

LEAN CONTRACTING

RELATIONAL CONTRACTING INFLUENCED BY LEAN THINKING

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DOCTORAL THESIS

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Preface

My thesis is a result of many happenings! My footsteps in the academic world, started decades ago, at the Technical University of Lund. However, those first steps come to a halt after some months, as my admirable supervisor, deceased professor Sven G. Bergström, left his chair. He advised me to find a position outside the academy in order to provide myself with practical experience before a later restart within the academy. I followed this advice very thoroughly, as I became to stay outside the academy for more than 30 years as contractor, as client representative, as a consultant and with product development. However, I have had a lot of contacts with the academy during those years elapsed, especially in connection to the development of and the application of innovations.

My restart in the academy was also due to another happening. This as I occasionally happened to meet next admirable academic, professor Lennart Elfgren. As he knew my background he provoked me by the following: “Bengt, you have to restart your academic career, it’s never too late”! As I have learnt to know Lennart to be a wise and honourable person, I decided to follow his advice. So here I am, thanks to Lennart!

My new period within the academy has been an exiting experience in many ways for an old man. There have been “ups and downs” and I have some times remembered the following quotation: “*I have become a kind of enfant terrible in my new homeland because of my inability to keep silent and swallow everything that happens here*” (*Einstein*). However, mostly I have enjoyed my years in the academy, conducting research within the field of construction management, that I earlier have learnt in practise, during my long period outside the academy. The need of knew knowledge in this field is evident in

many ways. However, the thirst for new knowledge from practisians within construction is not in parity with the real needs. My hope is that I, due to my long experience as practisian can help to bridge over the gap between academy and practisians. I have to admit that my practical knowledge and understanding of this area has helped me a lot in my research. Another quotation of Einstein is also in congruence with my own view: *One thing I have learned in a long life: That all our science, measured against reality, is primitive and childlike – and yet it is the most precious thing we have!*

To conduct a research project requires a lot of inputs, as well of hardware as of software. With regard to hardware, I want especially to acknowledge all the financial support I have been granted from my university, Formas, SBUF and Sveriges Bygginidustrier. However, the other portion of requisites needed, the software portion is even more important. In this context, I have to name some individuals who have helped me to survive as an academic. Firstly, I have to thank my supervisor, the admirable and charming professor Thomas Olofsson, who has assisted me in my research and become one of my beloved friends. Others to highlight are my co-supervisor professor Jan Johansson, the dean Göran Westerström, my research and ski colleague Per Erik Eriksson and professors Glenn Ballard and Lauri Koskela from the lean construction world. Additionally, I will thank all other colleagues I have learnt to know at the university and all other friends who have supported me with software of different kinds.

Finally, I will express my thanks from my hearth to my parents, my relatives, my friends and my girls Lena, Mia, Karin, Sanna and Elina for all their support to me, your life long student.

Luleå, 2008

Bengt Toolanen

Abstract

The construction sector represents a most vital proportion of Swedish society through its main task of meeting the demands regarding buildings and infrastructure needed, among other things, for living, work, leisure time, education and communication. That this is executed in an effective manner is an important issue for a sustainable development of society. However, the construction sector has time and again been the focus as well of a mass media attention as well as of public investigations following construction failures, unfavourable cost development and even unveiled cases of improper competition. The situation has led in Sweden as well as in many other countries to development of the construction process through application and development of new concepts and process tools. The current development of society also emphasizes the need for a changed and a more dynamic, flexible and innovative construction process to meet increased demands by law and by customers set upon the construction sector and also by a higher magnitude of more complex projects and projects surrounded with different kind of uncertainties due to, among other reasons, shorter lead-times.

How the actual set of project-oriented and external factors in the project context affects the contracting process and as how the choice of the contracting model affects the process design during the project execution phase, have also been studied in the scope of this research project. The findings of the research presented in this thesis contribute to the development of theory and practice within the field of contracting and the design of the construction process mainly in the following ways:

- The choice of an appropriate procurement model for contracting of projects is often very complex as there are a lot of contextual factors,

project specific factors and external factors, to consider in order to find solutions that promote an efficient construction process. The most important prerequisites to consider are the type of project, the market situation for bidding, the lead-time for the project and uncertainties causing risks of changes and variations during the project execution phase. This important choice is also affected by personal and cultural preferences regarding cooperation and distribution of responsibilities.

- The contracting model has three interacting and important components to be considered simultaneously in a procurement situation. Firstly the distribution of responsibilities between the client and the contractors (contract form), secondly how the contractor is compensated (compensation form) and finally how the governance of the project is structurally organized (governance structure).
- The choice of governance structure is in many ways based upon trust and is also the basic pillar of the procurement model, because it determines basically the type of cooperation and the nature of legal adherence that the client wants to establish in the project. The outsets are classical contract models with “arm’s length distance” between the actors and reliance on legal frameworks and relational based contract models with high emphasis on cooperation and trust.
- The choice of contract form is in legal terms mainly a question of how to distribute the responsibilities, especially regarding design, between the client and the contractors. However, this decision is also influenced by the project type, the market conditions and risk factors due to uncertainties of different kinds. This choice seems also to a high degree to be a question of trust between the client and contractors and is accordingly also linked to the choice of governance structure and compensation form.
- The choice of compensation form is also an important proportion of the procurement model to be regarded when contracting. This is especially important in the context of uncertainties, time and resource critical conditions and also when the client wants to get a base for active cooperation with the contractors in process design issues. Accordingly, the choice of compensation form is to a high a degree also connected to the choice of appropriate governance structure. In relational contracting transparency is one of the fundamentals of a trustful cooperation.

- In projects with a relational contracting oriented governance structure, for example with application of partnering concepts, it is important that the process design promotes an efficient project execution. An important indication of the research carried out in this thesis is that the core group in a relational contracting arrangement has to involve most of the strategic stakeholders in a trustful and equal manner. Other important factors are the establishment of an innovative climate through promotion of innovative thinking and a systematic search for innovations to apply for the benefit of the project in many ways. Innovations have also to be highlighted as an important component in team building and development of trust in an organisation.

Key words: Relational contracting, contracts, partnering, lean construction, lean thinking, lean contracting

Sammanfattning

Byggsektorn representerar en mycket viktig del av det svenska samhället genom sin huvudsakliga uppgift att möta de behov avseende lokaliteter och infrastruktur som behövs för boende, arbetsplatser, fritid, hälsovård, utbildning och kommunikation. Att detta sker på ett effektivt sätt är en viktig fråga för samhällets uthålliga utveckling. Emellertid har byggsektorn tidvis varit i fokus såväl för massmedial uppmärksamhet som för offentliga utredningar till följd av byggfel, ofördelaktig kostnadsutveckling och även otillåtna konkurrensbegränsningar. Denna situation har, såväl i Sverige som i många andra länder, bidragit till en utveckling av byggprocessen genom applikation och utveckling av nya koncept och processmetoder. Den aktuella samhällsutvecklingen förstärker också behovet av en förändrad och mer dynamisk, flexibel och innovativ byggprocess. Detta för att byggsektorn skall kunna möta ökade krav från lagar och kunder samt genom en ökad förekomst av komplexa projekt och av projekt innefattande en massa osäkerhetsfaktorer bland annat till följd av korta ledtider.

Inom ramen för detta forskningsprojekt har studerats såväl hur olika kombinationer av projektbundna och externa faktorer i projektets miljö påverkar upphandlingsprocessen samt även hur valet av upphandlingsmodell påverkar processutformningen i genomförandefasen. Resultaten av den forskning som presenteras i denna avhandling bidrar till teoriutveckling och även praktiskt inom området för projektupphandlingar och för utformningen av byggprocessen huvudsakligen på följande sätt:

- Vid upphandlingar av projekt är valet av en effektiv upphandlingsmodell ofta väldigt komplext eftersom det finns en massa påverkande faktorer, projektanknutna och externa, att beakta för att

finna lösningar som främjar en effektiv byggprocess. De viktigaste faktorerna att beaktas är typen av projekt, marknadssituationen för anbud, projektets ledtid och andra osäkerheter som medför risker för ändringar och avvikelser under projektets genomförandefas.

- Upphandlingsmodellen kan delas upp i tre interagerande och viktiga beståndsdelar som bör beaktas parallellt i en upphandlingssituation. För det första ansvarsfördelningen mellan beställare och utförare (entreprenad- eller genomförandeform), för det andra hur utföraren blir ekonomiskt ersatt (ersättningsform) och slutligen hur projektstyrningen är strukturerad (styrningsform).
- Valet av styrningsform är på många sätt förtroendebaserat och grundläggande i valet av upphandlingsmodell. Detta eftersom det bestämmer vilken typ av samverkan och legal struktur som beställaren vill etablera i sitt projekt. Ytterligheterna är klassiska kontraktsmodeller med "armlängds avstånd" mellan aktörerna och tillit till legala ramverk och relationsbaserade upphandlingsmodeller med stor tyngdpunkt på förtroendebaserad samverkan.
- Valet av entreprenadform är juridiskt sett främst en fråga om att fördela ansvar, speciellt designansvaret, mellan beställaren och entreprenörerna. Detta val påverkas också av projekttyp, av marknadsförutsättningarna och av riskfaktorer beroende av osäkra förutsättningar av olika slag. Valet verkar också vara i mycket hög grad vara en fråga om förtroende mellan beställare och entreprenörer och interagerar med valet av styrnings- och ersättningsform.
- Valet av ersättningsform är en viktig del av en upphandling. Detta är speciellt viktigt i sammanhang med osäkerheter, tid- och resurskritiska lägen och också i lägen då beställaren vill uppnå en bas för aktiv samverkan med entreprenörer i designfrågor. Valet av ersättningsform är också i hög grad kopplat till valet av styrningsform. I relationsinriktade projekt är transparent ersättningsform ett av fundamenten för en förtroendefull samverkan.
- Vid projekt med relationsinriktad projektstyrningsstruktur, exempelvis vid samverkan i partneringsform, är det viktigt att processdesignen är utformad för att ge en bas för effektivt projektgenomförande. En viktig indikation av denna forskning är att partneringsgruppen i ett relationsinriktat samverkansprojekt bör innefatta strategiska aktörer på

ett förtroendefullt och jämställt sätt. Likaså är det viktigt att ett innovativt klimat etableras genom innovativt tänkande och ett systematiskt sökande av innovationer som kan appliceras för projektets bästa på många sätt. Innovationer kan också användas som en viktig komponent i teambyggandet och i utvecklandet av förtroende i en organisation.

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1 RESEARCH CONTEXT

1.1 Introduction

The research presented in this thesis is connected to an area in society, the construction sector, which is important for a sustainable development of a lot of functions in society, because it deals with how to improve the implementation of set targets regarding safety, quality, economy, time and other functions in the delivery of building structures and other services connected to this sector in a sustainable way.

As well in Sweden as in a lot of other developed countries, in the industrialized world, the construction sector still stands for a considerable proportion, in Sweden about one tenth, of the GNP (Gross National Product). Accordingly is it sound and desirable to follow up with thoroughness, even from the perspective of an overall sustainable development of the society, the development within the construction sector.

Within many branches the ongoing globalization has led to increased competition, which has been an effective motive power for especially manufacturing branches, continuously to improve their overall efficiency. Application and development of innovative principles and methods, in order to continuously achieve more efficient process design solutions, has been a significant proportion of this development. In parallel with this global development within trade, have also the search and thirst for knowledge about innovative business and manufacturing concepts been globally accelerated. The development of more frequent and open global relations in parallel with the rapid growth of IT – media for spreading and sharing of information have been essential components in this development (*Womack, et.al. 1990*).

However, in a branch as the construction sector, the influence of globalization as a driving force for improved competition, efficiency and innovations is still not evident. In Sweden as well as in many other countries, the construction industry has mainly to be regarded as a domestic branch, protected in many ways from global competition.

In this first chapter I will give an overall presentation of the construction sector, the construction process and of my own background to provide a context to the scope of my research project. Furthermore, I will present the structure of my thesis.

1.2 The Swedish construction sector

The term *construction sector* is used in this thesis in the sense of *all activities in society contributing to the construction and to the refurbishment of building structures*. By building structures are meant all types of buildings, as well as of infrastructure projects. The most important stakeholders within the construction sector are construction clients, users, contractors, material suppliers, consultants and regulating bodies in society. The products from the construction sector are essential for the creation of building structures for instance job sites, for living, for leisure, for shopping and communications.

One of the most important roles of this sector is to meet demands on building structures from society in an economic and sustainable way. The yearly investments in building and refurbishment of building structures in Sweden were in 2007 about 200 billion SEK according to *SCB 2007*. This was about 7 % of the GNP (Gross National Product) 2007 of Sweden. Different government agencies account for about 25 % of the total investments within the construction sector. Thus, an efficient construction sector is also one of the fundamental bases for an overall sound and sustainable development of society.

However, during the last decades the construction sector has in Sweden, as in many other countries, often been the subject of public debates and been criticized for shortcomings in its role as supplier of products and services to society. Occurred cost overruns, delivery time delays and quality defects have in many ways damaged the esteem of the construction sector in society.

In Sweden, as in many other countries, these problems have also led to the set-up of public committees and research projects for scrutinizing the construction sector. In Sweden, the public investigations initiated by the Swedish

government, the Byggnadskostnadsdelegationen report *Från byggsekt till byggsektor* (SOU 2000:44) and the Byggnadskommisionens report, *Skärpning gubbar* (SOU 2002:115) should be mentioned in this context. In UK there have been similar public investigations reported, such as for example the Latham report *Constructing the team* (1993) and the Egan report *Rethinking construction* (1998).

According to conclusions from those investigations, traditional models for managing the construction process, often do not match the nature of today's building projects. This is mainly due to a higher proportion of projects with short lead times, higher complexity and prerequisites causing uncertainties of different kinds in the project execution. The relationships between the main actors are also often found to be more competitive and adversarial than cooperative. This is argued to derive from the traditional contracting and governance forms used, since they often lack incentives for cooperation. Also, many actors lack long term strategic thinking and are also reluctant about the value of enhanced cooperation, as a tool for improved efficiency in the construction sector (SOU 2000:44, SOU 2002:115).

According to the Byggnadskostnadsdelegationen report SOU 2000:44 the productivity development within the Swedish construction sector has been poor in comparison with the productivity development within other manufacturing branches. The construction sector also invests very little in research and development in comparison with other manufacturing sectors (SOU 2000:44).

Faktorprisindex och byggnadsprisindex 1968–2005, (1968=100)
Factor-price index and construction price index 1968–2005, (1968=100)

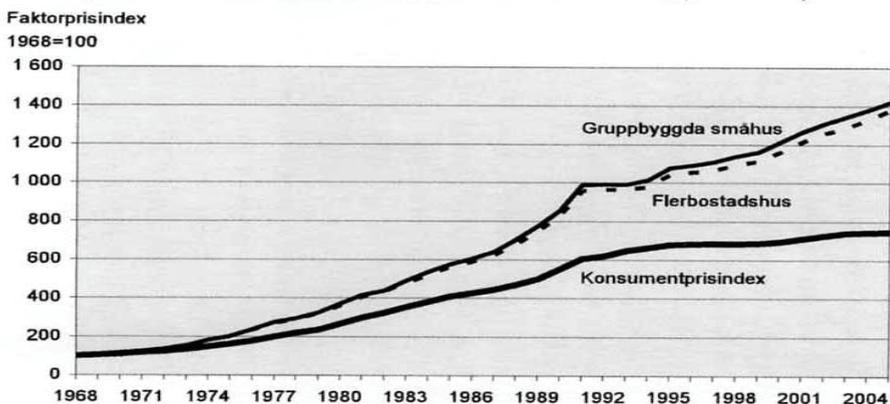


Figure 1.1: The development of factor-price index and construction price index 1968 – 2005 (1968=100), SCB 2007.

Figure 1.1 shows a comparison of development of the construction price index for dwellings and the development of factor-price index during the period 1968 – 2004. In the construction price all costs for the client (i.e. land, taxes, design, construction) are included. In this comparison the construction costs have increased about 90 % more than the consumer prices in common, which is a remarkable and severe notification about the situation being (SCB 2007).

The structure of the Swedish construction sector has changed a lot during the last decades, a lot due to structural changes in the public sector but also among stakeholders in the private sector. These changes have for example resulted in a less competitive environment, since concentration among traditional construction companies has occurred. For example, there are according to the Byggnadskostnadsdelegationen report, nowadays only three construction companies offering services in the whole of Sweden. The three companies also have together about a 40 % share of the available construction market (SOU 2000:44).

According to the Bygghjälperkommisionen report (SOU 2002:115), the clients have also lost a lot of their traditional role of controlling and influencing the development in the construction sector due to these structural changes. Besides, the fact that the processes of change in society are also having a more and more accelerated progress rate raises demands for a sound and effective progress within the construction sector. Thus there is need for developing this sector to better suit the changed demands. The construction sector also has to get an improved overall image, in order to attract new human resources in the future (SOU 2002:115).

1.3 Traditional contracting and process design

In this thesis is by *contracting* meant, as well the procurement of as well as the governance of consultants, contractors and other services in connection to design and construction project realisation phases. With the *process design* is primarily meant measures in order to define and to specify process structures, enabling the management and the governance of all resources and activities needed for the execution of construction projects.

According to Eriksson (2007, 2008) procurement of construction projects in Sweden is still directed to favour competition issues more than to promote cooperation. Thus, the procurement phase is by far dominated by the application of traditional contracting models based upon strict distribution of responsibilities among the stakeholders. Accordingly, classical governance

models of the planning, the design and the product realisation phases are still predominant. Thus for example, set targets concerning the products in contracts are mainly formulated through detailed specifications and drawings and mostly without involvement of the contractors in the product design.

Swedish construction contracts are mostly based upon standard rules worked out jointly by client federations and the Swedish Contractors` Federation. For example, the *AB 04* regulation is applicable to contracts in which the client has the main responsibility for the design of the project, whereas the *ABT 06* regulation is applicable for contracts where the responsibility for the design is distributed to the contractors. Both of these contract regulations, *AB04 and ABT 06*, are mainly based on classical transactional models of governance. Accordingly, they attempt in detail to spell out the responsibilities, authority, and compensation of each part in detail. Consequently, the use of traditional contract forms as DBB (design, bid and build) often results in a situation where the experience and know-how of the contractors are not utilized in the design of the product. Accordingly, the responsibility of process design issues is also linked to the contractual distribution of responsibilities. Thus, process design issues are often not dealt with jointly by all stakeholders in a project, in order to improve and optimize the construction process. The consequences are efficiency losses due to bad coordination, cooperation and sub-optimizing. Accordingly, these adversarial contracting approaches and the pursuit of optimization of the individual company gain, result in a less efficient project execution and low levels of productivity and innovation in the industry.

However, according to Anna Kadefors (*1997, 2004*) there are to be found co-operative relationships between client representatives and contractors even in projects with classical governance structures. Often, these kinds of interactions are informal and based upon compromises and exchange of services in order to avoid conflicts.

Barbara Colledge (*2004*) argue that in most construction projects uncertainties of different kinds are a defining characteristic and it is almost inevitable that unforeseen events and problems will occur during the project execution. This is especially true as projects become more dynamic (short lead-time) and technically complex. The important question in this context is whether contracts models often used today can govern these dynamic projects functions effectively in situations of variation. Unfortunately, it is quite evident that traditional contracts are not well suited for this purpose and a different type of contracting is needed to handle the challenges that dynamic projects impose (*Colledge 2004*).

1.4 Scope of the research and research objectives

My thesis deals, as well with how contracting models should be used in different project contexts as with how an appropriate use of contracting models can be used as a management tool in order to create a base for the design of and the implementation of efficient project processes. This to improve the achievement of set targets for the delivery of services and products within the construction sector.

As set out in the previous sections, the management of the construction process should be better adapted to the dynamic and the complexity of prevailing construction projects. Accordingly, it is often a question of finding governance structures promoting cooperation and innovation in order to find solutions to problems connected to uncertainties of many kinds. However, the presumptions for implementation of relational governance structures are in that respect highly determined by an appropriate use of contracting models promoting cooperation and innovation. Therefore, I have formulated the objectives with my research as follows:

The basic objective of this research is to study the interaction between internal and external project prerequisites (the project context) and the choice of an appropriate contracting model and how the project execution (process design) is affected by said choice. This to improve the knowledge of how construction projects should be contracted in order to improve the fulfilment of set targets especially regarding safety, economy, time and quality.

The research questions are:

- *How is the project context determined by different project related and external factors affecting the choice of contract form, compensation form and governance structure when contracting for a construction project?*
- *How can contracting be used as a target management tool?*
- *How can the application of relational contracting concepts affect the process design in the execution phase?*

1.5 My background

After taking my M.Sc. degree in 1971, I have worked as a contractor for 22 years, as a client's representative for 4 years and with research projects and

product and process development within the construction sector for about 10 years.

During my long experience within the construction sector in different positions, I have acquired a deep practical understanding in different fields of construction management. In my experience, the main problems within the construction process of today are mostly related to the use of classical contracting models. The reason for this is that they are often not well suited for complex and dynamic projects, that according to my experience require models that promote effective cooperation among the stakeholders in a project in order to utilise embedded knowledge and creativity.

1.6 Structure of the thesis

In this first chapter the overall research context, the research questions and objectives and my personal professional background are presented.

In the second chapter, the applied research design and research method will be presented.

In chapter 3, a theoretical background, mainly within the field of relational contracting and process design, to the studies performed is presented.

In chapter 4, a survey of how different project-related factors in the project context affect the choice of contracting models is presented.

In chapter 5, a case study regarding relational contracting is presented.

Chapter 6 provides conclusions of the studies conducted. Theoretical and practical contributions of the research are described. Recommendations are also made for further research.

“Doing the same thing over and over and expecting a different result is insanity”

(Albert Einstein)

2 RESEARCH METHODOLOGY AND RESEARCH DESIGN

2.1 Introduction

In chapter 1 the context, the scope and the objectives for this research project are described. Furthermore has the research questions been formulated in chapter 1 in order to get a base for the design of the research and for the choice of appropriate research methodologies.

Research within construction management has to be regarded as a fairly new discipline and has often been influenced by different scientific paradigms. The choice of research method should according to Yin (1993) be appropriate for the objectives and the type of the knowledge expected. Often is by that distinguished if the research type is descriptive, explanatory or exploratory.

As stated in chapter 1, both the area and the nature of the construction process are complex. Accordingly, research in the field of construction management must be regarded as complex, as a lot of different variables (components) affect the findings.

2.2 Research design

The governance of and the nature of the contracting processes are often complicated by a lot of factors, visible and invisible, which affect the outcome. Accordingly, research within the field of construction is also often complex, as a lot of different variables (components) affect the findings. Thus it is often difficult to find absolute causal clarity and generic dignity among single isolated factors and the outcome of a study.

Also in the studies conducted in this research project it is quite evident that, there are a lot of different factors (components), easily visible as well as invisible, that affect the outcome of the studies, which makes the use of quantitatively oriented research methods less appropriate.

Thus, as a scientific base for the studies in this research I choose the system approach described in the textbook *Methodology for Creating Business Knowledge* by Arbnor and Bjerke (1997). In research conducted according to the system approach the basic assumption is that reality is based upon components, that often have relationships to another, which often results, for example through synergies, in a situation in which reality differs from the sum of its components.

In research where the system view is applied, one often tries to find motive powers affecting the system and to map their significance for the entire system. Knowledge obtained from studies conducted is to be regarded as system dependent and thus often not to be regarded as generic in a quantitative way. Furthermore, when applying the system view, one often looks for indicative connections among components, contrary to the analytic way of finding cause-effect relationships, as reality is assumed not to be accumulative but to consist of a lot of interacting components.

2.3 Applied research methods

In order to study the overall objectives of this research, the following studies have been conducted:

- A literature review within the field of construction management in order to obtain knowledge of ongoing and prior research mainly within the field of procurement and relational contracting. This examination includes mainly textbooks, technical reports, conference proceedings, scientific journals and official reports.
- A survey in the form of an inquiry aimed at finding out how different project related factors (components) in a project context affect the choice of contracting models. The detailed design, accomplishment and findings of this study are described in Chapter 4.
- A case study in order to find an example of how innovations, cooperation and the overall process design can develop in a relational contracting context. This has mainly been conducted as an inquiry

study, as interviews and observations. The detailed design and accomplishment of the case study is described in Chapter 5.

2.4 Validity and reliability

The question of validity for exploratory studies can according to Yin (1994) be subdivided into *construct validity*, *internal validity*, *external validity* and *reliability*. While the construct validity is a measure of how well the study reflects the area of interest in question, the internal validity is often used as a measure of causalities in an explanatory study. The external validity of a study is a measure of how general the results of the study can be regarded to be whereas the reliability of a study is a measure of the reproducibility of the study. The validity and reliability issues of the studies conducted in this research will be discussed in connection to the presentations of findings.

“One thing I have learned in a long life: That all our science, measured against reality, is primitive and childlike – and yet it is the most precious thing we have!”

(Albert Einstein)

3 THEORY

3.1 Introduction

In chapter 1, the context, the scope and the objectives for this research project were described whereas in chapter 2 the choice of research methodology was presented. In this chapter the theoretical framework for the research conducted will be described.

As described in chapter 1, the problems being in the construction sector are especially associated with designing and constructing complex and dynamic projects in which for example the risk of variations and uncertainties is high. Furthermore, a lot of the criticism of the construction industry has also been focused on the inability to get the stakeholders of the project to engage co-operatively in the delivery of the client's objectives on time, cost and quality.

As a response to the prevailing situation new contracting models have been introduced, as well in Sweden as in other countries. Some of the new relational oriented contracting models have been advocated by many actors and claimed to be successful at meeting the new demands on the construction sector. In Sweden, too, there is a noticeable and growing interest in applying new theories and ideas, such as Lean Construction and partnering concepts. Thus it should, for this study, be of interest to find knowledge and also to learn from measures abroad in order to find ways to improve the efficiency in many ways within the Swedish construction sector.

Accordingly, in order to get a theory base for my research regarding contracting behaviour and process design, according to the research questions formulated in section 1.4, I have in this chapter concentrated my theory search mostly on the fields of relational contracting and process design.

3.2 Relational contracting

3.2.1 Contracting – the TCE view

In transaction cost economics (TCE), the issue of effective economic organization and governance is considered to be linked to the question of finding an appropriate system for the governance of transaction costs. By transactions are according to O. Williamson (1991) meant: *A transaction occurs when a good or service is transferred across a technologically separable interface*. Thus are transaction costs to be distinguished from, as well of costs generated of production itself as of internally and externally caused costs required for the delivery of a good or service. Thus, TCE applied as a theory base for contracting issues gives according to Oliver Williamson (1985) prominence to the importance of regarding especially human behaviour, asset specificity, frequency and uncertainty as basic attributes of the contracting process. The TCE approach is accordingly to combine economic and sociological perspectives on industrial organization (*Winch 1989*).

The assumptions about human behaviour are mostly based upon the rationality issue and also upon that of self-interest orientation. Thus, according to Williamson opportunism and bounded rationality are best suited to describe human behaviour attributes in connection with contracting issues. In particular, opportunism, a term expressing a high degree of self-interest orientation is to be considered when organizing transactions. Bounded rationality should be considered in TCE as an acknowledgement of limitations in cognitive competence. Actors are regarded to be *intendedly rational but only limitedly so* (*Williamsson 1985*).

Asset specificity is mainly linked to the attributes of the procured good or service. It is often according to Williamson (1985) useful to distinguish four types of asset specificity, namely site specificity, physical asset specificity, human asset specificity and dedicated assets. The unique value of the actual service or good in question is measured against possible alternative transactions with the same value. The more complex and customized the product or service of the exchange is, the more transaction specific investments are required (*Williamsson 1985*).

Frequency and uncertainty are besides asset specificity, other important factors (dimensions) to be identified and explicated in connection with transactions. Frequency refers to how often a transaction is repeated. Some transactions are one-off exchanges whereas others are more recurrent. Uncertainty is connected to the risk that disturbances caused by as well technical, administrative as well as human issues affect transactions. The fact that human uncertainties are often

linked to bounded rationality and opportunism makes the process of finding a suitable governance structure for managing transactions complicated (Williamsson 1985).

3.2.2 Relational contracting in construction

Application of transaction cost economies (TCE) to contracting is to a high degree a question of finding a suitable and efficient governance structure in an actual project context in order to optimize the transaction costs. According to Williamsson (1985), especially the investment characteristics, asset specificity, and the frequency of transactions should affect the choice of governance structure.

In his article *The construction firm and the construction project: a transaction cost approach* G. Winch (1989) maintains that in construction projects are the project context often to be regarded as very complex and uncertain. Accordingly, due to the complexity and uncertainty factors, the risk of high transaction costs due to opportunism and bounded rationality factor has to be attended. Furthermore is often the frequency factor of the type *one-off exchanges* which increases the risk of high transaction costs (Winch 1989).

For complex projects, relational contracting with *bilateral* or *unified* governance is to Williamsson (1985) most appropriate. In the first mentioned case the autonomy of the partners is maintained, whereas in the unified structure the transaction is organized under the same authority (vertical integration). Only simple projects are suited for a classical governance structure and thus also suited for reliance on the market and for classical contracting with adherence to legal frameworks and remedies.

According to Barbara Colledge (2004), the general value of relational contracting is mainly in terms of the commercial relationships that are formed. These connections not only foster mutual trust, but also facilitate the sharing of knowledge and information to generate innovation and value for the partners to the relationship. This approach is generally more people oriented, as it is the application of tacit knowledge by those involved that will result in a competitive advantage. Through these mechanisms, time, cost and quality risks are managed collectively and emphasis is placed on the achievement of wider, shared values or purposes such as a successful outcome for the client. According to Barlow & Jashapara (1998) the sharing of knowledge for commercial advantage is also often apparent in these contracting models.

A definition of relational contracting within construction is made by Barbara Colledge (2004) as follows:

Relational Contracting is a transaction or contracting mechanism that seeks to give explicit recognition to the commercial “relationship” between the partners to the contract. In essence, responsibilities and benefits of the contract are apportioned fairly and transparently, with mechanisms for delivery that focus on trust and partnership. At a project level in construction, this can improve working relationships between all project stakeholders, can facilitate efficient and effective construction, can enhance financial returns and can minimise the incidence and make easier the resolution of conflicts.

The implemented relational contracting models vary according to Goldberg (1976) with the nature of the exchange and the relationships between the partners. For example, whereas a micro-economic approach focuses on the individual exchange or discrete transaction, theoretically without the prior existence of duties, the relational contracting approach often also gives recognition to the wider framework of rights and duties created by law as well as social values. According to Antony Bryant and Barbara Colledge (2002) the main purpose of a relational oriented cooperation in a project is primarily to facilitate transactions between organisations and stakeholders in order to provide a framework for the conduct of the exchange.

That relational contracting may well be a useful route towards reduced transaction costs and also fostering co-operative relationships and better teamwork is argued for by Rahman & Kumaraswamy (2002) in their article *Joint risk management through transactionally efficient relational contracting*. Especially in projects that are complex and uncertain, the attitudes of the contracting partners and the co-operative relationships among the project participants are important for a successful project delivery.

According to Campbell (2004) relational contracts are better suited to accept change and to focus on cooperation to administer change and problem solving over time. For example in the case of disputes, whilst traditional contracts often rely on costly, time consuming procedures involving third parties to provide judgment, relational contracts focus on team problem solving and self-enforcing processes in order to make timely decisions. The overall project performance can also be affected in traditional contracts in a negative manner due to the lack of cooperation and coordination as partners tend to focus on sub optimization.

According to Antony Bryant and Barbara Colledge (2002) the spectrum of commercial relationship can be divided into three broad categories of governance structures, derived from Williamson (1981), namely *classical*, *neo-classical* and *relational* which align with the general economic concepts of markets, networks and hierarchies. Table 3.1 illustrates a range of economic models and governance structures for commercial transactions that form the basis of contracting models applied in the construction industry in many countries. From a trust perspective, the models in Table 3.1 predicated an increase of the level of trust between contracting partners as a function of the governance structure and the nature of the relationship.

Table 3.1: Economic models and governance structures (Colledge, 1992)

ECONOMIC MODEL	GOVERNANCE STRUCTURE	
Markets	Classical Contracting	<ul style="list-style-type: none"> • Reliance on the market; discrete transaction • Adherence to legal frameworks • Use of legal remedies • Standardised contract planning
Networks	Neo-Classical Contracting	<ul style="list-style-type: none"> • Longer-term relationship assume more importance • Development of relational tendencies • Contract provisions cater for flexibility
Hierarchies	Relational Contracting	<ul style="list-style-type: none"> • The relationship assumes equal or greater importance than legal framework • Significant sharing of benefits and burdens • Greater interdependence • Bilateral governance (e.g. Strategic Alliance, Partnering) • Unified governance (e.g. Joint Ventures, Mergers)

As transactional contracts often try to specify every possible contingency and assign liability if variations occur, they are according to Ian Macneil (1978) quite unsuitable in complex and uncertain conditions. In contrast to transactional oriented contracts, relational contracts are focused on teamwork and collaboration which leads to optimizing the project as a whole. Macneil (1978) also addresses this critical topic when stating that in relational contracts, *there can be present a 'sense of productive increase from the relationship which can dwarf variations in shares received by partners.*

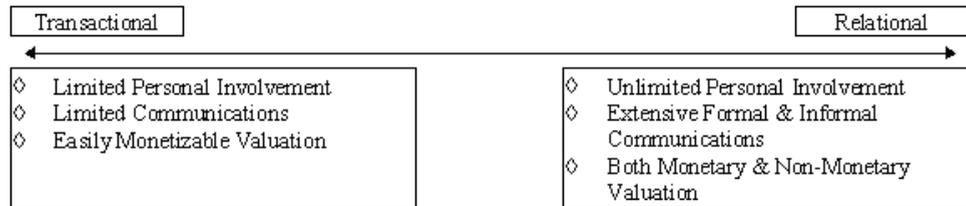
According to Bryant & Colledge (2002), the governance structure and the nature of the relationship should be changed as the nature of the service or product becomes more specialized, as is often the reality in construction projects. The reason is that a greater level of trust is required to sustain the relationship. Processes that foster team-working, sharing of information and long-term relationships are essential prerequisites for the development of trust in business relations. Other important elements to consider in such relations are transparency and equal treatment. Early involvement of the partners is often beneficial for the process, such as cooperation in the design phase of construction projects. In the construction industry the partnering concept is an example of attempts to create such a structure for governance.

Ian Macneil (1978) one of the leading proponents of relational contracting, describes a spectrum of contracts that run from discrete, transactional contracts at one end to relational contracts at the other. In Table 3.2, Miles and Ballard (2002) have illustrated how they consider the differences regarding relation types, duration, planning and participants in transactional (classical contract types) as well as in relational oriented contracts. Accordingly, transactional contracts often have certain characteristics, such as short duration, limited personal interaction, precise party measurement of easily measured objects of exchange and minimal future cooperation.

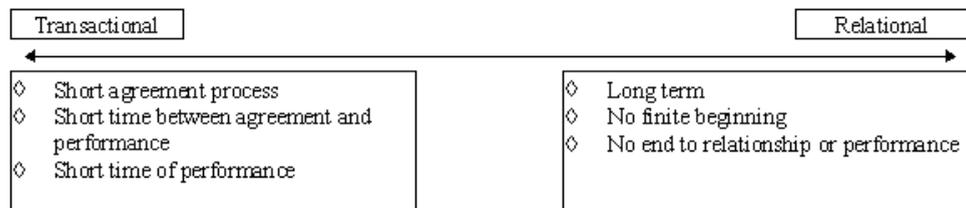
Furthermore, according to Ian Macneil (1998) the general value as we move along this spectrum towards relational contracting models is the increasing level of trust that becomes an essential component in sustaining and maintaining the relationship. Whilst most transactions are partially relational, in that they involve deeply embedded interconnected relations, the influential elements of relational contracting, which assume greater significance, are co-operation and dependency.

Table 3.2: Characteristics for different types of contracts (Miles & Ballard, 2002).

