statements do you think are missing? Why do you think these statements are missing.

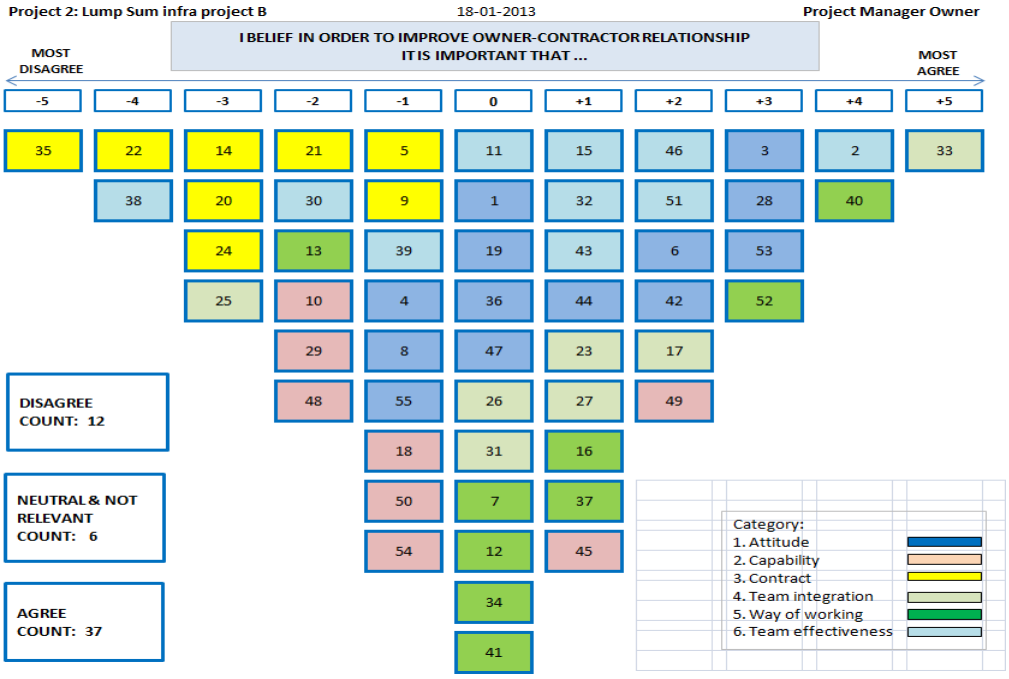
Statement:
Explanation:

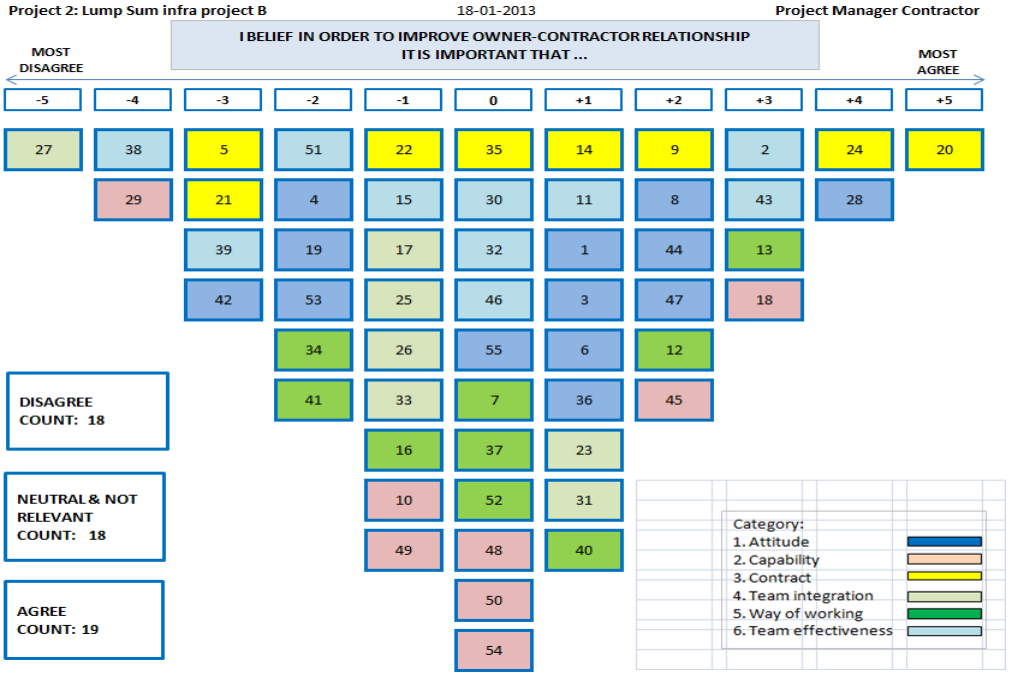
Statement:
Explanation:

