

CONTRACT MODELS AND COMPENSATION FORMATS IN THE DESIGN PROCESS

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ABSTRACT

This paper presents the most common contract models and compensation formats for the design process, and considers to what extent they give the designers the best opportunity to maximize value for the customer and minimizing waste in the design process.

The presented results are based on literature review combined with a study of documentation and interviews with key personnel, into Norwegian projects.

Findings show that lump sum and cost reimbursement are the most commonly used compensation formats for design. The most commonly used contract models are Prime Contract and Multi-Party Contract. From the case studies, it emerges that the designers' challenges do not lie in the contract model itself, but rather in whom they respond to – the client or the contractor. The paper further finds design-bid-build combined with cost reimbursement to be most favourable in the early iterative stages, where the scope is poorly defined and/or characterized by a flow of new information. The design-build contract combined with lump sum is more favourable in later sequential stages, when the scope is well defined. However, if the process is still characterized with constantly new information, cost reimbursement are highly recommended.

KEYWORDS

Contract, contract models, compensation formats, design management, lean design.

INTRODUCTION

The Architecture, Engineering and Construction industry (AEC) has a potential to increase its productivity and the value of the project. Traditional construction projects are executed with fragmented organization and contracts that hinders collaboration between participants. New procurement models and contract strategies need to be developed to meet these challenges. Creating an appropriate procurement model is an

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important task for a client to consider as it establishes the basic rules of the game and determine the execution as well as the result of a project (Toolanen and Olofsson, 2006; Lædre, 2006). According to El. Reifi and Emmitt (2013), different procurement models may cause inefficiencies in the early design phase, in terms of delays, budget overspends and, in many cases, less value being delivered to the client.

In order to address such challenges, the literature typically recommends approaches as Lean Project Delivery System, which encourage relational contracting and involvement of all key participants early in the project (Ballard, 2000a). Integrated Project Delivery (IPD) is a relational contract that is conceived to accommodate the intense collaboration required in complex building projects (Thomsen, et al., 2009). However, the use of IPD demands that the owner select team based on best value rather than on the lowest bid (Ghassemi and Becerik-Gerber, 2011). Actually, a competitive tendering process is best avoided in order to preserve the accumulated knowledge (Zimina, Ballard and Pasquire, 2012). In practise, such approaches prove difficult to apply. On public projects that include public founding, a competitive tendering process may be required by the public contract regulations. All countries that are members of World Trade Organization have to follow the Agreement on Government Procurement (GPA). In Norway, this specifically states that all public contracts shall undergo an open competitive tendering process that secure transparency and fairness in the process. Consequently, the industry is still favouring a traditional fragmented contract strategy, both in public and private sector (Lædre, 2006).

Through our study of the literature, we have not found many that discuss the influence of contract models and compensation format for design in projects using lean construction approaches. Through investigation of two major public Norwegian Hospital project, this paper addresses this knowledge gap. The research questions are:

- What are the most common contract models and compensation formats for the design process in Norway?
- To what extent do these facilitate the iterative and sequential design process?
- Which contract models and compensation formats give the designers the best opportunity to maximize value for the customer and minimizing waste in the design process?

Value is a complex subject in lean construction context, but the authors of this paper will use value to describe a good or a service that meets the customer's need at a specific price at a specific time (Womack and Jones, 1996).

RESEARCH METHODOLOGY

The research was carried out by a literature review in accordance with the procedures described by Bloomberg, Cooper and Schindler (2011) and investigation of two cases, according to the prescriptions of Yin (2009). This was carried out using a study of documentation and semi-structured interviews with key personnel. It was not possible to conduct an observational study as the designing in both cases was finished.

The literature review focused on contract models, compensation formats, design process, reducing waste and increasing value in the design process. Literature has been collected from research databases (Scopus, Compendex, IGLC Conference Papers and google scholar), library databases as well as from references of reviewed

articles. In addition, literature on the building process, lean design management and dependencies between tasks was reviewed.

