

# TRANSPARENCY AND COOPERATION—ESSENTIAL FACTORS OF LEAN CONTRACTING

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## ABSTRACT

Managing the growing extent of fast, complex and uncertain construction projects is in many ways the focus within prevalent Lean Construction theories. An essential prerequisite to get a more effective and lean construction process is to use adequate procurement models to promote innovation and cooperation. This paper presents a study of how different project related prerequisites affect the choice of performance, remuneration and cooperation models when contracting. The results are based on a field survey among professional construction clients with the purpose to investigate how different factors such as short lead time, market competition, different kinds of uncertainties and strategic considerations are affecting the contracting process.

Choosing the performance model is mainly connected to the distribution of responsibility of the design between the client and the contractor. However, project oriented and external factors can also impact this decision, e.g. lead time for project execution, technical complexity and lack of interested bidders increases the usage of design and build types of contracts.

Decisions of remuneration and cooperation models are highly connected to the risk management of projects where short lead time, poor competition and different kinds of uncertainties are present. Under these circumstances and when the client wants to participate strategically in the construction process, transparent models of remuneration and cooperation during a partnership are favoured.

## KEY WORDS

Procurement models, Project types, Lean contracting, Relational contracting, Field survey.

## INTRODUCTION

The construction sector represents an important part of the Swedish national economy, about 10% of Sweden's GNP, and employs approximately 10% of the total workforce. This sector is currently under pressure from community, clients and mass media following construction failures, unfavourable cost development and even cases of improper competition made public. These events have led to the organisation of public committees and research projects to scrutinise the said sector (SOU 2002: 115).

The main conclusions from these studies are that a change is needed in the construction sector, since it is obvious that the progress of productivity

has been very slow compared to other manufacturing sectors. The fulfilment of client expectations regarding time, economy and quality has frequently failed. It is also quite obvious that traditional models for managing the building process often do not match the nature of today's building projects. Actual community development requires a changed and more dynamic construction process with shortened lead times, while better fulfilling client demands (*ibid.*).

This paper presents findings from a field study where the interaction between actual internal and external prerequisites for a project and the contracting process was studied. The main objective was to investigate how the growing extent of quick, uncertain and complex projects affects the

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choice of suitable performance, remuneration and cooperation forms (Toolanen 2004).

**CONSTRUCTION CONTRACTS AND MODELS**

**GENERAL**

Most projects in Sweden are still traditionally contracted, based upon transactional oriented contract models. Much energy and effort are spent on specifying administrative and technical details to get an administrative base for the transactional oriented construction process. This process is often time and money consuming and seldomly gives the involved stakeholders incentives for innovations and cooperation that will improve the execution phase of the project. The partnering patch for more relational oriented cooperation forms has until now been applied in Sweden very rarely compared to, for example the UK (Bennet and Jayes, 1998). However, there is a noticeable growing interest within the Swedish construction sector to apply new theories and ideas, such as Lean Construction, and achieve a more effective construction process.

Miles and Ballard (1997) discuss the needs of developed contracting models to facilitate and support the need of achieving a more behavior oriented construction process (relational contracting). The authors have hypothesised that complex, uncertain projects under time pressure require more development towards relational forms of cooperation compared with simple, certain and slow projects, see Figure 1. This has also implications on the nature of the work to be executed (production task), the system of managing the work (production system) and on the organizational structure and relationships between the parties (organization structure and contracting models) (Miles and Ballard 1997).



Figure 1: The Project Spectrum (Miles and Ballard 1997).

Further development of existing contracting models and implementation of new models are a central issue of possibly achieving a more rela-

tional oriented and effective construction process. The importance of contracting models on project execution can probably never be overestimated, since the possibility of achieving a more effective and lean construction process depends on the rules of the game. Contracting models should be grouped according to how different combinations of performance, remuneration and cooperation models interact with project execution to achieve an optimised process design (Toolanen 2004).

**PERFORMANCE MODELS**

Sweden uses three generic contract forms:

- Prime contracting models (DBB: design–bid–build)
- Design and build models (DB: design–build)
- Construction management models (CM)

These generic contractual forms are subdivided into six performance models. The Swedish abbreviations and the meanings of the different performance models are explained in Table 1.