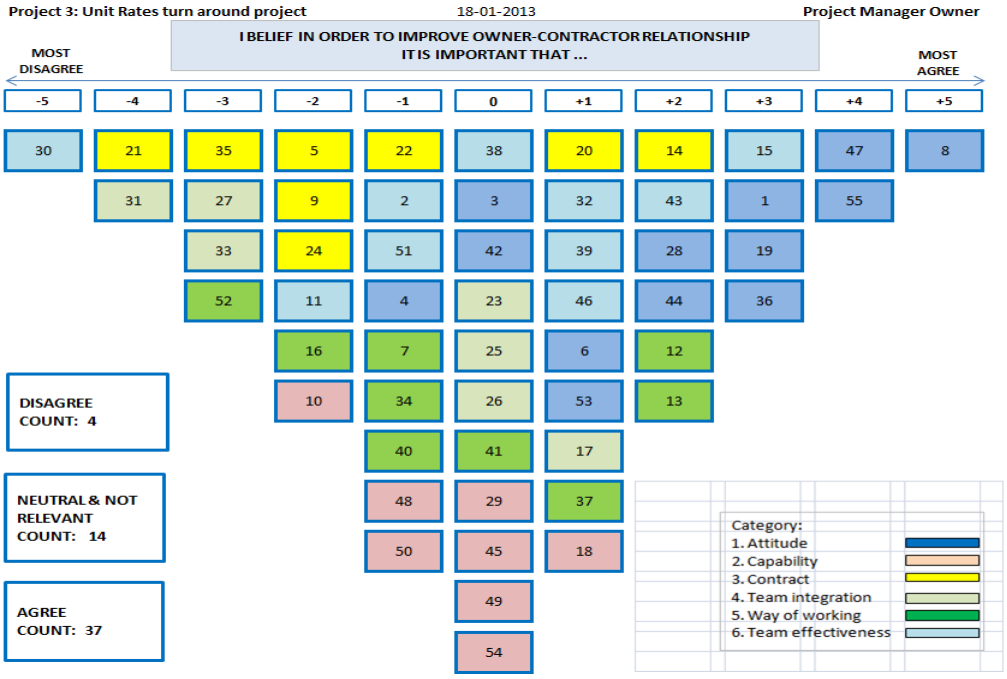
Appendix G – Q-Sort Distribution for the Project Managers of the Studied Projects