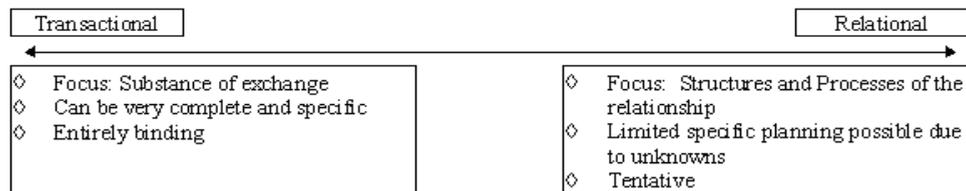
Relation type



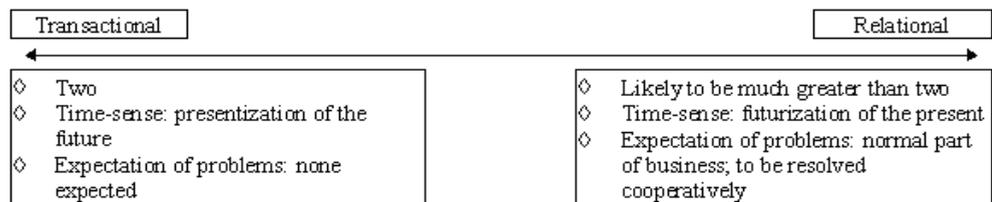
Duration



Planning



Participants



Most construction projects of today, according to Bryant & Colledge (2002), are highly specialised, complex, with broad categories of stakeholders, with lead-time depressed durations for commencement, design and completion.

Therefore is it not surprising that many construction projects contain some forms of relational contracting approaches and that the use of relational contracting in the construction industry has grown worldwide. The authors present in a model shown in Table 3.3, how different project types in the context of the frequency of exchanges would affect the choice of appropriate governance structure when contracting. In the model a division into three project types is proposed:

- *non-specific* – a standard product or service
- *mixed* – a non-standard product or service but not highly specialized
- *idiosyncratic* – a highly specialized product or service

Table 3.3: Interaction investment features- frequency – appropriate governance structure (Bryant & Colledge, 2002)

Investment Type	Frequency	
	Occasional	Recurrent
Non-specific	<ul style="list-style-type: none"> • market governance (classical contracting) • less reliance on previous experience • reputation governed by market 	<ul style="list-style-type: none"> • market governance (classical contracting) • greater reliance on past experience and relationship that has developed • reputation through direct experience
	<ul style="list-style-type: none"> • market alternatives protect each party against opportunism by an opposite • concentrated efforts to sustain the relation are not made because the relation is not independently valued 	
Mixed	<ul style="list-style-type: none"> • stronger incentive to see contract through to completion: not so easy to obtain a replacement • cost of transaction-specific governance structure is prohibitive but market governance provides no incentive to sustain relationship • mechanisms to resolve future disputes are introduced e.g. third party assistance • trilateral governance (neo-classical contracting) 	<ul style="list-style-type: none"> • greater incentive to sustain the relationship • primary reliance on market is unreliable • the cost of a specialized governance structure can be recovered • bilateral structure where autonomy of the parties is maintained (relational contracting)
Idiosyncratic	<ul style="list-style-type: none"> • as mixed occasional • there is a transition to a unified structure as the transaction becomes more idiosyncratic 	<ul style="list-style-type: none"> • as mixed recurrent but bilateral structure is replaced with unified structure (relational contracting)

3.2.3 Partnering as a relational contracting concept

According to Gransberg et al. (1999) structured partnering was introduced by the U.S. Army Corps of Engineering in the 1980s. This was primarily to avoid litigation in connection with the execution of complex projects. In some countries in Europe the use of partnering concepts has been advocated by government agencies as a way of improving the construction process. Especially in UK the Latham report (1994) and the Egan report (1998) have

had a great impact on the introduction of partnering as a concept for relational contracting. According to Saad, et al. (2002) partnering concepts are applied in more than half of the projects in UK (*see Figure 3.1*). In Sweden we have later on had similar government investigations as those in UK, for example SOU 2004:44 and SOU 2002:115, endorsing the need of changes towards more cooperatively oriented contracting models.

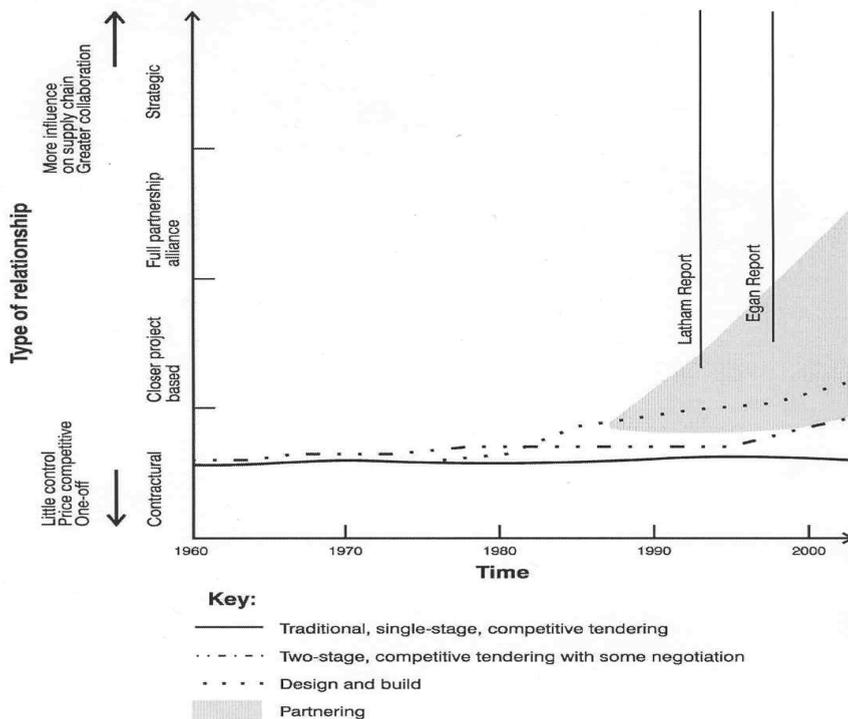


Fig. 1. Type of relationships in the construction industry.

Figure 3.1: Type of relationships in the construction industry in UK (Saad, et al. 2002)

For example in UK, according to Bennet & Jayes (1998), the use of partnering concepts has resulted in a lot of improvements of the overall construction process through changes regarding governance of and cooperation in projects. According to Barlow et al. (1997) and Egan (1998) partnering aims above all at increasing cooperation and integration among the involved actors through trust, commitment and fewer disputes. Furthermore the use of partnering concepts can also improve quality, safety performance, sustainability, human resource management, implementation of innovations and the achievement of time and cost reductions.

Bennet & Jayes (1998) describe in the book *Seven Pillars of Partnering* how the use of partnering concepts has developed in UK. Whilst in the first generation partnering, the process design was aimed mostly at finding mutual objectives for the partners, transparent decision making and providing continuous improvements, the second generation of partnering considers more the strategic components in partnering. The authors define the second generation of partnering as follows: *Partnering is a set of strategic actions which embody the mutual objectives of a number of firms achieved by cooperative decision making aimed at using feedback to continuously improve their joint performance* (Bennet, Jayes 1995, 1998).

According to Bennet & Jayes (1998) this second generation partnering normally starts with a strategic decision by the client to cooperate with a group of consultants, contractors and specialists in project execution. In this context it is important to consider the different components (pillars) of the partnering structure. Figure 3.2 shows the main components (*the seven pillars*) to be considered by the partners in order to establish a structure of the project processes.

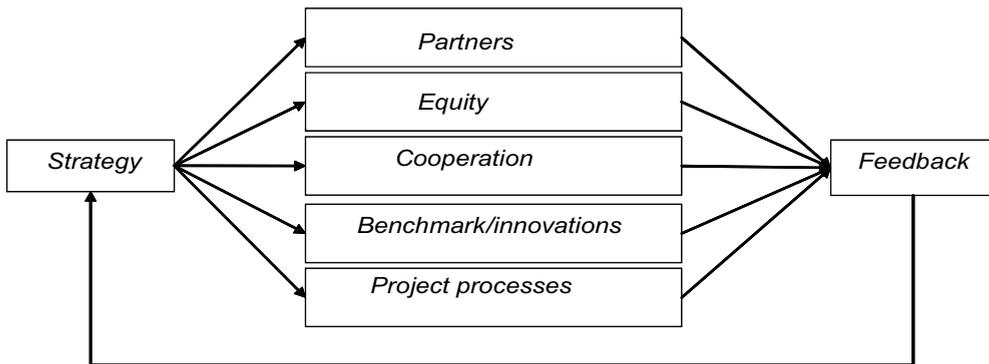


Figure 3.2: *Seven pillars of partnering* (Bennet, Jayes 1998)

The definitions of the main components in partnering are according to the report *Seven Pillars of Partnering* (1998) the following:

- *Strategy* - developing the main objectives of the project and also a strategy for how the stakeholders can meet the objectives on the basis of knowledge and feedback. A strategy should regard the most important targets in the project, develop and formulate tactics and procedures supporting the achievements of targets and give guidelines for design of the main processes of the project.

- *Membership - identifying the strategic stakeholders (partners) who need to be involved to ensure availability and development of all necessary skills.* Thus the membership pillar deals with the organisation of the partnering group. Members (partners) of a relational oriented group should be interested in acting with transparency and in long-term strategic thinking and be focused on the achievement of customer value. It is often of high value to get influence from different competencies on the group of partners and this also serves to enrich the flow of information through effective communication.
- *Equity – ensuring of fair rewarding of the stakeholders.* The equity pillar deals with how monetary incentives, investments and resources are allocated in the partnering project in order to enhance long term oriented cooperation in the project. Thus it deals with investments in as well the development of human and as well as technical resources. In that sense the transparency and justice aspects are important to consider. It is also often essential to realise the importance of profitability for the partners, as a sound economy is a good base for long term investments. Economic incentives should promote efforts above normal and also be regarded fair.
- *Integration – improvement of the way stakeholders involved work together through cooperative measures and trust building.* An effective partnering process is based on good cooperation among the stakeholders in a project. A basic element of that is the existence of trust and the development of trust in an organic way at every organisational level. It is a great advantage if the organisation of a project is regarded as homogeneous and integrated even if in practise it consists of resources from different cultures and competencies (a virtual organisation). A good base for achieving this is teambuilding activities and other activities promoting trust. Other things promoting integration are such as common IT- strategies and a high level of competence in the organisation.
- *Benchmarks – setting measured targets that lead to continuous improvements in performance from project to project.* The main intention by the benchmarks/innovations pillar is to achieve continuous improvements through the search for new knowledge promoting innovations. For the organisation in question, innovations primarily mean new knowledge of technical and management solutions aimed at improving the efficiency of the project. Innovations can be initiated through knowledge from other projects within construction or other branches (benchmark) or through implementation of knowledge obtained from research projects. An important factor regarding innovations is to establish

incentives to encourage stakeholders to participate in an innovation process. In many ways it is a question of establishing an innovative climate in the actual organisation in question.

- *Project processes - establishing standards and procedures that embody best practice based on process engineering.* The process design pillar deals with how different processes and structures ought to be designed in order to achieve the fulfilment of set targets and other customer values in a project. Higher demands on shorter lead times, quality and economy often require other models for arranging the design and production phases in projects. An important component of this is to achieve multi-dimensional cooperation in the project among the client, the consultants and the contractors in order to take care of all competences in favour of the project.
- *Feedback – to learn lessons from project and task forces to guide the development of a strategy.* A system for follow-up and feedback is essential in order to evaluate results and to learn from this for the future. A proportion of that is also essential for a fair handling of established incentives in the project. Furthermore is it important to evaluate the effects of implemented innovations.

According to Bennet & Jayes (1998) the components of the second generation partnering structure *form a controlled system to deal with the rapidly changing markets and technologies that shape today's construction sector.* The authors present some spectacular efficiency improvements achieved in UK by implementation of partnering concepts. The book also contains a vision about a third generation partnering concept in which the contractors, consultants and manufactures together in partnering networks will take the full responsibility for delivering products and services to their customers.

In the article *Development of a conceptual model of construction partnering*, Cheng & Li (2001) present as well a conceptual model of object partnering as of strategic partnering. They have identified critical success factors of the two types of partnering. The results indicate that there are some common critical factors as top management support, mutual trust, open communication, and effective co-ordination affecting both types of partnering. Additional success factors for strategic partnering are long-term commitment, continuous improvement, learning climate and partnering experience.

Johan Nyström (2005) presents how different authors have conceptualized the most important components of partnering (*see Table 3.4*). According to his investigation, the *trust* and the *mutual understanding* components were pointed

out to be the most important. Secondly, the *predetermined dispute resolution method* was also regarded to be an important component.

Table 3.4: *Components of partnering (Nyström 2005)*

Papers/ Components	Trust	Mutual understanding	Economic incentive contracts	Relationship building activities	Continuous and structured meetings	Facilitator	Choosing working partners	Predeterm. dispute resolution method	Open- ness
Barlow 2000	X	X	X			X			
Cheng <i>et al.</i> 2000	X	X			X	X		X	
Crane <i>et al.</i> 1999	X	X					X		
Kadefors 2002	X	X	X	X	X	X	X	X	X
Kemi 2001	X	X	X	X		X			
Koraltan and Dikbas 2002	X	X			X			X	
Kwan and Ofori 2001	X	X							
Larson 1995	X	X		X	X			X	X
Naoum 2003	X	X	X					X	
Ng <i>et al.</i> 2002	X	X				X		X	X
Packham <i>et al.</i> 2003	X	X	X	X	X				
Rhodin 2002	X	X		X	X	X		X	
Thompson and Sanders 1998	X	X	X	X				X	X
	13	13	6	6	6	6	2	8	4

According to Barbara Colledge (2004) the shift towards more relational contracting relationships has been evident due to the increase of project partnering agreements together with the development of relational oriented process tools such as project team goals, meetings and reviews. Whilst the value for the project lies in the achievement of time, cost or quality objectives the wider benefit is in the process of delivery creating a team or community of stakeholders committed to resolving construction challenges that emerge.

However, the issue of what benefits an application of partnering brings to the construction sector is debated in some scientific reports. For example in his dissertation, *Partnering: definition, theory and evaluation (2007)*, Johan Nyström holds up that he has not been able to verify any benefits. He puts it in the following way: ... *no general trend concerning the outcome in terms of cost, quality, contract flexibility, avoidance of disputes or construction time can be seen!* In his study there were ten projects partnering projects compared with other ten non-partnering projects for the purpose of finding unique effects of partnering.

The value of traditional forms of partnering has also been questioned by Miles and Ballard (2002) in their article *Contracting for Lean performance: contracts and the Lean construction team*. In this article the authors argue against the established partnering concept as they regard it to be only a temporary solution to overlay the problems with existing contract forms. The authors main critics against the partnering concept is that it is mostly only an *add to and overlay to existing contract forms with a relation building exercise!* This as partnering is almost always excluded from the formal contract and is executed by a separate *mutual understanding* document which according to the authors can result in a *situation which is inherently ambiguous at best and schizophrenic at worst*.

3.3 Application of lean thinking in contracting

3.3.1 Definition of Lean thinking

By Lean thinking is here meant a set of ideas, principles and methods for an efficient governance of processes in product development and production. The main “theory” base of Lean thinking is derived on findings from a world-wide benchmarking study, the International Motor Vehicle Program (IMVP), of the car making industries. The findings from this research program were presented by Womack & Jones & Roos in their book *The Machine that changed the World (1990)*. Lean thinking as a conception was later on presented by Womack & Jones (1996) in the book *Lean Thinking*.

According to Womack & Jones (1996) the basic Lean thinking principles are defined as follows (see Figure 3.3):

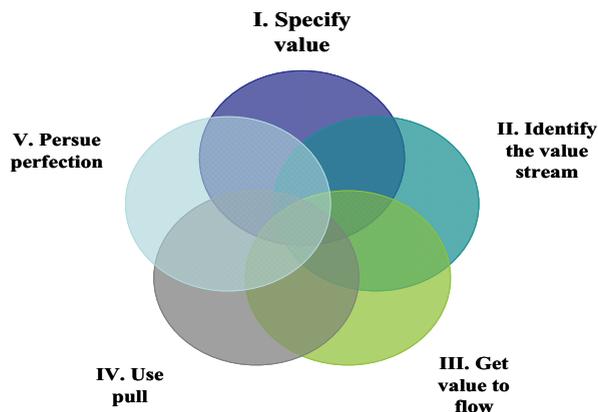


Figure 3.3: Lean Thinking principles

1. *Specify value*- Definition and specification of value is the critical starting point. Value can only be defined by the ultimate customer and has to be expressed in terms of a specific product or service, which also has also to meet set targets concerning for example time, price and quality. Value has to be created by the producer.
2. *Identify the value stream* - The value stream (value chain) is the set of all specific actions needed to deliver a product or service. The value stream can often be subdivided into the problem – solving (design) task, the information management task (planning) and the physical transformation task (manufacturing).
3. *Flow* – After the value chain has been mapped and optimized to avoid waste (muda) of different kinds the next step in the delivery of value is to get in place an efficient delivery method of the product or service. The production theory most applicable for this is according to Lauri Koskela (2000) an appropriate combination of transformation, flow and value theories (the TFV concept). The flow theory is useful for understanding the necessity of considering the links and interaction among different sub value chains in order to minimise different kinds of waste.
4. *Pull* - The pull principle in lean thinking has been created to avoid waste in the delivery chain due to overproduction, products in storage and failures in production due to for example lack of information. The principle is that no activity should be started before it is ascertained that all the prerequisites for the release of the activity are fulfilled (approved design, material, personel resources, a.s.o.).
5. *Perfection* - a very important principle when delivering products and services creating value for the customer is that of perfection. This concept means that all set targets for example regarding quality, economy and time are fulfilled in a manner satisfactory to the customer.

3.3.2 The background to Lean thinking

The historical development of process models in the automobile industry and especially of models later on named as Lean Thinking, Lean Production or Toyota process models (TPS) is described in books such as *The Machine that changed the World (1990)*, *Lean Thinking (1996)* and *The Toyota Way (2004)*. In my view, the reasons for changing procurement and process models in the

automobile industry have an evident analogy to the situation within the construction sector.

In the automobile industry, the traditional model for procurement before the application of new theories such as TPS (Toyota Production System), was very similar to procurement models still often used within the construction sector. According to these models, most of the design (specification) of components, products and systems were made without cooperation with suppliers before the procurement of manufacturing capacity. The procurement procedure was then very classical contracting oriented and often linked to finding the lowest possible price. This can be compared to the traditional procurement process of setting fixed prices in construction of projects to fixed price by using contract forms such as DBB (Design, Bid and Build). (*Womack, et.al., 1990*)

This manner of procurement often resulted in shortcomings in the fulfilling of set targets in the automobile industry. Often this also resulted in missed deliveries and economic problems as clients were forced to renegotiate with suppliers in order to secure deliveries of goods. The motives for this were often also linked to variations, for example due to required changes of specification. The problems were also influenced by the lack of long term agreements between the client and the supplier. There was also often a lack of incentives for the suppliers to invest in product and process development. The production process for components was also often designed according to the ideas of mass production, which often resulted in big volumes in storage in order to get buffers for securing deliveries. (*ibid.*)

In connection to the development of Lean production concepts, the cooperation and the procurement models were changed in a fundamental way in order to avoid problems in the client – supplier relation. Accordingly, cooperative models promoting effective cooperation were developed, in accordance with neo-classical and relational contracting concepts (*see Table 3.1*). This was especially evident in the product development (design) phase in order to take care of the knowledge and the demands of all partners involved. Table 3.5 shows the effects of this strategy in Japan, where it has been used to incorporate the suppliers in the product development phase. While the total engineering hours for developing a new car model were 1.7 million hours on average and the suppliers' share was 51 % in Japan the American carmakers used 3.1 million hours and the suppliers' share was only 14 %. The development time was also considerably shorter in Japan (13.8 months) than in USA (25.0 months). (*ibid.*)

Table 3.5: Comparison of product development performance in automobile industry (Womack, et.al., 1990)

Product Development Performance by Regional Auto Industries, Mid-1980s				
	<i>Japanese Producers</i>	<i>American Producers</i>	<i>European Volume Producers</i>	<i>European Specialist Producers</i>
Average Engineering Hours per New Car (millions)	1.7	3.1	2.9	3.1
Average Development Time per New Car (in months)	46.2	60.4	57.3	59.9
Number of Employees in Project Team	485	903	904	
Number of Body Types per New Car	2.3	1.7	2.7	1.3
Average Ratio of Shared Parts	18%	38%	28%	30%
Supplier Share of Engineering	51%	14%	37%	32%
Engineering Change Costs as Share of Total Die Cost	10–20%	30–50%	10–30%	
Ratio of Delayed Products	1 in 6	1 in 2	1 in 3	
Die Development Time (months)	13.8	25.0	28.0	
Prototype Lead Time (months)	6.2	12.4	10.9	
Time from Production Start to First Sale (months)	1	4	2	
Return to Normal Productivity After New Model (months)	4	5	12	
Return to Normal Quality After New Model (months)	1.4	11	12	

3.3.3 Lean construction – lean thinking in construction

By the term Lean construction is in this thesis primarily meant process design models in construction emanating from benchmark with branches linked to the development and application of lean thinking concepts such as the Toyota Production System (TPS).

The LCI – the Lean Construction Institute (USA), has defined Lean construction by following wording:

Lean Construction is a production management-based approach to project delivery - a new way to design and build capital facilities. Lean production management has caused a revolution in manufacturing, design, supply and assembly. Applied to construction, Lean changes the way work is done through techniques and applies them in a new project delivery process. As a result: The

facility and its delivery process are designed together to better reveal and support customer purposes. Positive iteration within the process is supported and negative iteration reduced.

Work is structured throughout the process to maximize value and to reduce waste at the project delivery level.

Efforts to manage and improve performance are aimed at improving total project performance because it is more important than reducing the cost or increasing the speed of any activity.

Control is redefined from “monitoring results” to “making things happen.” The performances of the planning and control systems are measured and improved.

The reliable release of work between specialists in design, supply and assembly assures value is delivered to the customer and waste is reduced. Lean Construction is particularly useful on complex, uncertain and quick projects. It challenges the belief that there must always be a trade between time, cost, and quality.

Among adherents of the establishment of Lean thinking ideas in the construction sector (Lean construction) it is also often stressed that the increase of quick, uncertain and complex projects requires changes in how projects are contracted and managed. In the article *Contracting for Lean performance: contracts and the Lean construction team*, Miles and Ballard (1997) discuss the need for developed contracting models facilitating and supporting the need for achieving a more behaviour oriented (relational contracting) construction process. In that article the authors also argue for a more developed contracting model which has to be more holistic and addresses efficiency and value issues in an appropriate and sustainable way. Furthermore Glenn Ballard (2008) in an article *The Lean Project Delivery System: An Update* maintain that the implementation of the Lean Project Delivery System (LPS) (*Figure 3.4*) in contracting requires a cultural change as new forms of contract and unaccustomed roles and responsibilities require new ways of behaving and thinking.

Lean Project Delivery System

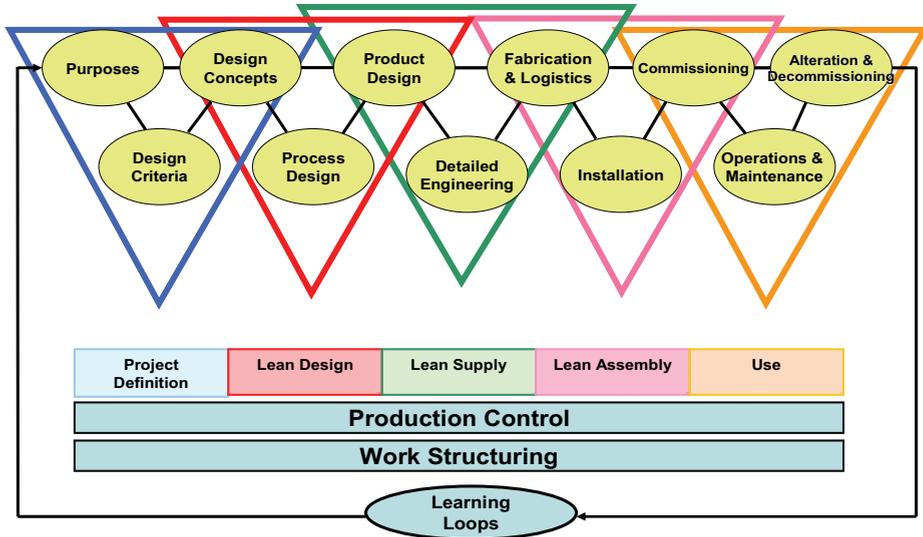


Figure 3.4: Lean Project Delivery System (Ballard, 2006 and 2008)

3.4 The IPD concept as a model of lean contracting

Leading advocates at LCI (Lean Construction Institute) - USA have been involved in the development of a new concept IPD (Integrated Project Delivery) in connection with huge hospital projects in California, USA. In those projects Lean construction concepts, such as the Last planner concept, are applied (Ballard 2008; Matthews & Howell 2006).

According to William A. Lichtig (2007), in his paper *Ten key decisions to a successful construction project*, the IPD concept is based on Lean Project Delivery System (see figure 2.3), a prescriptive model for managing construction projects emanating from the Toyota production System, and also on formation of strategic suppliers in an integrated project delivery team. Thus ideas of the Lean enterprise, according to definitions set out in the book *Lean Thinking* (1996), are in the IPD concept been implemented as a bilateral governance structure, see Table 3.1, for integration of firms and stakeholders. The organisation of this enterprise is structured as is common for companies in general with a core group (*the board of directors*) consisting of directors representing the client, the main contractor and consultants.

The main principles for the governance of the IPD lean enterprise are shown in the model in Figure 3.5. *William A. Lichtig (2007)* calls them as *The Five Big Ideas* for efficient project management.

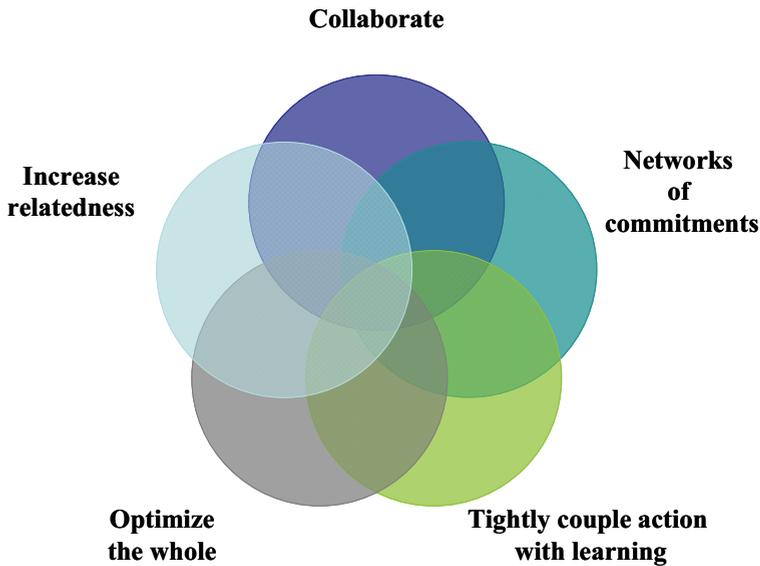


Figure 3.5: The IPD concept – The five big ideas (Lichtig, 2007)

According to the framework illustrated by Figure 3.5, the components are described as follows:

1. *Collaborate* – really collaborate throughout design, planning and execution. Through collaborative design, planning and execution activities the stakeholders get an opportunity to implement their knowledge for the benefit of the project. Methods connected to this are for example concurrent engineering, set based design and the Last planner concept for cooperative planning for improved coordination and governance. The Last Planner concept is developed as a planning method for efficient coordination and use of resources especially in connection to complex and dynamic projects (*Ballard 2000*).

2. *Increase relatedness among all project participants.* Participants need to develop relationships founded on trust, if they are, for example, to share their mistakes as learning opportunities for their project and for coming projects.
3. *Projects are networks of commitments.* The Last Planner is according to Glenn Ballard (2000) a concept for coordination and cooperation is a useful tool for establishment and follow-up of commitments.
4. *Optimize the project not the pieces.* According to the Lean Thinking principles (see Figure 3.3) this component can be compared with that of flow.
5. *Tightly couple action with learning.* Continuous improvement of project economy, lead - time and overall project values is often based upon a culture in which project stakeholders learn in action. A separation of planning, execution and governance activities contributes to poor project performance as the learning process is obstructed in many ways.

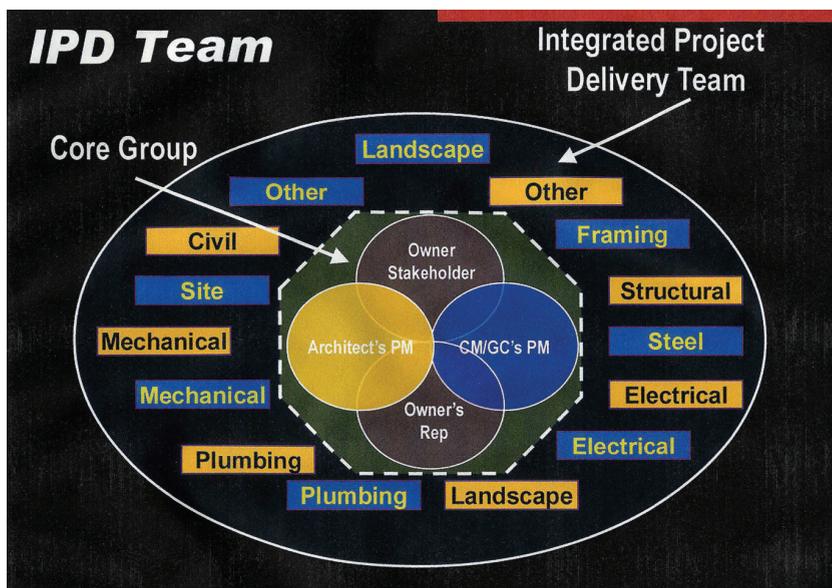


Figure 3.6: Typical IPD organisation structure (Lichtig, 2007)

The implementation of the IPD concept has according to William Lichtig (2007) and Glenn Ballard (2008) been very successful and beneficial for the outcome of the projects where the IPD concept has been implemented. Glenn Ballard (2008) exemplifies the benefits in the following way:

Let's look at one project, Shawano Clinic, to see the impact of lean project delivery. On this project, the target cost was embedded in the client's allowable cost. Figure 8 (here Figure 3.7) shows the project cost budget and how the expected cost changed over time in relation to the target cost. Ultimately the target cost was achieved, along with a return to the client of unused contingency and funding of client changes without additions to the budget. Expressed in percentage terms, the target cost (construction budget) was set 3.6% below the current best practice benchmark; the actual cost was 14.6% below target, and 17.6% below the benchmark. Most of the released funds were used to provide value-adding scope, especially for imaging capability, with the remainder returned to the client. In addition, the project was completed 3.5 months ahead of schedule, generating 70 additional days of clinic revenue for the owner, amounting to nearly \$1 million.

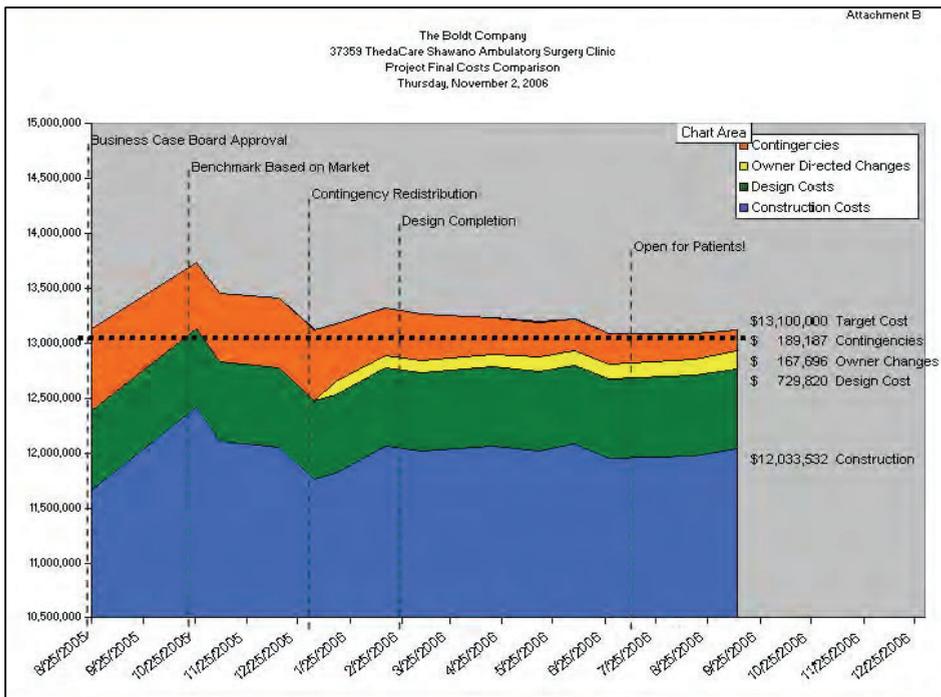


Figure 3.7: The Shawano Clinic project, project final cost schedule (Ballard 2008).

3.5 Prevailing contracting models in Sweden

3.5.1 Contract forms

In Sweden there are three generic contract forms dependant upon how the responsibility for the design and coordination is distributed between the client and the contractors. The basic models are DBB (Design – Bid – Build), DB (Design – Build) and CM (Construction management). The responsibility for coordination is normally distributed to the main contractor in DB and DBB forms whereas in CM forms the client normally has to coordinate by himself the different stakeholders of the project. These generic contract forms are subdivided into six performance models. The various Swedish performance models and the characteristics of the different models are presented in Table 3.6, (*Råsled 1990*).

The DBB contract forms have traditionally been the most frequently at the Swedish construction market, especially among clients within the public sector. In this contract form the client takes the responsibility for the design and specification of the project before the procurement procedure.

In DB contract models the contractors usually has most of the responsibility for the product design while following some performance based demands set out by the client. The traditional type of DB contract form in Sweden is *totalentreprenad* (*TE* in Table 3.6) and this has for decades been favoured by some clients for certain types of projects where the clients have tried to specify their performance - based demands through functional requirements, literally or by means of technical specifications and drawings. *FE* (*funktionsentreprenad*) is a newer type of DB contract form where the techniques for performance based demands are more systematically handled and supported by knowledge obtained from research projects (*Lagerqvist 1996*).

Table 3.6: Swedish contract forms, after Råsled (1990).

Contract/contract forms Abbreviation (The Swedish term)	Contract forms			Main characteristics
	DBB	DB	CM	
FE (Funktionsentreprenad)		X		Systematically performance based. The contractor responsible of the design and coordination.
TE (Totalentreprenad)		X		Traditional design & build form. The contractor responsible for most of the design and for coordination.
GE (Generalentreprenad)	X			The prime contractor selected by the client procures and coordinates the subcontractors. The client responsible for the design
SGE (Samordnad generalentreprenad)	X			Client procures special contractors and selects one of them to be a coordinated prime contractor responsible for coordination. Client responsible for the design
DE (Delad entreprenad)			X	No prime contractor, special contractors will be coordinated by the client itself. Client responsible for the design and specification.
MDE or CM (Mycket delad entreprenad, Construction management)			X	No prime contractor, subcontractors are coordinated by the client. Client responsible of design

3.5.2 Compensation forms

The by far greatest proportions of the construction contracts in Sweden have a fixed price basis for compensation. This is in my view one of the biggest sources for litigation when handling quick, dynamic and complex projects where the initial project program, which the selection of the contractor is based on, often has to be revised due to dynamically occurring changes.

Cost reimbursable forms (transparent) for compensation either have some incentives or have none. The form of compensation without incentives is mostly used in smaller projects within refurbishment and maintenance where the scope of work is seldom well defined. For bigger projects the incentive based cost reimbursable form predominates. In those the incentive is often based upon sharing of savings and overflows in comparison with a set target price.

3.5.3 Governance structures

The governance structure applied in a construction project determines basically the features of cooperation and coordination as described in Table 3.1. The main governance structures are classical contracting, neo-classical contracting and relational contracting.

Explicit relational contracting concepts for cooperation according to models set up mainly in UK, such as partnering, have been fragmentarily practised in Sweden up to now. The reason for this can be discussed and argued about, but my belief is that the existing cultural and conservative attitudes among the clients are an important barrier. However a neo-classical model (*Table 3.1*), based upon mutual strategic considerations, of formalised partnering has been used by project execution for decades in Sweden. In those, the partners can make a lot of deals in order to improve the working climate and trust in order to find prerequisites for long term business cooperation. This facilitates problem solving when the involved partners have a longer time horizon for balancing losses and gains.

3.6 Conclusions

The relational contracting path within construction has mainly been developed in order to improve governance of construction projects in contexts with complexities and uncertainties of different kinds, due to circumstances as fore example time restrictions, market situation and uncertainties in specifications. By application of relational contracting concepts the belief is that trust based

cooperation in projects diminishes i.e. the transaction cost and the risk of inefficiencies due to opportunistic behaviour, conflicts and variations (Kadefors 2004; Winch 1989).