The main difference between each model is primarily how the design responsibility is distributed between client and contractors. In prime contracting models (DBB) and construction management contract forms (CM), the client/owner representative is responsible for the design, while in design-build forms (DB) most of the design responsibility is distributed to the contractor.

Prime contracting forms are often applied when the client wants to have one contractor (prime contractor) responsible for the execution and coordination of the project, while keeping the design responsibility for himself. Table 1 shows how these prime contracting forms are divided into three basic types in Sweden, depending on how the procurement of subcontractors is arranged. In the GE type, only the prime contractor is selected and procured by the client, while the prime contractor procures the subcontractors. However, in multiple primes (SGE or DE) most subcontractors are selected and procured by the client. After this initial selection process, one of the subcontractors will be selected to have the responsibility of coordinating and acting as a prime contractor in one of the multiple primes forms (SGE), whereas the client will coordinate the selected subcontractors in the other (DE) by himself. Most projects in Sweden are procured as DBB contracts, mainly due to conservatism and culture.

In DB contract forms, contractors are usually responsible for most of the product design, while following some performance-based demands set out by the client. The traditional type of DB contract form in Sweden is TE, favoured by some clients for many decades for certain types of projects

Table 1: Swedish performance models

| Swedish performance models<br>Abbreviation (The Swedish name) | Type of contract |    |    | Main characteristics   |
|---|------------------|----|----|--|
|   | DBB              | DB | CM |  |
| GE (generalentreprenad)                                       | X                |    |    | Client selects prime contractor. Prime procures and coordinates the subcontractors                   |
| SGE (samordnad generalentreprenad)                            | X                |    |    | Client procures special contractors and selects one of them to be the coordinating prime contractor. |
| DE (delad entreprenad)  | X                |    |    | No prime contractor, special contractors will be coordinated by the client itself.                   |
| FE (funktionsentreprenad)                                     |                  | X  |    | Systematically performance based   |
| TE (totalentreprenad)   |                  | X  |    | Traditional design & build   |
| MDE or CM (mycket delad entreprenad)                          |                  |    | X  | No prime contractor, consultants and subcontractors are coordinated by the clients representative    |

where clients have tried to specify their demands through functional requirements or by technical specifications and drawings. FE is a new type of DB contract form where the performance based demands are more systematically handled and supported by results obtained from some research projects.

The construction management type (MDE or CM) is when consultants and all contractors are procured and coordinated by the client's representative.

#### REMUNERATION MODELS

The majority of construction contracts in Sweden have a fixed price basis (FP) for remuneration. This is probably one of the biggest sources for litigation when handling quick, dynamic and complex projects, especially when the initial project program, for which the selection of the contractor is based upon, has to be revised due to dynamically occurring changes.

Cost reimbursable forms (transparent) for remuneration are either with some incentives or without. The latter form of compensation, billing based on time and material, is mostly used in smaller projects within reconstruction and maintenance where the scope of work is not always well defined. For bigger projects the incentive based cost reimbursable form predominates, mainly based upon sharing savings and overflows of a target price.

#### COOPERATION MODELS

Explicit partnering concepts for cooperation, as per models mainly designed in the UK, have been used very little in Sweden up to now. The reasons can be discussed and argued, but it is probably a consequence of culture and conservative attitudes among clients. However, a parallel model to for-

malise partnering (business partnership) based upon mutual strategic considerations, has been used for decades in Sweden. In these types of projects, the partners can make a lot of deals to improve the working climate and trust so as to find prerequisites for long term business cooperation. The longer time horizon for balancing gains and losses have shown to facilitate cooperation and problem solving among the involved actors.

#### STANDARD CONTRACT FORMS

Swedish construction contracts are mostly based upon standard rules worked out jointly by client federations and the Swedish Contractors Federation. The AB 04 regulation applies to DBB and CM contracts, while the ABT 94 is developed for DB contracts (AB04, ABT 94). Both contract regulations are based on the transactional model and regulate in detail the responsibilities, authority and compensation of each party. Even in projects where partnering is applied as a model for cooperation these transactional regulations are used as a base for distribution of risks and responsibilities.