Two cases were chosen to study, notably: two major Norwegian hospital projects: St. Olav Hospital construction phase 2 (will further be referred to as St. Olav Hospital) and New Østfold Hospital. The projects are recent, allowing the informants to remember the project well and be able to contribute valid data. Equally, the projects are similar in type yet carried out with different contract models and compensation formats in the different phases of the project. St. Olav Hospital started in 2005 and ended in 2009. It consisted of several buildings, 85.000 m² in total. New Østfold Hospital started in 2011, and is expected to be finished November 2015. The Hospital consists of one building, accounting to 85.500 m². In total, eleven interviews were carried out with five designers/engineers, four contractors, and two representatives from the owner organization. An interview-guide was used to ensure reliable and comparable data. The procedure enabled the interviewer to pursue interesting answers or unexpected themes that could appear during the interview. In order to obtain comparable data, all of the interviewees were posed the same questions.

The documentation studied consisted of documents received from the informants, and were mainly organization maps, schedule plans, presentations of the projects and preliminary reports. The documentation review provided details that corroborated information from the interviewees (Yin, 2009).

The use of IPD as recommended in the Lean literature is not commonly used within Norwegian construction industry. Therefore, we limit the contract models to design-build (DB), and design-bid-build (DBB). We do not consider the organization of these cases, but to what extent they facilitate for the iterative and sequential design process. Standard rules and regulation for contract models in Norway present two of the most important standard contracts for assignment between a builder/client and consultant/designer, NS8401 (Standard Norge, 2010a) and NS8402 (Standard Norge, 2010b). These provide guidelines for the use of lump sum and cost reimbursement, and occur in each end of the distribution of responsibility and risk. Therefore, we limit the compensation format to these extremes. Theoretically, both of the contract types and compensation format can be combined with each other. However, in this study we limit to the combination DBB with cost reimbursement and vice versa DB with lump sum, according to the combinations of the case studies. The study is seen from the designer's point of view, and the conclusion emphasizes value seen from the client's perspective.

THEORETICAL FRAMEWORK

THE DESIGN PROCESS

Lean thinking can be summarized in five principles according to Womack and Jones (1996), notably value, value stream, flow, pull and perfection. Of these, they claim that value is the critical starting point. They consider value defined by the customer, and explain it as a good or a service that meets the customer's needs at a specific price at a specific time. What creates value in design is a complex question. It will be a result of the conversation between the ends, means, and constraints of the client (Ballard, 2008). Unlike production, where rework is inherently negative and wasteful, iterations can be both positive and negative in the design phase (Ballard, 2000b).

Allowing the iterative processes to run as long as necessary can be beneficial to the value of the project. If they run too long, however, they can have serious implication on the project, concerning time and cost (Knotten, et al., 2015).

The design phase will typically start with a high degree of complexity and interdependency between the different tasks as the design team is looking for better solutions to the problem. As the problems get solved, the complexity of the project decreases and consists mostly of sequential tasks like delivering drawings and descriptions. The process can therefore be seen as a highly iterative and creative in the early phase of design, and more sequential later when most of the decisions are already taken (Knotten, et al., 2015).

The MacLeamy curve, in Figure 1, shows us how uncertainty in a building project decreases over time as the level of information increases. Research has highlighted the importance of the early design phases in helping to reduce uncertainty and improve quality (Samset, 2008; El.Reifi and Emmitt, 2013). The cost of making changes and modifications in the later phases of the project increases considerably versus doing this in the front-end phase of the project. Samset (2008) argues that sufficient time for planning and designing is essential to prevent late changes for the design team. In order to reduce uncertainty and prevent changes and variation orders late in the process, he proposes three actions: collecting information early in the project, doing a proper design job, and coordination between disciplines to prevent collisions, errors and erroneous assumptions.

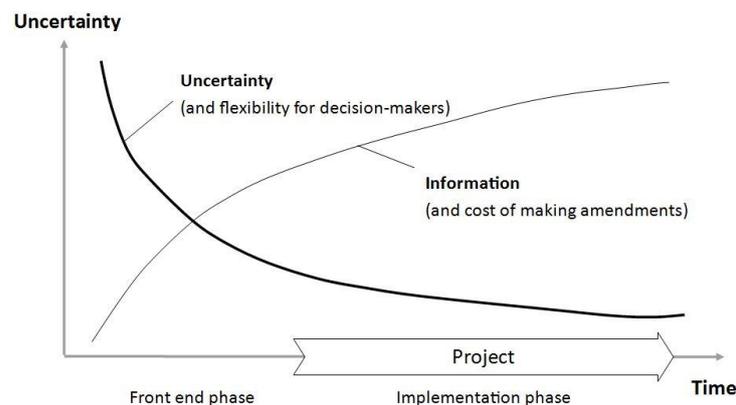


Figure 1: Uncertainty and information in projects over time (Samset, 2008).