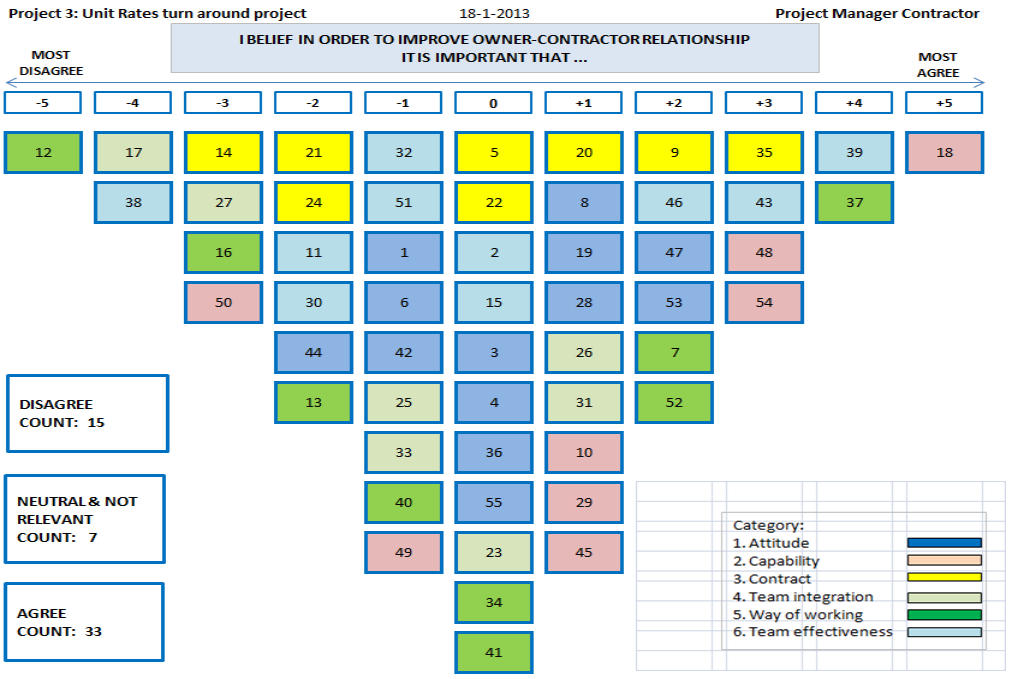


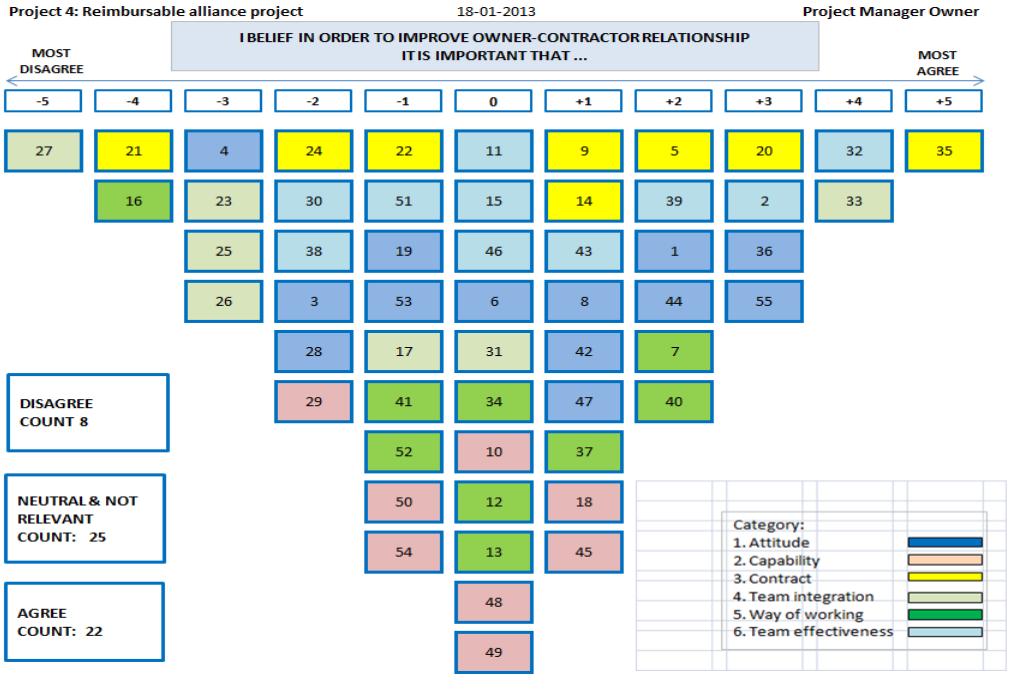


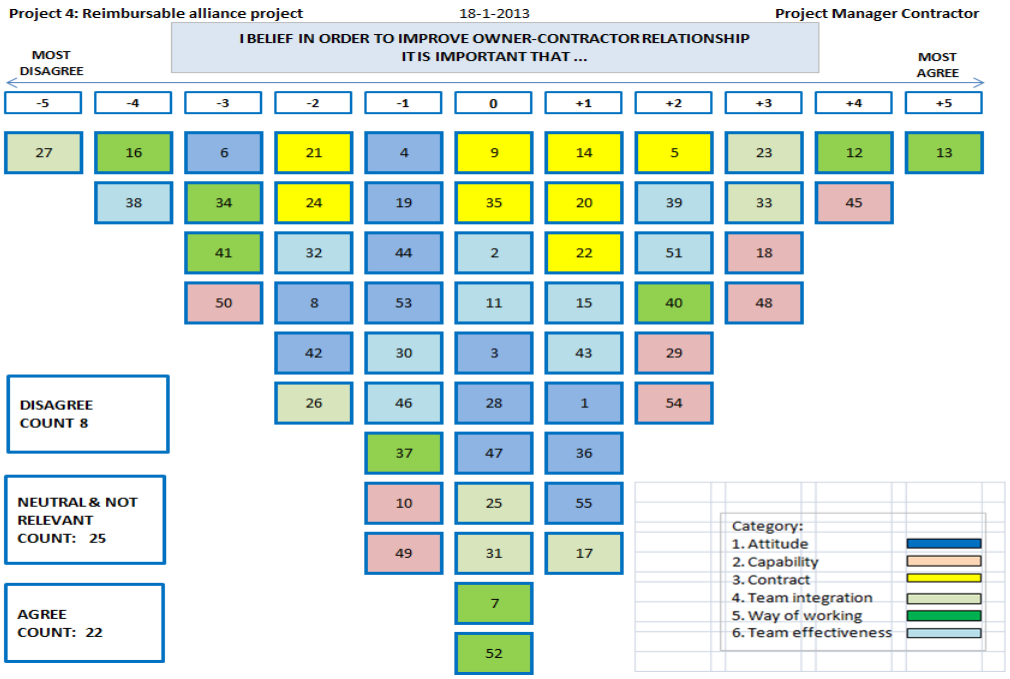

Project 2: Lump Sum infra project B
18-01-2013
Project Manager Owner
I BELIEF IN ORDER TO IMPROVE OWNER-CONTRACTOR RELATIONSHIP IT IS IMPORTANT THAT ...
MOST DISAGREE
MOST AGREE
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
35 22 14 21 5 11 15 46 3 2 33
38 20 30 9 1 32 51 28 40
24 13 39 19 43 6 53
25 10 4 36 44 42 52
29 8 47 23 17
48 55 26 27 49
18 31 16
50 7 37
54 12 45
34
41
DISAGREE COUNT: 12
NEUTRAL & NOT RELEVANT COUNT: 6
AGREE COUNT: 37
Category:
1. Attitude
2. Capability
3. Contract
4. Team integration
5. Way of working
6. Team effectiveness


Project 2: Lump Sum infra project B
18-01-2013
Project Manager Contractor
I BELIEF IN ORDER TO IMPROVE OWNER-CONTRACTOR RELATIONSHIP IT IS IMPORTANT THAT ...
MOST DISAGREE
MOST AGREE
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
27 38 5 51 22 35 14 9 2 24 20
29 21 4 15 30 11 8 43 28
39 19 17 32 1 44 13
42 53 25 46 3 47 18
34 26 55 6 12
41 33 7 36 45
16 37 23
10 52 31
49 48 40
50
54
DISAGREE COUNT: 18
NEUTRAL & NOT RELEVANT COUNT: 18
AGREE COUNT: 19
Category:
1. Attitude
2. Capability
3. Contract
4. Team integration
5. Way of working
6. Team effectiveness