#### A FIELD SURVEY OF CONTRACTING MODELS IN RELATION TO PROJECT COMPLEXITY

Because the contract sets the rules of the project, it creates the foundation for the construction process and most of the incentives needed to move the project in the right direction. Injudicious contracting is the source of many problems in the construction. It is also stressed within Lean Construction that the increase of quick, uncertain and complex projects requires changes to how projects are contracted and managed (Miles and Ballard 1997).

A field survey was carried out among 32 Swedish construction professionals to study how differ-

Table 2. Description and characteristics of the different decision environment

| Decision environment |   | Characteristics |       |              |           |           |
|----------------------|---|-----------------|-------|--------------|-----------|-----------|
|                      |   | Lead time       |       | Resources    | Uncertain | Strategic |
| Abbr                 | Description   | slow            | quick | not critical | critical  |           |
| N                    | <b>Normal</b> , design and construction can be time-wise separated, no lack of bidders                                    | X               |       | X            |           |           |
| R                    | <b>Resource critical</b> , design and construction can be time-wise separated, risk for lack of bidders                   | X               |       |              | X         |           |
| T                    | <b>Time critical</b> , short lead time, design and construction has to be parallel, no lack of bidders                    |                 | X     | X            |           |           |
| R&T                  | <b>Resource and Time critical</b> , short lead time, design and construction has to be parallel, risk for lack of bidders |                 | X     |              | X         |           |
| U                    | <b>Uncertainty</b> , risk for late changes and redesign, uncertainty in the build. program                                |                 |       |              | X         |           |
| S                    | <b>Strategically</b> , client interested to promote innovations, long-term thinking                                       |                 |       |              |           | X         |

ent project types and the actual set of prerequisites connected to a project affect the contracting process. In the survey the respondents were asked to act as advisors, free from organizational obligations, to a client in different contracting situations. Most of the respondents (75%) were selected among representatives active in professional federations, such as clients, consultants and contractors, while the remaining (25%) were randomly selected among client representatives active in the Swedish client federation (Byggherreforum). The main motive for this selection procedure was to ensure that the respondents had sufficient knowledge and experience of the range of project types, decision environments and contracting models investigated in the study. To simulate project requisites ranging from slow, certain and simple projects to quick, uncertain and complex projects, four project types representing different levels of technical complexity were studied under seven different overall situations (decision environment). The variables in the decision environment were lead time, market situation (resources), uncertainties and strategic considerations (Toolanen, 2004).

Table 2 overviews the different variables used in the inquiry study. The different decision environments, briefly described in Table 2, were also presented to the respondents as a shared common understanding of the vocabulary. The objective was to investigate how the distinctive features of the different environments affected the choice of contracting models. The contracting alternatives presented to the respondent consisted of three important parts, i.e. the distribution of responsi-

bilities (performance form), how the contractor is compensated (remuneration form) and how cooperation is structurally organized (cooperation form). For every unique combination of project type and decision environment (Table 2), the respondents had to decide which combination of performance, remuneration and cooperation forms were most recommendable. The importance of studying the combined parts of the total contracting model was based on a hypothesis when planning for the field study. The result of the study showed that the three parts considerably influenced the outcome and were important to get a better understanding of the client's reasoning in the contractual situation.

The results presented in the following sections demonstrate some of the findings in the field study by Toolanen (2004).

#### CHOICE OF PERFORMANCE MODEL

Figure 2 shows the influence of prerequisites, such as lack of resources, lead time, uncertainties and strategic considerations, on the choice of performance model. The *Normal* decision environment reflects the client regarding the project be slow, certain and simple, where 55% of the respondents recommended the DBB form as the preferred performance model. *Strategic* considerations represent the other extreme case where most respondents were in favour of the DB contract form (75%). When the prerequisites for the project deviated from the *Normal* situation—quicker, more uncertain and complex—the results



show the DB performance models to be favoured more.

From this study we see that clients strongly favour DB contract forms in a situation of dynamic and uncertain conditions, indicating the distribution of responsibility for design to the contractor to be somewhat a question of forced action of trust when the uncertainty in the decision environment increases.