Partnering is by far the most well-known relational contracting oriented concept. However is there to be found divergent opinions about what the most important components of partnering are and also regarding the real benefits of the concept (Nyström 2005). Critics of partnering as Miles and Ballard (1997) argues for a more developed relational contracting model which has to be more holistic and address efficiency and value issues in an appropriate and sustainable way. Accordingly have the process design issues to be regarded in order to promote i.e. application of innovations, supply chain management (SCM) and efficient coordination of resources.

According to my experience, the relational contracting patch has in fact been favoured by contractors for decades, often without any theoretical background like the one presented in this chapter. On the other hand, most client representatives have been and are still very reluctant towards and suspicious about the adoption of these concepts.

The IPD concept presented is in my view a very interesting concept for governance of complex and dynamic projects. This concept is derived by adherents of implementation of lean thinking ideas into construction and is applied in dynamic and complex construction projects in USA. I regard the IPD concept as an interesting model of relational based contracting. Accordingly, as the concept demonstrates a successful and simultaneous implementation of theories about relational contracting and lean process solutions it is justifiable to name the IPD concept to be a *lean contracting concept*.

4 SURVEY REGARDING PROCUREMENT BEHAVIOUR

4.1 Introduction

In this chapter a survey is presented of procurement of projects within the construction sector. The study was conducted in the form of an inquiry among professional actors within the construction sector.

As described in previous chapters' procurement issues in connection to construction projects are a very important to consider in order to get an appropriate basis for governance of the construction process. This is especially important in connection with projects with uncertainties involved, due to technical complexity, time restrictions and other challenging conditions.

As an overall context to the survey, the research objectives of the survey and my considerations when designing the inquiry and how it was implemented are presented. Further more, the results from the study are analyzed and discussed in order to answer the research questions.

4.2 Research objectives of the survey

The main purpose of this survey was to study how different internal and external project prerequisites (*the project context*) affect the procurement process and the choice of contracting models. The objective was to find answers to the following research questions (see section 1.4):

- *How is the project context determined by different project related and external factors affecting the choice of contract form, compensation form and governance structure when contracting for a construction project?*
- *How can contracting be used as a target management tool?*

4.3 Design of the survey - considerations

During the planning and design of the inquiry, used in the survey conducted, some main assumptions were taken into consideration in order to consider the validity and reliability aspects of the study. This survey was according to the prerequisites made in chapter 2 to be conducted as a system view based research. This as the context of the study has to be regarded as complex and thus is the findings to be based upon the actual conglomeration of components in the project context. Accordingly, the findings are not to be regarded to be generic.

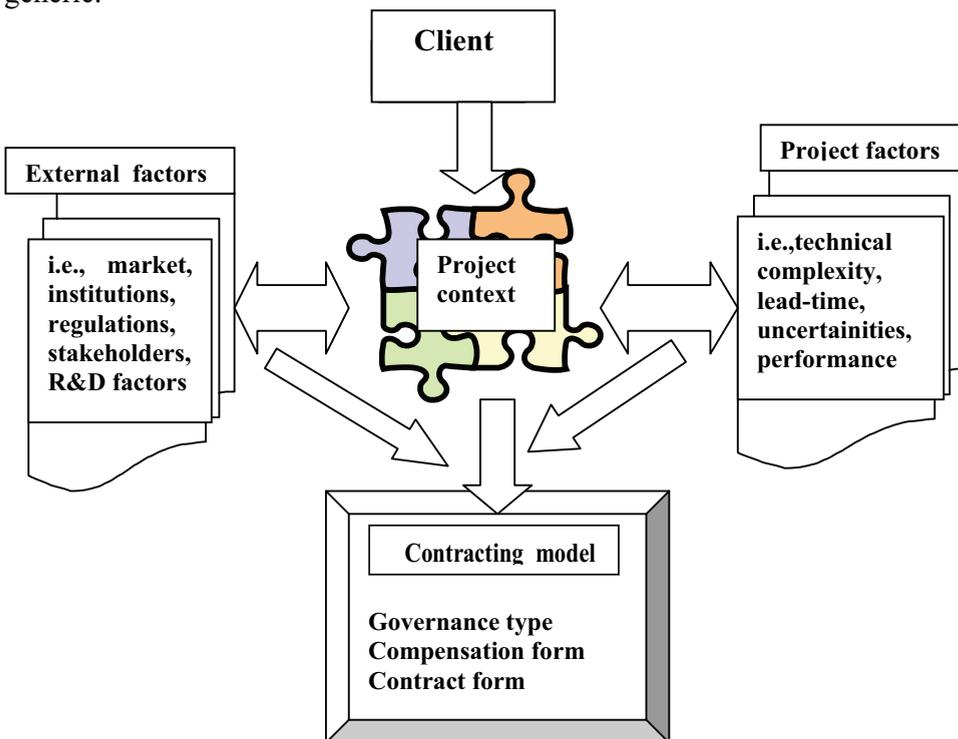


Figure 4.1: System model of the contracting process

A conceptualized system model of the contracting process is shown in Figure 4.1. The model illustrates that the choice of contracting model is affected by the actual set of as well of external as of internal factors, the *project context*.

The contracting model in this study consists of three important components. Firstly the distribution of responsibilities (*contract forms*, see Table 3.6), secondly how the contractor is compensated (*compensation type*), fixed price or transparent compensation and finally how the cooperation is structurally organized (governance structure, see Table 3.1).

The *project context* alternatives were described according to Table 4.2 and the *project types* according to Table 4.1. The project types were defined in the questionnaire in order to provide a spectrum of technical complexity, frequency on the market and also concerning traditional contracting manners.

Table 4.1: Description of project types used in the enquiry study

Project type	Description in the questionnaire
Office building	Office building project 12000 m2. High set functional demands regarding quality, flexibility and comfort (ventilation, a.s.o). Project cost: appr. 300 MSEK.
Dwellings	Apartment buildings with four story houses and total area of flats, appr. 7000 m2 in stage A. 20000 m2 of flats are planned to be built in later stages.
Business centre 20000 m2	A developer (construction client) is planning to build a big business centre and has for the moment found clients for 75% of the total area. The demands are high set regarding flexibility and quality. Project budget: appr. 275 MSEK
Business centre 7500 m2	A developer (construction client) is planning to build a medium size business centre with customer parkings in the same building and has contracts for most of the total area. The demands are high set regarding flexibility and quality. Project budget: appr. 130 MSEK

Table 4.2: Description and main characteristics of different project contexts, (Toolanen, et.al 2005)

Project context		Characteristics					
Abbr.	Description	Lead-time		Resources		Uncertain.	Strategic
		slow	quick	not critical	critical	conditions	considerations
N	Normal , design and construction can be time-wise separated, no lack of bidders	X		X			
R	Resource critical , design and construction can be time-wise separated, risk for lack of bidders	X			X		
T	Time critical , short leadtime, design and construction has to be parallel, no lack of bidders		X	X			
R&T	Resource and Time critical , short lead-time, design and construction has to be parallel, risk for lack of bidders		X		X		
U	Uncertainty , risk for late changes, redesign and other uncertainties					X	
S	Strategically , client interested to promote innovations, long-term thinking						X

4.4 The enquiry study – accomplishment and evaluation

A basic prerequisite for the accomplishment of the survey was to find respondents with professional knowledge in the field of contracting and also

with a good knowledge of more up-to-date contracting models, because it would be interesting to find out the attitudes towards new models and how to use them as target management tools. In to my view, an interesting and also important prerequisite for the study was that the respondents were asked to act in an advisory role when answering the inquiry. The main reason for this was to try to get respondents to act free from their daily business positions and thus avoid influence from organisational and cultural barriers in their decision making.

In the inquiry, the respondents had to choose which combinations of contract form, compensation form and governance structure they found best suited for different kinds of projects in the context of certain project related and external circumstances, called the *project context*. The seven different project context alternatives were described in the questionnaire with the intension of mirroring different prerequisites in a spectrum from normal lead time and fair competition on the market to severe time restrictions, lack of resources and uncertainties of different kinds. This refers to the dimension of asset specificity according to TCE (Transaction Cost Economies), as described in section 3.2.1. The translated questionnaire is shown in appendix 1. In appendix 2 is the original questionnaire in Swedish shown.

The questionnaire was initially sent to 28 persons and was answered by 24 of them. Fifteen of the respondents were by profession client representatives, four as construction management consultants and three as contractors. The initial population of respondents (*pop 1*) was later on followed by a group of randomly selected client representatives among members of the Swedish Construction Clients Federation (Byggherreforum). The main purpose with the second group was to get a randomly selected population of respondents for the study. In this second part of the survey, the questionnaire was sent to 12 persons and was answered by 8 of them.

For every type of project (Table 4.1) and the actual kind of project context in the question (Table 4.2), a total of 28 combinations, the respondents had to choose which combination of contract form, compensation form and cooperation form (governance structure) they found most recommendable. The number of answers in every single category was evaluated as percentage of the total number of answers for every single project context, in order to make the evaluation more illustrative in diagrams. In the second part of the inquiry study the respondents were asked to rank in a more generic manner the different factors affecting the choice of contract forms, compensation and

cooperation forms. In this a scale (0 – 6 points) was used in order to get a value for the importance of the different factors.

In the presentation and the analysis of results, the main findings are based on the amalgamated results of the two populations of respondents and hence on answers from 32 respondents (Pop 1+ Pop 2). However, in order to illustrate the respective influence of different groups of respondents (different systems), the results of the different populations are separated (Pop 1 and Pop 2 respectively).

The results of the survey were evaluated and analyzed according to the system view model in order to find indicator – effect connections between different variables. The reason was that the reality has to be considered to be very complex and thus it is quite impossible to get generic results with a high degree of confidence. Thus, in my view it is more of a qualitative validation than of a quantitative one.

4.5 The inquiry – results and analysis regarding contract forms

4.5.1 Choice of contract model in different project contexts

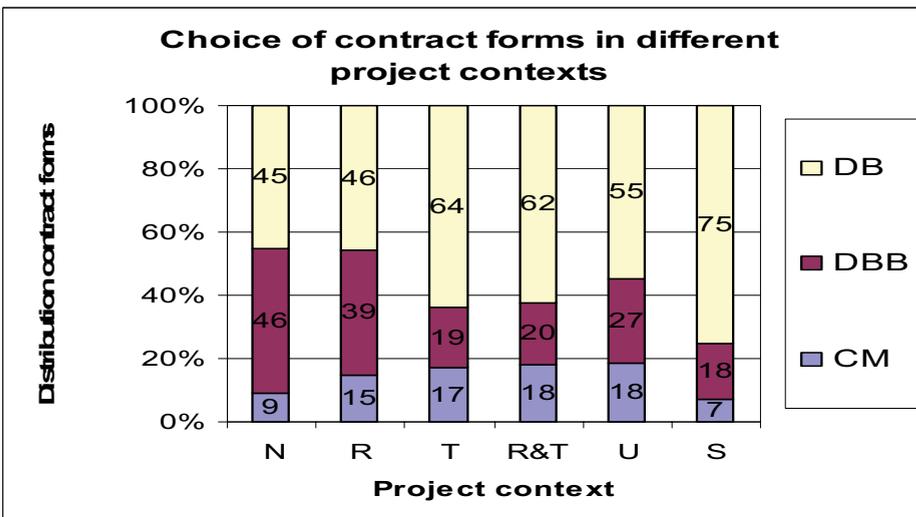


Figure 4.2: Choice of contract forms in different project contexts (see Table 4.2). Average values for four project types and 2 populations of respondents.

According to the results from the inquiry presented in *Figure 4.2* the choice of contract forms are considerably influenced by changes in external and internal factors in the project context. In a situation N (*normal*) in which lead time is not critical and also in a situation R (*resource critical*) in which there is a risk that the client is getting a limited number of interested bidders are DBB contract forms slightly more popular than the DB forms. In a situation of uncertainties (*U*) the recommendations are also divided, as only slightly more respondents prefer DB forms to DBB forms.

However in a situation in which, due to time restrictions (*T*), the design and most of the production phase have to be parallel, two thirds of the respondents recommend DB forms of contract. In those the main responsibility of the product design is transferred to the contractor. The situation is also similar in a situation of time and resource restrictions (*R&T*). Furthermore in a situation in which the client has strategic considerations linked to the choice, project context alternative (*S*), three out of four respondents (75%), recommend DB contract forms.

4.5.2 Different project types – project context N (*normal*)

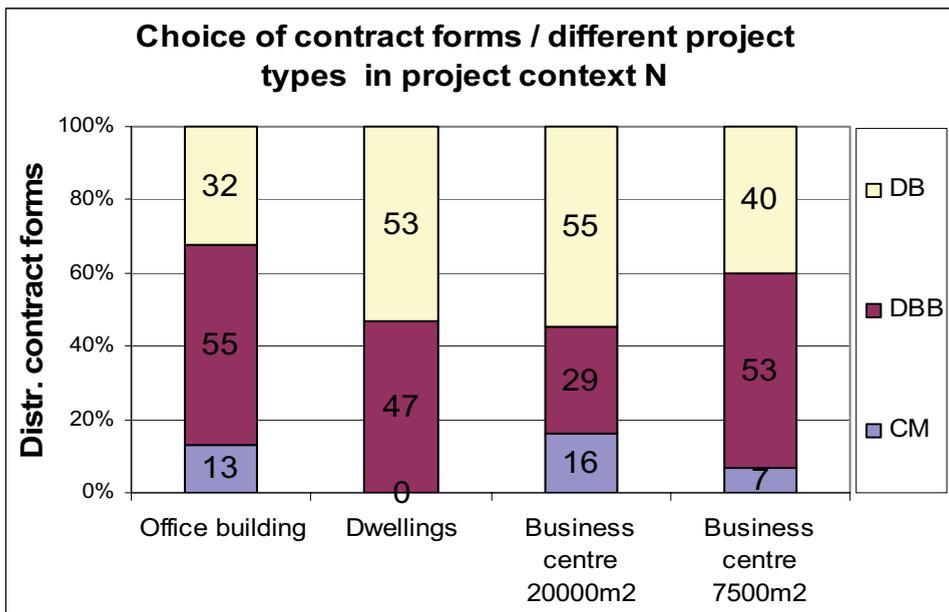


Figure 4.3: Different project types (Table 4.1) – choice of contract form in project context N (Table 4.2)

The prerequisites in project context N (Figure 4.3) enable a quite free choice of contract form, since, if desired, there is time for finishing the design phase before the start-up of construction activities on the site. The number of interested bidders is also not characterised by lack of resources, according to the conditions in a situation of competition like the one that the market R is in.

Figure 4.3 illustrates how the different project types affect the recommendations for suitable contract form. In the case of project type large business centre and also the dwelling project, a small majority of the respondents recommend DB forms as most suitable. On the contrary, for the project type business centre 7500 m² (61 %) and for office building (66 %), DBB forms are recommended by a majority.

The results indicate that more complex project types, such as a large business centre, are regarded suited also during the design phase for the responsibility of the contractor. The reason is most likely that in these circumstances the client considers the experience the contractor has about effective technical solutions to be beneficial for the project outcome. In the case of project type dwellings, in which the functional demands are simpler and also easy to describe by the client, a majority of respondents also recommend DB contract forms.

4.5.3 Different project types – project context R

The prerequisites in project context R, see Figure 4.4, are mainly characterised by the risk that there might be difficulties in finding a desirable number of interested bidders, because the market situation for construction projects is booming. The time situation in this alternative allows design and construction activities, if desired, to be separated.

As illustrated by Figure 4.3 and Figure 4.4 the choice of contract form is only slightly affected by the resource critical market situation R in comparison with the situation N (*normal*). However, more of the respondents recommend CM forms in which the client keeps the responsibility of the design of the project by himself and the project is subdivided in smaller proportions when contracting. Some respondents think probably that this is a way to attract more bidders for their projects.

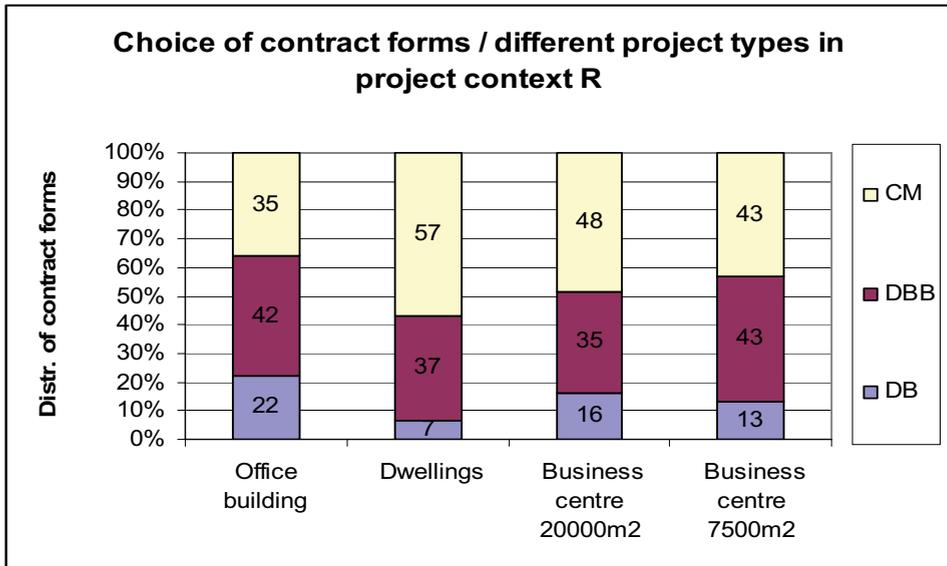


Figure 4.4: Different project types (Table 4.1) – choice of contract form in project context R (Table 4.2)

4.5.4 Different project types –project context T

The prerequisites in project context T (*time critical*) are mainly characterised by a depressed lead-time for the project. The time situation does not allow design and construction activities to be separated. Accordingly, the construction activities on site have to be started in parallel with most of the design activities.

The results in this alternative indicate (Figure 4.5) that in a pressed for time situation, when design and construction have to be parallel, most respondents suggest a solution in which the contractor gets the main responsibility of the design phase. It is also notable in this project context that the traditional and most frequently used contract form in Sweden, DBB, in which one general contractor is responsible for the entire project, is only recommended by a minority (10 - 23%) for the different project types.

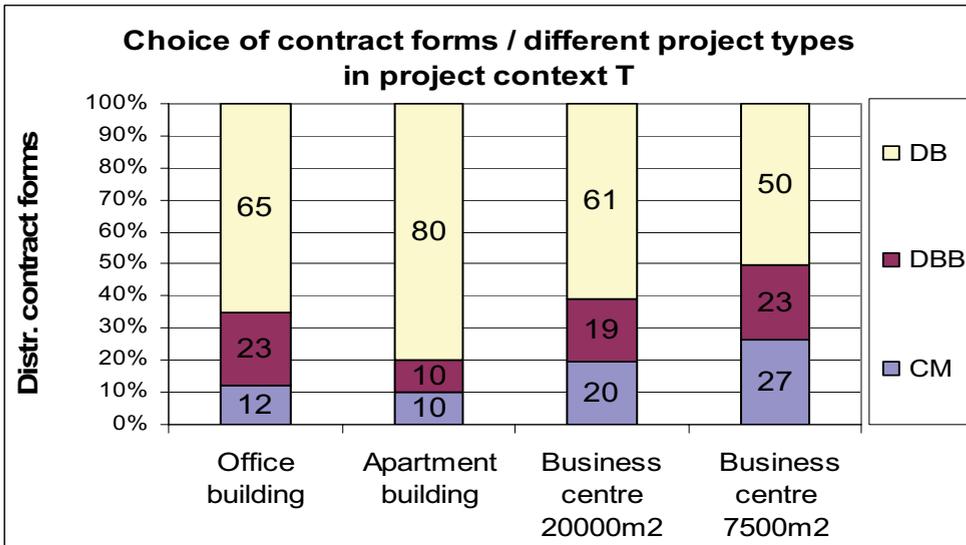


Figure 4.5: Different project types (Table 4.1) – choice of contract form in project context T (Table 4.2)

However, it is notable that in the case of the smaller business centre project 27% of the respondents suggest a solution to the time critical situation by using CM contract forms (see Figure 4.5). This solution enables the client to keep the responsibility of design to himself and to contract stage wise if he prefers to use classical contracting concepts.

4.5.5 Different project types –project context U (uncertainties)

The prerequisites in project context U, see Figure 4.6, are mainly characterised by the risk of late changes, such as a revised building programme, of prerequisites for the project. In this case there is a risk of high transaction costs and cost overruns due to changed specifications and re - planning of time schedules and allocation of resources.

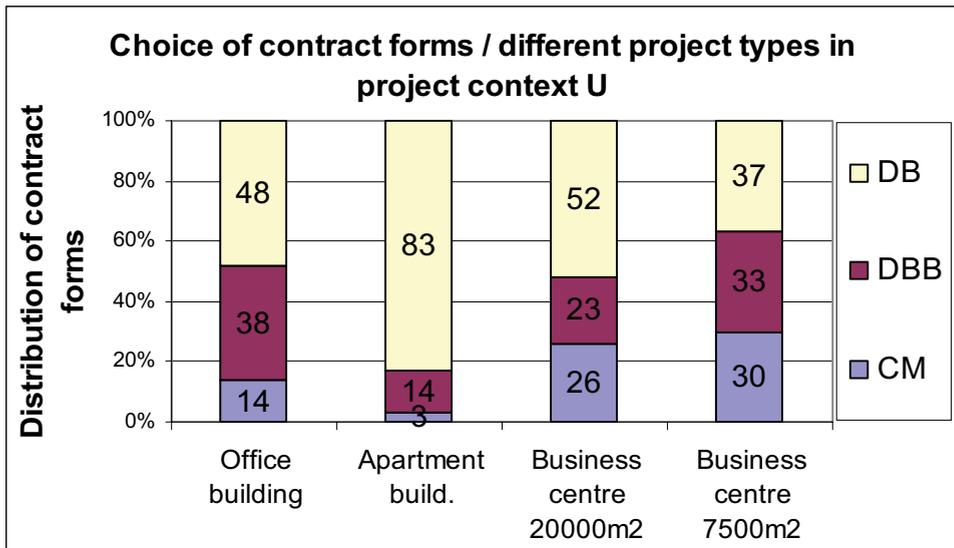


Figure 4.6: Different project types (Table 4.1) – choice of contract form in project context U (Table 4.2)

As illustrated in Figure 4.6, in a situation characterised by uncertainties, the advice about a suitable contract form for the different project types differs a lot. For the project types *office building* and *business centre 20000m2* about one out of two respondents prefer the DB form of contract which indicates that half of the clients have confidence enough to transfer most of the design responsibility to the contractors even if there are uncertainties involved.

Contrary to the case of the smaller business centre the three contract forms get almost the same support. Accordingly this indicates that two of three respondents recommend that the client keep the responsibility of design to himself. Why a small business centre is regarded as suitable for DBB and CM contract forms by two of three respondents, is in my view, due to as well market considerations (more bidders) as well as to difficulties in describing functional demands upon the product.

In the case of the dwelling project, more than four out of five respondents prefer DB forms. This project type is also traditionally mostly procured by using DB forms, probably due to a low degree of technical complexity and also due to the possibility for the client to express functional demands on the product.

4.5.6 Choice of contract form – different groups of respondents

The prerequisites in project context N (Table 4.2) enables a quite free choice of contract form, if desired, as there is time for finishing the design phase before the start up of construction activities on site. The number of interested bidders is also, according to the assumptions, high, which ensures favourable competition for the client, as the market is not characterised by lack of resources.

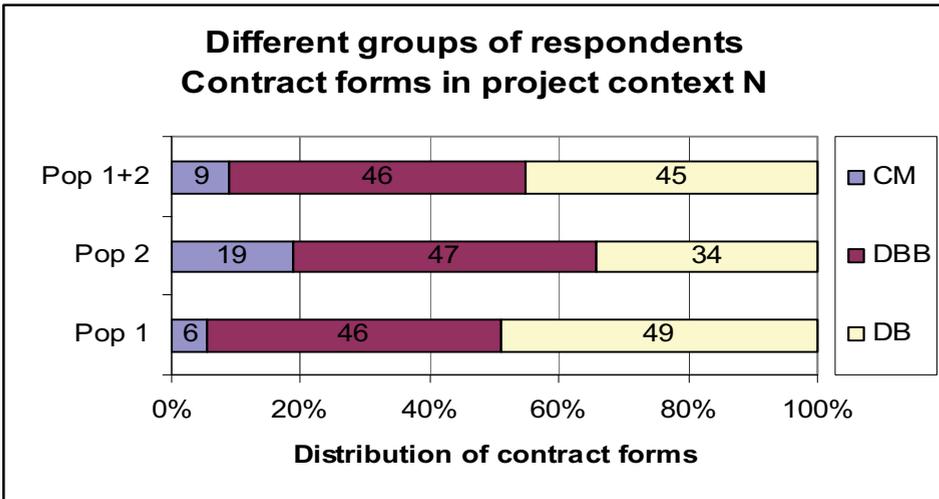


Figure 4.7: All project types – choice of contract form in project context N (Table 4.2) by different groups of respondents

The results illustrated in Figure 4.7 indicate that the support for the DBB contract form is quite similar for the two populations of respondents in a situation when there is no time pressure in the project. In contrast, there are some differences in how the two groups are acting in the choice of either DB or CM contract forms which indicates that they have differing views regarding the distribution of the responsibility of design. Whereas in the first group of respondents (pop 1) the distribution of design responsibility is mainly divided between the client and contractors in the second population (pop 2) a majority prefer that the client keeps the responsibility to himself. The amalgamated results are presented as Pop 1+2.

4.5.7 All project types – project context R (resource critical)

The prerequisites in project context R (Table 4.2) are characterised by the risk that there may be difficulties in finding a desirable number of interested bidders as the market situation resembles a boom in the construction market. The time situation allows design and construction activities, if desired, to be separated.

As illustrated in figure 3.7 the choice of contract form is quite divergent in this project context between the two groups of respondents. While 53 % in the one population are in favour of DB contract forms only 25 % prefer these in the other group. This fact indicates that the opinion about how to handle a resource critical situation might in some degree be bound to personal considerations regarding the distribution of responsibility of design. It seems that many clients, who prefer to keep the responsibility to themselves, try to manage the critical market situation by splitting up the project by using the CM contract form in order to facilitate for a wider group of contractors to participate in bidding.

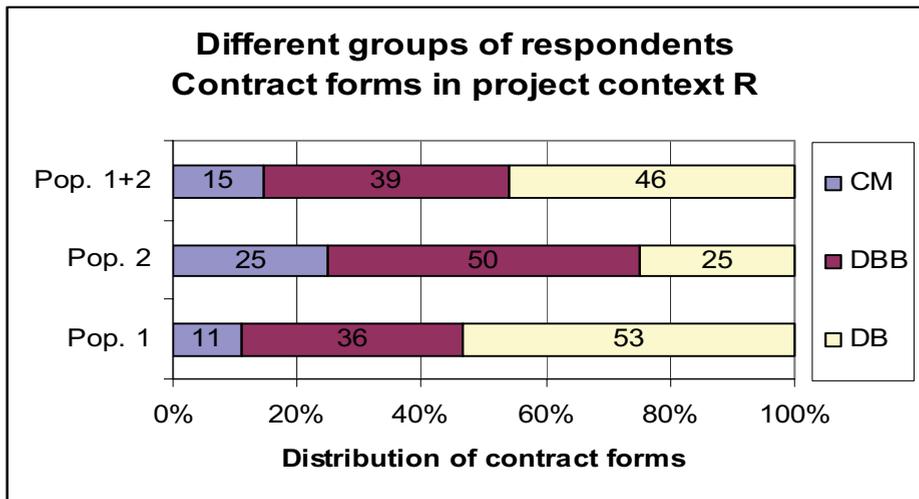


Figure 4.8: All project types – choice of contract form in project context R (Table 4.2) by different populations of respondents

4.5.8 All project types – project context T (time critical)

The prerequisites in project context T (Table 4.2) are mainly characterised by a depressed lead time for the project. The time situation does not allow design

and construction activities to be totally separated. Accordingly, the construction activities at site have to be started in parallel with most of the design activities.

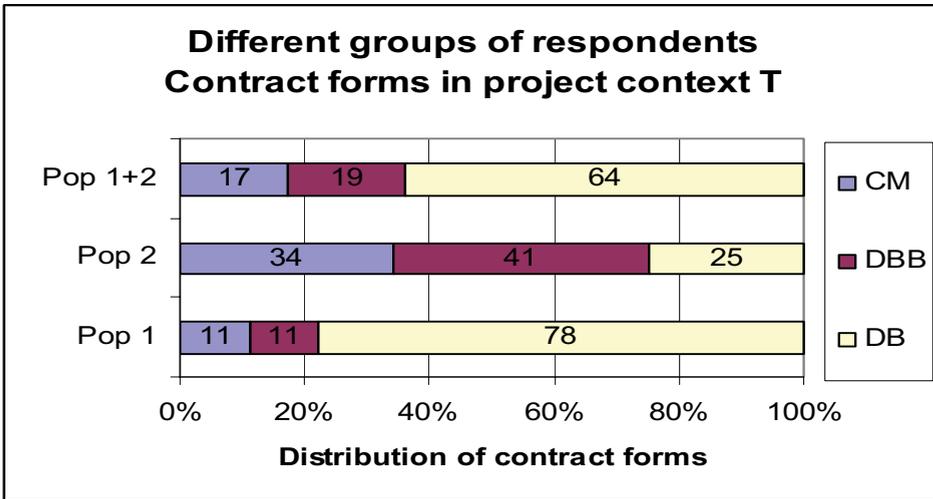


Figure 4.9: All project types – choice of contract form in project context T (Table 4.2) by different populations of respondents

As illustrated in Figure 4.9 the two groups of respondents act quite differently when recommending the choice of contract form in a situation of short lead time for a project. Whereas 78 % of the respondents in the one group (pop 1) favours DB contract forms only 25 % in the other group (pop 2) give that recommendation. As in the project context R (see above) this fact indicates that the opinion about how also to manage a time critical situation is to a high degree bound to personal preferences regarding the distribution of responsibility for design.

Accordingly, as the prerequisite was that the design and construction activities have to be parallel, the decisions regarding the responsibility of design also have implications for how to procure contractors in this context. This is evident as the proportion preferring the CM contract form is about three times bigger in the group that recommends that the client keep the responsibility of design. CM as contract form enables design and contracting in stages.

4.5.9 All project types – project context R+ T resource and time critical)

The prerequisites in project context R + T (Table 4.2) are mainly characterised by a depressed lead time for the project and a risk for getting few bids due to a boom situation in the market. The time situation does not allow design and construction activities to be separated. Accordingly, the construction activities on site have to be started in parallel with most of the design phase.

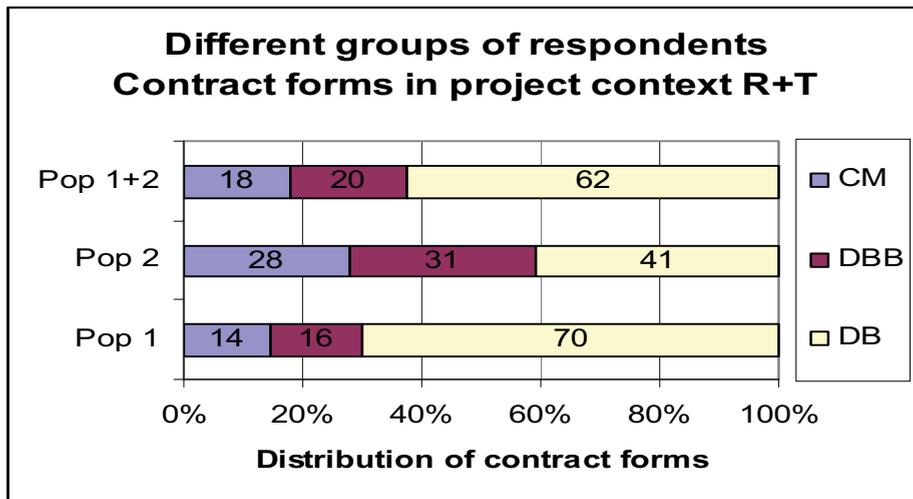


Figure 4.10: All project types – choice of performance (contract) form in project context R + T (Table 4.2) by different populations of respondents

In this project context, (Figure 4.10) the choice of an appropriate contract form is also bound to personal preferences as 70 % of the respondents in one group (pop1) prefers DB contract while only 41 % in the other group (pop 2) prefer these.

The results in this project context (R+T) are more like the results in the previous project context above (T) than in the case with only resource considerations (context R). This fact indicates that depressed lead time has more implications for the choice of contract form than considerations with regard to the market situation.

4.5.10 All project types – project context U (uncertainties)

The prerequisites in project context U (Table 4.2) are mainly characterised by the risk of late changes, such as a revised building programme, and of prerequisites for the project. In this case there is a risk of cost and time overruns due to changed specifications, re-planning of time schedules and allocation of resources.

In project context U, as illustrated in Figure 4.11, the choice of the most suitable contract form is also bound to personal preferences as the choice is quite different regarding DB and DBB contract forms between the two groups of respondents (pop 1 and pop 2).

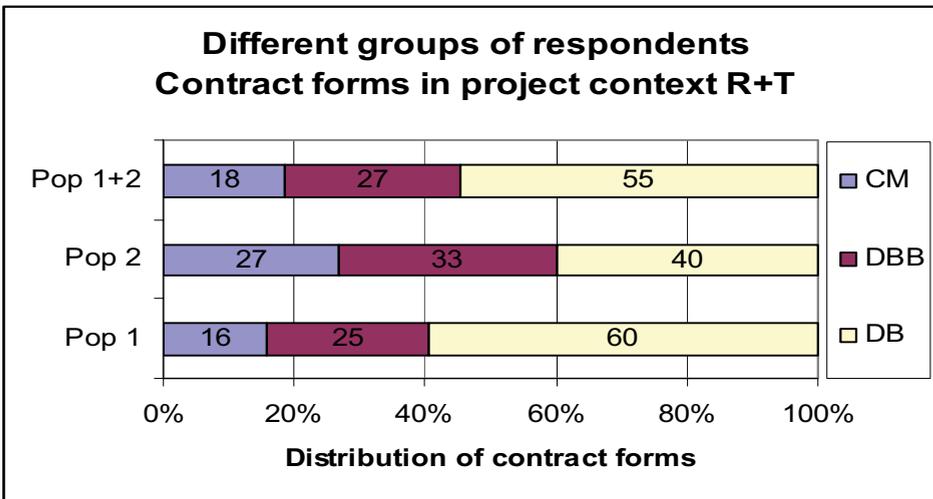


Figure 4.11: All project types – choice of contract form project context U (Table 4.2) by different populations of respondents

4.6 The inquiry – results and analysis regarding choice of compensation forms

4.6.1 Choice of compensation form in different project contexts

The different compensation forms that the respondents had to recommend to be used in the different procurement situations were either fixed price or transparent compensation.

4.6.2 Choice of compensation form - all project types and all respondents

Figure 4.12 illustrates how different project contexts are affected by the choice of compensation form. The figures are average values for four different project types and two populations of respondents.

When the project has a project context N (Table 4.2) without restrictions time wise and when the market has a satisfactory amount of interested bidders for the project, 82 % of the respondents recommend the use of fixed price compensation. In a situation with risk of lack of interested bidders (R) and when the lead time is depressed (T) however the proportion recommending fixed price drops to 58 % and 55 % respectively, whereas in a situation when both these conditions are present (R + T) only 39 % of the respondents are in favour of fixed price. Finally when the project context alternatives with uncertainties (U) and strategic considerations (S) are present a large majority of the respondents choose transparent compensation to be most advisable as 78 % and 85 % respectively recommend this option.

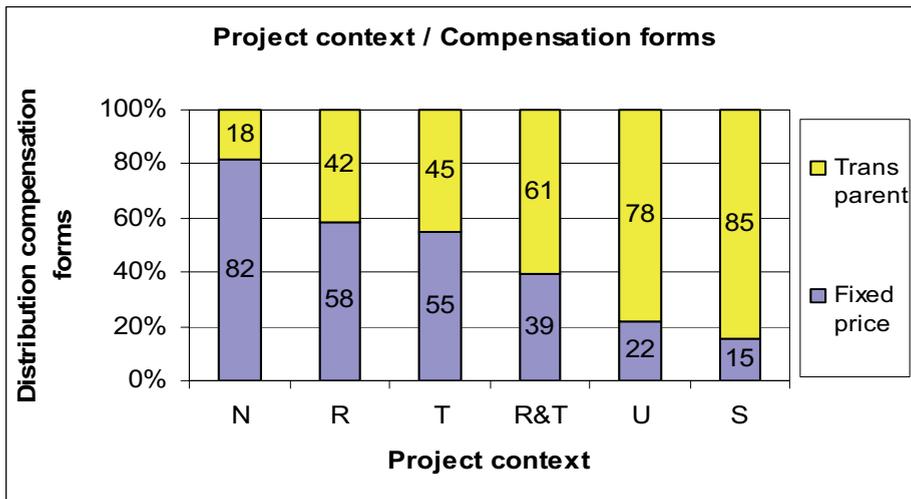


Figure 4.12: Recommended compensation forms in different project contexts (Table 4.2)

The results shown in Figure 4.12 are very surprising as they deviate considerably from what is the manner in practise, as most projects are procured on a fixed price basis even if the project context in question very often has to be regarded as pressed for time and also with a lot of uncertainties present.