Project 3: Unit Rates turn around project
18-01-2013
Project Manager Owner
I BELIEF IN ORDER TO IMPROVE OWNER-CONTRACTOR RELATIONSHIP IT IS IMPORTANT THAT ...
MOST DISAGREE
MOST AGREE
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
30 21 35 5 22 38 20 14 15 47 8
31 27 9 2 3 32 43 1 55
33 24 51 42 39 28 19
52 11 4 23 46 44 36
16 7 25 6 12
10 34 26 53 13
40 41 17
48 29 37
50 45 18
49
54
DISAGREE COUNT: 4
NEUTRAL & NOT RELEVANT COUNT: 14
AGREE COUNT: 37
Category:
1. Attitude
2. Capability
3. Contract
4. Team integration
5. Way of working
6. Team effectiveness


Project 3: Unit Rates turn around project
18-1-2013
Project Manager Contractor
I BELIEF IN ORDER TO IMPROVE OWNER-CONTRACTOR RELATIONSHIP IT IS IMPORTANT THAT ...
MOST DISAGREE
MOST AGREE
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
12 17 14 21 32 5 20 9 35 39 18
38 27 24 51 22 8 46 43 37
16 11 1 2 19 47 48
50 30 6 15 28 53 54
44 42 3 26 7
13 25 4 31 52
33 36 10
40 55 29
49 23 45
34
41
DISAGREE COUNT: 15
NEUTRAL & NOT RELEVANT COUNT: 7
AGREE COUNT: 33
Category:
1. Attitude
2. Capability
3. Contract
4. Team integration
5. Way of working
6. Team effectiveness


Project 4: Reimbursable alliance project
18-01-2013
Project Manager Owner
I BELIEF IN ORDER TO IMPROVE OWNER-CONTRACTOR RELATIONSHIP IT IS IMPORTANT THAT ...
MOST DISAGREE
MOST AGREE
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
27 21 4 24 22 11 9 5 20 32 35
16 23 30 51 15 14 39 2 33
25 38 19 46 43 1 36
26 3 53 6 8 44 55
28 17 31 42 7
29 41 34 47 40
52 10 37
50 12 18
54 13 45
48
49
DISAGREE COUNT 8
NEUTRAL & NOT RELEVANT COUNT: 25
AGREE COUNT: 22
Category:
1. Attitude
2. Capability
3. Contract
4. Team integration
5. Way of working
6. Team effectiveness


Project 4: Reimbursable alliance project
18-1-2013
Project Manager Contractor
I BELIEF IN ORDER TO IMPROVE OWNER-CONTRACTOR RELATIONSHIP IT IS IMPORTANT THAT ...
MOST DISAGREE
MOST AGREE
-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5
27 16 6 21 4 9 14 5 23 12 13
38 34 24 19 35 20 39 33 45
41 32 44 2 22 51 18
50 8 53 11 15 40 48
42 30 3 43 29
26 46 28 1 54
37 47 36
10 25 55
49 31 17
7
52
DISAGREE COUNT 8
NEUTRAL & NOT RELEVANT COUNT: 25
AGREE COUNT: 22
Category:
1. Attitude
2. Capability
3. Contract
4. Team integration
5. Way of working
6. Team effectiveness

Appendix H (1) – Perspective 1, Composed Q-sort Result: Most Agree, Most Disagree and Most Distinguishing Statements

Perspective 1: Statements and Quotations of Project Managers	
Most agree statements	**Category**
8: Contractor's senior management displays consistent/passionate leadership (5)	**Contractor attitude**
Owner PM 1: *(8 & 55) Senior management of both parties must be focussed on the best formation of the project team so that the conditions for the project are optimal. This includes the right freedom for team members to operate. Too little freedom is negative for the progress of the project. It is like a soccer game: you need the right players on the various positions in each team to play a top match.* *Owner PM 3:* *This determines the culture of the whole contractor organization. What you then get is that other employees are also (selected on being) passionate.*	
55: Owner's senior management displays consistent and passionate leadership (4)	**Owner attitude**
Owner PM 3: *This is the mirror view of statement 8. In that case also the owner team is created based on that principle.*	
43: All people in the project team trust each other (4)	**Team effectiveness**
Owner PM 1: *Trust is the basis for cooperation. It is the people together that make the project. Then you have to show to show your weaknesses to other persons. Therefore the sound basis of mutual trust is needed.* *Contractor PM 1:* *Performing projects is people's work and cooperation is also people's work.*	
Agree statements	**Category**
47: Owner's and contractor's senior management are proactively involved in handling escalated conflicts/disputes (3)	**Joint attitude**
Owner PM 3: *Then both parties know what is going on and are both concerned. It illustrates that both parties value the importance and shall therefore both initiate the right actions and support these to resolve problems.*	
15: All people accept joint responsibilities for the team's achievement (3)	**Team effectiveness**
Contractor PM 1: *Derived from a common vision, common objectives create ownership for which people are prepared to accept responsibility.*	
12: The contractor is involved early during the front end development of the project (3)	**Way of working**
Contractor PM 3: (OPPOSING OPINION, MOST DISAGREE) *This is a disadvantage for the contractor. The contractor has another interest than the owner and so the contractor project manager has another interest than the owner project manager. Being involved in the FED makes the contractor accessory and puts a co-responsibility at the contractor for the decisions made in the FED phase. If you as a contractor than - during the execution phase - come up with a request for extra work compensation, it will be countered by the opposition that you as contractor should have seen this during FED and should have warned at that stage for it.* *Contractor PM 4:* *This is understood as FED of the project execution phase. This gives the most insight in the project with its connection to the business case. If this is not done properly, than the project will not come to a good end. And it is the owner's task to organize this. It is his toko.* *The owner has to make the contractor familiar with his objectives and follow him to accept these. With this the basis is laid for the alliance cooperation.*	
1: Owner's senior management provides necessary recourses and support to the project team (3)	**Owner attitude**
-	