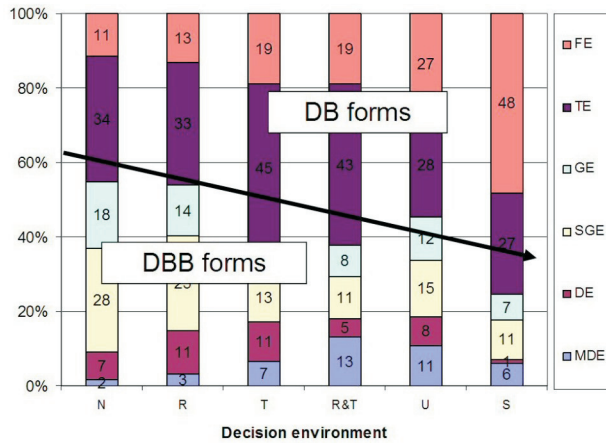


Figure 2: Interaction between performance model (Table 1) and decision environment (Table 2), (Toolanen 2004). N—normal, R—resource critical, T—Time critical, R&T—Time and resource critical, U—Uncertain and S—Strategic consideration.

Figure 3 shows how different project types affect the choice of performance model in a decision situation where the project execution lead time is short. The prerequisites in this case stated that the design process had to proceed simultaneously to the construction activities due to a lack of time. The figure shows that the project type somewhat affects the choice.

The most popular project type for selecting the DB models (80% of the respondents) was the apartment building project. This somewhat surprising result can be explained by the good possibility in this case to define the functional demands, as the project is extremely well known for by most clients. By tradition in Sweden, this project type has also been contracted for decades using DB models. In general the CM (the MDE model) alternative is less popular in Sweden than in many other countries. While only 3% preferred the CM model for office building and apartment projects, 10% of the clients chose the CM alternative for technical more complex projects, such as the business centre. A noticeable result in contrast to the general situation in the Swedish market is that the DBB models are selected by a minority of the clients for all project types when contracting for quick projects. The prime contractor variant of

DBB (GE) in particular seems to be selected by very few of the clients.

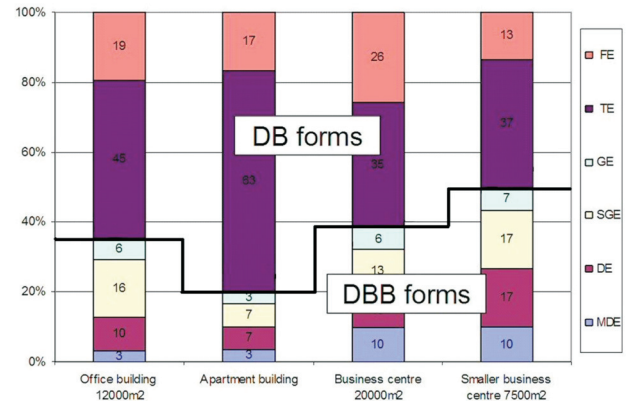


Figure 3: Choice of performance model (see Table 1) for different project types where design and construction is executed in parallel (time critical) (Toolanen 2004).

N—normal, R—resource critical, T—Time critical, R&T—Time and resource critical, U—Uncertain and S—Strategic consideration.

#### CHOICE OF REMUNERATION FORMS

Figure 4 shows how different factors in the decision environment (Table 2) affect the choice of remuneration model by contracting. In a normal situation when the project can be called slow, certain and simple, the fixed price (FP) compensation model was favoured by 82% of the clients.

Contrary to this, transparent compensation models were strongly favoured when projects are quick, uncertain and complex. When the client judges the project to be uncertain or has strategic considerations, 80–85% considers transparent remuneration as an essential part of the contracting model.

This indicates that clients in a situation of quick, uncertain and complex projects are afraid of hidden agendas if using fixed price models of remuneration. A transparent model for compensation should also be combined with some bonus agreement (LRI), according to the majority of clients.

How the project type affects the remuneration model is shown in Figure 5, where the competition situation is regarded to be fair for the client and when the lead time is not critical (*slow*). It is quite obvious that technically complex projects, such as a big business centre, attract more clients to use transparent compensation models (LR + LRI) compared to technically more simple projects.