However the findings are in good correlation with the theoretical considerations for complex and dynamic projects according to chapter 3. It is obvious in this study how important a variable, the choice of compensation form is to get the best possible conditions for project governance in different project context alternatives.

4.6.3 Different project types – project context N (normal)

Figure 4.13 illustrates how different project types affect the choice of compensation form also in an uncomplicated project context N (Table 4.2). Whereas 90%, 93% and 87% respectively are in favour of fixed price compensation for office building, dwellings and small business centre only 58% are in favour of this option in the more complex project type big business centre.

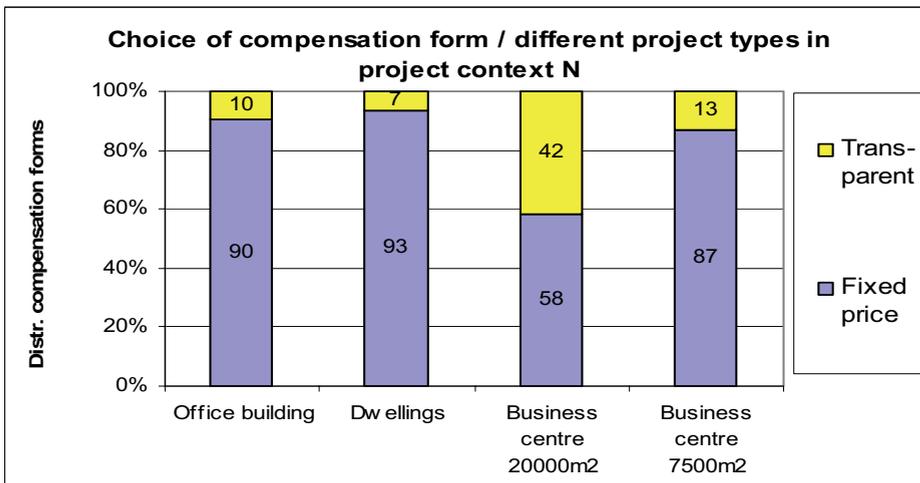


Figure 4.13: Recommended compensation forms in the context of different project types. Project context N (Table 4.2)

4.6.4 Different project types – project context R (lack of resources)

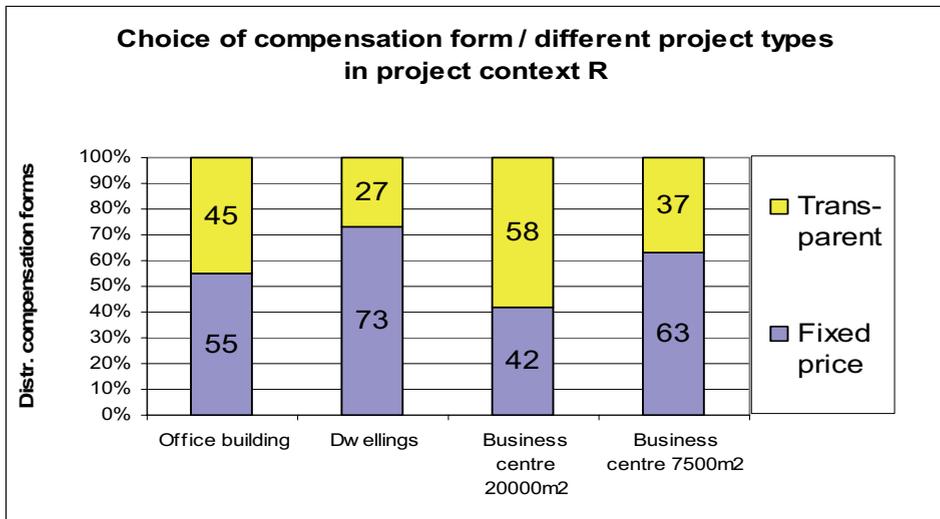


Figure 4.14: Recommended compensation forms in the context of different project types. Project context R (Table 4.2)

Figure 4.14 shows how the use of transparent compensation forms depends on the project type in a project context R (Table 4.2). Whereas majorities of 55% and 63% recommend fixed price compensation for the project types *office building* and *small business centre*, a majority of 73% recommend this option for the dwelling project. As only a minority of 42% are in favour of fixed price compensation for the big business centre project it is quite evident that the more complex a project is the more are transparency and relational contracting concepts recommended when contracting.

4.6.5 Different project types – project context T (time critical)

The prerequisites in project context T (Table 4.2) are mainly characterised by a depressed lead time for the project. The time situation does allow design and construction activities to be totally separated. Accordingly, the construction activities at site have to be started in parallel with most of the design activities.

Figure 4.15 illustrates how the choice of compensation form is affected by the project type in the context of a time critical project. In this context transparency is recommended by a majority of respondents (61 %) for the most complex

project, the big business centre, while fixed price is more suitable for the other project types.

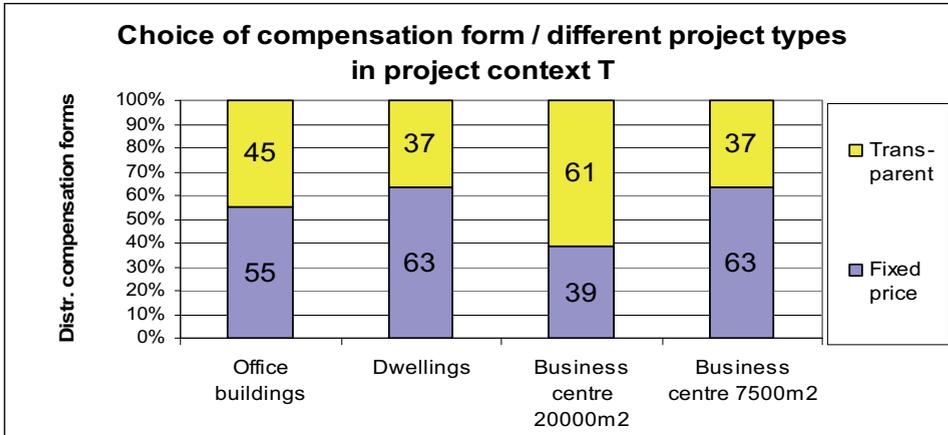


Figure 4.15: Recommended compensation forms in the context of different project types. Project context T (time critical).

4.6.6 Different project types – project context U (uncertainties)

The prerequisites in project context U (Table 4.2) are mainly characterised by the risk of late changes, such as revised building programme, of prerequisites for the project. In this case there is a risk of cost and time overruns due to changed specifications and re-planning of time schedules and allocation of resources.

As shown in Figure 4.16 all project types in the project context U are, according to majorities of respondents, most suited to be procured with transparent compensation.

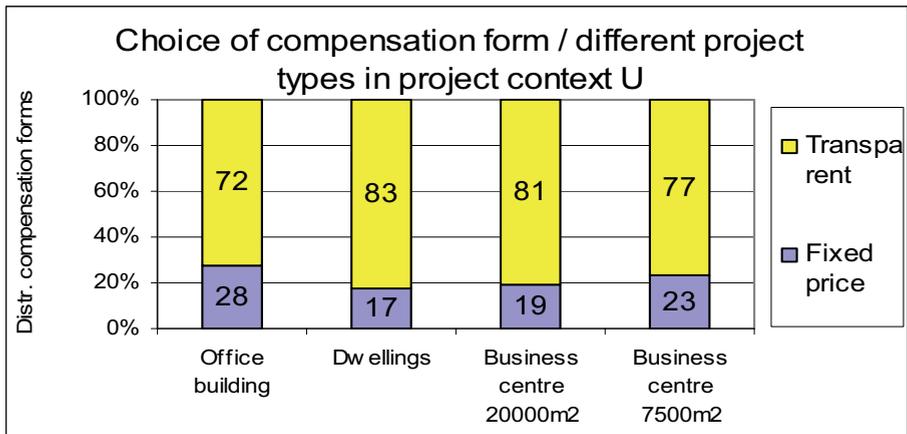


Figure 4.16: Recommended compensation forms in the context of different project types. Project context U (Table 4.2)

4.6.7 Choice of compensation form – different populations of respondents

4.6.8 All project types – project context N (Normal)

According to Figure 4.17 the two populations are in agreement about the most suitable compensation form as in both groups four out of five recommend fixed price.

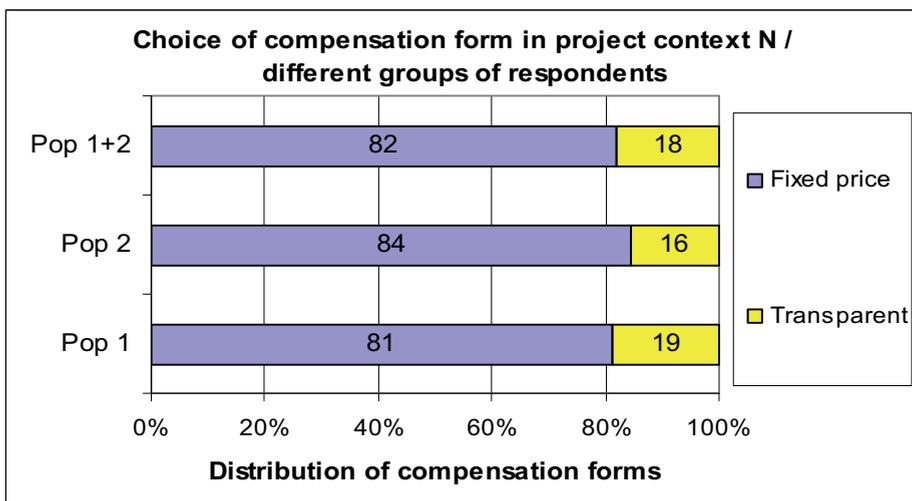


Figure 4.17: All project types – choice of compensation form in project context N (Table 4.2) by different populations of respondents

4.6.9 All project types – project context R (resource critical)

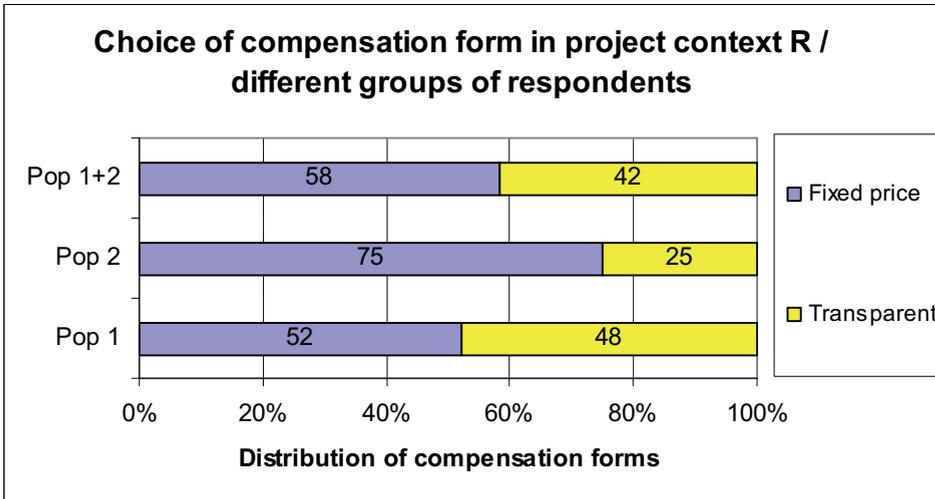


Figure 4.18: All project types – choice of compensation form in project context R (Table 4.2) by different populations of respondents

In a situation when there is risk of few interested bidders due to lack of available resources (R) the choice of compensation form will according to Figure 4.18 be quite different in comparison with the previous situation (N). The answers from the two groups also differ greatly, as 52 % in the first group (*pop 1*) prefer fixed price whereas 75 % favour this option in the other (*pop 2*). As the *pop 1* group is three times bigger than *pop 2* the mean value for all respondents is 58 % for fixed price. This difference is mainly connected to the different recommendations regarding contract form as *pop 2* recommends split up of the project in smaller proportions when contracting.

4.6.10 All project types – project context T (time critical)

According to the prerequisites in the inquiry, it was stated that in a time critical situation the design and the production activities at site have to be parallel. Figure 3.18 shows how the distribution between fixed price and transparent compensation varies between the groups of respondents. Whereas in the first group (*pop 1*) half of the respondents choose transparent compensation only one out of three prefers this option in the other group. This difference is as in

project context R, this difference is mainly connected to the differences regarding the choice of contract form (see figure 3.8).

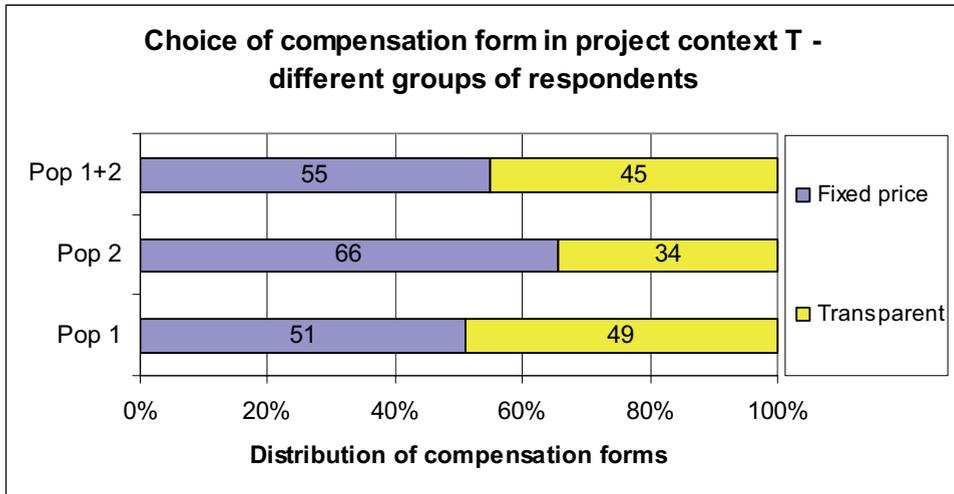


Figure 4.19: All project types – choice of compensation form in project context T (Table 4.2) by different populations of respondent

4.6.11 All project types – project context R+T (resource and time critical)

In a project context, R+T, that is resource critical as well as time critical, about three out of five respondents totally prefer transparent compensation. Also in this case, too, the respondents in pop 2 are more conservative in their choice than those in pop 1 (see Figure 4.20).

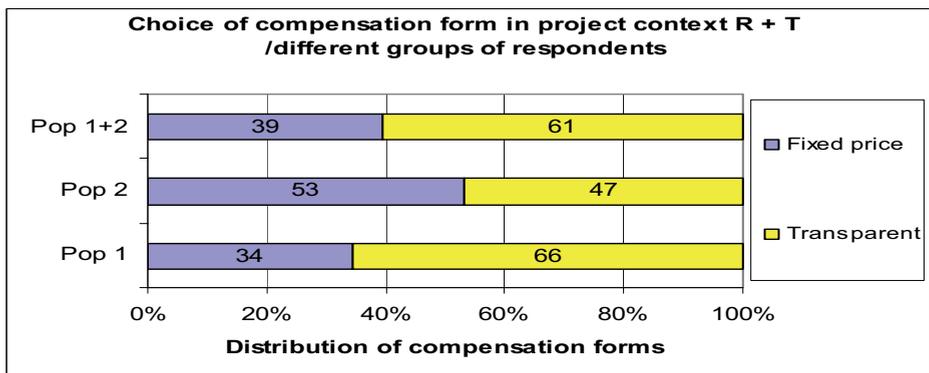


Figure 4.20: All project types – choice of compensation form in project context R+T (Table 4.2) by different populations of respondents

4.6.12 All project types – project context U (uncertainties)

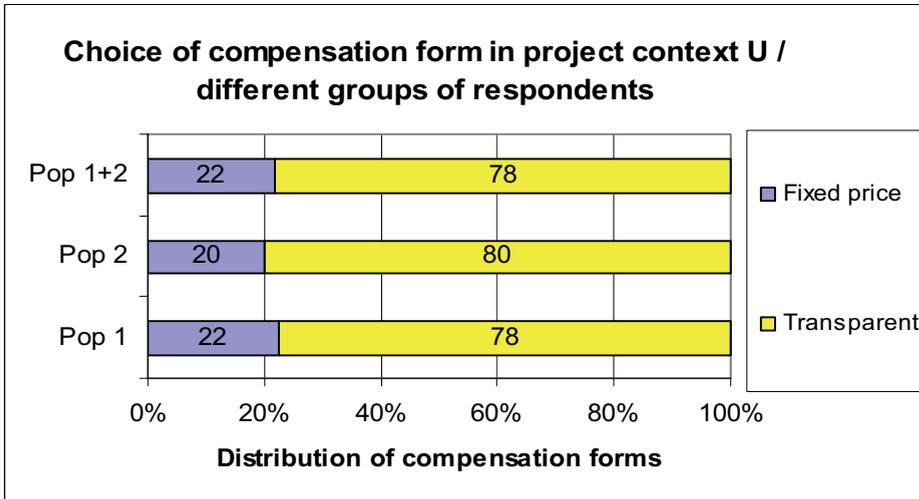


Figure 4.21: All project types – choice of compensation form in project context U (Table 4.2) by different populations of respondents

As the project context is characterised by uncertainties (U in Table 4.2) both populations of respondents prefer transparency as about four of five prefer transparent compensation as illustrated by Figure 4.21.

4.7 The inquiry – results and analysis regarding choice of governance structure

The different governance structures that the respondents had to recommend to be used in the different procurement situations were exemplified in the study by cooperation forms as strategic partnering, project partnering, business partnership and traditional transaction oriented cooperation (see SI – SIV in questionnaire in appendix 1). In the context of the relational contracting theory presented in chapter 3 (Table 3.1), SI is defined in this study as a representative of the classical governance structure in which most things rely on legal frameworks and a functioning market. The business partnership used in Sweden for decades is a representative of a neo-classical contracting governance structure (see Table 3.1) in which the importance of long-term

relationship and relational tendencies is focused on in many ways. The two partnering concepts are representatives of the relational contracting models developed in the last decade.

4.7.1 Choice of governance structure - all project types and all respondents

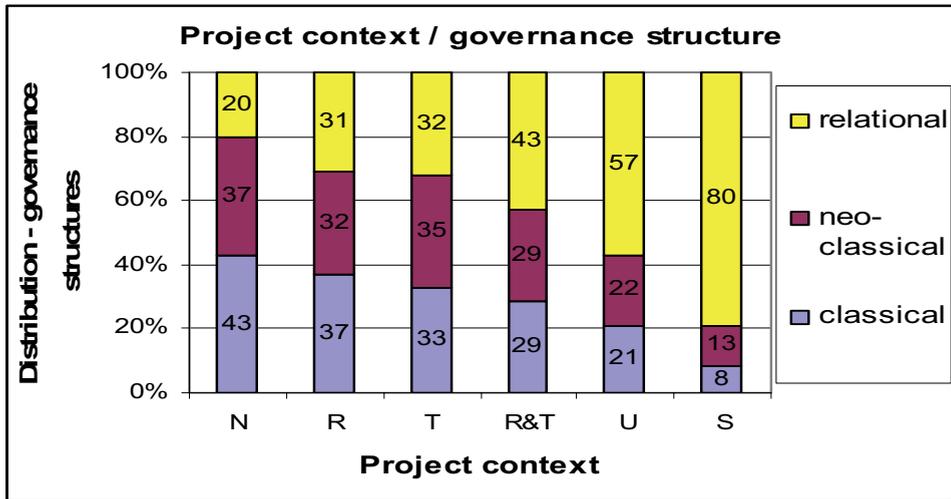


Figure 4.22: Recommended governance structures in different project contexts

Figure 4.22 illustrates how different project context prerequisites (Table 4.2) affect the choice of a suitable governance structure. The figures are average values for four different project types and for the two populations of respondents. It is obvious that the choice of governance structure is affected to a great extent by the different project context situations according to definitions set out in (Table 4.2).

It is notable that cooperation oriented governance structures (*neo-classical* and *relational contracting*) are most often recommended to be used in all project context alternatives. However, the recommended governance structure is to a high degree also dependent upon the project context in question. Whereas 43 % recommend a classical governance structure in project context N only 8 % recommend that in project context S. The number of respondents recommending relational contracting concepts with a bilateral governance structure also increases in this spectrum of project context alternatives from 20% to 80% respectively.

4.7.2 Different project types – project context N (normal)

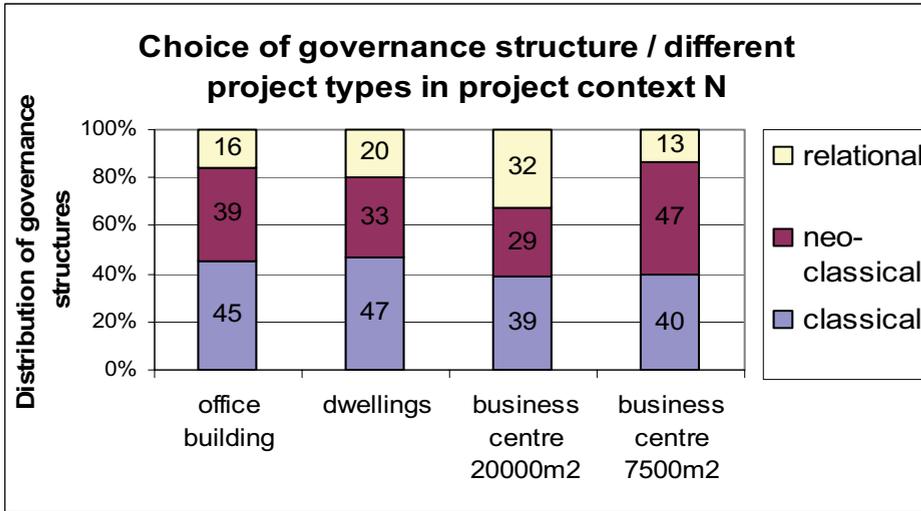


Figure 4.23: Recommended governance structures in the context of different project types. Project context N (Table 4.2)

Also in a project context in which it is possible to finalise the design before contracting a majority of respondents also prefer using relational-oriented governance structures for all studied project types. The relational contracting oriented partnering concepts are slightly less popular than the neo-classical business partnership model for projects that are more frequent and less complex, such as a dwelling or small type of business centre. However, for the most technically complex project type, the big business centre, the two relational oriented cooperation forms, project partnering and strategic partnering, are both preferred by three out of ten respondents.

4.7.3 Different project types – project context R (resource critical)

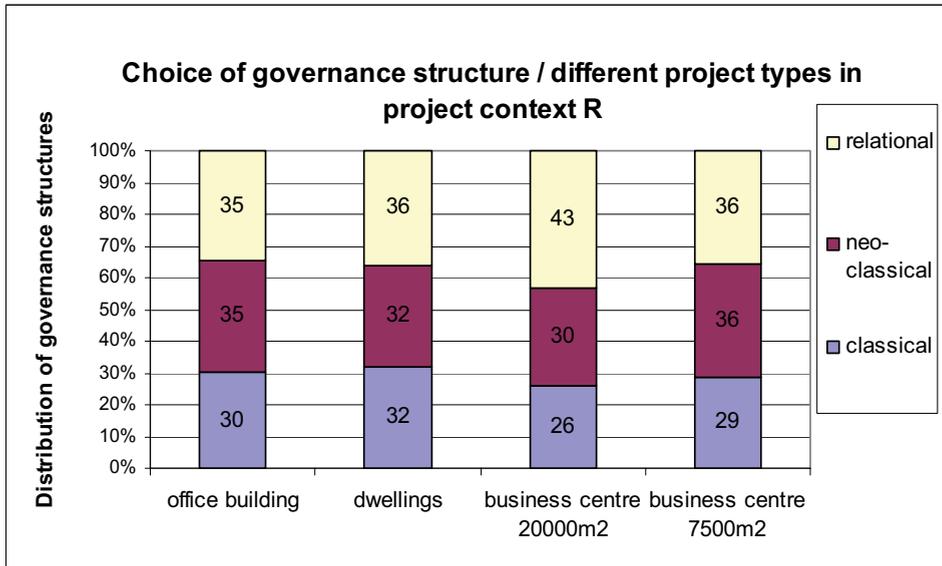


Figure 4.24: Recommended governance structures in the context of different project types. Project context R (Table 4.2)

As illustrated by figures 3.22 and 3.23 in the project context R the proportion of the respondents in favour of relational contracting concepts is larger than in a project context in which the number of interested bidders is likely to be bigger (N). It is notable that relational contracting and neo-classical types of project governance are recommended by about seven out of ten of the respondents for all project types.

4.7.4 Different project types – project context T (time critical)

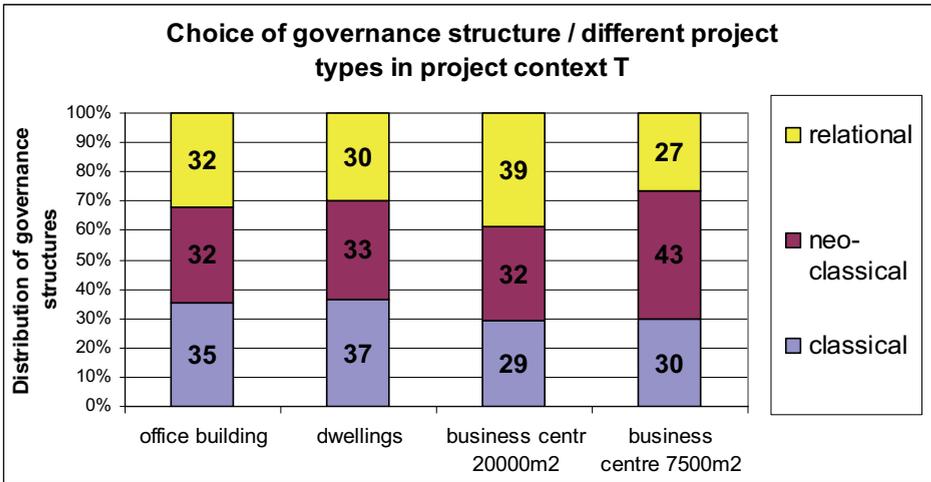


Figure 4.25: Recommended governance structures in the context of different project types. Project context T (Table 4.2)

In a time critical project context (T in Table 4.2) the design and production at site have to be parallel. As shown in Figure 4.25, for all types of project, governance promoting cooperation is preferred much more than classical contracting. This is especially evident for business centre project types as neo-classical and relational governance structures are preferred by seven out of ten respondents.

4.7.5 Different project types – project context U (uncertainties)

As illustrated in figure 3.25 relational contracting forms are by large majorities found most recommendable in a situation in which uncertainties prevail. It is also notable that relational contracting forms are especially recommendable for the dwelling project type. This project type is also a good example of a frequent (idiosyncratic) project type according to Table 3.3.

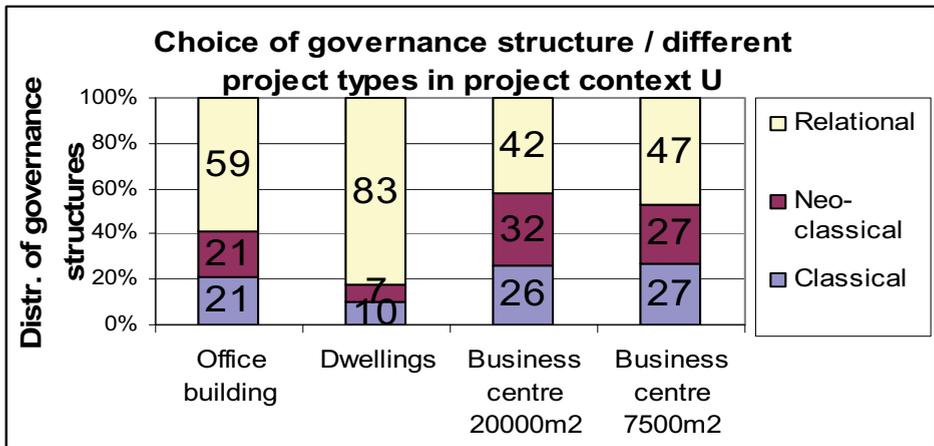


Figure 4.26: Recommended governance structures in the context of different project types. Project context U (Table 4.2)

4.7.6 Choice of cooperation form – different populations of respondents

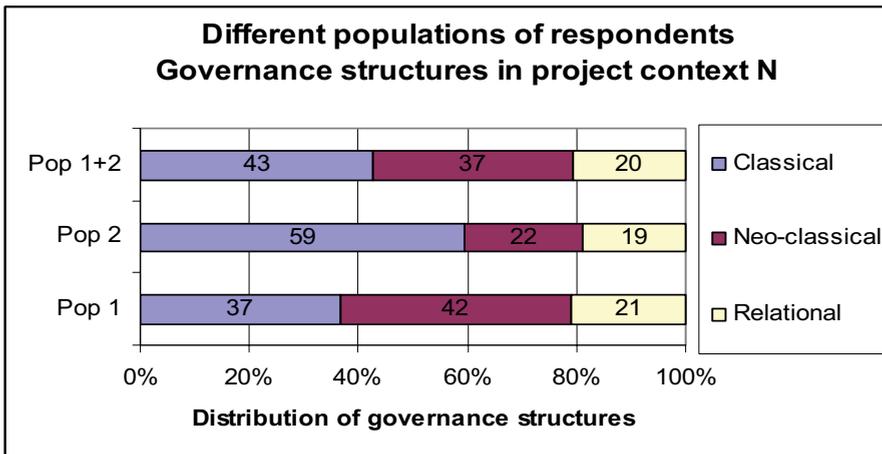


Figure 4.27: All project types – choice of governance structure by different populations of respondents in project context N (Table 4.2)

As illustrated by Figure 4.27 the two populations of respondents were in agreement about using relational contracting concepts of governance structure, as one out of five in both groups suggested that it should be used in this project context. On the other hand, they were not in agreement about the suitability of using classical contracting forms as 37 % and 59 % respectively proposed the

use of that form. This difference is probably connected to the choice of contract form as the respondents in *pop 2* prefer CM and DBB contract forms more than those in *pop1*.

4.7.7 All project types – project context R (Resource critical)

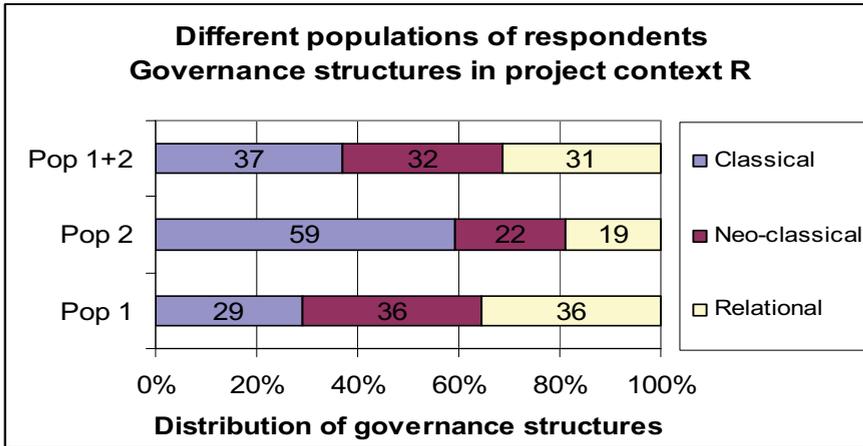


Figure 4.28: All project types – choice of governance structure in project context R (Table 4.2) by different populations of respondents

In a project context in which there is a risk of lack of resources is according to Figure 4.28 the situation regarding suitable governance structure is only slightly changed in comparison with the Normal situation (see Figure 4.27).

4.7.8 All project types – project context T (time critical)

According to Figure 4.29 in project context T (Table 4.2), when the project is pressed for time and the design phase cannot be separated from the production phase, the proportion of respondents choosing partnering concepts is much bigger in both populations of respondents than in the alternatives described above. The situation is also similar (see Figure 4.30) in project context R + T in which also the market situation is also regarded as unfavourable for the client. However, they are not in agreement about the suitability of classical governance forms as shown in both Figure 4.29 and Figure 4.30. This difference is mostly dependent upon different opinions between the two populations regarding the choice of suitable contract forms as illustrated in Figure 4.9 and Figure 4.10.

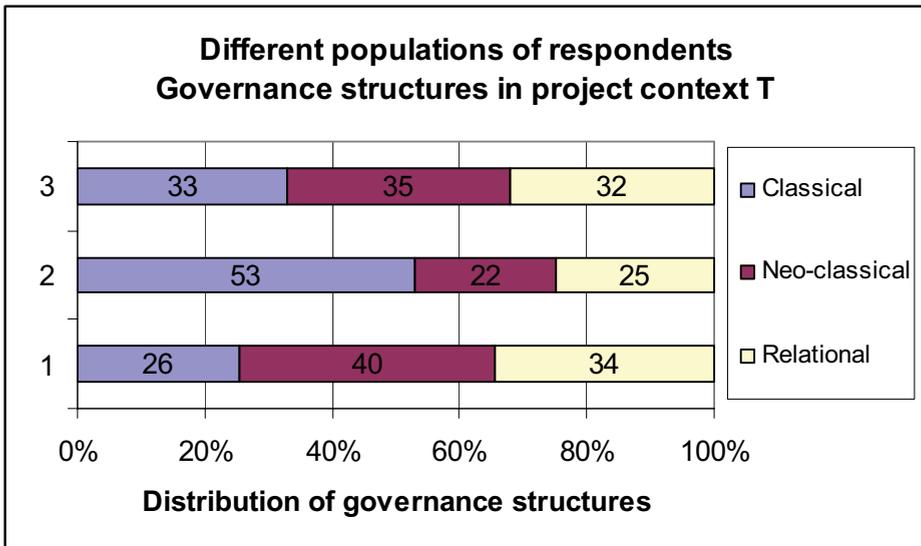


Figure 4.29: All project types – choice of governance structure in project context T (Table 4.2) by different populations of respondents

4.7.9 All project types – project context All project types – project context T (time critical)

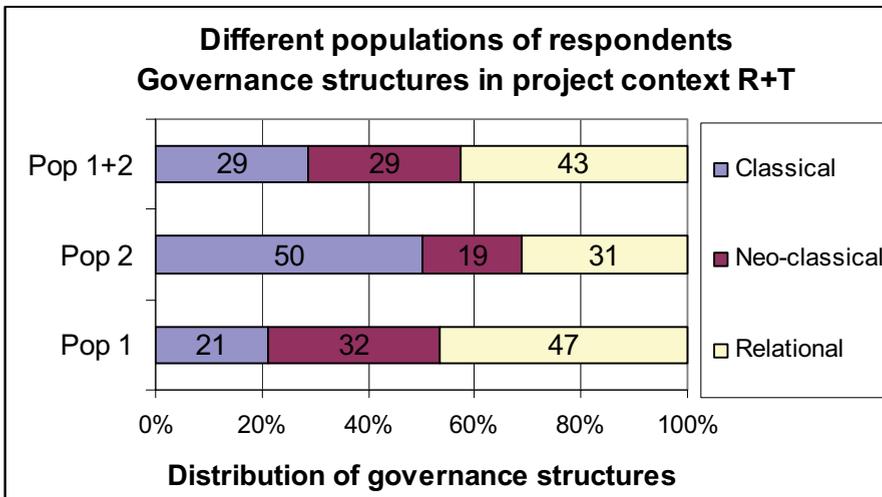


Figure 4.30: All project types – choice of cooperation form in project context R + T (Table 4.2) by different populations of respondents

4.7.10 All project types – project context U (Uncertainties)

When the project context is classified U (uncertainties) the respondents in both populations recommend the choice of relational contracting forms of cooperation in a high degree, as illustrated in Figure 4.31. It is also notable that they are much more of the same opinion than in the previous project context cases.