Most disagree statements	**Category**
30: As long as people perform well, social activities and events have to be restricted (-5)	**(negative statement) Team effectiveness**
Owner PM 1: *Financial capacity of the owner is no issue for working together in the project team as long as mutual trust exists. Especially binding activities on supervisory level are needed to maintain a positive climate of cooperation and to exchange information.* *Owner PM 3:* *You should nobody in the team restrict on these matters. Period. In general you should not restrict any people on these matters.*	
21: The contract includes explicit incentives schemes (-4)	**Contract aspects**
Contractor PM 1: *Incentive schemes are not the greatest drivers to make people work together.* *Owner PM 3:* *In general these sorts of explicit provision are for senior management, not for the workers who actually have to perform the execution of the project and have to make it happen. Therefore explicit intensive schemes do not contribute to the project objectives Q/T/C/SHE and thus not to the team effectiveness.* *Owner PM 4:* *I am a supporter of IPA, the International Project Analysis. From publications of the IPA, I learned that the result of incentives in mega contracts is zero. It does not contribute to the overall project quality.*	
10: The owner has strong financial capacity (-4)	**Owner capability**
Owner PM 1: *Financial capacity of the owner is no issue for working together in the project team as long as mutual trust exists.* *Contractor PM 1:* *Not of importance for the execution phase. It is a given fact from the procurement process.*	
Disagree statements	**Category**
35: The contract specifies targeted performance and its criteria (-3)	**Contract aspects**
Owner PM 2: *In that case, all creativity within the project team will be killed, taking out the main drive for cooperation.* *Owner PM 4:* *(OPPOSING OPINION, MOST AGREE)* *The most difficult but also the most important for your project is to define and translate: Strategy into> Business Case into> Project KPI's into> Contract Conditions. For every project you need to make clear to everyone involved and to specify in the contract: the business case and the objectives of the project. If you do not have this you will not end up with a good project.*	
16: Owner and contractor have compatible systems and procedures (-3)	**Way of working**
Owner PM 4: *This is not necessary because there are so many systems that can link.* *Contractor PM 4:* *Compatible systems are absolutely not necessary. Systems and procedures must be chosen and implemented based on the project requirements and demands.*	
33: A single project team is formed from owner & contractor's key personnel (-3)	**Team integration**
Owner PM 2: *(OPPOSING OPINION, MOST AGREE)* *This creates a common responsibility throughout the entire organization.* *Owner PM 4:* *(OPPOSING OPINION, MOST AGREE)* *By this the key positions must be equally shared to avoid a skew distribution of control and assure balance of power.*	
52: Owner/contractor jointly develop procedures for conflict/dispute handling (-3)	**Way of working**
-	
Most distinguishing statements	**Category**
8: Contractor's senior management displays consistent & passionate leadership	**Contractor attitude**
55: Owner's senior management displays consistent and passionate leadership	**Owner attitude**
25: The owner aligns its internal functions such as business/operations	**Team integration**

Appendix H (2) – Perspective 2, Composed Q-sort Result: Most Agree, Most Disagree and Most Distinguishing Statements

Perspective 2: Statements and Quotations of Project Managers	
Most agree statements	**Category**
2: All people in the project team share a common vision and set of objectives (5)	**Team effectiveness**
Contractor PM 1: *Common objectives bind people and through this people are prepared to accept responsibility.* *Owner PM 2:* *This is the basis for good cooperation.*	
43: All people in the project team trust each other (4)	**Team effectiveness**
Owner PM 1: *Trust is the basis for cooperation. It is the people together that make the project. Then you have to show to show your weaknesses to other persons. Therefore the sound basis of mutual trust is needed.* *Contractor PM 1:* *Performing projects is people's work and cooperation is also people's work.*	
40: Owner and contractor jointly identify and manage project risks (4)	**Way of working**
Owner PM 2: *Common interests are the basis for cooperation, but the will and motivation must also exist. And you need a trust relationship.*	
Agree statements	**Category**
28: When problems occur, owner and contractor do not blame each other but focus on solutions and mutual interests (3)	**Joint attitude**
Contractor PM 2: *By proactive actions conflict situations are avoided: strive to search for solutions, otherwise you end up in trench warfare. To facilitate this you need a clear structure for problem solving and dispute resolution.*	
53: The owner recognizes contractor's commercial interest (3)	**Owner attitude**
-	
42: The contractor internalizes the owner's long term goals as their own goals (3)	**Contractor attitude**
-	
51: All people in the project team are personally engaged towards the team's achievement (3)	**Team effectiveness**
-	
Most disagree statements	**Category**
38: No contentious issues and conflicting opinions in the project team are allowed (-5)	**(negative statement) Team effectiveness**
Contractor PM 1: *Not allowing for different opinions is bad for the relationship and hardens viewpoints of people. People must be able to share opinions and respect each other.* *Owner PM 2:* *In this case no basis exists for constructive discussions and there is no mutuality.* *Contractor PM 2:* *There must be room for conflicting opinions, as long as it remains on a professional level and people stay on speaking terms. It must not become a colourless team.* *Contractor PM3:* *This does not support the team motivation and is therefore not good for the team performance.* *Contractor PM 4:* *Cherish, understand and solve. Why sees someone something different? It is important that they say why. This offers an opportunity to create a bond. The people in the team are no trained monkeys. If you do not get acquainted with other opinions you cannot improve. It is counteracting for tunnel view, supports motivation and contributes to the alignment of objectives.*	
35: The contract specifies targeted performance and its criteria (-4)	**Contract aspects**