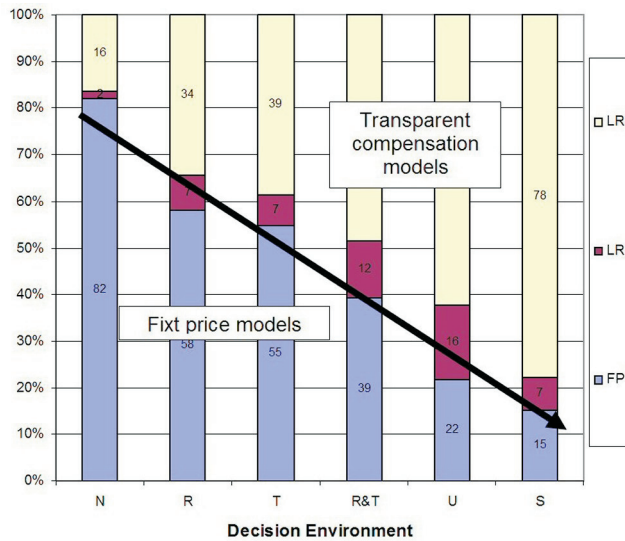


Figure 4: Interaction between remuneration models and the decision environment (Table 2) (Toolanen 2004). N—normal, R—resource critical, T—Time critical, R&T—Time and resource critical, U—Uncertain and S—Strategic consideration. LRI—transparent compensation model with incentive, LR—billing based on time and material, FP—fixed price model.

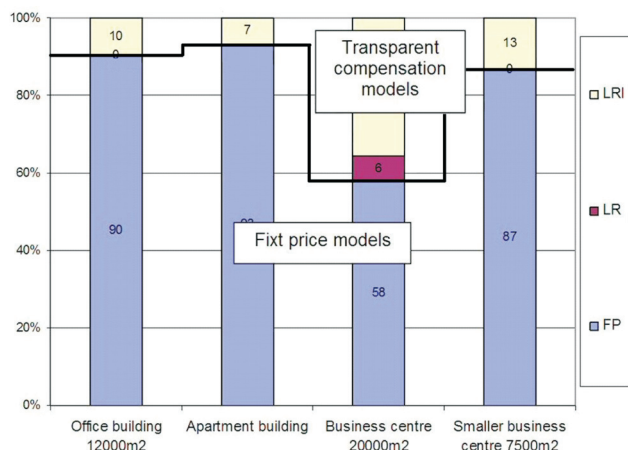


Figure 5: Different project types and choice of remuneration models in a normal decision environment (Table 2) (Toolanen 2004).

N—normal, R—resource critical, T—Time critical, R&T—Time and resource critical, U—Uncertain and S—Strategic consideration. LRI—transparent compensation model with incentive, LR—billing based on time and material, FP—fixed price model.

**CHOICE OF COOPERATION MODEL**

Figure 6 shows the influence of the decision environment on the choice of cooperation model. The different cooperation models used in the study were strategic partnering (S IV), project partnering (S III), traditional business partnership (S II) and traditional transaction oriented relationship (S I).

The normal decision environment reflects the situation when the client regards the project to be slow, certain and simple. Here, 80% of the respondents chose traditional transaction and business oriented cooperation models (S I + S II), whereas only 20% preferred relational oriented cooperation (S III + S IV). However, in a situation of low competition in the market and short lead time for the project, more than 30% of the clients preferred partnering concepts. If the situation was influenced by uncertainties and strategic considerations, 60–80% would prefer the partnering concepts.

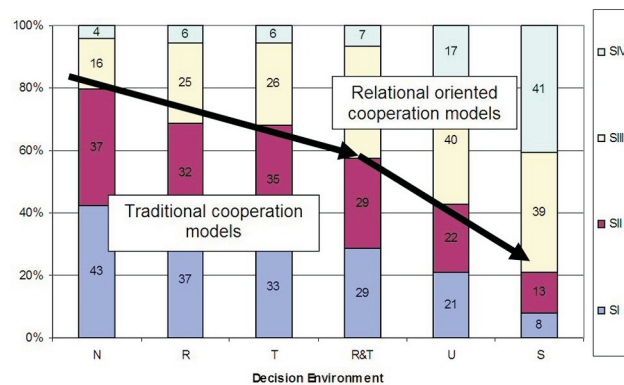


Figure 6: Interaction between cooperation models SI—SIV and decision environment (Table 2) (Toolanen 2004). N—normal, R—resource critical, T—Time critical, R&T—Time and resource critical, U—Uncertain and S—Strategic consideration. SI—traditional transaction relationship, SII—traditional business partnership, SIII—project partnering and SIV—strategic partnering.