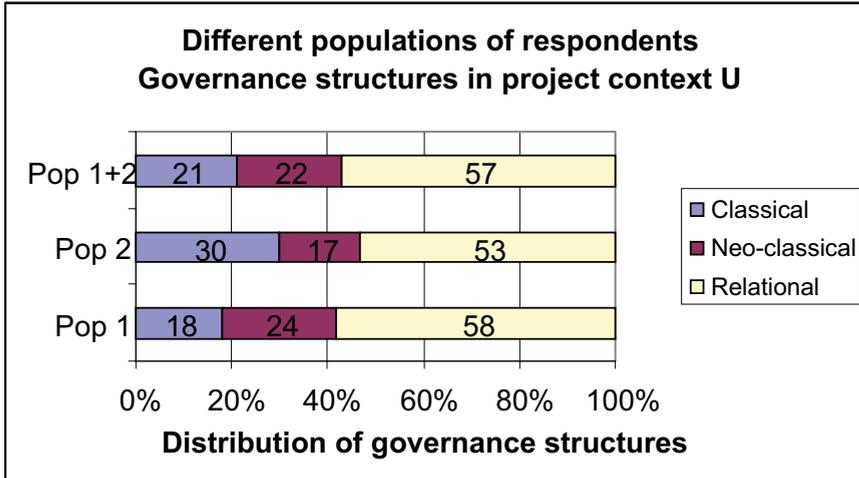


Figure 4.31: All project types – choice of cooperation form in project context U (Table 4.2) by different populations of respondents

4.8 Inquiry regarding general parameters to regard when contracting

In the second proportion of the inquiry, the respondents were asked to rank in a more generic manner the different factors affecting the choice of contract form, compensation form and governance structure. In this part a scale (0 – 6 points) was used to get a value for the importance of different factors.

4.8.1 Choice of contract form in the context of external factors

According to the results (Figure 4.32) regarding the influence of external factors when choosing a suitable contract form, the market situation (competition) seems to be the most important factor to consider. How the market situation influences the choice of contract form is described in section 4.7.

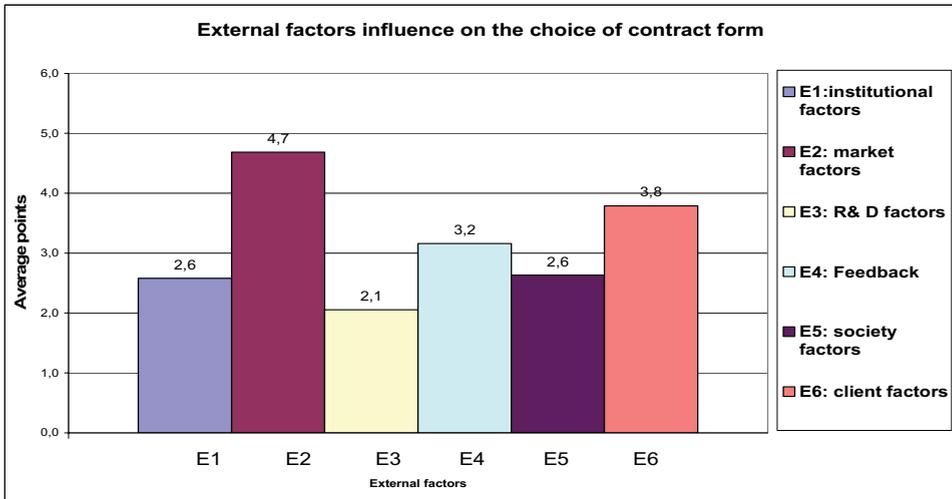


Figure 4.32: Choice of contract form in the context of external factors

4.8.2 Choice of contract form in the context of project related factors.

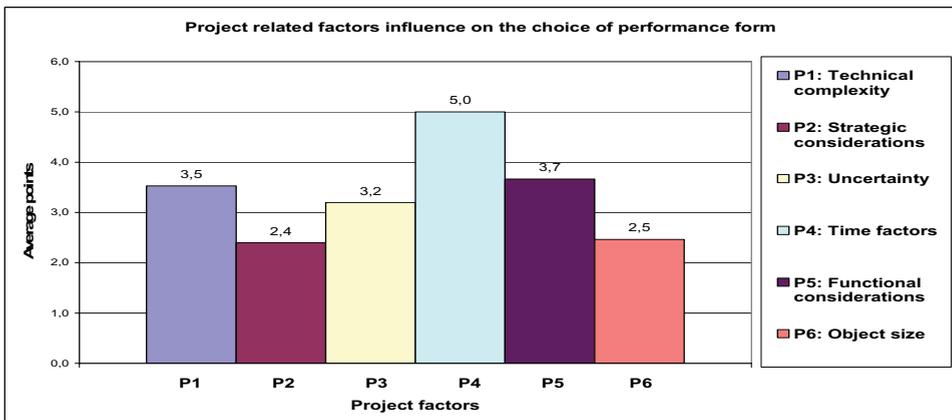


Figure 4.33: Choice of contract form in the context of project related factors

The influence of project-related factors on the choice of a suitable contract form is illustrated in Figure 4.33. The lead-time context is regarded to be most important as it has got 5.0 points. The object size and also strategic considerations seem to be far less important as they have got 2.5 and 2.4 points respectively.

4.8.3 Choice of compensation form in the context of external factors

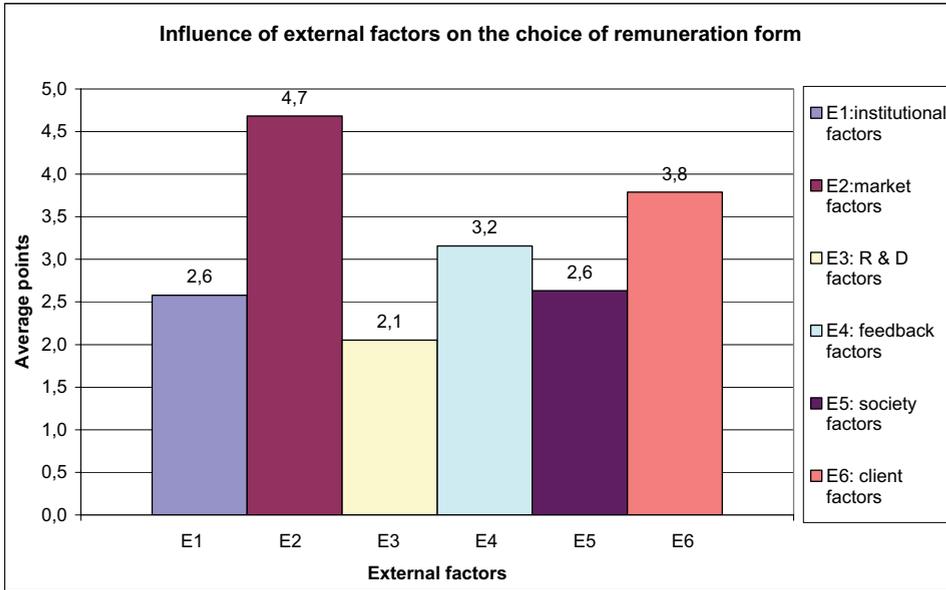


Figure 4.34: Choice of compensation form in the context of external factors

According to Figure 4.34 the market factors (4.7 points) are most important to consider when choosing an appropriate compensation form when contracting. Other important factors are client factors, as they have got 3.8 points. The term *client factors* implies that the client is interested in being involved actively in the construction process, for example through application of relational contracting concepts such as partnering.

4.8.4 Choice of compensation form in the context of project related factors

As illustrated in figure 3.33 the most important project factors to consider when choosing the most suitable compensation form are uncertainties and time factors as they have got 4.5 and 4.1 points respectively. Even the degree of technical complexity is also regarded as important to consider.

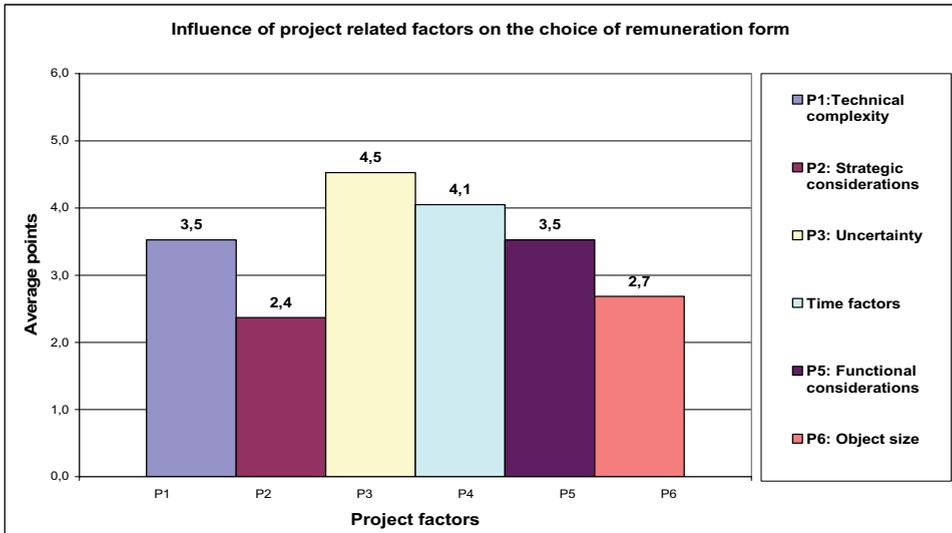


Figure 4.35: Choice of compensation form in the context of project related factors

4.8.5 Choice of governance structure in the context of external factors

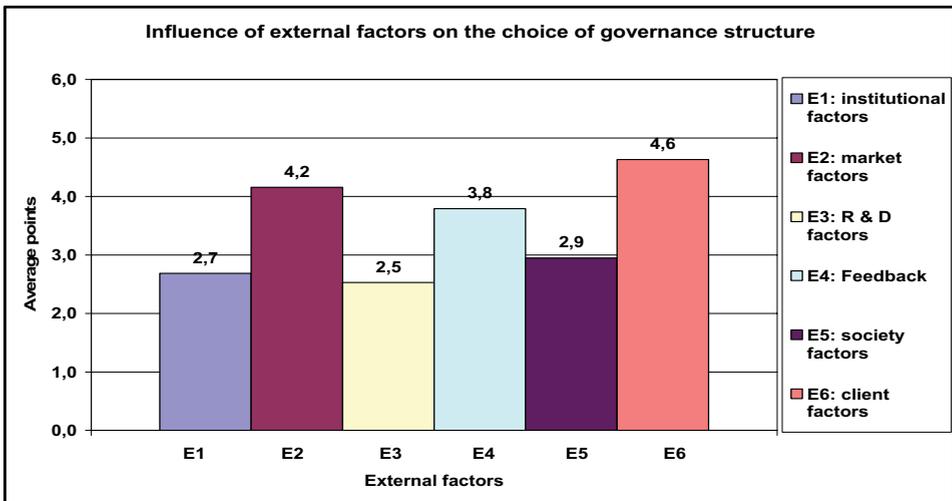


Figure 4.36: Choice of governance structure in the context of external factors

As shown in Figure 4.36 the most important external factors to consider when choosing an appropriate governance structure are client factors and the market

situation. The term *client factors* means that the client is interested in being involved actively in the construction process, for example through partnering.

4.8.6 Choice of governance structure in the context of project related factors

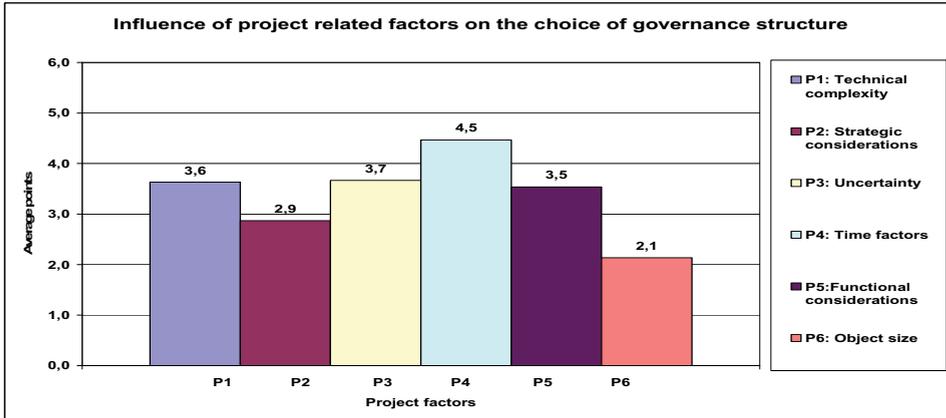


Figure 4.37: Choice of governance structure in the context of project related factors

According to Figure 4.37 important project related factors to consider when choosing a governance structure when contracting are the time situation, uncertainties and technical complexity.

4.9 Concluding analysis and discussion

4.9.1 Contracting in a situation without time and resource restrictions (N)

In the inquiry this project context was named Normal (N), in the sense that the client can decide quite freely regarding contract forms as the lead-time for the project enables free choice concerning the responsibility of design. Thus it is possible to finalize the design of the project before initiating the bidding procedure. The market situation is also considered to have a situation of satisfactory competition which enables the client to get bids for his project.

In this project context the aggregated mean values from the two populations and four project types indicate that DBB (design, bid and build) and DB are favoured to almost the same degree (see Figure 4.2) as contract forms. Concerning the choice of compensation form, fixed price is recommended by

four out of five respondents (*see Figure 4.12*). Traditional governance forms are recommended by a large majority of the respondents as only one out of five favours partnering concepts. It is notable, however that almost two of five respondents recommend the business relationship form, as shown in figure 4.22. Thus neo-classical and relational governance structures promoting cooperation are favoured by a large majority even in this uncomplicated project context, too.

How different project types affect the choice of procurement models in project context N (*see Table 4.2*) is presented in figures 4.2, 3.12 and 4.23. The choice of contract form is to a high degree affected by the project type. Whereas in the case of a technically complex project as a large business centre and in a more technically simple project type such as the dwellings, DB forms are preferred by only about every second respondent, nine out of ten recommend that model in the smaller business centre project. It is also notable that very few of the respondents recommend using the CM (Construction management) approach in which the client keeps the responsibility of design to himself and contracts the project stepwise.

Regarding the choice of compensation form there are also big differences due to the actual project type in question (*see Figure 4.13*). For technically more complex projects, transparent compensation is chosen to a higher degree than in the case of technically simpler projects. Thus transparent compensation is recommended only by less than one out of ten respondents in the case of a dwelling, while four out of ten recommend that in the case of a large business centre.

The choice of governance structure is also highly influenced by the project type (*see Figure 4.23*) as one out of three respondents favour partnering cooperation in the case of the business centre project while only one out of five prefers that in the case of a dwelling project.

According to figure 4.7 the two groups of respondents' favour the traditional DBB form to the same degree whereas there are some slight differences regarding the choice of CM and DB forms.

Regarding the choice of governance structure and compensation form illustrated in figures 4.26 and 4.27 the two groups of respondents are in quite good agreement.

Discussion

The results regarding how the respondents in this study recommend the choice of contracting model in the project context N reveal some noticeable indications.

- The choice of DB or DBB contract form is basically affected by the question of distribution of responsibility for design. This issue is also highly marked by personal preferences.
- For more complex projects the proportion favouring DB forms increases, probably mainly due to the belief that contractors can in such situations provide technically and economically favourable solutions due to their experience of such projects. For the follow-up of technical and economic goals, transparent compensation and close cooperation in the execution phase are recommendable tools to be used by the client.
- In the case of technically simpler project such as the dwelling project case, DB forms are favoured by clients, as they distribute more of the risk to the contractor, often result in less expenditure for the design and the client can be quite confident to get a product fulfilling functional demands.

4.9.2 *Contracting in a situation with lack of resources*

In the study this project context was named R (see Table 4.2). In this context the client can as in the previous case (N) decide regarding procurement models without regard to the lead-time for the project. Thus it is possible to finalize the design of the project before initiating the bidding procedure. But the market situation is considered to have a situation of unsatisfactory competition (lack of resources) so there is a risk that the number of bidders will be restricted.

In this project context, the aggregated mean values from the two populations and four project types, indicate that DBB (design, bid and build) and DB (design and build) contract forms are favoured to almost the same degree (*see Figure 4.2*), which is quite like the situation in the previous project context N. However, it is notable that fixed price is recommended only by every second of the respondents (*see Figure 4.12*) in this context and that one of three respondents also prefers relational contracting concepts as governance structure.

How different project types affect the choice of procurement models in project context R is presented in figures 4.4, 4.14 and 4.24. In comparison with the situation in the project context N it is quite evident that the procurement strategy is affected by the market conditions. Thus CM and DBB contract forms are chosen, as they also give an extended group of contractors a chance to submit bids without taking responsibility of design.

Regarding the choice of compensation form there are also big differences due to the actual project type (*see Figure 4.13*). For technically more complex projects, transparent compensation is chosen to a higher degree than in the case of less complex projects. Thus transparent compensation is recommended by less than one of ten respondents in the case of a dwelling project while four of ten recommend that in the case of a large business centre.

The choice of governance structure is also highly influenced by the project type (*see Figure 4.23*) as one of three respondents favour partnering cooperation in the case of a large business centre project, while only one of five prefers that in the case of a dwelling project.

Discussion

The results regarding how the respondents in this study recommend the choice of contracting model in the project context R show some notable indications. The choice of DB or DBB contract forms seems basically to be affected by the question of distribution of responsibility for design. For more complex projects the proportion favouring DB forms increases, probably mainly due to the belief that contractors can in such situations provide technically and economically favourable solutions due to their experience of such projects. For the follow-up of technical and economic goals transparent compensation and close cooperation in the execution phase seem to be recommendable tools to be used by the client.

In the case of technically simpler projects such as the dwelling project, DB forms are favoured, as they diminish the client's risk and also the cost for the design. The client can also be quite confident to get a product fulfilling functional demands without transparent compensation and close cooperation (partnering) in the execution phase, as the functional targets are quite easy to define and are well known to most actors.

4.9.3 Contracting in a situation with critical lead-time

In the study this project context was named T (time critical). According to the prerequisites set out in the questionnaire, it was not possible to finalize the design of the entire project before initiating the bidding procedure. In comparison with the situation in project context N it is obvious that the strategy for the choice of suitable contract, compensation and governance structures is changed a lot with regard to the critical time context (*see Figures 4.33, 4.35 and 4.37*), since two out of three respondents recommend the DB (design and build) contract form, every second recommends transparent compensation and one of three relational contracting concepts such as partnering for cooperation.

The choice of contract form is also influenced by the project type according to figure 3.4. In the case of a dwelling project, four out of five respondents are in favour of DB as the most recommendable contract form. In contrast, in the case of a business centre project only every second recommends DB as the most suitable contract form.

Regarding the choice of compensation form, it is indicated that the project type has a big influence on whether transparent or fixed price is recommended. Thus transparent compensation is recommended by two out of three respondents in the case of a large business centre project while only one of three suggests that model in the case of an apartment building project. Contrary to this is the choice of governance structure only slightly influenced by the project type.

Discussion

According to the prerequisites, given in this time critical alternative (project context T) of the study, it was stated that the lead time was pressed. The results indicate that there are some different strategy options to be discerned in this case:

- if the project is technically complex and the client wants the contractor to be responsible of the design (DB form) he prefers in this case a relational oriented governance model through the use of transparent compensation and through cooperation in business partnership or formal partnering concepts. This option reveals a strategic choice by the client that gives him a good insight into the project execution phase and hence also an opportunity to follow up of the fulfilment of set targets continuously.

- if the project is technically simpler, as in the case of a dwelling project the need for relational oriented governance models is often not regarded to be of less importance than in a more complex project. This is probably due to the fact that the risk of not reaching set targets regarding costs and functions in this case is regarded as low.

4.9.4 Contracting in a situation with critical lead-time and lack of resources

In the study this project context was named R + T (resource and time critical). This option is a combination of the contexts presented above. According to the prerequisites set out in the questionnaire, there is a risk that few will be interested in bidding for the project and that it will be not possible to finalize the design of the entire project before initiating the bidding procedure.

The results show that the strategy for the selection of contract form, what concerns the choice between DB (design and build) and DBB (design, bid and build) forms, is much like the case in the project context time critical (T). However, more of the respondents prefer the CM form of contract in this case than in the previous ones, which make it possible to divide the project into a number of subcontracts. Two of three respondents recommend transparent compensation in this option and every second is also in favour of relational contracting concepts, such as partnering, for cooperation.

Discussion

This project context reflects as well a time pressed situation as a situation in which the business activity within the construction sector is strained due to a lot of ongoing projects. In such a situation the strategy for a client will be to find a suitable contracting model in order to attract resources (bidders) and also to find governance forms that make it possible to follow up the costs as well as the design of the project more efficiently. This explains the preferences for relational contracting models with transparent compensation and cooperative governance structures such as partnering.

4.9.5 Contracting in a situation of uncertainties

In the study this project context was named U (uncertainties). According to the prerequisites set out in the questionnaire, this context was exemplified with the risk of late layout changes in the project, which could involve additional as well additional as outgoing activities.

It is notable that in this project context are four out of five respondents recommend transparent compensation forms and three of five are also in favour of partnering concepts for cooperation (*see Figures 4.12 and 4.22*).

Discussion

The project context U is to a high degree connected to the situations described above. A short lead-time often contributes to a situation in which the time for design is too short for getting appropriate considerations from all stakeholders. This increases the levels of risks and uncertainties in a project.

In such a situation much of the design and of the execution also have to be parallel. In such a context it is an advantage for the outcome of the project if the client chooses a governance model enabling close and transparent cooperation during the execution phase.

4.9.6 Validity and reliability of results

According to Yin (1994) the validity for studies of this kind can be divided into the subcategories: construct validity, internal validity, external validity and reliability. The construct validity is connected to how well the study design has established the correct operational measures in regard to the task that is studied and also how well it reflects the real objects of study. Internal validity is connected to studies where causal relationships are investigated and is a measure for whether or not casual relationships have been established. External validity is a measure for the possibility to generalize the findings beyond the actual study. Reliability of a study is determined by whether or not it is possible to repeat the study and to get the same results.

According to the research method applied (*see Chapter 2*) the results have to be regarded as representative only for the system model used in the study and the actual population of respondents. This is because the reality has to be regarded as complex in many ways. Thus the external reliability in a scientific evaluation has to be regarded as low.

Regarding the construct validity, I tried to eliminate some of the risks of failures when designing the questionnaire. One of the most important things was to avoid influences from organisational restrictions (cultural influences), which entail the risk that respondents answer how they act in their actual job position. In order to limit this cultural influence, I asked the respondents to act as independent professional advisors in procurement situations. The different

project context situations were constructed to reflect real situations from my long experience as contractor. Thus my opinion is that the construct validity has to be set high in this study.

The internal validity of this study is a measure of for how casual relationships are proven to been established. According to the scientific basis for this study, the ambition was to find indications of casual relationships between the variables and the actual project context and the choice of contracting model. In my view the study indicates that the project context has a great influence on the contracting process.

4.10 Conclusions

The inquiry indicates that the project context has a great impact on the contracting process. The most important prerequisites to consider are the type of project, the market situation for bidding, the lead-time for the project and other uncertainties. This study also indicates that the contracting model has three interacting and important pillars to consider. First the distribution of responsibilities (contract or contract form), secondly how the contractor is compensated (compensation form) and finally how the cooperation and the coordination of the project is structurally organized (governance structure).

Whereas in a classical governance structure much effort is focused on how to distribute the responsibility of design (specifications) and on adherence to legal frameworks, in a relational contracting governance structure, effort is more directed at finding effective cooperation concepts based upon trust and transparency. The reason for this is the ambition to find structures and concepts encouraging actors to work in trustful cooperation for the best of the project. In this study this is indicated by the fact that clients in situations of time pressure, complex projects and uncertainties more recommend to choose contracting models enabling transparency and relational oriented cooperation forms, than to try to keep the design solely to themselves and to rely on classical governance structures. For example, in a situation when the project is pressed for time or the market situation is unfavourable for the client the most practical solution for procurement seems to be to apply DB (design and build) as contract form and to ensure a good insight into the progress of the project execution through application of transparent compensation and relational contracting concepts for project governance. Accordingly, the use of a classical governance structures is not recommendable in a complex, time pressed and uncertain project context. When compared to the overall situation of today within the Swedish construction sector the findings indicate quite clearly that a

behavioural change towards application of relational contracting concepts is recommendable.

However, this study indicates also that when the project context is considered to be without time pressure and the client have the opportunity to take the responsibility of and to finalize the design before finding a suitable contractor for his project, DBB contract forms, fixed price compensation and classical and neoclassical governance structures are favoured by a majority. This might also have advantages for some projects as by that more contractors can participate in bidding as they do not need to take the responsibility of design and as also the cost for bidding is also reduced.

5 CASE STUDY OF RELATIONAL CONTRACTING

5.1 Introduction

As described in previous chapters' contracting issues in connection to construction projects are a very important to consider in order to get an appropriate basis for governance of the construction process. This is especially important in connection with projects with uncertainties involved, due to technical complexity, time restrictions and other challenging conditions.

In this chapter a case study is presented of process design issues in the context of a project contracted with a relational contracting governance structure. The study was conducted in the form of an inquiry, as observations and as interviews among stakeholders involved as client representatives, contractors and consultants in the execution of the project.

The main objective by the case study conducted was to study the interaction between external conditions (the project context), the procurement process and the selected strategy for project execution (the process design).

The overall context to the case study, the research objectives of the survey and my considerations when designing the case study and how it was accomplished are presented. Further more, the results from the study are analyzed and discussed in order to answer the research questions.

5.2 The context for the case study

This case study of relational contracting was conducted in connection with a huge project, a pelletizing plant for a Swedish mining company (LKAB) owing iron ore mines and delivering its products especially to European steel mills. Due to extremely favourable market conditions for pelletized iron ore products, LKAB decided in December 2004 to build a new pelletizing plant (MK3) in the north of Sweden. The MK3 project is a large and a technically complex project with an overall budget of about 350 million USD. It consists of a dressing plant, a pelletizing mill and a loading/unloading depot for a yearly capacity of 2.5 million tons of pellets.

The MK3 project context had components, according to Figures 4.2, 4.11, 4.22 in Chapter 4, of resource and time limitations (*R&T*), uncertainties (*U*) and strategic considerations (*S*) to be regarded in a contracting situation. This was because the lead-time was set extremely short, there was a lack of resources in the region in question, the project had to be started with a lot of uncertainties and LKAB had plans for other projects of the same type.

Thus LKAB decided to procure the MK3 project in order to get a relational contracting oriented governance system for the project that favoured transparency and cooperation among the stakeholders. LKAB initiated the procurement procedure by submitting an inquiry consisting of layout drawings, descriptions and estimation of quantities to get a basis for the procurement and also for the internal LKAB decision procedure. Thus, a request for bidding was sent to invited contractors in September 2004. It stated that the procurement process was to be based on DB (Design and Build) as contract form, on cost reimbursable compensation with incentives and that the project was planned to be executed as a *partnering* project. Thus the project was procured according to the recommendations given by Toolanen (2006) in a paper *Footprints of procurement strategies at the Swedish construction market*.

A preliminary contract for the civil works was finalized with the main civil contractor NCC four weeks after the distribution of the inquiry. The civil works at site were started immediately after the LKAB board decision to invest in the project in November 2004. The set target lead-time from the decision by the LKAB board to the first production of iron ore pellets was about 24 months which was roughly 6-8 months shorter than at comparable projects conducted in the past. In Table 2 the quantities of some strategic parts of the civil works are presented.

Table 5.1: Rough quantities of some strategic construction parts in the MK3 project (Toolanen & Olofsson 2007)

Construction parts	Quantity	Truckloads
Steel Construction	7 500 tons	210
Reinforcing bars	2 000 tons	80
Concrete, casted on site	56 600 tons	3 700
Concrete, prefabricated	18 000 tons	540
Roofing and walling material	5 500 m ³	195
Wood material	550 m ³	36
Process equipment	9 700 tons	1 370

5.3 Implemented process design in the MK 3 project

The MK3 project addresses the issues concerning the design of project processes primarily by the use of 3D and virtual reality (VR) to communicate and coordinate the design in a concurrent engineering approach and by the implementation of a joint planning system for the project.

5.3.1 The use of IT- systems in the MK 3 project

The use of visualization (VR) was implemented in the MK3 project in order to create an iterative and concurrent design process as conceptualized in figure 5.1. All design of subsystems occurred simultaneously in a concurrent design environment. Most of the information that made up the VR models in the design and review processes of the plant originated from 3D CAD models developed by multidisciplinary design teams (Toolanen & Olofsson 2007).

The project coordinator was responsible for the overall design process, whereas the functional design teams were responsible for the design of the subsystems in the plant, i.e. process equipment, building structure, installations et cetera. They provided input of information to the *VR database* where a VR consultant, working for the client managed all the VR data and also updated VR prototypes accessible for everyone to use in the project. The provided VR prototypes, denoted VR1 to VRn in Figure 5.1, were also used in the design review meetings that took place once every fortnight. Errors discovered during these design review meetings were immediately delegated to the design teams concerned. Errors, design changes that were addressed were logged and later confirmed in the next meeting. Decisions on major changes in the design are

taken after conducting a risk analysis regarding achievement of the main goals in the project.

Accordingly, one important target with the implementation of the IT support system was to support collaborative working methods, such as concurrent engineering, where communications, sharing of information and coordination of multidisciplinary design teams are identified as important components (Olofsson, et.al 2007).

The design process of the MK3 project has had the following design priorities:

- the design of the pelletizing process
- the plant layout (the plant and its surroundings)
- the construction of the buildings sheltering the process equipment

Thus was the ambition to prioritize the achievement of functional demands linked to the assembling and functionality of the process equipment in the plant instead of the actual building.

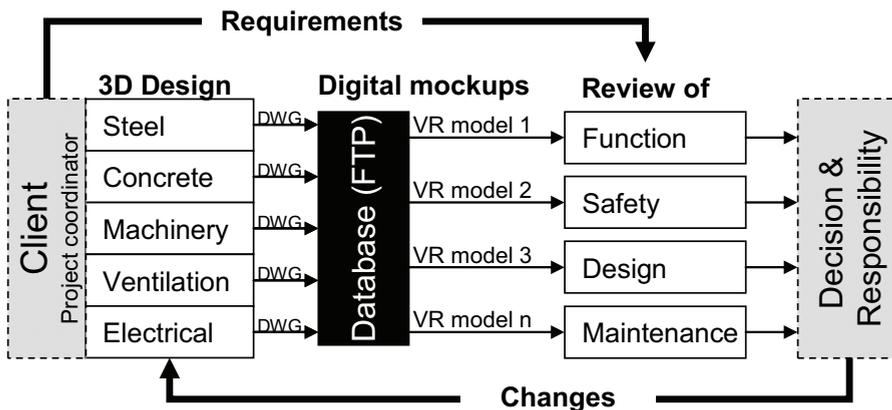


Figure 5.1: An iterative design process using VR models (digital mock-ups) in the MK 3 project (Toolanen & Olofsson 2007)

The implemented VR system has in the MK3 project been used as a tool in design coordination and in the review and decision processes throughout the whole MK3 project (see Figure 5.2). All design of subsystems occurred simultaneously in a concurrent design environment. Most of the information that makes up the VR model in the design and review process of the plant originated from 3D CAD models developed by multidisciplinary design teams.

These teams worked together to meet the common project targets set up by the client.

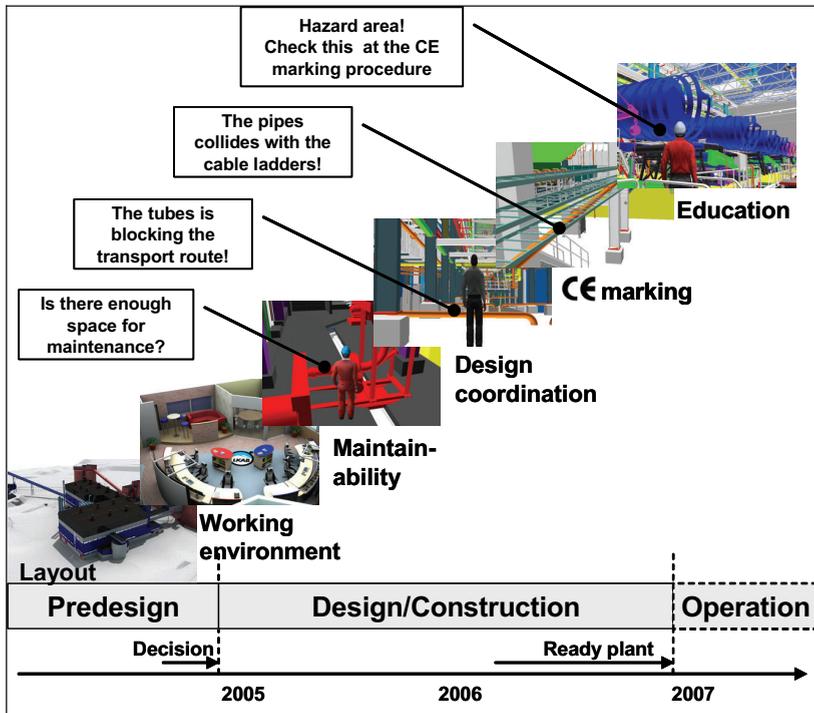


Figure 5.2: Benefits from the design process in the MK3 project, (Olofsson et al. 2006)

5.3.2 The planning system in the MK3 project

In order to ensure a good coordination of all the activities during the construction process it was a decision by the main partners of the MK 3 project to invest in and to use Primavera as a common planning platform (see Figure 5.3). The master schedule was based upon delivery of detailed descriptions of every single activity from the main subcontractors responsible for installations, process equipment and civil works. With this arrangement it was found necessary to establish a centralized planning department in order to manage the system due to all the tremendous amount of information. The main features expected using the common planning systems were (Toolanen & Olofsson 2007):

- one Master consolidated from all main delivers

- each equipment specified from Design to Commissioning
- inter project relationships gives control & understanding
- overview per subproject / system / area / equipment etc.
- linked Training activities to each system / equipment
- well defined structures gives accurate reports
- *on time* analysis enabling faster decision making

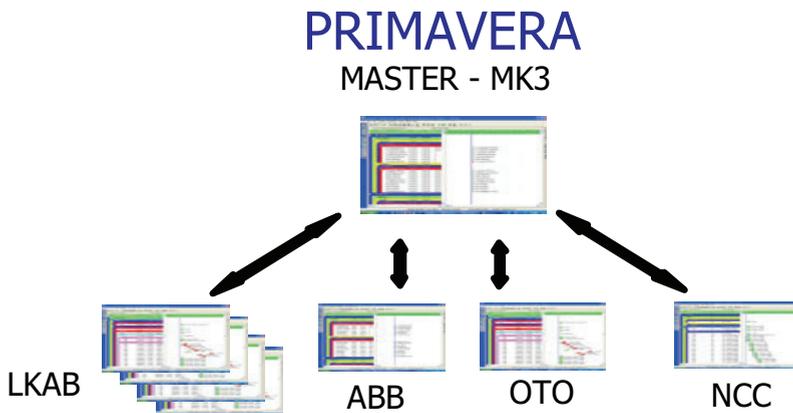


Figure 5.3: The Primavera planning structure

5.4 Design of the case study

5.4.1 Objectives with the study

From the theory background as presented in Chapter 3 was learnt what considers relational contracting:

To sustain a relational oriented cooperation in projects requires great levels of trust among the stakeholders. A key to the development of a trustful relationship is often processes and structures, process design issues that foster team-working and sharing of information. Important elements to consider in such relations are also transparency and equal treatment. In the construction industry, the partnering concept is an example of attempts to get such a relational contracting oriented structure for governance. Early involvement the

partners is often beneficial for the process, such as cooperation in the design phase in construction projects.

Accordingly, the main objective by the case study conducted was to study the contextual support and obstacles of the process design measures implemented in the relational contracting context applied through the procurement process.

The case study consisted of an inquiry, observations and interviews in order to respond to the research question (see section 1.4):

- *How can the application of relational contracting concepts affect the process design in the execution phase?*

5.4.2 Design of a system model of the relational oriented construction process

The system model used (see Figure 5.4) in the case study and for the description of the main important components of partnering is based mostly on Bennet & Jayes's report *Seven Pillars of partnering* (1998).

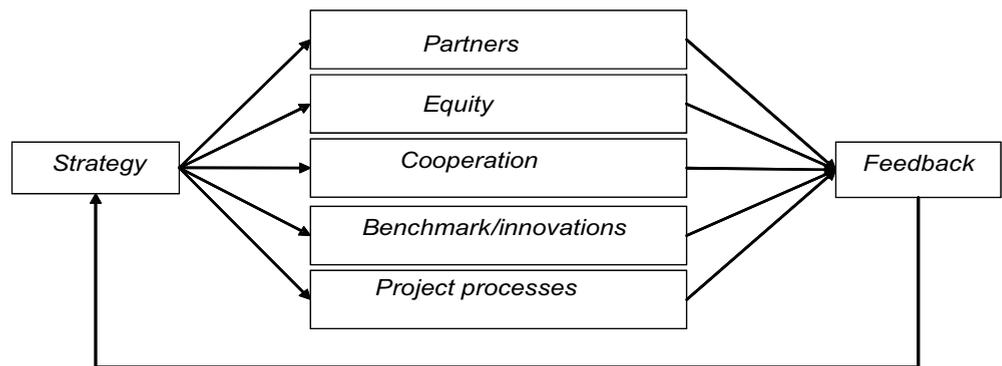


Figure 5.4: System model used in the case study at the MK 3 case study, (Toolanen 2007)

5.4.3 Design of the inquiry

In the inquiry the respondents/stakeholders were asked to respond to a series of statements in order to get their view concerning different aspects of the partnering process. I formulated the 35 statements to get response to the different characteristics of the different components in the model of the relational oriented contracting process. The answers to the statements were

positioned on a six grade scale with the extremes from *not agreeing at all* to *agreeing totally* or from *has functioned badly* to *has functioned excellently*. The statements in the questionnaire used in the inquiry are shown in Table 5.2.