Owner PM 2: *In that case, all creativity within the project team will be killed, taking out the main drive for cooperation.* *Owner PM 4:* *The most difficult but also the most important for your project is to define and translate: Strategy into> Business Case into> Project KPI's into> Contract Conditions. For every project you need to make clear to everyone involved and to specify in the contract: the business case and the objectives of the project. If you do not have this you will not end up with a good project.*	
10: The owner has strong financial capacity (-4)	**Owner capability**
Owner PM 1: *Financial capacity of the owner is no issue for working together in the project team as long as mutual trust exists.* *Contractor PM 1:* *Not of importance for the execution phase. It is a given fact from the procurement process.3*	
Disagree statements	**Category**
21: The contract includes explicit incentives schemes (-3)	**Contract aspects**
Contractor PM 1: *Incentive schemes are not the greatest drivers to make people work together.* *Owner PM 3:* *In general these sorts of explicit provision are for senior management, not for the workers who actually have to perform the execution of the project and have to make it happen. Therefore explicit intensive schemes do not contribute to the project objectives Q/T/C/SHE and thus not to the team effectiveness.* *Owner PM 4:* *I am a supporter of IPA, the International Project Analysis. From publications of the IPA, I learned that the result of incentives in mega contracts is zero. It does not contribute to the overall project quality.*	
22: The contract specifies remuneration scheme fairly/transparently (-3)	**Contract aspects**
Owner PM 2: *This is on itself ok, but it is no drive for cooperation. A contractor knows without this exactly what his rights are.*	
25: The owner aligns its internal functions such as business/operations (-3)	**Team integration**
-	
29: The contractor has a high reputation and credibility in marketplace (-3)	**Contractor capability**
Contractor PM 2: *This has no significant influence on operational project management level.*	
Most distinguishing statements	**Category**
2: All people in the project team share a common vision and set of objectives	**Team effectiveness**
53: The owner recognizes contractor's commercial interest	**Owner attitude**
42: The contractor internalizes the owner's long term goals as their own goals	**Contractor attitude**

Appendix H (3) – Perspective 3, Composed Q-sort Result: Most Agree, Most Disagree and Most Distinguishing Statements

Perspective 3: Statements and Quotations of Project Managers	
Most agree statements	**Category**
18: The contractor has strong capabilities in project management (5)	**Contractor capability**
Contractor PM 3: *This is where it all starts with. It is a basis condition. Because this makes the project performance good, the relationship will be good*.*	
20: The contract clearly specifies roles and responsibilities of the parties (4)	**Contract aspects**
Contractor PM 2: *Good agreements make good friends.*	
35: The contract specifies targeted performance and its criteria (4)	**Contract aspects**
Owner PM 2: *In that case, all creativity within the project team will be killed, taking out the main drive for cooperation.* *Owner PM 4:* *The most difficult but also the most important for your project is to define and translate: Strategy into> Business Case into> Project KPI's into> Contract Conditions. For every project you need to make clear to everyone involved and to specify in the contract: the business case and the objectives of the project. If you do not have this you will not end up with a good project.*	
Agree statements	**Category**
45: The owner assigns its people sufficiently and with appropriate skills, knowledge and experience (3)	**Owner capability**
Contractor PM 4: *The owner must put sufficient efforts in the project. The owner has the knowledge about the assets involved and exactly this knowledge must be made available for the project: the do's and don'ts. The owner can prognosticate these in advance.*	
43: All people in the project team trust each other (3)	**Team effectiveness**
Owner PM 1: *Trust is the basis for cooperation. It is the people together that make the project. Then you have to show to show your weaknesses to other persons. Therefore the sound basis of mutual trust is needed.* *Contractor PM 1:* *Performing projects is people's work and cooperation is also people's work.*	
39: The project team's primary concern is to execute the project excellently (3)	**Team effectiveness**
Contractor PM 3: *If the execution of the project is good, the project performance is good. This has a positive influence on the relation and the relationship effectiveness, which on its turn again contributes to good project execution*.*	
48: The contractor has strong technical capability such as engineering, procurement and construction (3)	**Contractor capability**
-	
Most disagree statements	**Category**
27: All people in the project team work without organizational and hierarchical boundaries (-5)	**Team integration**
Contractor PM 2: *Without boundaries structure is missing and thus the basis for cooperation.* *Owner PM 4:* *Without boundaries division of responsibilities is not clear, which is the basis for a good division of the work tasks.* *Contractor PM 4:* *If you have not created a structure, the project will become a failure. And with the structure there must always come a roadmap and a framework with clear TRP's (Tasks, Responsibilities and Powers) on high level.*	
38: No contentious issues and conflicting opinions within the project team are	**(negative statement)**