The last figure, Figure 7, shows the influence of different project types on the choice of cooperation model in a situation of uncertain project requisites. It was noticed that the project type greatly affects the choice, especially for the apartment project where the share preferring partnering concepts was over 80%.

**CONCLUSIONS**

The study clearly indicates that the use of different contract models is highly dependent on the actual decision environment, as shown by the extracts from the Swedish inquiry presented in this paper (Toolanen 2004).

Traditional performance, remuneration and cooperation models are favoured when the project is not under time pressure (slow project), not technically complicated (simple) and when market conditions favour the client. This is probably due to traditions and cultural influences. However, when complexity in the decision environment (Table 2) is increased, a larger part of the projects will be procured by models giving the contractor the design responsibility (DB forms), using trans-

parent remuneration forms, and by applying more relational oriented cooperation forms. Technical project complexity by itself also contributes in different manners to the use of transparent remuneration forms and relational oriented partnership.

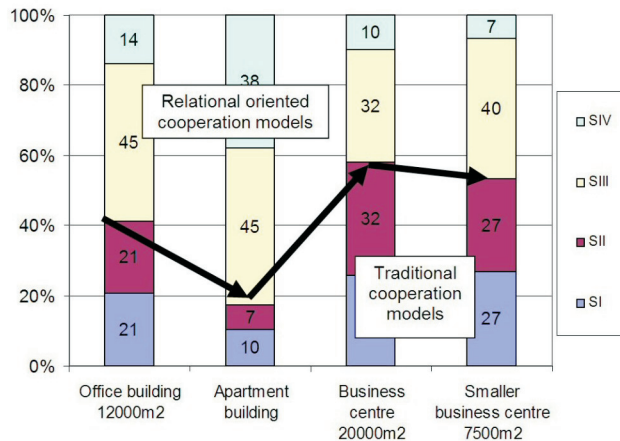


Figure 7: Different project types and the choice of cooperation model (SI—SIV) in an uncertain decision environment (Table 2) (Toolanen 2004).

SI—traditional transaction relationship, SII—traditional business partnership, SIII—project partnering and SIV—strategic partnering.

How quick projects affect the choice of procurement and cooperation models is an interesting and actual question due to increasingly shorter lead times. The study clearly indicates lead time to greatly influence the contract model, as up to 80% of respondents favour DB contracts, 50% choose transparent compensation forms and 30% partnering as the best solutions even if the project is technically simple.

When market competition is regarded to be unfavourable for the client due to a lack of interested bidders, different contracting strategies are selected depending upon the project complexity. For smaller projects, most clients recommend DBB models without a prime contractor in the hopes of getting more bids, since smaller contractors can also participate. However, DB models are favoured in technically more complex projects despite the risk of few bids.

When project uncertainty exists, e.g. high risk for changes, transparent remuneration models are preferred by 80% of the respondents. As much as 60% recommend partnering as cooperation model under these circumstances. Hence, transparency and relational oriented partnership seems to be favoured by a large majority of the respondents, especially when the risk for change is high.

In the following situations:

- uncertain and complex project situations;

- unfavourable market situations for the client;
- situations of short lead time (quick projects),

the main findings are that transparent remuneration forms and partnering as cooperation form are highly recommended. The choice of performance model is dependent on the client's willingness to delegate design responsibility as long as the lead time is not critical. The study also indicates a movement away from fixed price contracting, probably caused by the adversarial relationship it produces between the stakeholders as well as the negative impact on the construction process. The study also shows that the use of transparent compensation models and relational oriented cooperation models (partnering) are highly connected to each other. This indicates a change of behaviour towards relational contracting models, thereby supporting the implementation of Lean Construction theories and methods. However, more research is needed, especially in defining a more general strategy for the selection of contractual agreements that promote the conditions for an improved lean process design.

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