Table 5.2: Statements in the questionnaire, the MK3 project.

<p>S1: The project will be managed with a positive spirit and shall be marked by teamwork, honesty, openness and knowledge sharing among the stakeholders.</p> <p>S2: We will create motivation and commitment by all through participation and communication.</p> <p>S3: Ensure balance between the goals regarding functions, time and economy.</p> <p>S4: As a reference project develop cooperation models that will be leading for future projects</p> <p>S5: High level of ethics and morale will characterize the project.</p> <p>S6: Diminish curtailments and prejudices</p> <p>S7: Ensure cooperation among the stakeholders in the project.</p> <p>S8: In comparison with a conventional DB project the cooperation between client, consultants and main contractor has been much more efficient in the design phase.</p> <p>S9: In comparison with a conventional DB project the cooperation among client, consultants and main contractor has been much more efficient in the construction phase</p> <p>S10: LKAB, NCC, WSP and Sweco Bloco are partners according to the partnering charter! Is your opinion that the partnering group has been composed in an optimal way?</p> <p>S11: The group of partners should have been enlarged with other strategic suppliers and subcontractors?</p> <p>S12: The partnering group has functioned as a homogeneous group and all stakeholders have been allowed to contribute their competence in an open minded and trustful way!</p> <p>S13: All partners have to accept to work with open books (transparency)</p> <p>S14: The partnering concept in this project makes this project cheaper for LKAB (client) than if it had been contracted in a traditional way.</p> <p>S15: The partnering concept in this project causes this project to get a shorter lead time than if it had been contracted in a traditional way.</p> <p>S16: The partnering concept in this project makes this project achieve set quality and functional targets better than if it had been contracted in a traditional way.</p> <p>S17: The partnering group that has worked with the MK3 project has given priority to long term thinking and the wellbeing of the project over short-term profits.</p> <p>S18: The white-collar workers of the MK3 project have as a rule got useful and relevant training in order to better understand the meaning and the requirements of a partnering project.</p> <p>S19: The blue-collar workers of the MK3 project have as a rule got useful and relevant training in order to better understand the meaning and the requirements of a partnering project.</p> <p>S20: The investments in development and training of employees in the MK3 project (the human capital) have been well balanced.</p> <p>S21: In the MK3 project well-balanced investments have been made in the use of IT support systems (Cad VR and e.t.c.)</p>
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S22: In the MK3 project well-balanced investments have been made in the use of engineering technology (new materials, new products, new production technology, e.t.c.).

S23: The incentive agreements being in the project support in a good way the overarching targets of the partnering charter.

S24: The incentive agreements existing in the project are rewarding in a fair manner and give incentives for unusual achievements.

S25: The partnering cooperation, the incentive agreements and the transparent economics accounting in this project makes it cheaper for LKAB (client) than if it had been contracted in a traditional way.

S26: The partnering cooperation, the incentive agreements and the transparent economic accounting in this project imply that it gets a shorter lead-time than if it had been contracted in a traditional way.

S27: The partnering cooperation, the incentive agreements and the transparent economic accounting make this project achieve set quality and functional targets better than if it had been contracted in a traditional way.

S28: The partnering cooperation, the incentive agreements and the transparent economic accounting make this project to implement more innovations than if it had been contracted in a traditional way.

S29: The existing partnering cooperation has made the climate for innovations better than if the project had been contracted in a traditional way.

S30: I am totally satisfied with how technical innovations (new materials, new products, new production technology and e.t.c.) have been implemented in the MK3 project.

S31: The visualisation by CAD techniques is a very valuable innovation in the MK3 project and it has also been utilized in an optimal way.

S32: In the MK3 project, suggestions of the employees regarding continuous improvements have been taken advantage of in a good manner.

S33: My opinion is that the system in the MK3 project for feedback of experiences for the benefit of future projects is good and well-balanced.

S34: My opinion is that the system being in the MK3 project regarding follow-up of results is good and gives incentives for the white-collar workers at the MK3 project to go in for high achievements, good cooperation with others and improvements.

S35: I am convinced that the follow-up system we have in the MK3 project will take care of well-balanced experiences and learning of the partnering process and of the rest of the project in favour of future LKAB projects.

5.4.4 Accomplishment of the case study

The questionnaire was distributed in digital form to 35 stakeholders actively involved as main contractors, client representatives and as consultants in the MK 3 project. The questionnaire was answered by a total of 23 respondents, 11 of whom were contractors, 6 were client representatives and 5 were consultants.

Supplementary information regarding process design issues was obtained through observations and also through interviews.

The observations made during the MK3 study were connected to two workshops, jointly arranged by the stakeholders involved as partners of the MK3 project, and to five study visits during the project realisation phase.

Interviews were conducted with five executives among the stakeholders of the project in order to find out their point of view considering the relational contracting processes applied in the MK3 project.

5.5 Results of the case study

5.5.1 Analysis of the relational contracting process at the MK 3 project

In the following, an analysis is presented of the partnering process at the MK3 project based upon the model shown in Figure 5.4. The data for the analysis was mainly obtained from the inquiry, in which the different components (pillars) in Figure 5.4 were described according to the presentations below. The input for the analysis of the different components of the partnering process is based upon results from different combinations of the statements in Table 5.2.

Strategy

The strategy component of partnering is the basic element of the partnering process and expounds the overall targets and guidelines of the project. It is important to regard experience from previous projects according to the report *Seven Pillars of partnering (1998)* as feedback when formulating a strategy.

A strategy should regard:

- the most important targets in the project
- tactics and procedures supporting the achievements of targets
- the guidelines for design of the main processes

In the MK3 project most of the strategic considerations were formulated in a document, the Partnering charter (*Partneringdeklarationen 041130, see Appendix 5*). This document was a result of an initial workshop with participants from the client, the main contractor and the civil consultants. This document was also signed by the stakeholders. In the document were

formulated the overall targets for the project regarding work environmental issues, the equity, functional goals and the overall time schedule. The overall strategy for design of the main processes was also expressed in it. Buy this document was the overall base for the relational contracting issues also set out.

Partners

The partners (membership) component deals with the organisation of the partnering group. Partners of a relational oriented group should be interested in acting with transparency and in long-term thinking (strategic) and be focused on the achievement of customer value. It is often of high value to get influence from different competencies to the group of partners and this also in order to enrich the flow of information through effective communication. (Bennett, J., Jayes, S., 1998).

Figure 5.5 shows the evaluation of the results from the inquiry concerning the membership pillar. The evaluation was based upon five statements in Table 5.2 estimated to reflect this pillar.

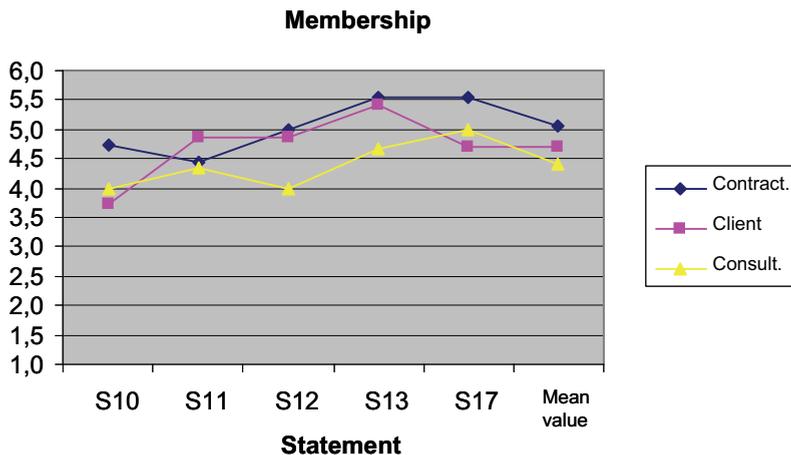


Figure 5.5: Results regarding the membership pillar

The results from this proportion of the study indicate that the actual partnering group was considered to have been too limited and too inhomogeneous (S10, S11) as only the main contractor and the client were full partners. The respondents were in agreement of the importance of transparency (S13) and long term thinking (S17) for the relational contracting process.

Equity

The equity pillar deals with how monetary incentives, investments and resources are allocated in the partnering project in order to enhance long term oriented cooperation in the project. Thus it deals with investments in as well the development of human as well as technical resources. In that sense are the transparency and justice aspects are important to consider. It is also often important to acknowledge the importance of profitability for the partners, as a sound economy is a good base for long term investments. Economic incentives should promote efforts above normal levels and also to be regarded as fair. (Bennett, J., Jayes, S., 1998).

In the partnering charter for the MK3 project it was explicitly stated that transparency has to be paid regard to in the project. It was also stated as a target that the partners should have a chance to get reasonable profits and also a fair chance to be rewarded by incentives.

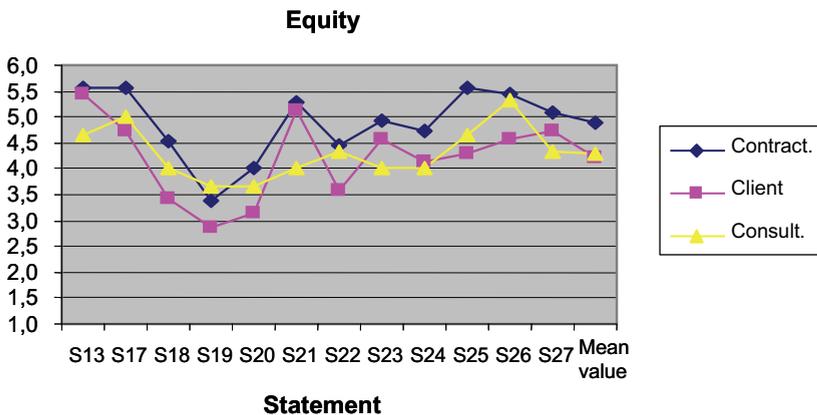


Figure 5.6: Results regarding the equity pillar

The results of the inquiry, as illustrated in Figure 5.6 indicate that many of the respondents, especially among the consultants, are not satisfied with the incentive models applied in the project (S23, S24). A majority of the respondents also state that they are not satisfied with the investments in education in relational contracting issues of the employees in the project (S18, S19 and S20). However the relational contracting model used is considered by a majority of the respondents to have been favourable for the achievement of set targets regarding lead time, technical functions and the economic outcome of the MK3 project (S25, S26 and S27). A majority of the respondents think that the investments in 3D Cad visualisation were well balanced (S21), but they

also express dissatisfaction with the overall level of innovations present in the project (S22).

Cooperation

An effective partnering process is based on a good cooperation among the stakeholders in a project. A basic element of that is the existence of trust and the development of trust in an organic way at every organisational level. It is a great advantage if the organisation of a project is regarded as homogeneous and integrated even if it in practise consists of resources from different cultures and competencies (*a virtual organisation*). A good base for achieving this is teambuilding activities and other activities promoting trust. Other things promoting integration are such as common IT- strategies and a high level of competence in the organisation. (Bennett, J., Jayes, S., 1998).

Regarding the integration pillar in the MK3 project, it is notable that was stated in the partnering charter that cooperation was to be based upon openness, teamwork and good communication. In the MK3 project workshops and other meetings were held in order to enhance the development of trust.

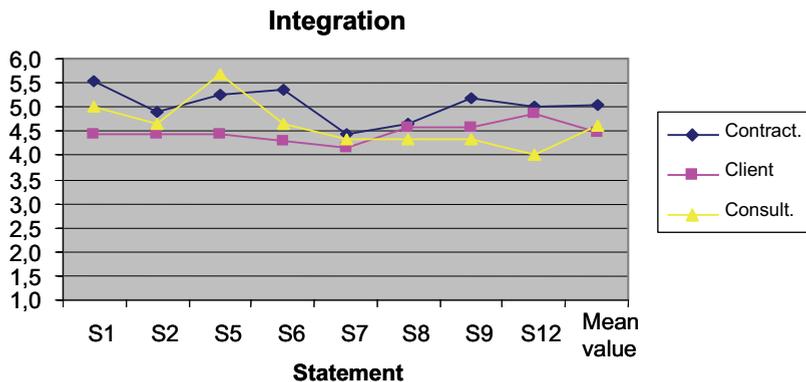


Figure 5.7: Results regarding the integration pillar

According to results from the inquiry, illustrated by Figure 5.7, the integration had in the view of a majority of the respondents developed in a good way. However, the contractors and consultants were somewhat more satisfied than the client representatives.

Benchmarks/Innovations

The main intention of the benchmarks / innovations pillar is to achieve continuous improvements through application of new knowledge promoting innovations. Innovation primarily means new knowledge for the organisation in question about technical and management solutions in order to improve the efficiency of the project. Innovations can be initiated through knowledge from other projects within construction or other branches (benchmark) or through implementation of knowledge obtained from research projects. An important factor regarding innovations is to establish incentives to encourage stakeholders to participate in an innovation process. In many ways it is a question of establishing an innovative climate in the organisation in question. (Bennett, J., Jayes, S., 1998).

According to the results from the inquiry (see Figure 5.8) regarding the benchmarking pillar the establishment of the partnering structure was considered an important innovation in itself in the project.

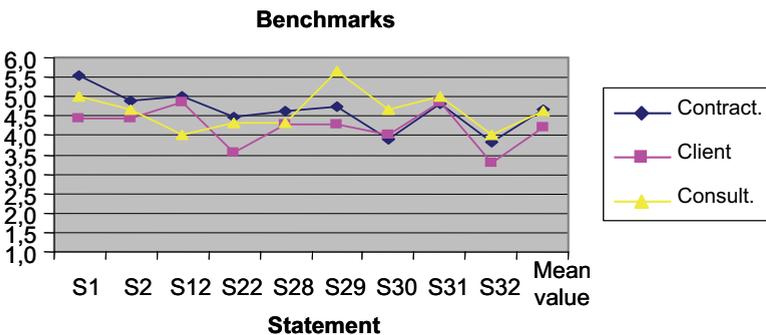


Figure 5.8: Results regarding the benchmark pillar

Also the use of 3D CAD and VR was considered to have been a successful innovation in the project according to a majority of the respondents (S31). Regarding other technical innovations, the opinion expressed especially by the client representatives was that there were very few examples of this in the project (S22, S30). Thus the potential for innovations through continuous improvements was not satisfactorily considered (S32) in the MK 3 project, even if it was considered to have been somewhat better than what has been normal in other projects.

Project processes

The process design pillar deals with how different processes and structures ought to be designed in order to achieve the fulfilment of set targets and other customer values in a project. Higher demands on shorter lead times, quality and economy often require other models for arranging the design and production phases in projects. An important component in that is to get a multi dimensional cooperation in the project among the client, the consultants and the contractors in order to take care of all competences for the benefit of the project. (Bennett, J., Jayes, S., 1998).

The design of the processes should also consider the interaction among the different components (pillars) in the Seven Pillars concept (see figure 4.2) in order to achieve a climate promoting continuous improvements and implementation of innovations. In this way it is possible to gain positive effects from the partnering cooperation.

According to the results from this study, in the MK3 project the process design was concentrated on processes enabling a good communication among the designers and contractors through concepts such as 3D CAD, VR and Concurrent Engineering. Furthermore, all strategic procurements were executed in cooperation between the client and the main contractor.

Feedback

A system for follow-up and feedback is essential in order to evaluate results and to learn from them for the future. A proportion of that is also essential for a fair handling of established incentives in the project. Furthermore, it is important to evaluate effects of implemented innovations.

The results from the inquiry regarding the feedback pillar indicate (see Figure 5.9) that the respondents maintain that the project gained a shorter lead time (S15) through the partnering cooperation, if it was compared with the theoretical case in which this project had been traditionally contracted. Contrary to this, the belief in lower project costs was not unanimous as there was a difference in the opinions especially between the contractors on one side and the client and consultants on the other, (statement S14 in Figure 5.9). The results from the study also indicate that especially the client and consultants were not satisfied with the feedback pillar (S33, S34).

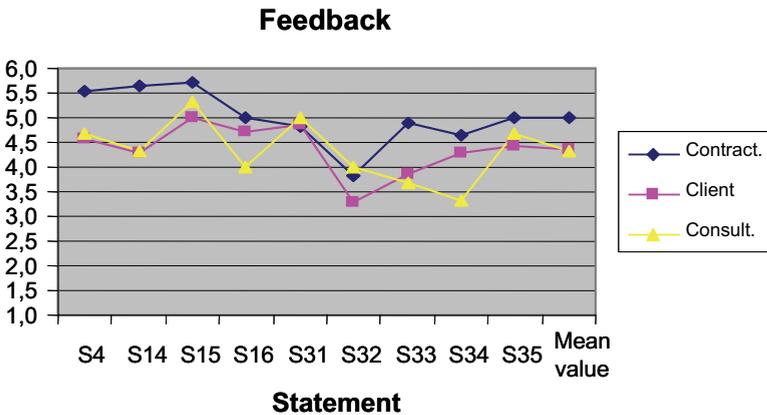


Figure 5.9: Results regarding the feedback pillar

5.6 Analysis, discussion and conclusions

5.6.1 Analysis of findings of the inquiry

The evaluation of the cooperation and the process design in the MK3 project, on basis of results of the inquiry conducted, is based upon a model for partnering according to the report *Seven Pillars of partnering* (Bennet, J., Jayes, S., 1998). This model has been found to provide a good basis for an analysis of the different factors that are, by experience from partnering projects in UK, important to consider in a relational contracting project. The components of the process design should be adapted to the special targets and presuppositions in the project in question in order to optimize the process structure. The main ambition of the inquiry was to evaluate the applied partnering structure and other process design issues at the MK3 project in order to find strengths and weaknesses in it.

According to the overall results from the inquiry conducted in connection to the construction of the MK3 project, a huge majority of the respondents are convinced that the application of relational contracting concepts for governance of the project was successful. Thus it was also an important prerequisite for achieving the set targets regarding functions, lead time and economy.

One of the main advantages of the relational contracting was the improved climate of cooperation among the stakeholders in comparison with conventionally procured and governed projects. The improved cooperation was

a necessary prerequisite for making use of all strategic competencies in an efficient way in order to secure the overall targets of the project. An especially important proportion of the process was to get a process design enabling cooperation among the client, the contractor and the consultants, in order to enable achievement of product design solutions meeting set functional targets in an efficient way (concurrent engineering). As an effect of the combination of cooperation, transparency and trust among the stakeholders it is quite evident that these process design features enabled changes improving functions to be conducted even in late phases in the project as well.

The use of visualisation through the use of 3D CAD and VR was considered by most stakeholders, besides the use of partnering as the overall base for relational contracting, to have been the most important innovation in the MK3 project. On the other hand, the overall climate for innovations was not regarded as satisfactory according to many respondents. Thus, for example the need for information about and education in the established process design was not regarded as optimal.

According to many respondents it would have been an advantage to extend the number of partners in the partnering arrangement in order to further improve the cooperation among the strategic suppliers to the project. This would have facilitated the coordination of the different stakeholders in order to minimize lead time and to reduce costs (resources) in the project. The results also highlight the need for involving all the stakeholders, also the blue collar workers, in a project in order to achieve better coordination, cooperation and efficiency in future projects.

5.6.2 Findings of observations

The main observations regarding process design issues acquired through participation in workshops can be summarized as follows:

- The overall climate of openness, cooperation and trustful participation among the stakeholders was evident.
- The use of IT-support through 3D visualisation (VR) was by a majority of stakeholders considered to have been a practically useful tool in many ways.

- The production planning system applied, was criticised by many to have been too complicated and for not having delivered adequate information.
- Innovations seemed not to be highlighted as issues for the workshops

5.6.3 Discussion and conclusions

The main target, with the case study conducted, was to evaluate the applied process design at the MK3 project considering contextual support and obstacles due to process design issues. An ambition by the study was also to contribute to the ongoing innovation process regarding application of relational contracting concepts in Sweden.

According to the overall results from the study conducted in connection to the construction of the MK3 project, a huge majority of the respondents were convinced that the application of partnering as a relational contracting concept had been successful in many ways. For example, it was regarded by most respondents to have been an important condition for achieving set targets regarding functions, lead time and economy. One basic reason for this was the improved climate of cooperation achieved among the stakeholders in comparison with conventionally procured and governed projects. However, there were also to be found critics, especially within the client organization, who were in doubt about the benefits of the partnering processes implemented in the MK3 project.

The improved cooperation in the project was also by a majority regarded to have been a necessary prerequisite for taking care of strategic competencies in an efficient way in order to secure the overall targets of the project. For example had the actual process design enabled efficient cooperation among the client representatives, the contractors and the consultants in product design issues (concurrent engineering). As an effect of the combination of good cooperation, transparency and trust among the stakeholders it was quite evident that also design changes improving functions had been possible to be conducted even in late phases of the project.

The use of visualisation through the use of 3D CAD and VR was regarded by most stakeholders, besides the use of partnering as the overall base for relational contracting, to have been the most important innovations in the MK3

project. On the contrary had the overall climate for innovations not been regarded in a satisfactory manner. Thus was, for example the need of information about and education in the established process design not regarded in an optimal way.

According to many respondents it had been a favour to extend the number of partners in the partnering arrangement in order to further improve the cooperation among the strategic delivers to the project. This had further improved and enabled the coordination of different stakeholders in order to minimize lead time and to reduce costs (resources) in the project. Also was by the results of the study highlighted the need of involving all the stakeholders, also the blue collar workers, in a project in order to achieve better coordination, cooperation and efficiency in future projects.

6 CONCLUSIONS

6.1 Introduction

In this chapter, some conclusions of the research conducted in this thesis are drawn. At first, conclusions of the study regarding how different internal and external project prerequisites, the project context, affect the choice of contracting model for different project types are presented. This proportion of the thesis was conducted as an inquiry in which respondents had to give advice considering the choice of appropriate combination of, contract form, of compensation form and the overall governance structure. Secondly, conclusions from a case study conducted at a huge project, the MK 3 pelletizing plant at the mine company LKAB, in which a relational contracting concept in the form of partnering was applied as governance structure are presented.

Based upon the studies conducted and also upon theories considering relational contracting (Chapter 3), the scientific and practical contributions of this thesis are presented in sections 6.4 and 6.5. Furthermore, in section 6.6, ideas of future research within the relational contracting field within construction are discussed.

6.2 Conclusions of the study regarding procurement behaviour

The main objectives by the survey regarding procurement behaviour were to study how different internal and external project prerequisites (*the project*

context) affect the contracting process and the choice of contracting model. This with the objective to find answers to the research questions:

- A. How does the project context, determined by different project related factors and external prerequisites affect the choice of contract form, compensation form and governance structure when contracting for a construction project*

- B. How can contracting be used as a target management tool?*

6.2.1 Answer to the research question A:

The inquiry conducted indicates that the project context has great impact on the contracting process. The most important prerequisites to consider are project type, market situation for bidding, lead time for the project execution and uncertainties enabling risks for changes and variations during the project execution phase. This study shows also that the contracting model has three interacting and important components to consider. First the distribution of responsibilities (contract form), secondly how the contractor is compensated (compensation form) and finally how the project is structurally administrated and organized (governance structure).

The answer to the research question A is illustrated by Table 5.1 that shows the most recommended choices of contract forms, compensation forms and of governance structures in different project contexts. In the figure is presented agglomerated values for four project types. The findings (Table 5.1) indicate that the most recommended combination of contract form, compensation form and of governance structure, the contracting model, is in high a degree affected by the project context.

A notable finding of the survey is that the choice of contract form is as well influenced by the project context as also of personal preferences, probably also a question of trust, regarding distribution of the responsibility of design. For example, those who are reluctant to distribute the responsibility of design to contractors by choosing DB (design and build) as a contract form prefer even in time pressed situations, when design and construction activities have to parallel, to keep the responsibility of design by them selves. However, in more complex project contexts, the recommendation of the use of DB forms is evident, probably due to the belief that contractors can in such situations provide technically and economically favourable solutions due to their experience of such projects.

Accordingly, in complex project contexts, are transparent compensation and trust based cooperation through application of relational contracting concepts in the execution phase recommended. The main motive power in these contexts seems to be the facilitation of the follow up of technical and economical targets through collaboration and transparency.

Table 6.1: Interaction between project context and choice of contracting model. Most recommended combinations.

	Most recommended contract form		Most recommended compensation form		Most recommended governance type	
	Design-Bid-Build	Design-Build	Fixed price	Transparent	Transactional	Relational
Decision context						
Normal , design and construction can be time-wise separated, no lack of bidders	X		X			X
Resource critical , design and construction can be time-wise separated, risk for lack of bidders	X		X			X
Time critical , short leadtime, design and construction has to be parallel, no lack of bidders		X	X			X
Resource and Time critical , short lead-time, design and construction has to be parallel, risk for lack of bidders		X		X		X
Uncertainty , risk for late changes and redesign, uncertainty in the build. program		X		X		X
Strategically , client interested to promote innovations, long-term thinking		X		X		X

Notable is also that the application of transparent compensation forms and relational oriented governance structures are highly interacting solutions for complex and dynamic projects. It is also very clearly indicated by the results of this study that the use of fixed price compensation is not recommendable in connection to relational contracting concepts Accordingly is the use of fixed price compensation in connection to partnering projects not recommendable.

In the case of a technically simple project type as the dwelling project are DB (design and build) contract forms and classical project governance concepts favoured in high a degree even in project contexts where DBB (design, bid and build) contracts form are favoured for other project types. My explanation to this is that it gives the client less risk and often diminished costs for the entire project. This as the client can be quite confident to get a product fulfilling functional demands without application of relational contracting concepts for project governance as the product is well known for most actors and easy to specify regarding functional demands.

Regarding the choice of compensation form it is indicated that the project type has big influence on whether transparent or fixed price is recommendable. Thus, in a project context characterized by uncertainties, is transparent compensation most recommendable to be applied in the case of a large business centre project whereas in the case of a dwelling project fixed price compensation is to prefer. Contrary to this is the choice of governance structure only slightly influenced by the project type.

Accordingly, the findings of this research indicate how the increased frequency of more complex and time pressed projects should be handled contractually. For those project types and project contexts are contracting models enabling and promoting trust based cooperation among the strategic stakeholders strongly recommended to be applied.

When compared to the overall situation of today within the Swedish construction sector the findings indicate quite clearly that a change towards application of more relational oriented contracting concepts, such as partnering concepts, is desirable. This as the main target for the client should be to apply structures and concepts for the project execution promoting actors to work in trustful cooperation for the best of the project. In this research this is indicated especially in situations of time pressure, complex projects and uncertainties. In such project contexts, the clients are recommended more to focus on to get transparency and relational oriented governance structures than to try to keep the design solely by themselves and to apply classical governance structures.

Accordingly is the use of DBB contract forms, fixed price compensation and classical governance structures not recommendable in complex, time pressed and uncertain project contexts.

Contrary, when the project context is regarded to be without time pressure and there are lots of interested bidders are classical DBB contract forms, fixed price compensation and classical and neoclassical governance structures still a recommendable model for contracting. This might also have advantages for some projects as by that more contractors can participate in bidding as they do not need to take the responsibility of design and also as the cost for bidding for contractors will be reduced. Furthermore can adherence to classical governance structures be to prefer if the client is unwilling to mobilize required competence for participating in a relational contracting oriented construction process in an efficient way. This can especially be the case for “one time” clients.

6.2.2 *Answer to the research question B:*

A finding of this study is that the choice of contract form can in high a degree be used as a target management tool by the client in order to achieve set targets. The tools to use in this case are the interacting pillars of the contracting model, namely the governance structure, the compensation form and the contract form. Especially important by that is the choice of an appropriate governance structure, as it basically determines if the client wants to establish trust based cooperation with the contractors or if he prefers to keep “arm lengths distance” and to establish reliance on legal frameworks and the use of legal remedies.

Basically, the choice of compensation form interacts strongly with the choice of governance structure and therefore should trust based relational governance structures be coupled to transparent compensation forms. However, the use of transparent compensation forms can also be used in connection to classical governance structures as a tool for the client to get better insight especially in economical issues. This can be an effective measure, especially in project contexts with uncertainties, and also in contradiction to a common understanding, when the client distrusts the market factors to be functioning in a favourable manner and he wants a good insight in the costs of the project. This important choice is also affected by the project context and also by personal preferences regarding cooperation and distribution of responsibilities.

The choice of contract form is basically to be used in order in order to get a desired distribution of responsibilities for the design of the project. Furthermore, this tool can be used in projects from the utility point of view, for example, through the use of DB (design and build) contract forms in order to get contractors to contribute to the design of the project with their knowledge and experience of similar projects. Contrary in cases when the client is reluctant to distribute the responsibility of design he can use the CM (construction management) contract form as a tool to overcome problems with lead-time, uncertainties and so on, as the design and contracting activities can be parallel.

6.3 Conclusions of the study regarding the relational contracting process at the MK 3 project

The study in this thesis regarding process design issues in a relational contracting oriented project context was conducted as a case study at a huge project, the MK3 pelletizing project at LKAB. The system model (*see Figure 5.4*) used for the study was based upon a model of partnering according to the report *Seven Pillars of partnering (1998)*.

The overall objective with this study was to evaluate the applied process design at the MK3 project, with the objective to find strengths and weaknesses in it, in order to learn from it for future projects. In this context has to be pointed out that this was a pilot project for the client, what concerns the application of a partnering concept for cooperation.

According to the overall results from the study conducted in connection to the construction of the MK3 project, a huge majority of the respondents were convinced that the application of partnering, as a relational contracting concept, was successful in many ways. For example, it was considered to have been an important prerequisite for achieving set targets regarding functions, lead time and economy. One basic reason for this was the improved climate of cooperation, achieved among the stakeholders in comparison with conventionally procured and governed projects.

The improved cooperation in the project was also considered to have been a necessary prerequisite for taking care of strategic competencies in an efficient way. For example had the actual process design enabled efficient cooperation among the client representatives, the contractors and the consultants in product design issues (concurrent engineering). As an effect of the combination of good cooperation, transparency and trust among the stakeholders, it was quite

evident that also design changes improving the performance of the project had been possible to be conducted even in late phases of the project execution.

The use of visualisation through the use of 3D CAD VR was regarded by most stakeholders, besides the use of partnering as the overall base for relational contracting, to have been the most important innovations in the MK3 project. On the contrary had the overall climate issues for innovations not been regarded in a satisfactory manner. For example, the need of information about and education in the established process design had not been considered in a satisfactory manner.

According to many stakeholders, to extend the number of partners in the partnering arrangement in order to further improve the cooperation among the strategic delivers to the project had been a favour. This had further improved and enabled the coordination of strategic suppliers in order to minimize lead time and to reduce costs in the project. By the results of the study was also highlighted the need of involving also the blue collar workers more actively, in process design issues in order to improve coordination, cooperation and efficiency in projects.

6.4 Theoretical contributions of this thesis

6.4.1 Principles and model of Lean contracting

By the concept Lean contracting is meant *the implementation, as well of contracting models emanating from relational contracting concepts as of process design concepts influenced by lean thinking principles and methods.*

In Figure 6.1, a conceptualized model of the Lean contracting process is shown. The Lean contracting process is in that model been based on a model of Lean thinking principles (*see Figure 3.3*). Accordingly, my proposal for the principles of Lean contracting, based on the findings in this thesis, will be as follows:

1. *Identify the project values and the project context* - Definition and specification of value is the critical starting point. Value can only be defined by the ultimate customer and has to be expressed in terms of a specific product or service, which also has to meet set targets concerning, for example, time, price and quality. The project context is an identification of external and internal factors that have to be considered in order to find an appropriate governance structure and

organisation of the project. Important external factors to consider are market conditions, regulations, stakeholders and also research and development factors whereas internal factors are lead-time, project complexity and uncertainties of different kinds.

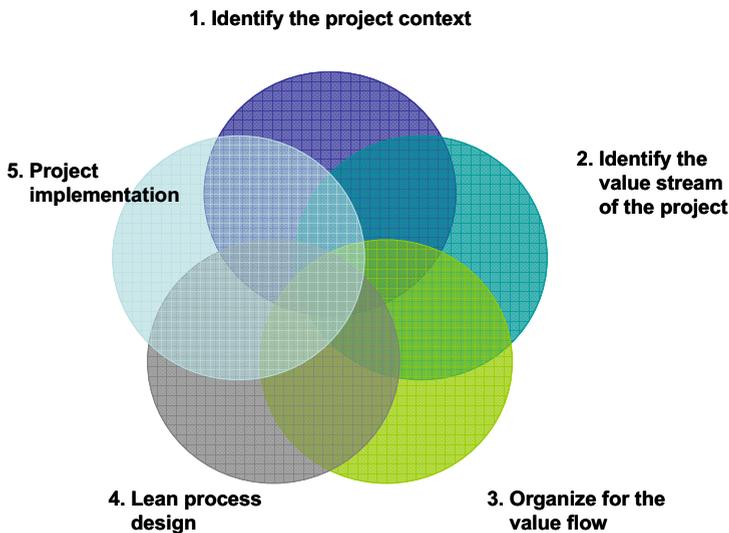


Figure 6.1: A conceptualized model of the Lean contracting

2. *Identify the value streams of the project* - The value stream (value chain) is the set of all specific actions needed to deliver a product or service. The value stream can often be subdivided into the problem – solving (design) task, the information management task (planning) and the physical transformation task (manufacturing). Especially in connection to a construction projects, it is very important to consider that the value stream mapping has to identify the strategic competencies and the resources, required for the achievement of set targets.
3. *Organize for the value flow* – After the value chain has been mapped and optimized to avoid waste (*muda*) of different kinds the next step in the delivery of value is to get in place an efficient delivery method of the product or service. The production theory most applicable for this, is according to Lauri Koskela (2000) an appropriate combination of transformation, flow and value theories (the TFV concept). The flow

theory is useful for understanding the necessity of considering the links and interaction among different sub value chains in order to minimise different kinds of waste. In this phase, the client has to decide how the strategic competencies and resources are acquired to the project. Accordingly, in this phase the client has to find an appropriate contracting model, considering the actual set of external and internal factors, constituting the project context (*see figure 5.4*). For complex and dynamic projects and for project with uncertainties of different kinds is the relation contracting oriented governance structure most recommendable.

4. *Lean process design according to the pull principle.* The pull principle in lean thinking has been created to avoid waste in the delivery chain, due to overproduction, products in storage and failures in production due to for example lack of information. The principle is that no activity should be started before it is ascertained that all the prerequisites for the release of the activity are fulfilled (approved design, material, human resources, etc.). The process design has to consider processes that promote, among others, allocation of innovations, concurrent engineering, IT – systems for visualisation and for planning systems for efficient coordination and cooperation, such as the Last planner concept (*Ballard 2000*).
5. *Project implementation and feedback according to the principle of perfection.* When delivering products and services, creating value for the customer, is the principle of perfection important to be considered as it means that all set targets for example regarding quality, economy and time has to be fulfilled in a satisfactory and efficient manner to the customer. Feedback is essential for the learning process and thus also for continuous improvements (kaizen).

6.4.2 *The overall feature of contracting models - the three interacting components*

This thesis indicates that the choice of an appropriate contracting model is often very complex as there are a lot of contextual factors to regard in order to find solutions that promote an efficient construction process. Accordingly, the study in this thesis regarding contracting of construction projects reveals that there are a lot of both project bound factors and external factors to regard when

designing an appropriate contracting model. Furthermore, this thesis indicates that the contracting model consists of three interacting components (*Figure 6.2*), namely the governance structure, the contract form and the compensation form.

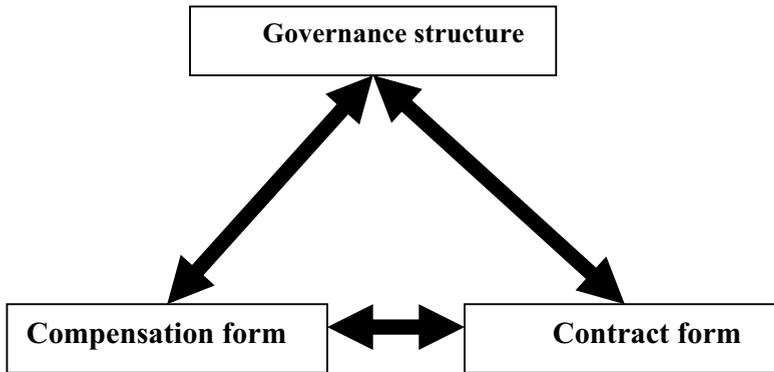


Figure 6.2: The interacting components of contracting

6.4.3 The choice of governance structure – the basic component of contracting

The choice of governance structure is the basic pillar of the contracting model. This as it establishes the type of cooperation and the nature of legal adherence the client wants to establish in the project. According to TCE (Transaction Cost Economics) there are three basic governance structures to regard when contracting. In Table 6.2, the features of the different governance structures with regard to construction projects are described.