allowed (-4)	**Team effectiveness**
Contractor PM 1: *Not allowing for different opinions is bad for the relationship and hardens viewpoints of people. People must be able to share opinions and respect each other.* *Owner PM 2:* *In this case no basis exists for constructive discussions and there is no mutuality.* *Contractor PM 2:* *There must be room for conflicting opinions, as long as it remains on a professional level and people stay on speaking terms. It must not become a colourless team.* *Contractor PM 3:* *This does not support the team motivation and is therefore not good for the team performance.* *Contractor PM 4:* *Cherish, understand and solve. Why sees someone something different? It is important that they say why. This offers an opportunity to create a bond. The people in the team are no trained monkeys. If you do not get acquainted with other opinions you cannot improve. It is counteracting for tunnel view, supports motivation and contributes to the alignment of objectives.*	
16: Owner and contractor have compatible systems and procedures (-4)	**Way of working**
Owner PM 4: *This is not necessary because there are so many systems that can link.* *Contractor PM 4:* *Compatible systems are absolutely not necessary. Systems and procedures must be chosen and implemented based on the project requirements and demands.*	
Disagree statements	**Category**
21: The contract includes explicit incentives schemes (-3)	**Contract aspects**
Contractor PM 1: *Incentive schemes are not the greatest drivers to make people work together.* *Owner PM 3:* *In general these sorts of explicit provision are for senior management, not for the workers who actually have to perform the execution of the project and have to make it happen. Therefore explicit intensive schemes do not contribute to the project objectives Q/T/C/SHE and thus not to the team effectiveness.* *Owner PM 4:* *I am a supporter of IPA, the International Project Analysis. From publications of the IPA, I learned that the result of incentives in mega contracts is zero. It does not contribute to the overall project quality.*	
50: The owner has strong capability in project management (-3)	**Owner capability**
-	
41: The contractor offers competitive solutions for a well-performing owner (-3)	**Way of working**
-	
4: The owner believes that the contractor will make efforts to deliver their commitments (-3)	**Owner attitude**
-	
Most distinguishing statements	**Category**
18: The contractor has strong capabilities in project management	**Contractor capability**
20: The contract clearly specifies roles and responsibilities of the parties	**Contract aspects**
35: The contract specifies targeted performance and its key criteria	**Contract aspects**

* Note in Table 4.7 that in his explanations to his most agree statements 18 and 39, the contractor project manager of project 3 assumes an interactive influence between project performance and relationship effectiveness. His line of reasoning is that good project execution leads to good project performance. This on its turn has a positive influence on the relationship, which has a positive influence on good project execution. He also assumes the positive influence of strong project management capabilities on the team relationship as well as on the owner-contractor relationship.

Appendix I (1) – Effectiveness Assessment Maturity Model Data Matrix for the Studied Projects

Maturity Model Project Data Matrix		Project 1 – Lump Sum infra project A		Project 2 – Lump Sum infra project B	
		PM Owner	PM Contractor	PM Owner	PM Contractor
Main criteria	Sub-criteria	Maturity Level		Maturity Level	
Objectives	Objectives alignment	3	3	1	3
	Benefits	3	4	1	3
	Continuity of work	3	2	1	2
Trust	Type of trust	2	2	1	2
	Confidence in others'	4	3	2	3
	Monitoring others' work	3	2	1	1
Collaboration	Working relationship	4	4	2	3
	Culture	4	4	1	4
	Mutual help	3	3	2	3
Communication	Information exchange	3	3	2	3
	Sharing learning	2	3	2	3
	Cost data transparency	2	2	1	3
Problem solving	Early warning	3	3	1	3
	Effectiveness	3	2	1	1
	Avoidance of recurrence	3	1	1	2
Risk allocation	Risk sharing	3	2	1	2
	Allocation principle	3	3	2	2
	Balance of risk and	3	3	2	2
Continuous improvement	Joint effort	4	3	2	2
	Performance	4	2	2	3
	Incentives	2	2	3	2
Non-weighted average					
Objectives		3	3	1	3
Trust		3	2	1	2
Collaboration		4	4	2	3
Communication		2	3	2	3
Problem solving		3	2	1	2
Risk allocation		3	3	2	2
Continuous improvement		3	2	2	2
Maturity level overall non-weighted average		3,0	2,7	1,5	2,5
Performance (1,2,3,4: poor, reasonable, moderate, good)	Quality	3	3	2	2
	Time	4	4	1	1
	Budget	4	4	1	1
	HSE	4	4	2	3
Performance non-weighted average		3,8	3,8	1,5	1,8