Explicit relational contracting concepts for cooperation according to models set up mainly in UK, such as partnering, have been very little practised in Sweden up to now. However, a neo-classical model (

Table 6.2) based upon mutual strategic considerations, often without adherence to legal frameworks, has been used within contracting since decades in Sweden. In those, the partners have made a lot of deals in order to improve the

working climate and trust in order to find prerequisites for long term cooperation.

Table 6.2: Features of different governance structures

GOVERNANCE STRUCTURE	FEATURES
Classical Contracting	<ul style="list-style-type: none"> • Reliance on the market; discrete transactions • Adherence to legal frameworks • Use of legal remedies • Standardised contract planning • “arm length” distance between the stakeholders
Neo-Classical Contracting	<ul style="list-style-type: none"> • Longer-term relationship begins to assume more importance • Development of relational tendencies • Contract provisions cater for flexibility • “business partnership” based upon efficient cooperation and trust
Relational Contracting	<ul style="list-style-type: none"> • The commercial relationship assumes equal or greater importance compared to the legal agreement • Significant sharing of benefits and burdens • Greater interdependence • Bilateral governance (e.g. Strategic Alliance, Partnering) • Unified governance (e.g. Joint Ventures, Mergers, lean enterprise concepts)

6.4.4 *The choice of contract form – establishment of contractual responsibilities*

The choice of contract form is mainly a question of how to distribute the responsibility, considering design and coordination, between the client and the contractors. The study accomplished, indicates that this decision is mainly influenced by the project type, the market conditions and risk factors due to uncertainties. This choice seems also in a high degree be a question of trust between the client and contractors and is accordingly also linked to the choice of governance structure.

At the Swedish construction market, classical contracting structures, based upon standardized contract regulations (*AB04 and ABT 06*), worked out jointly by client federations and the Swedish Contractors Federation, are still favoured.

Accordingly, the *AB 04* regulation is applied for contracts in which the client has the main responsibility of design of the project (DBB contract forms) whereas the *ABT 06* regulation is applicable for contracts where the responsibility of design is distributed to the contractors (DB contract forms). The contract regulations applied, the AB04 and the ABT06 regulations, attempt in detail to spell out the responsibilities, authority, and compensation of each party. An embarrassing circumstance in connection to relational contracting oriented projects, as partnering projects, is that in lack of legal frameworks suited for such projects the classical contracting based regulations, AB 04 and ABT 94, are applied.

6.4.5 *The choice of compensation form – tight interaction with the governance structure*

The studies conducted indicate that the choice of compensation form is an important proportion of the contracting model, this as it is an important prerequisite for the achievement of relational oriented cooperation in projects in which that is a desirable perquisite according to the findings in this thesis. This is especially important in the context of project uncertainties, time and resource critical conditions and also when the client wants to get a base for active cooperation with the contractors in process design issues. Accordingly is the choice of compensation form in high a degree also connected to the choice of appropriate governance structure. In relational contracting is transparency one of the fundamentals of a trustful cooperation.

6.5 Practical implications and advice for practitioners

6.5.1 Introduction

The results of the studies conducted have quite evidently some practical implications regarding contracting within the construction sector and for the design of the construction process. In this section I will draw some conclusions based upon the results obtained of the studies conducted with an ambition to give advice to practitioners in contracting issues.

6.5.2 The client – the main conductor

The client has to consider that he has a very important role in the contracting process as he often has the ultimate power to conduct the overall process design. He has initially the power to decide considering the governance structure. The extremes regarding governance structures are, either to keep the contractors on “arm lengths” distance through appliance of classical governance structure with reliance to market, legal frameworks and remedies or to apply relational contracting oriented governance structure promoting multidisciplinary and trustful cooperation among the stakeholders. The choice between these extremes, if simplified in this way, should be simple for most clients and the question is why this is not a reality in practise. This thesis reveals some explanations to why relational contracting concepts are not applied in many projects and also why there are some examples of unsuccessful applications. According to my point of view the most apparent reasons are lack of knowledge and experience regarding relational contracting, lack of innovative climate in prevailing organisations, lack of strategically long term thinking and also lack of needed support from top management level to apply new concepts.

6.5.3 Process design in relational contracting

An important lesson learned regarding relational contracting from this thesis and also from other studies is that the core group in a relational contracting arrangement has to involve all strategic stakeholders in a trustful and equal manner. The most common mistake in projects is to exclude sub contractors, consultants and some specialists from the core group in partnering arrangements. This can be contra productive in many ways, as much of their knowledge and experience are not utilized in an effective manner for the best of the project. Other mistakes are to miss the establishment of an innovative

climate through promotion of innovative thinking and a systematic search for innovations to apply for the best of the project in many ways. Innovations has also to be highlighted as a strategic component in other ways, as for example as an essential proportion of team building and development of trust in an organisation.

Most examples of relational contracting projects, which can be found by a review of research projects conducted in Sweden, are connected to some kind of partnering agreements based upon traditional contract regulations and also mostly limited to the main contractor and the client as partners. A common conclusion from those studies accomplished, is that real improvements in comparison with more traditionally governed projects are not been possible to approve. According to my view this is a result of lack of knowledge and experience of what is required to pay attention to in the process design. The presentation of the IPD concept in Chapter 3 is included in this thesis with the aim to give an example of process design worth to learn from and to copy as it demonstrates the value of involving all strategic stakeholders and also to apply innovative processes, a lot of them also emanating from lean thinking concepts

6.5.4 *The contracting path – affected by the project context and the project type*

According to the Lean contracting concept for contracting, conceptualised in section 6.4.1, the client has initially to define the project values and the project context. After this basic evaluation of the project, the client has to find and to decide on a suitable governance structure for his project. The extremes are, cooperative approach through neo-classical or relational contracting models or reliance on legal frameworks and remedies through classical contracting models. Secondly, the client has to choose an appropriate compensation form (fixed price or transparent compensation) and contract form (*see Table 3.6*).

According to the recommendations in section 6.5.1, based on the findings in this thesis, relational contracting is recommended as governance structure (*see Table 6.2*) especially in connection to projects that are complex, uncertain and dynamic. In connection to such projects, it is an advantage if the client has the trust to contract on basis of cooperation and transparency. An alternative to the relational contracting governance model is the neo-classical governance structure (*see Table 6.2*)

Contrary, in connection to projects with as well an uncomplicated project context as when the client is reluctant to apply relational contracting concepts

is classical contracting model recommendable (see Table 6.2). In such projects will the adherence to legal frameworks and remedies be the base for the governance of the contracting process.

In Figure 6.3, the recommended choice of contracting components, for the project type business centre, is illustrated on basis of findings in this thesis. In this uncomplicated project context, project context named N (Table 4.2), cooperation in a neo-classical or in a relational project governance structure, transparent compensation and DB (design and build) as contract form are recommended. For clients who prefer a classical governance structure is fixed price compensation recommended. Basically, the choice of contract form has to be based on how the client wants to distribute the responsibility of design. In DB (design and build) contract form, the contractor will be responsible of design whereas in the DBB (design, bid, build) and in the CM (construction management) contract forms the client keeps the responsibility by himself.

In figure 6.4, the recommended choice of contracting components (the contracting path), for the project type business centre is shown in a complex project context, project context U (see figure 3.2).

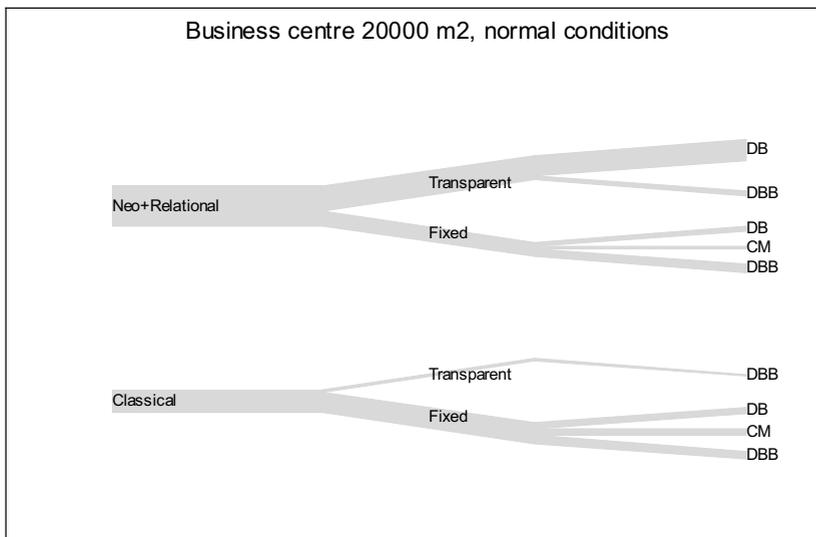


Figure 6.3: Recommendation of contracting paths for a business centre project in project context N (Table 4.2)

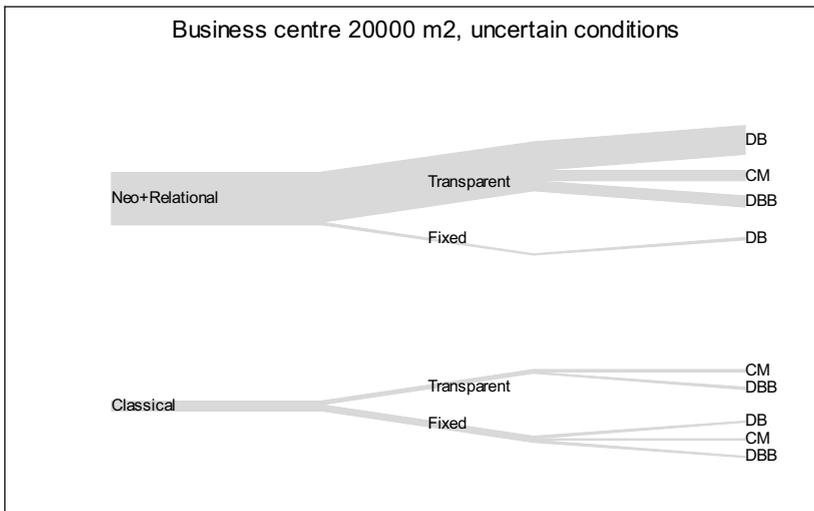


Figure 6.4: Recommendation of contracting paths for a business centre project in project context U (Table 4.2)

In this complex project context, the choice of relational governance structure, of transparent compensation and of DB as contract form are the most recommended contracting components.

6.5.5 Future research

In connection to the studies conducted, the analysis of findings and the conclusions drawn I have touched a lot of areas and subjects suitable for future research projects. In the following, some of those ideas are further developed.

- The influence of cultural factors in the construction sector is evident in many ways. For example, the application of relational contracting concepts is still rare within the construction sector despite the

recommendations in this thesis and in other research projects. Why is the situation, as described in a paper by Eriksson & Toolanen (2006), of the kind: *Do as I say, don't do as I do* still most prevalent?

- The findings in this thesis considering the benefit of partnering concepts are thought-provoking. In some reports, efficiency gains of up to 30 % are reported whereas in others no efficiency gains are found. My belief is that the interaction between process design issues and the efficiency gains is a plausible and by far neglected explanation?
- The implementation of Lean thinking principles and lean methods in construction is desirable in many ways. One example highlighted in this thesis is the Last Planner concept for improved cooperation and coordination and thus also for improved efficiency in construction projects. This concept is suited for further development and adjustments for the benefit of the Swedish construction sector.

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Appendix I: A study of choices of forms of procurement and cooperation

(Translated version of the original questionnaire according to Appendix II)

Background

At the Section of Production Management, Luleå University of Technology, there is ongoing research on new forms of implementation such as performance contracts (including Lean Construction) and new forms of cooperation such as partnering, among other things. This investigation is a part of a research project, chiefly financed by Formas, within the framework programme “Byggherre med kunden i fokus” (‘Building proprietor with the client in focus’), which is focused on communication models in the building proprietor’s situation of choice concerning forms of procurement and cooperation for attaining good goal fulfilment in the implementation of construction projects.

Observe! The original system model was according to Appendix II!
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Investigation design

- 1) Selection of participants
- 2) This form is sent to the participants for reflection and for filling in the questionnaire, which is designed as a role-play, and which should be sent back (as soon as possible) for processing and as a preparation for the following interview. The form can be returned via e-mail!
- 3) A follow-up interview on issues raised through the inquiry (personal meeting or by telephone).

Preconditions for your role

You will be asked as a consultant to give advice to a building proprietor, who is a recurrent client and who is about to make an investment in a construction project focused on long-term ownership, about a suitable choice of procurement forms (contracting, remuneration and cooperation forms). In the selection you will not have to take existing resources in the building proprietor's own organisation into consideration, as it is presupposed that any lack can be covered by hired resources (consultant solutions).

The presented projects are fictitious and reflect different alternative preconditions concerning project factors and external factors that may be assumed to influence the choice (cf. the simplified system model on p. 1).

Guiding system model description

(Note! system model shown in Appendix II)

Project factors

(P1) Technical complexity: the degree of uncertainty about the project's functions and its technical and aesthetic solutions (with regard to both the building proprietor and other actors).

(P2) Strategic factors: Requests for product and production technology development of the object in question and/or of future projects of the same kind.

(P3) Uncertainty factors: risk of programme changes in the production phase, too, etc.

(P4) Time factors: Available process time for project implementation from programme phase to completion. Time critical means that planning and production must take place in parallel.

(P5) Functional factors: Opportunity to govern by objectives through functional demands (great opportunity means that there are (or are perceived to be) developed “tools” for description and follow-up).

(P6) Object size: Building cost in financial terms (large: > 100 MSEK, medium: 50 - 100 MSEK, normal: < 50 MSEK).

External factors

(E1) Institutional factors: the set of elements and structures in the project’s environment that the building proprietor cannot influence directly (laws, the Public Procurement Act, industrial agreements, etc.).

(E2) Market factors: the resource situation, in particular in the contractor market (a surplus of resources implies a “recession” with plenty of interested contractors and a lack of resources implies a “boom” with a lack of interested contractors).

(E3) R&D factors: the knowledge level concerning research results and their applicability (innovative prerequisites).

(E4) Benchmarking - experience retrieval: the experience retrieval situation (good implies that there are comparable projects internally or externally to gather experience from and bad implies projects such as “pilot projects”).

(E5) Societal factors: refers to the societal “pressure for change” (large implies that there is strong pressure on the industry to initiate change processes from clients, citizens, authorities, etc.).

(E6) Client factors: the client’s interest in participating in the construction process in order to follow up and watch the fulfilment of customer values (great interest implies that the client wants to take active part in the product development, for example through continuous information and also in partnering cooperation).

Definition of options

Note: The definitions of procurement and cooperation forms are briefly and generally stated here.

Contract forms

MDE (DBB form): Construction management contracting (CM) where the building proprietor appoints somebody as building proprietor representative to carry out procurement and governance of planners, contractors as well as some suppliers (materials without labour input). The project is as a rule implemented with planning and building in parallel through division of the project into many sub objects in order to save time and achieve competitive pressure.

DE (DBB form): The building proprietor makes an agreement with and governs the planners in the planning phase for production of construction documents and then procures contractors, often from different sectors, and handles himself most of the agreement and coordination responsibility in the production phase in relation to the procured contractors (side contractor relation). There is often little opportunity to implement planning and production in parallel.

SGE (DBB form): The building proprietor makes an agreement with and governs the planners in the planning phase for production of construction documents and then procures contractors, often from different sectors. These are finally coordinated under one of the chosen contractors who becomes the coordinated general contractor and thus takes over the agreement responsibility (including the coordination responsibility) for the others (who become subcontractors) in relation to the client. There is often little opportunity to implement planning and production in parallel.

GE (DBB form): The building proprietor makes an agreement with the planners and governs these in the project planning and product design phase for the development of production documents and inquiry data. Then a general contractor is procured in competition as responsible for the production phase in relation to the building proprietor. The general contractor then procures subcontractors as required. There is often little opportunity to implement planning and production in parallel.

TE (DB form): The building proprietor produces programme documents and inquiry data and procures and hands over the responsibility to a contractor for

implementing the necessary (according to the contractor's assessment) remaining planning and required production work to a completed product. The programme documents govern to varying degrees the contractor's liberty to choose products and systems. Planning and production can thereby take place in parallel to a great extent.

FE (DB form): This is like the total contracting procedure in terms of procurement but is focused on systematically expressing the client's expectations (customer values) in functional terms and quality requirements and on making the fulfilment of these a criterion for approval of the contractor's undertaking. The contractor is to a great extent given the responsibility for designing product and system solutions and the freedom to do so.

Remuneration forms

FP (Fixed price agreement): The procurement is carried out as a fixed price undertaking based on the client's inquiry data.

LR (Reimbursable costs): The procurement is most often based on cost price principles in accordance with AB 92 (Ch. 6, §§ 7, 8).

LRI (Reimbursable costs with incentives): The procurement is as a rule based on an estimated cost budget and on principles for regulation of the estimated cost and for regulation of deviations from the estimated cost (distribution of profit/loss). In some cases the incentive constructions can also include goal fulfilment of time and soft parameters.

Cooperation forms

SI (classical governance): Customary relation among parties with a strong concentration on follow-up of contractual rights and duties, based to a great extent on the AB system ('General provisions for building, construction and installation contracts'). This is characterised by a short-term focus and few opportunities for contact among organisations and limited trust (governed by transactions).

S II ("business partnership", neo-classical governance): Cooperative relation among parties focused on "buyer/seller partnership". Less strong concentration on follow-up of contractual rights and duties, based on the AB system ('General provisions for building, construction and installation contracts'). Striving for long-term relations governs the behaviour to some

extent and there is a desire to reach agreements through compromises. Limited trust and risk distribution according to contractual conditions are however governing. No structured partnership relation.

S III (relational contracting, project partnering): Cooperative relation among parties of the type **project partnering** with a focus on attaining trustful cooperation among the parties through teamwork. This is structured by means of jointly approved goal descriptions and models for solving problems and conflicts, technical cooperation and development. In its developed form there are also contributions to cooperation of alliances in the interface between the principal contractor and the subcontractors (strategic contractors). Openness, honesty and trust among the parties are a prerequisite for good teamwork. Striving for long-term relations governs the behaviour to a very great extent.

S IV (relational contracting, strategic partnering): Cooperative long-term relation, called **strategic partnering**, aimed at bringing about a powerful development of efficiency through experience retrieval and a continuous development process. This is strengthened by a continuity of similar projects to also provide incentives for investments in industrial processes for construction and installation systems (vertical integration). Total trust and a striving for cooperation in order to attain the parties' strategic objectives.

Inquiry

Advice on answering the inquiry

- 1) Mark the response option that you recommend as the first alternative with a cross or with extra bold type or on paper with a circle round the chosen option.
- 2) If you do not want to consider all the options, just skip the one you do not wish to respond to.
- 3) You can make comments if you wish.
- 4) Return the form by post or e-mail.

Project type 1: Office building 12,000 m²

Office building on the client's own land with a premises programme of about 12,000 m². The building should give the tenants a high degree of comfort (climate, etc.), a good feeling of quality and be flexible to possible future needs for rearrangement of the areas. Estimated project cost about 300 MSEK.

Choice situation 1a:

The project is to be implemented in a building market situation with a recession (good resource supply) and the available time for the project implementation is normal and not time critical.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 1b:

Preconditions: As in 1a) but a boom (lack of resources)

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 1c:

Preconditions: As in 1a) but a time critical project

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 1d:

Preconditions: As in 1a) but both a boom and time critical

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 1e:

Preconditions: As in 1a) but the building proprietor fears that there might be extensive changes in the premises programme (adaptations to tenants) after the choice of implementation form.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 1f:

Preconditions: As in 1a) but the building proprietor feels that it is important to bring about a development process concerning product and production technology in order to develop the productivity of its projects.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Project type 2: Block of flats

The building proprietor (a municipal housing company) intends to build a block of flats for tenancy rights on its own land in an attractive urban location with a dwelling space of 7,000 m² (in four-storey buildings) in phase I. There is space in the area for building a further dwelling space of about 20,000m². The standard of the object should be normal for modern rented flats. Project budget about 130MSEK (phase 1).

Choice situation 2a:

The project will be implemented in a building market situation with a recession (good resource supply) and the available time for project implementation is normal and not time critical.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV Comments:

Choice situation 2b:

Preconditions: As i 2a) but a boom (lack of resources)

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 2c:

Preconditions: As in 2a) but a time critical project (quickest possible completion)

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 2d:

Preconditions: As in 2a) but both a boom and time critical

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Choice situation 2e:

Preconditions: As in 1a) but the building proprietor feels that it is important to bring about a development process concerning product and production technology in order to develop the productivity of its projects of the same type.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Project type 3, shopping centre, about 20,000 m²

The building proprietor has purchased a site with a right to erect buildings with an area of about 21,000 m² and has, through contacts with prospective tenants, good hopes of finding tenants for the project and has a largely established premises programme (about 75%) and regards the issue of financing as solved in a satisfactory way. The idea is that the object should be attractive to customers by having a good functional standard (climate and environment factors) and be flexible to rearrangements (adaptations to tenants) Project budget about 275MSEK.

Choice situation 3a:

The project will be implemented in a building market situation with a recession (good resource supply) and the available time for project implementation is normal and not time critical.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV Comments:

Choice situation 3b:

Preconditions: As in i 3a) but a boom (lack of resources)

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV Comments:

Choice situation 3c:

Preconditions: As in 3a) but a time critical project

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV Comments:

Choice situation 3d:

Preconditions: As in 3a) men both a boom and time critical

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV Comments:

Choice situation 3e:

Preconditions: As in 3a) but the building proprietor fears that there might be extensive changes in the premises programme (adaptations to tenants) when there are contracted tenants up to 100% after the choice of implementation form.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 3f:

Preconditions: As in 1a) but the building proprietor feels that it is important to bring about a development process concerning product and production technology in order to develop the productivity of its projects of the same type.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Project type 4 Small shopping centre, about 7,500 m²

The building proprietor (a private project developer – property manager) has purchased a site close to the centre of a small town with about 30,000 inhabitants. He has signed a preliminary contract with the Swedish Alcohol Retailing Company, Posten AB and a pharmacy for letting with a total premises programme of about 4,000 m² and has some prospective tenants for the remaining building area of about 3,000 m² (in a two-storey shopping centre). On the site there is a right to erect buildings with a building area of a maximum of 10,000 m². Parking is planned to be solved by means of a roof car park with an exterior driving ramp. Project budget about 130MSEK.

Choice situation 4a:

The project will be implemented in building market situation with a recession (good resource supply) and the available time for project implementation is normal and not time critical.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 4b:

Preconditions: As in i 4a) but a boom (lack of resources)

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 4c:

Preconditions: As in 4a) but a time critical project

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 4d:

Preconditions: As in 4a) but both a boom and time critical

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 4e:

Preconditions: As in 4a) but the building proprietor fears that there might be extensive changes in the premises programme (adaptations to tenants) when there are contracted tenants up to 100% after the choice of implementation form.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

Choice situation 4f :

Preconditions: As in 4 a) but the building proprietor feels that it is important to bring about a development process concerning product and production technology in order to develop the productivity of its projects of the same type.

Choice of contract form: MDE – DE – SGE – GE – TE - FE

Choice of compensation form: FP – LR -LRI

Choice of cooperation form: S I - S II - S III - S IV

Comments:

General questions concerning the choice of procurement and cooperation forms

a) Which external factors and project factors do you think generally govern the choice of **contract form**? Choose among external factors (e1 - e6) and project factors (p1 - p6) according to pages 2-3 (Prio 1 = most important, Prio 6 = least important) and rank your answer.

Prio 1 Prio2 Prio 3 Prio 4 Prio 5 Prio 6

External factors:

Project factors:

b) Which external factors and project factors do you think generally govern the choice of **compensation form**? Choose among external factors (e1 - e6) and project factors (p1 - p6) according to pages 2-3 (Prio 1 = most important, Prio 6 = least important) and rank your answer.

Prio 1 Prio2 Prio 3 Prio 4 Prio 5 Prio 6

External factors:

Project factors:

c) Which external factors and project factors do you think generally govern the choice of **cooperation form (governance structure)**?

Choose among external factors (e1 - e6) and project factors (p1 - p6) according to pages 2-3 (Prio 1 = most important, Prio 6 = least important) and rank your answer.

Prio 1 Prio2 Prio 3 Prio 4 Prio 5 Prio 6

External factors:

Project factors:

Personal data

Your personal data will be treated confidentially

Name: _____

Present occupation: _____

Employer: _____

Place of business: _____

Personal experience background – state how many years in the respective
occupation (contractor, consultant, etc.):

Educational
background: _____

Thank you for participating!

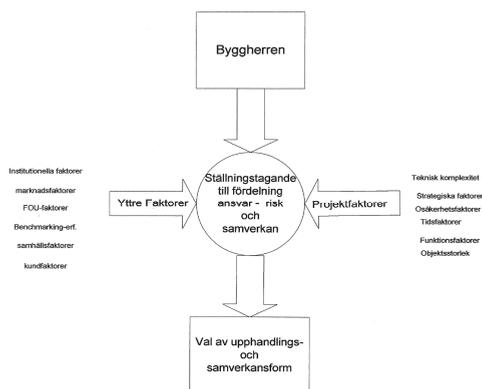
Appendix II: Studie om val av upphandlings- och samverkansform

(Questionnaire, in appendix I, in Swedish)

Bakgrund

Vid Luleå Tekniska Universitet, avd för Produktionsledning, pågår bl.a. forskning kring nya genomförandeformer som funktionsentreprenad (inkl. Lean Construction) samt kring nya samverkansformer som partnering.

Denna undersökning ingår som del i ett forskningsprojekt, huvudsakligen finansierat av Formas, inom ramprogrammet ”Byggherre med kunden i focus” som har inriktning på kommunikationsmodeller vid byggherrens valsituation beträffande upphandlings- och samverkansformer för uppnående av god måluppfyllelse vid genomförande av byggnadsprojekt.



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Undersökningsupplägg

- 1) Urval av deltagande personer
- 2) Detta formulär skickas till deltagarna för begrundan och ifyllande av enkätdelen, som är utformad som ett rollspel, och som önskas återsänd (snarast möjligt) för bearbetning och som förberedelse för efterföljande intervju. Det går bra att returnera formuläret genom mailfunktionen!
- 3) Uppföljande intervju kring från enkätdelen aktualiserade frågeställningar (personligt sammanträffande eller per telefon).

Förutsättningar för din roll:

Du ombeds att som rådgivare ge rekommendationer till en byggherre, som är en återkommande beställare och är i begrepp att göra en investering i ett byggprojekt med inriktning på långsiktigt ägande, om lämpligt val av upphandlingsform (entreprenad-, ersättnings- och samverkansform). I valsituationen behöver du ej ta hänsyn till befintliga resurser i byggherrens egen organisation utan det förutsättes att eventuell brist kan täckas med inhyrda resurser (konsultlösningar).

Presenterade projekt är fiktiva och återspeglar olika alternativa förutsättningar vad beträffar projektfaktorer och yttre faktorer som kan tänkas påverka valet (jämför med förenklad systemmodell på sid 1)

Orienterande systemmodellbeskrivning

Projektfaktorer

(P1) Teknisk komplexitet : grad av osäkerhet om projektets funktioner och dess tekniska och estetiska lösningar (dels hos byggherren och dels hos övriga aktörer)

(P2) Strategiska faktorer: önskemål om produkt- och produktionsteknisk utveckling för objektet ifråga och/eller för framtida projekt av samma art

(P3) Osäkerhetsfaktorer: risk för programförändringar även i produktionsfasen, m. m..

(P4) Tidsfaktorer: Tillgänglig processtid för projektgenomförande från programfas till färdigställande. Tidskritiskt innebär att projektering och produktion måste pågå parallellt.

(P5) Funktionsfaktorer: Möjlighet att målstyra genom funktionskrav (stor möjlighet innebär att det finns (eller uppfattas finnas) utvecklade ”verktyg” för beskrivning och uppföljning)

(P6) Objektsstorlek: Byggekostnad i ekonomiska termer (stort: > 100 Mkr, medelstort: 50 – 100 Mkr, normalt: < 50 Mkr)

Yttre faktorer

(Y1) Institutionella faktorer: uppsättning av element och strukturer i projektets omgivning som byggherren inte direkt kan påverka (lagar, LOU, bransch överenskommelser, m.m.)

(Y2) Marknadsfaktorer: Resursläget speciellt på entreprenörsmarknaden (resursöverskott innebär ”lågkonjunktur” med gott om intresserade entreprenörer och resursbrist innebär ”högkonjunktur” med ont om intresserade utförare)

(Y3) FOU-faktorer: kunskapsläge vad beträffar forskningsresultat och deras applicerbarhet (innovativa förutsättningar)

(Y4) Benchmarking - erfarenhetsåterföring: erfarenhetsåterförings situationen (god innebär att det finns jämförbara projekt internt eller externt att få erfarenhet från och dålig innebär projekt av typen ”pilotprojekt”)

(Y5) Samhällsfaktorer: avser det samhälleliga ”omvandlingstrycket” (stort innebär att det finns kraftigt tryck på branschen att få igång förändringsprocesser från kunder, medborgare, myndigheter, m.m.)

(Y6) Kundfaktorer: kundens intresse att medverka i byggprocessen för att följa upp och bevaka uppfyllandet av kundvärden (högt intresse innebär att kunden vill medverka aktivt i produktens framtagning, t.ex. genom kontinuerlig information och även i partnering samverkan)

Definition av valmöjligheter:

Anm: Definitionerna av upphandlings- och samverkansformer har här gjorts kortfattat och generaliserande!

Genomförandeformer

MDE (mycket delad entreprenad): Bygglämningsentreprenad (CM) där byggherren utser någon som byggherreombud att genomföra upphandlig och styrning av projektörer, entreprenörer och även vissa leverantörer (material utan arbetsinsatser). Projektet genomförs i regel med projektering och byggande parallellt genom uppdelning av projektet i många delobjekt i syfte att få tidsbesparingar och konkurrenstryck.

DE (delad entreprenad): Byggherren träffar avtal med och styr projektörerna i projekteringsfasen för framtagning av bygghandlingar och upphandlar därefter entreprenörer, ofta fackuppdelat och handhar själv det mesta av avtals- och samordningsansvaret i produktionsfasen mot upphandlade entreprenörer (sidoentreprenörsförhållande). Ofta liten möjlighet till att bedriva projektering och produktion parallellt.

SGE (samordnad generalentreprenad): Byggherren träffar avtal med och styr projektörerna i projekteringsfasen för upprättande av bygghandlingar och upphandlar därefter entreprenörer, ofta fackuppdelat. Slutligen sker samordning av dessa under en av valda entreprenörer som blir samordnad generalentreprenör och övertar därmed avtalsansvaret (inkl. samordningsansvar) för de andra (som blir underentreprenörer) mot beställaren. Ofta liten möjlighet till att bedriva projektering och produktion parallellt.

GE (generalentreprenad): Byggherren träffar avtal med projektörerna och styr dessa under projektgestaltning- och produktutformningsfasen till bygghandlingar och förfrågningsunderlag. Därefter upphandlas generalentreprenör i konkurrens som ansvarig för produktionsfasen gentemot byggherren. Generalentreprenören upphandlar därefter underentreprenörer efter behov. Ofta liten möjlighet till att bedriva projektering och produktion parallellt.

TE (Totalentreprenad): Byggherren tar fram programhandlingar och förfrågningsunderlag samt upphandlar och överlåter ansvaret till en entreprenör att utföra erforderlig (enligt entreprenörens bedömning) återstående projektering och erforderliga produktionsarbeten till färdig produkt. Programhandlingarna styr i olika grad entreprenörens frihetsgrader vad beträffar produkt- och systemval. Projektering och produktion kan därmed ske parallellt i stor omfattning.

FE (Funktionsentreprenad): Lika totalentreprenadförfarandet upphandlingsmässigt men med inriktning på att systematiskt uttrycka kundens förväntningar (kundvärden) i funktionstermer och kvalitetskrav och ställa uppfyllandet av dessa som krav för godkännande av entreprenörens åtagande. Entreprenören får ansvar och frihet att i stor utsträckning utforma produkt- och systemlösningar.

Ersättningsformer

FP (Fast pris avtal): Upphandlingen utförs som fastpris åtagande baserat på beställarens förfrågningsunderlag.

LR(Löpande räkning): Upphandlingen baseras oftast på självkostnadsprinciper enligt AB 92 (kap 6, §§ 7,8)

LRI (Löpande räkning med incitamentskonstruktioner): Upphandlingen baseras i regel på riktkostnadsbudget samt med principer för reglering av riktpreis samt för reglering av avvikelser från riktpreis (fördelning av vinst/förlust). I vissa fall kan incitaments konstruktioner omfatta även måluppfyllelse av tid- och mjuka parametrar.

Samverkansformer

S I : Sedvanlig partsförhållande med stark koncentration mot uppföljning av kontraktsmässiga rättigheter och skyldigheter, baserade i hög grad på AB-systemet (Allmänna bestämmelser för byggnads-, anläggnings- och installationsentreprenader). Karaktäriseras av kortsiktigt focus och enstaka tillfällen till kontakt mellan organisationer och liten tillit (transaktionsstyrt)

S II: Samarbetsinriktat partsförhållande med inriktning mot ”köpar-/säljarpartnerskap”. Mindre stark koncentration mot uppföljning av kontraktsmässiga rättigheter och skyldigheter, baserat på AB-systemet (Allmänna bestämmelser för byggnads-, anläggnings- och installationsentreprenader). Strävan efter långsiktiga relationer styr beteendet i viss grad och det finns önskan om att nå överenskommelser genom kompromisser. Begränsad tillit och riskfördelning enligt kontraktsmässiga villkor dock styrande. Ej strukturerat partnerskapsförhållande.

S III: Samverkansinriktat partsförhållande av typ **projektpartnering** med inriktning att få ett förtroendefullt samarbete och samverkan mellan parterna genom teamwork. Detta struktureras upp med gemensamt antagna målbeskrivningar samt modeller för problem- och konfliktlösning, teknisk

samverkan och – utveckling. I utvecklad form även bidrag till samverkan av allianser i gränssnittet mellan huvudleverantör och underleverantörer (strategiska leverantörer). Öppenhet, ärlighet och förtroende mellan parterna en förutsättning för gott teamwork. Strävan efter långsiktiga relationer styr beteendet i mycket hög grad.

S IV: Långsiktigt samverkansförhållande mellan parterna, benämnt **strategisk partnering**, med avsikt att få till stånd en kraftfull effektivitetsutveckling genom erfarenhetsåterföring och en kontinuerlig utvecklingsprocess . Detta förstärks av en kontinuitet av likartade projekt för att ge incitament även för investeringar i industriella processer för bygg- och installationssystem (vertikal integration). Total tillit och strävan att samverka för uppnående av parternas strategiska mål.

Enkät del

Råd för besvarande av enkät del

- 1) Markera det svarsalternativ som du förordar som första hands alternativ genom en kryssmarkering eller att markera med ”fet stil” över valet eller vid papperskopia genom att ringa in valt alternativ.
- 2) Ifall du ej vill ta ställning till alla alternativ så hoppa över det som du inte känner för att svara på!
- 3) Det går bra att ge kommentarer ifall du vill!
- 4) Returnera formuläret per post eller genom e-mail!

Projekt typ 1: Kontorsbyggnad 12000 m2

Kontorsbyggnad på egen mark med ett lokalprogram om ca 12000 m2. Byggnaden skall ha ge hyresgästerna en hög komfort (klimat,m.m.), hög kvalitetskänsla och vara flexibelt för ev. framtida omdisponeringsbehov av ytor. Uppskattad projektkostnad ca 300 Mkr

Valsituation 1a:

Projektet skall utföras i ett byggmarknadsläge med lågkonjunktur (god resurstillgång) och tillgänglig tid för projektgenomförandet är normalt och ej tidskritiskt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 1b:

Förutsättningar: Som i 1a) men högkonjunktur (resursbrist)

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 1c:

Förutsättningar: Som 1a) men tidskritiskt projekt

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 1d:

Förutsättningar: Som 1a) men både högkonjunktur och tidskritiskt

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 1e:

Förutsättningar: Som 1a) men byggherren befarar att det kan bli aktuellt med väsentliga förändringar av lokalprogrammet (hyresgäst Anpassningar) efter valet av genomförandeform.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - SIV

Valsituation 1f:

Förusättningar: Som 1a) men byggherren känner att det är angeläget att få tillstånd en utvecklingsprocess beträffande produkt- och produktionsteknik för att få till stånd en produktivitetsutveckling för sina projekt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - SIV

Projekttyp 2: Flerbostadshus

Byggherren (ett allmännyttigt fastighetsbolag) har för avsikt att bygga ett flerbostadsområde för hyresrätter på ägd mark i ett attraktivt storstadsområde med ca 7000 m² bostadsyta (i 4 vånings hus) i etapp I. På området finns utrymme att bygga ca 20000m² ytterligare lägenhetsyta. Objektets standard skall vara normalt för moderna hyreslägenheter. Projektbudget ca 130 Mkr (etapp 1).