Maturity Model Project Data Matrix
rev. 21-01-2013

		Project 3 — Unit Rates turnaround project		Project 4 — Reimbursable alliance project	
		PM Owner	PM Contractor	PM Owner	PM Contractor
Main criteria	Sub-criteria	Maturity Level		Maturity Level	
Objectives	Objectives alignment	2	4	4	3
	Benefits	1	4	4	4
	Continuity of work	2	3	4	4
Trust	Type of trust	2	4	2	2
	Confidence in others'	3	4	2	2
	Monitoring others' work	3	4	1	4
Collaboration	Working relationship	3	4	4	3
	Culture	4	4	3	3
	Mutual help	3	4	4	3
Communication	Information exchange	3	3	3	3
	Sharing learning	3	3	4	3
	Cost data transparency	2	2	4	2
Problem solving	Early warning	3	3	3	4
	Effectiveness	3	3	3	4
	Avoidance of recurrence	3	3	3	3
Risk allocation	Risk sharing	1	2	4	4
	Allocation principle	2	4	4	3
	Balance of risk and	3	4	3	3
Continuous improvement	Joint effort	3	4	3	2
	Performance	3	2	4	3
	Incentives	2	2	4	4
Objectives		2	4	4	4
Trust		3	4	2	3
Collaboration		3	4	4	3
Communication		3	3	4	3
Problem solving		3	3	3	4
Risk allocation		2	3	4	3
Continuous improvement		3	3	4	3
Maturity level overall non-weighted average		2,6	3,3	3,5	3,2
Performance	Quality	4	4	4	4
(1,2,3,4: poor,	Time	4	4	4	4
reasonable,	Budget	3	4	4	4
moderate, good)	HSE	4	4	4	4
Performance non-weighted average		3,8	4,0	4,0	4,0

Appendix I (2) – Effectiveness Assessment Maturity Model Data Matrix Overview for the Studied Projects

Maturity Model Project Data Matrix Overview

Main criteria	Sub-criteria	----- Project 1 ----- Lump Sum infra project A			--- Project 2 --- Lump Sum infra project B			--- Project 3 --- Unit Rates turnaround			--- Project 4 --- Reimbursable alliance project		
		Maturity Level			Maturity Level			Maturity Level			Maturity Level		
		PM Owner	Δ	PM Contr	PM Owner	Δ	PM Contr	PM Owner	Δ	PM Contr	PM Owner	Δ	PM Contr
Objectives	Objectives alignment	3	0	3	1	2	3	2	2	4	4	1	3
	Benefits	3	1	4	1	2	3	1	3	4	4	0	4
	Continuity of work	3	1	2	1	1	2	2	1	3	4	0	4
Trust	Type of trust	2	0	2	1	1	2	2	2	4	3	1	2
	Confidence in others'	4	1	3	2	1	3	3	1	4	3	1	2
	Monitoring others' work	3	1	2	1	0	1	3	1	4	2	2	4
Collaboration	Working relationship	4	0	4	2	1	3	3	1	4	4	1	3
	Culture	4	0	4	1	3	4	4	0	4	3	0	3
	Mutual help	3	0	3	2	1	3	3	1	4	4	1	3
Communication	Information exchange	3	0	3	2	1	3	3	0	3	3	0	3
	Sharing learning	2	1	3	2	1	3	3	0	3	4	1	3
	Cost data transparency	2	0	2	1	2	3	2	0	2	4	2	2
Problem solving	Early warning	3	0	3	1	2	3	3	0	3	3	1	4
	Effectiveness	3	1	2	1	0	1	3	0	3	3	1	4
	Avoidance of recurrence	3	2	1	1	1	2	3	0	3	3	0	3
Risk allocation	Risk sharing	3	1	2	1	1	2	1	1	2	4	0	4
	Allocation principle	3	0	3	2	0	2	2	2	4	4	1	3
	Balance of risk and	3	0	3	2	0	2	3	1	4	3	0	3
Continuous improvement	Joint effort	4	1	3	2	0	2	3	1	4	3	1	2
	Performance	4	2	2	2	1	3	3	1	2	4	1	3
	Incentives	2	0	2	3	1	2	2	0	2	4	0	4
	sum	64	12	56	32	22	52	54	18	70	73	15	66
	average	3	0,6	2,7	1,5	1,0	2,5	2,6	0,9	3,3	3,5	0,7	3,1

Maturity levels non-weighted average

Objectives		3	0	3	1	1,7	2,7	1,7	2	3,7	4	0,3	3,7
Trust		3	0,7	2,3	1,3	0,7	2	2,7	1,3	4	2,7	0	2,7
Collaboration		3,7	0	3,7	1,7	1,6	3,3	3,3	0,7	4	3,7	0,7	3
Communication		2,3	0,4	2,7	1,7	1,3	3	2,7	0	2,7	3,7	1	2,7
Problem solving		3	1	2	1	1	2	3	0	3	3	0,7	3,7
Risk allocation		3	0,3	2,7	1,7	0,3	2	2	1,3	3,3	3,7	0,4	3,3
Continuous improvement		3,3	1	2,3	2,3	0	2,3	2,7	0	2,7	3,7	0,7	3
Maturity level overall non-weighted average		3	0,5	2,7	1,5	0,9	2,5	2,6	0,8	3,3	3,5	0,5	3,2

Performance *(1,2,3,4: poor, reasonable, moderate, good)*	Quality	3		3	2		2	4		4	4		4
	Time	4		4	1		1	4		4	4		4
	Budget	4		4	1		1	3		4	4		4
	HSE	4		4	2		3	4		4	4		4
Performance non-weighted average		3,8		3,8	1,5		1,8	3,8		4	4		4