Valsituation 2a:

Projektet skall utföras i ett byggmarknadsläge med lågkonjunktur (god resurstillgång) och tillgänglig tid för projektgenomförandet är normalt och ej tidskritiskt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - SIV

Valsituation 2b:

Förutsättningar: Som i 2a) men högkonjunktur (resursbrist)

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 2c:

Förutsättningar: Som 2a) men tidskritiskt projekt

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 2d:

Förutsättningar: Som 2a) men både högkonjunktur och tidskritiskt

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 2e:

Förutsättningar: Som 2a) men byggherren befarar att det kan bli aktuellt med väsentliga förändringar av lokalprogrammet (hyresgäst Anpassningar) efter valet av genomförandeform.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 2f:

Förusättningar: Som 2a) men byggherren känner att det är angeläget att få tillstånd en utvecklingsprocess beträffande produkt- och produktionsteknik för att få till stånd en produktivitetsutveckling för sina projekt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - SIV

Projekttyp 3, affärscentrum ca 20000 m2

Byggherren har förvärvat en tomt med byggnadsrätt för ca 21000 m2 lokalyta och har genom kontakter med presumtiva hyresgäster en god förhoppning att hitta hyresgäster till projektet och har ett lokalprogram till stora delar fastlagt (ca 75%) och ser finansieringsfrågan som löst på ett tillfredsställande sätt. Inriktningen är att objektet skall vara kundattraktivt genom att ha god funktionsstandard (klimat- och miljöfaktorer) och vara flexibelt för omdisponeringar (hyresgäst Anpassningar). Projektbudget: ca 275 Mkr

Valsituation 3a:

Projektet skall utföras i ett byggmarknadsläge med lågkonjunktur (god resurstillgång) och tillgänglig tid för projektgenomförandet är normalt och ej tidskritiskt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - SIV

Valsituation 3b:

Förutsättningar: Som i 3a) men högkonjunktur (resursbrist)

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 3c:

Förutsättningar: Som 3a) men tidskritiskt projekt

Val av genomförandeform: MDE - DE - SGE - GE - TE - FE

Val av ersättningsform: FP - LR - LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 3d:

Förutsättningar: Som 3a) men både högkonjunktur och tidskritiskt

Val av genomförandeform: MDE - DE - SGE - GE - TE - FE

Val av ersättningsform: FP - LR - LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 3e:

Förutsättningar: Som 3a) men byggherren befarar att det kan bli aktuellt med väsentliga förändringar av lokalprogrammet (hyresgäst Anpassningar) efter valet av genomförandeform.

Val av genomförandeform: MDE - DE - SGE - GE - TE - FE

Val av ersättningsform: FP - LR - LRI

Val av samverkansform: S I - S II - S III - S IV

Valsituation 3f:

Förutsättningar: Som 3a) men byggherren känner att det är angeläget att få tillstånd en utvecklingsprocess beträffande produkt- och produktionsteknik för att få till stånd en produktivitet utveckling för sina projekt.

Val av genomförandeform: MDE - DE - SGE - GE - TE - FE

Val av ersättningsform: FP - LR - LRI

Val av samverkansform: S I - SII - SIII - S IV

Projekttyp 4 Mindre affärscentrum, ca 7500 m2

Byggherren (enskild projektutvecklare – fastighetsförvaltare) har förvärvat en tomt nära en stadskärna i en mindre stad med ca 30000 invånare. Han har preliminärt tecknat avtal med systembolaget, posten och ett apotek om uthyrning med ett sammanlagt lokalprogram om ca 4000 m2 och har några presumptiva hyresgäster till resterande planerad lokalyta om ca 3000 m2 (i ett tvåvåningars affärscentrum). På tomten finns byggrätt till max. 10000 m2 lokalyta. Parkeringar är tänkt lösas som takparkering med utvändigt körramp. Projektbudget ca. 130 Mkr

Valsituation 4a:

Projektet skall utföras i ett byggmarknadsläge med lågkonjunktur (god resurstillgång) och tillgänglig tid för projektgenomförandet är normalt och ej tidskritiskt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 4b:

Förutsättningar: Som i 4a) men högkonjunktur (resursbrist)

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 4c: Förutsättningar: Som 4a) men tidskritiskt projekt

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 4d: Förutsättningar: Som 4a) men både högkonjunktur och tidskritiskt

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 4e: Förutsättningar: Som 4a) men byggherren befarar att det kan bli aktuellt med väsentliga förändringar av lokalprogrammet (hyresgäst Anpassningar) efter valet av genomförandeform.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Valsituation 4f: Förutsättningar: Som 4a) men byggherren känner att det är angeläget att få tillstånd en utvecklingsprocess beträffande produkt- och produktionsteknik för att få tillstånd en produktivitet utveckling för sina projekt.

Val av genomförandeform: MDE - DE - SGE – GE – TE – FE

Val av ersättningsform: FP – LR – LRI

Val av samverkansform: S I - SII - SIII - S IV

Allmänna frågeställningar kring val av upphandlings- och samverkansformer

a) Vilka yttre faktorer och projektfaktorer tror du är i allmänhet styrande vid valet av **genomförandeform**?

Välj av yttre faktorer (y1 – y6) och projektfaktorer (p1 – p6) enligt sid 2-3 (Prio 1 =viktigaste, prio 6 =minst viktigast) och rangordna ditt svar

Prio 1 Prio2 Prio 3 Prio 4 Prio 5 Prio 6

Yttre faktorer:

Projektfaktorer:

b) Vilka yttre faktorer och projektfaktorer tror du är i allmänhet styrande vid valet av **ersättningsform**?

Välj av yttre faktorer (y1 – y6) och projektfaktorer (p1 – p6) enligt sid 2-3 (Prio 1 =viktigaste, prio 6 =minst viktigast)

Prio 1 Prio2 Prio 3 Prio 4 Prio 5 Prio 6

Yttre faktorer:

Projektfaktorer:

c) Vilka yttre faktorer och projektfaktorer tror du är i allmänhet styrande vid valet av **samverkansform**?

Välj av yttre faktorer (y1 – y6) och projektfaktorer (p1 – p6) enligt sid 2-3 (Prio 1 =viktigaste, prio 6 =minst viktigast) och rangordna ditt svar

Prio 1 Prio2 Prio 3 Prio 4 Prio 5 Prio 6

Yttre faktorer:

Projektfaktorer:

Personuppgifter

Dina personuppgifter kommer att behandlas konfidentiellt!

Namn: _____

Nuv.befattning: _____

Arbetsgivare: _____

Verksamhetsort: _____

Pers.erfarenhetsbakgrund- ange hur många år i resp.bransch (entreprenad,
konsult, e.t.c):

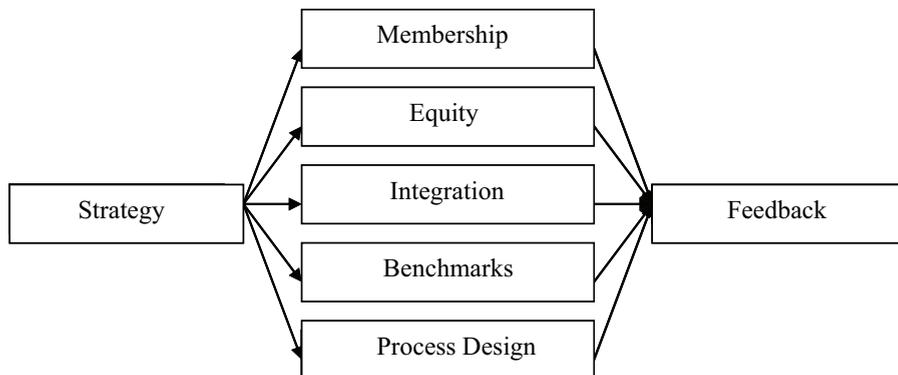
Utbildningsbakgrund: _____

Tackar för visat intresse!

Appendix III: The MK3 case study

MK3

A study of partnering cooperation in the construction of the pelletizing plant MK3 in Malmberget.



Questionnaire October -05

Bengt Toolanen

Luleå University of Technology

Introduction

As a part of the follow-up of the MK3 project, LKAB and NCC have decided to allow me (Bengt Toolanen), who work as a researcher at Luleå University of Technology, to make an evaluation of the partnering process in the project. I have chosen to base my evaluation to a great extent on experiences from England of partnering, as described in *Seven Pillars of Partnering* (Bennet, J. & Jayes, S., 1998). In this report seven fundamental elements have been distinguished as particularly important basic prerequisites for a successful partnering process. These are described on the front endpaper and also briefly presented in this inquiry.

I sincerely hope that as a recipient of this questionnaire you will want to answer as many questions as possible. I guarantee anonymity for you, and in my result analysis I will avoid as far as possible to point out single individuals so that they can be identified, On the other hand, I think that it might be of interest for the analysis to classify different activity categories such as clients, consultants and contractors.

Seven Pillars (cf. the figure on the front end paper):

Strategy

The strategy pillar in Seven Pillars is supposed to function as the central brain in the partnering process and chiefly be responsible for the strategic (often long-term) project process. The strategy and government by objectives are as far as possible based on feedback (experience retrieval) from the process. A strategy should include:

- the most important project objectives (goal formulations);
- tactics and procedures for supporting the goal fulfilment;
- design of the main process for attaining the objectives (process design).

An established strategy should be documented through a partnering statement (overarching objective and success criteria), overarching business and organisation plans, development and efficiency plans. An important element of a strategy is creating incentives for development and innovations. An important feature of this is to try to avoid rigid governance that can stifle individual initiatives for changes and innovations.

Project processes/Process design

An often occurring demand on the design of project processes is that these should meet customer demands for short lead-times and for quality and economy. The increasing demands on the process design require altered models for the organisation of design and production. An important part of this is that cross-sectorial and multidimensional cooperation be achieved through close collaboration among the builder, the designers and the contractors, so that available competence and know-how are used in a constructive way. It is important in the process design that all basic pillars of the partnering process be considered (Seven Pillars). Process models should heed wishes to create a climate promoting continuous improvements and implementation and development of innovations. In this way one of the fundamental objectives of partnering will be achieved, that is, to obtain efficiency gains in a balanced and controlled manner.

Data for this part will be captured by the answers to the inquiry.

Integration/Cooperation

An efficient partnering process is based on cooperation among the actors. A fundamental prerequisite for this is that there is trust that is developed organisationally at all levels of the organisation. A project organisation should be perceived externally as homogeneous and integrated even if it constitutes a cooperative unit of resources from different companies and competencies (a virtual organisation). A good basis of this consists of active teambuilding and trust-creating activities, shared IT strategies and high competence and knowledge levels among the participants.

In the MK3 project's partnering statement, dated April 11 2004, there are goals concerning creation of trust, chiefly through openness, shared views, good communication, etc. in the partnering cooperation.

1. The project will be conducted in a positive spirit and be characterised by shared views, honesty, openness and exchange of knowledge among the parties.

Worked								Did	not
very well	6	5	4	3	2	1		work	at all

Comments:

2. We will create motivation and commitment among in everybody through participation and communication

Worked very well 6 5 4 3 2 1 Did not work at all

Comments:

3. Ensure balance among the hard objectives function, time and economy.

Worked very well 6 5 4 3 2 1 Did not work at all

Comments:

4. As a reference project, develop forms of cooperation that will set the tone for future projects

Worked very well 6 5 4 3 2 1 Did not work at all

Comments:

5. High ethics and morals will characterise the project.

Worked very well 6 5 4 3 2 1 Did not work at all

Comments:

6. Decrease territorial guarding and prejudices.

Worked very well 6 5 4 3 2 1 Did not work at all

Comments:

7. *Ensure cooperation among the project actors.*

Worked								Did not
very well	6	5	4	3	2	1		work at all

Comments:

8. *Compared to a conventional project structure of a package deal, has the cooperation among the client – the consultants - the package deal contractor functioned much more efficiently in the product design (planning, construction)?*

Agree							Do not agree
completely	6	5	4	3	2	1	

Comments:

9. *Compared to a conventional project structure of a package deal, has the cooperation among the client – the consultants - the package deal contractor functioned much more efficiently in the building production phase?*

Agree							Do not agree
completely	6	5	4	3	2	1	

Comments:

Membership

Membership is about who should be partners in a partnering relation. Companies wishing to be included as partners must have a long-term perspective in their actions and be interested in transparency and in setting their focus on customer value. An important aspect of the choice of partners is evaluation of their competence and company culture. It is often of great value that the partnering group is cross-sectorially and multidimensionally composed and that the communication aspects are taken into consideration.

The partnering statement 30/11/04 was signed by representatives of LKAB, NCC, WSP and Sweco Bloco.

10. LKAB, NCC, WSP and Sweco Bloco are partners according to the partnering statement. Do you think that the partnering group is optimally composed?

Very Badly
well composed 6 5 4 3 2 1 composed

Comments:

11. The partnering group should have been augmented with strategic subcontractors (e.g. body component suppliers, installation engineers, etc.)

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

12. The partnering group has functioned as a homogeneous group and everybody has been able to contribute their competence in an open and trustful manner

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

13. Everybody who is included as a partner (partnering member) must accept working with open financial accounting (transparency)

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

14. The current partnering cooperation in the project results in the project as a whole being less expensive for LKAB than if it had been conventionally procured

Agree						Do not agree
completely	6	5	4	3	2	1

Comments:

15. The current partnering cooperation in the project will lead to a shorter construction time on the whole than if it had been conventionally procured

Agree						Do not agree
completely	6	5	4	3	2	1

Comments:

16. The current partnering cooperation in the project will result in the project as a whole meeting the quality and function demands better than if it had been conventionally procured

Agree						Do not agree
completely	6	5	4	3	2	1

Comments:

Equity / Economy – Investments

This is about objectives of developing a longer-term way of thinking concerning for example investments in the development of both human resources and technology. The economic system should have a high degree of transparency and acknowledge the necessity of all participants having an opportunity of getting a sound economic result (profit acceptance) in order to establish a base for long-term activities and investments. Economic incentives should have a fair profile and function as incentives for achievements above standard level.

In the partnering statement of 30/11/04 this is expressed through demands for openness in prognoses and chances of reasonable profits and through an ambition to attain positive incentive outcomes.

17. The partnering group working with MK3 has prioritised a long-term perspective and the well being of the project over short-term financial gains (both individual and company ones)

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

18. The participating white-collar workers in MK3 have as a rule been given useful and relevant further education in order to better understand the meaning of and demands on a partnering project

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

19. The participating blue-collar workers in MK3 have as a rule been given useful and relevant further education in order to better understand the meaning of and demands on a partnering project

Agree Do not agree
completely 6 5 4 3 2 1

20. The investments made in development and education of the MK3 project's employees (the human capital) have been well balanced

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

21. Well balanced investments have been made in the MK3 project in the use of IT auxiliary systems, (Cad visualisation, etc.)

Agree Do not agree
 completely 6 5 4 3 2 1

Comments:

22. Well-balanced investments have been made in the MK3 project in traditional technology (new materials, products, production technology, etc.)

Agree Do not agree
 completely 6 5 4 3 2 1

Comments:

23. The incentive agreement constructions used in the project lend good support to the overarching objectives in the partnering statement

Agree Do not agree
 completely 6 5 4 3 2 1

24. The incentive agreement constructions used in the project are justly rewarding and provide incentives for exceptional achievements

Agree Do not agree
 completely 6 5 4 3 2 1

25. Partnering cooperation, incentive agreement constructions and the transparent financial accounting in the project will result in the project as a whole being less expensive for LKAB than if it had been conventionally procured

Agree Do not agree
 completely 6 5 4 3 2 1

26. Partnering cooperation, incentive agreement constructions and the transparent financial accounting in the project will result in the project as a whole having a shorter construction time than if it had been conventionally procured

Agree Do not agree
completely 6 5 4 3 2 1

27. Partnering cooperation, incentive agreement constructions and the transparent financial accounting in the project will result in the project as a whole meeting the quality and function requirements better than if it had been conventionally procured

Agree Do not agree
completely 6 5 4 3 2 1

Benchmarks / innovations

The objective is to bring about continuous improvements through search for innovations. In this case the term “innovations” refers to new knowledge and new technological and managerial solutions for the organisation in question being used in order to make the project more efficient. Innovations can for example be initiated through looking for knowledge from other projects in the industry or from other industries (benchmarking) or through implementation of knowledge from research. Part of the innovation work is to give the co-workers incentives and encouragement to search for and follow up innovations. Experience shows that constant small improvements are often those that contribute most to making a project more efficient. It is a matter of establishing a good innovation climate encouraging the entire human capital to engage in innovative behaviour.

In the MK3 project the establishment of the partnering concept is in itself an innovation in the project.

27. The current partnering cooperation, the incentive agreement constructions and the transparent financial accounting in the project will result in the project as a whole implementing more innovations than if it had been conventionally procured

Agree							Do not agree
completely	6	5	4	3	2	1	

28. The current partnering cooperation has resulted in the innovation climate being better than if the project had been conventionally procured

Agree							Do not agree
completely	6	5	4	3	2	1	

29. I am completely satisfied with the way in which technical innovations (new material and product selections, production technology solutions, etc.) have been established in the project MK3

Agree							Do not agree
completely	6	5	4	3	2	1	

30. Visualisation with Cad technology is a very valuable innovation in the MK3 project and it has been used optimally

Agree							Do not agree
completely	6	5	4	3	2	1	

31. In the MK3 project the co-workers' (including the construction workers') proposals for continuous improvements have been utilised in a positive manner

Agree							Do not agree
completely	6	5	4	3	2	1	

Feedback

An efficient feedback system is in general very important for experience retrieval and measurement of results from processes of corner cutting and change. A follow-up system must be adapted to the project in question in a flexible and well-planned way. Information handling can often be automated and made more time efficient by using an IT system.

In view of future investments, this point should be very important for LKAB in particular.

32. I think that the system for follow-up of experiences for future projects established in the MK3 project is good and well balanced

Agree Do not agree
completely 6 5 4 3 2 1

33. I think that the system for follow-up of results established in the MK3 project is good and creates incentives for the white-collar workers in MK3 to strive for good achievements, good cooperation with other categories in the project and for making the work more efficient

Agree Do not agree
completely 6 5 4 3 2 1

34. I am convinced that the follow-up system used in the project MK3 will capture well-balanced experience and learning from the partnering process and for the project as a whole in view of LKAB's future projects

Agree Do not agree
completely 6 5 4 3 2 1

Comments:

Thank you for participating!

Bengt Toolanen

Your personal data (will be de-identified):

Name:

Address / mail

Tel:

Category: Client Consultant Contractor Other
(what?)

I am interested in discussing the whole issue in an interview: Yes
No

Mail or post your answers not later than 31 October to: Bengt Toolanen, Öströmsvägen 11, 975 95 Luleå,

Tel: 0920-642 37, Mobile: 070-3203960

Mail addresses: bengt.toolanen@e-bostad.net or bengt.toolanen@ltu.se

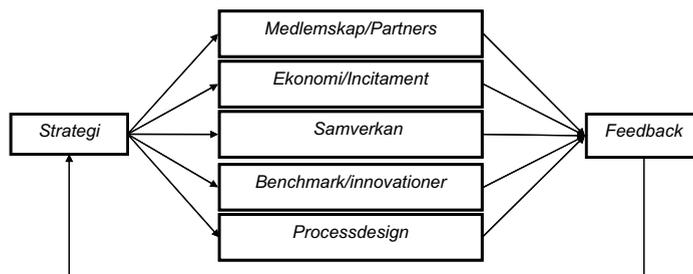
Appendix IV: MK3 Studien

(Questionnaire in Swedish)

MK3

Studie av partneringsamverkan vid byggandet av pelletsanläggning MK3 i Malmberget.

Enkätformulär okt -05



Bengt Toolanen

Luleå Tekniska Universitet

Introduktion

Som ett led i uppföljningen av MK3- projektet har LKAB och NCC beslutat att låta mig (Bengt Toolanen) som är verksam som forskare vid Luleå Tekniska Universitet göra en utvärdering av partneringprocessen vid projektet.

Jag har valt att basera min utvärdering i stor utsträckning på erfarenheter från England beträffande partnering vilka redovisas i *Seven Pillars of partnering* (Bennet, J., Jayes, S., 1998). I denna har sju olika baselement särskilts som viktiga basförutsättningar för en lyckad partneringprocess. Dessa framgår av figur på försättsidan samt av kortfattade beskrivningar i denna enkät.

Jag hoppas innerligt att du som fått denna enkät vill svara på så många frågor som möjligt! Jag garanterar anonymitet för dig och i min resultatsanalys kommer jag att så långt möjligt att undvika att peka ut enskilda personer så att dessa kan identifieras. Jag tror däremot att det kan vara av intresse för analysen att gruppera olika verksamhetskategorier som beställare, konsult och entreprenör.

Seven Pillars (jfr med figur på omslagssidan!):

Strategy / Övergripande processdesign

Strategi benet i Seven Pillars skall fungera som centralhjärnan i parteringprocessen och främst ansvara för den strategiska (ofta långsiktiga) projektprocessen. Strategier och målstyrning baseras i möjligaste mån på feedback (erfarenhetsåterföring) från processen.

En strategi bör inkludera:

- de viktigaste projektmålsättningarna (målformuleringarna)
- taktik och procedurer för att stödja måluppfyllelse
- huvudprocessutformning för att nå målen (process design)

En fastlagd strategi bör dokumenteras genom: partneringdeklaration (övergripande mål samt framgångskriterier), övergripande affärs- och organisationsplanplaner, utvecklings- och effektiviseringsplaner.

Viktiga inslag i en strategi är att skapa incitament för utveckling och innovationer. Ett viktigt inslag i detta är att försöka undvika rigid styrning som kan kväva enskilda initiativ till förändringar och innovationer.

Data till denna del kommer att fångas upp av svaren på enkäten.

Projektprocesser/ Processdesign

Ett ofta förekommande krav på utformningen av projektprocesser är att dessa skall möta kundkrav på korta ledtider, kvalitet och ekonomi. De ökade kraven på processdesignen kräver ändrade modeller för organisation av design och produktion. Ett viktigt inslag i detta är att en tvärfacklig och flerdimensionell samverkan uppnås genom nära samarbete mellan byggherre, designers och utförare så att tillgänglig kompetens och kunskap används på konstruktivt sätt.

Vid processdesignen är det viktigt att alla grundpelare för partneringprocessen beaktas (Seven Pillars). Processmodeller skall beakta önskemålen om att få till stånd ett klimat uppmuntrande till kontinuerliga förbättringar och implementering och utveckling av innovationer. Därmed uppnås en av grundmålsättningarna för partnering som är att få effektivitetsvinster på ett balanserat och kontrollerat sätt.

Data till denna del kommer att fångas upp av svaren på enkäten.

Integration / Samverkan – samarbete

En effektiv partneringprocess bygger på samverkan mellan aktörerna. En grundförutsättning för detta är att förtroende finns och utvecklas organisatoriskt på alla organisationsnivåer. En projektorganisation skall uppfattas externt som homogen och integrerad även om den utgör en samverkande enhet av resurser från olika företag och från olika kompetenser (en virtuell organisation). En bra bas för detta är aktiva teambuildings- och förtroendeuppbyggnadsaktiviteter, gemensamma IT – strategier och höga kompetens- och kunskapsnivåer hos de medverkande.

I MK3 projektets partneringdeklaration daterad 041130 finns målsättningar beträffande förtroendeuppbyggnad, främst genom öppenhet, samsyn, bra kommunikation, m.m., för partneringsarbetet.

1. Projektet skall drivas i en positiv anda och präglas av samsyn, ärlighet, öppenhet och kunskapsutbyte mellan parterna.

Fungerat								Fungerat
mycket väl	6	5	4	3	2	1		inte alls

Synpunkter:

2. *Vi skall skapa motivation och engagemang hos alla genom delaktighet och kommunikation*

Fungerat
mycket väl 6 5 4 3 2 1 Fungerat
inte alls

Synpunkter:

3. *Säkerställa balans mellan de hårda målen funktion, tid och ekonomi.*

Fungerat
mycket väl 6 5 4 3 2 1 Fungerat
inte alls

Synpunkter:

4. *Som referensprojekt utveckla samarbetsformer som blir tongivande för framtida projekt*

Fungerat
mycket väl 6 5 4 3 2 1 Fungerat
inte alls

Synpunkter:

5. *Hög etik och moral skall prägla projektet.*

Fungerat
mycket väl 6 5 4 3 2 1 Fungerat
inte alls

Synpunkter:

6 Minska revirtänkande och fördomar.

Fungerat mycket väl	6	5	4	3	2	1	Fungerat inte alls
------------------------	---	---	---	---	---	---	-----------------------

Synpunkter:

7. Säkerställa samverkan mellan projektets aktörer.

Fungerat mycket väl	6	5	4	3	2	1	Fungerat inte alls
------------------------	---	---	---	---	---	---	-----------------------

Synpunkter:

8. Jämfört med ett konventionellt projektupplägg vid en totalentreprenad har samverkan och samarbetet mellan beställare – konsulter - totalentreprenör fungerat mycket effektivare vid produktdesignen (projektering, konstruktion)

Håller helt med	6	5	4	3	2	1	Håller ej med
--------------------	---	---	---	---	---	---	------------------

Synpunkter:

9. Jämfört med ett konventionellt projektupplägg vid en totalentreprenad har samverkan och samarbetet mellan beställare – konsulter - totalentreprenör fungerat mycket effektivare i byggproduktionsskedet

Håller helt med	6	5	4	3	2	1	Håller ej med
--------------------	---	---	---	---	---	---	------------------

Synpunkter:

Membership / Medlemskap

Handlar om vilka som skall vara partners i en partneringrelation. Företag som har en ambition att ingå som partners måste ha långsiktighet i sitt agerande och vara intresserade av transparens och en kundvärdes fokusering. En viktig aspekt vid val av partners är att utvärdera dessas kompetens och företagskultur. Det är ofta av stort värde att partneringgruppen blir tvärfackligt och flerdimensionellt sammansatt och att kommunikationsaspekterna beaktas. Partneringdeklarationen 041130 har undertecknats av aktörer från LKAB, NCC, WSP och Sweco Bloco.

10. LKAB, NCC, WSP och Sweco Bloco är partners enligt partneringdeklarationen. Tycker du att partneringgruppen varit optimalt sammansatt?

Mycket Dåligt
 väl sammansatt 6 5 4 3 2 1 sammansatt

Synpunkter:

11. Partneringgruppen borde utökats med strategiska underleverantörer (t.ex stomkomponentleverantörer, installatörer, e.t.c)

Håller Håller
 helt med 6 5 4 3 2 1 ej med

Synpunkter:

12. Partneringgruppen har fungerat som en homogen grupp och alla har fått bidra med sin kompetens på ett öppet och förtroendefullt sätt

Håller Håller
 helt med 6 5 4 3 2 1 ej med

Synpunkter:

13. Alla som är med som partners (partneringmedlemmar) måste ställa upp på att arbeta med öppen ekonomisk redovisning (transparens)

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

14. Aktuell partneringsamverkan i projektet medför att projektet totalt sett blir billigare för LKAB än om det hade varit konventionellt upphandlat

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

15. Aktuell partneringsamverkan i projektet medför att projektet totalt sett kommer att få en kortare byggtid än om det hade varit konventionellt upphandlat

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

16. Aktuell partneringsamverkan i projektet medför att projektet totalt sett kommer att hålla kvalitets- och funktionskraven bättre än om det hade varit konventionellt upphandlat

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

Equity / Ekonomi – investeringar

Handlar om målsättningar att få ett långsiktigare tankesätt beträffande bl.a. investeringar i utveckling av såväl humana resurser som teknologi. Ekonomiska systemet bör ha hög grad av transparens och bejaka nödvändigheten av alla inblandade har möjlighet till att få en sund ekonomi (vinstbejakandet) för att få en bas för långsiktighet och investeringar. Ekonomiska incitament bör ha en profil av rättvisa och fungera som incitament för prestationer utöver standardnivå.

I partneringdeklarationen 041130 uttrycks detta genom krav på öppenhet i prognoser, möjlighet till skälig vinst och att positivt incitamentsutfall skall eftersträvas.

17. Den partneringgrupp som jobbat med MK3 har prioriterat långsiktighet och projektets väl före kortsiktiga ekonomiska vinster (såväl individuella som företagsanknutna)

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

18. De medverkande tjänstemännen i MK3 har i regel fått nyttig och relevant vidareutbildning för att bättre förstå innebörden i och kraven i ett partneringprojekt

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

19. De medverkande kollektivarbetarna i MK3 har i regel fått nyttig och relevant vidareutbildning för att bättre förstå innebörden i och kraven i ett partneringsprojekt

Håller							Håller
helt med	6	5	4	3	2	1	ej med
Synpunkter:							

20. De investeringar som gjorts i utveckling och utbildning av MK3 projektets anställda (humankapitalet) har varit väl avvägda

Håller							Håller
helt med	6	5	4	3	2	1	ej med
Synpunkter:							

21. I MK3 projektet har gjorts välavvägda investeringar i användandet av IT hjälpsystem (Cad visualisering, m.m.)

Håller							Håller
helt med	6	5	4	3	2	1	ej med
Synpunkter:							

22. I MK3 projektet har gjorts välavvägda investeringar i traditionell ingenjörsteknologi (nya material, produkter, produktionsteknik, m.m.)

Håller							Håller
helt med	6	5	4	3	2	1	ej med
Synpunkter:							

23. De incitamentsavtalskonstruktioner som finns i projektet stödjer på ett bra sätt de övergripande målen i partneringdeklarationen

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

24. De incitamentsavtalskonstruktioner som finns i projektet är rättvist belönande och ger incitament för osedvanliga prestationer

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

25. Partneringsamverkan, incitamentsavtalskonstruktioner och den transparenta ekonomiredovisningen i projektet medför att projektet totalt sett blir billigare för LKAB än om det hade varit konventionellt upphandlat

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

26. Partneringsamverkan, incitamentsavtalskonstruktioner och den transparenta ekonomiredovisningen i projektet medför att projektet totalt sett kommer att få en kortare byggtid än om det hade varit konventionellt upphandlat

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

27. Aktuell partneringsamverkan, incitamentsavtalskonstruktioner och den transparenta ekonomiredovisningen i projektet medför att projektet totalt sett kommer att hålla kvalitets- och funktionskraven bättre än om det hade varit konventionellt upphandlat

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

Benchmarks / innovationer

Målsättningen är att åstadkomma ständiga förbättringar genom sökande av innovationer. Med innovationer menas i detta fall att för aktuell organisation ny kunskap och nya tekniska och managementmässiga lösningar används för att effektivisera projektet. Innovationer kan exempelvis initieras genom att söka kunskap från andra projekt inom branschen eller från andra branscher (benchmarking) eller genom implementering av kunskap från forskning. Ett led i innovationsarbetet är att ge incitament och uppmuntran för medarbetare till att söka förbättringar och att följa upp dessa. Erfarenheten har visat att de ständiga små förbättringarna oftast är de som mest bidrar till effektiviseringar. Det handlar om att etablera ett gott innovationsklimat som engagerar och uppmuntrar hela humankapitalet till innovativt beteende.

I MK3 projektet är själva etableringen av partneringskonceptet en innovation i projektet!

27. Aktuell partneringsamverkan, incitamentsavtalskonstruktioner och den transparenta ekonomiredovisningen i projektet medför att projektet totalt sett kommer att implementera fler innovationer än om det hade varit konventionellt upphandlat

Håller							Håller
helt med	6	5	4	3	2	1	ej med

Synpunkter:

28. Aktuell partnersamverkan har medfört att innovationsklimatet har blivit bättre än om projektet hade varit konventionellt upphandlad

Håller
helt med 6 5 4 3 2 1 ej med

Synpunkter:

29. Jag är helt nöjd med hur tekniska innovationer (nya materialval, produktval, produktionstekniska lösningar, m.m.) etablerats i projekt MK3

Håller
helt med 6 5 4 3 2 1 ej med

Synpunkter:

30. Visualisering med Cad teknik är en mycket värdefull innovation i MK3 projektet och denna har använts optimalt

Håller
helt med 6 5 4 3 2 1 ej med

Synpunkter:

31. I MK3 projektet har medarbetarnas (även byggnadsarbetarnas) förslag på ständiga förbättringar tillvaratagits på ett bra sätt

Håller
helt med 6 5 4 3 2 1 ej med

Synpunkter:

Feedback

Ett effektivt system för feedback är mycket väsentligt för erfarenhetsåterföring och mätning av resultat från effektiviserings- och förändringsprocesser i allmänhet. Ett uppföljningssystem skall anpassas till aktuellt projekt på ett flexibelt och genomtänkt sätt. Informationshanteringen kan ofta automatiseras och tidseffektiviseras genom användning av IT system.

För speciellt LKAB med tanke på kommande investeringar bör denna punkt vara mycket angelägen.

32. Jag tycker att det system för uppföljning av erfarenheter för framtida projekt som etablerats i MK3 projektet är bra och välbalanserat

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

33. Jag tycker att det system för uppföljning av resultat som etablerats i MK3 projektet är bra och incitamentskapande för tjänstemännen på MK3 att satsa på goda prestationer, god samverkan med andra kategorier i projektet och effektiviseringar

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

34. Jag är förvissad om att det uppföljningssystem som vi har i projektet MK3 kommer att fånga upp välbalanserat erfarenhet och lärdom av partneringprocessen och projektet i övrigt inför LKAB:s kommande projekt

Håller								Håller
helt med	6	5	4	3	2	1		ej med

Synpunkter:

Tackar för din medverkan!

Bengt Toolanen

Dina uppgifter (anonymitetsskyddas):

Namn:

Adress / mail

Tel:

Kategori: Beställare Konsult Entreprenör Annan
(vad?)

Jag är intresserad att diskutera det hela vid en intervju: Ja Nej

**Maila eller posta svaren senast 31 oktober till: Bengt Toolanen,
Öströmsvägen 11, 975 95 Luleå,**

Tel: 0920 – 642 37, Mob: 070 - 3203960

Mailadresser: bengt.toolanen@e-bostad.net alt. bengt.toolanen@ltu.se

Appendix V: MK3 Partnering charter



PROJEKT MK3 PARTNERINGDEKLARATION



Vi har som partners vid workshopen i Gällivare 30/11-04 beslutat att arbeta mot nedanstående mål och framgångskriterier vid genomförandet av projektet MK3 :

MK3 skall överträffa allas förväntningar som projekt och produktionsanläggning.

Partnering:

- Projektet skall drivas i en positiv anda och präglas av samsyn, ärlighet, öppenhet och kunskapsutbyte mellan parterna.
- Vi skall skapa motivation och engagemang hos alla genom delaktighet och kommunikation.
- Säkerställa balans mellan de hårda målen funktion, tid, ekonomi.
- Som referensprojekt utveckla samarbetsformer som blir tongivande för framtida projekt.
- Hög etik och moral skall prägla projektet.
- Minska revirtänkande och fördomar.
- Säkerställa samverkan mellan projektets aktörer.

Funktion / Arbetsmiljö:

- Inga olycksfall med sjukfrånvaro under anläggningstiden.
- MK3 skall skapa en bra arbetsmiljö ur drift och underhållssynpunkt.
- MK3 skall producera rätt volym till rätt kvalitet i rätt tid både som projekt och produktionsanläggning.

Ekonomi:

- Prognoser präglade av öppenhet med förslag till förbättringar.
- Alla aktörer skall ges möjlighet till skäligen vinst.
- Innehålla projektets beviljade medel och gemensamt sträva mot positivt incitamentsutfall.

Tid:

- Produktionsstart 2006-10-01.
- Gemensam tidplanering / prioritering

Handwritten signatures and notes:

WSP (with logo) *Mycket Kul i 3 år.* *SWECO BLOCO* (with logo)

Vertical signature on right: Miss Stenlund Inger Östlund

Other signatures: Johan Karlsson, Per-Anders Larsson, Kell Christ, etc.