There are many ways to divide the building process into phases to create an overview and control over critical stages. An example of division into phases is RIBA (2013), who breaks the process down to eight phases: Preparation & Brief, Concept Design, Design Development and Technical Design, Construction, Handover and Close Out & In Use. For the case of simplicity, the authors of this paper choose to consider the building process as twofold with front-end phase and implementation phase. The front-end phase represent the iterative phases, and the implementation phase the later sequential phases.

CONTRACT MODELS IN NORWAY

When a client chooses how to carry out a project, he can choose design-bid-build (DBB) and manage the design team himself, or he can choose design-build (DB). In the former, the client is responsible for the design team, and in the latter, he makes

the contractor responsible for the design team (Toolanen and Olofsson, 2006). In addition, the client may choose untraditional contracts for his project, e.g. IPD.

There are several advantages and disadvantages for the client to consider, standing before the selection of contract model. Choosing DB may cause cheap solutions, as the contractor wants to save money (Lædre, 2006). This could further lead to solutions that are not optimal in a life-cycle cost evaluation, and may have negative consequences for the clients operation costs (Grimsmo, 2010). On the other hand, the contractor has a better basis to focus on building solutions (Lædre, 2006). The contractors have valuable information about technical products, solutions and materials that is advantageous to include in the front-end phases, and will benefit the client as the constructability will improve (Sødal, et al., 2014).

Whether it is the client or the contractor to contract the designers, there are several contract types to choose from. Two frequently used models when contracting designers in Norway are so called Prime Contract (totalprosjektering) and Multi-Party Contract (gruppeavtale). In the Prime Contract, the client writes a contract with one designer who becomes responsible for all design-work. The prime designer may enter into contracts himself to complement expertise or increase resources to carry out the commission. The Multi-Party Contract is a jointly responsible group of several designers that have signed a mutual contract with the owner, as well as an internal contract between themselves.

COMPENSATION FORMATS FOR DESIGN IN NORWAY

Lump sum

Lump sum reward the designers according to the result of their work. For the client/contractor, this permit predictable costs and reduces the risk of cost overruns related to the design work. It is a good choice if the client/contractor project a very high level of available information, and desires a low level of design control effort (CII, 2003). According to Eikeland (2001), the designers will be motivated to be efficient to increase their winnings. It is desirable for the designers to produce the agreed product with the least possible use of resources to satisfy the minimum requirements of the product. The focus on reducing time and cost could provide erroneous focus in the design process, and the designer may end up discarding good solutions for the project as a whole.

Cost reimbursement

Cost reimbursement reward the designers based on actual time taken to perform the assignment. It requires low level of available information at award of design contract, and high level of client's design budget risk and design control effort (CII, 2003). The contract is better than average for allowing changes during design and the client can be involved in critical aspects of design (CII, 2003). Cost reimbursement is a good choice for commissions with weakly defined scope and where the designers' work is poorly described (Lædre, 2006). Unlike lump sum, cost reimbursement will motivate the designers to provide high efforts, as it provides a higher profit (Eikeland, 2001). This is positive in relation to the quality of the product, but negative in the sense that the designers may become inefficient.

FINDINGS AND DISCUSSION

THE MOST COMMON CONTRACT MODELS AND COMPENSATION FORMATS FOR THE DESIGN PROCESS IN NORWAY

Contract models

In St. Olav Hospital, the client chose to contract the designers on a Multi-Party Contract in the front-end phase. The design group consisted of several designers in a jointly responsible group that signed a mutual contract with the client. Later, in the implementation phase, the client established four DB-contracts. This resulted in fragmentation of the design team, as the client split the group in four and delegated them to each contractor. In New Østfold Hospital, the client chose to manage the whole project himself, which included approximately 50 contracts with designers, contractors and suppliers. The client chose to contract the designers on a Prime Contract through the whole project, and thereby made them responsible for all design-work. Findings indicate that Prime Contract and Multi-Party Contract are the most commonly used contract models in Norway. Interestingly, findings show that the designers were unable to tell the difference between advantages and disadvantages in these contracts. The interviewees argue that the challenges lies in to whom the designers should respond to – the client or the contractor. The further findings will therefore explain the advantages and disadvantages between the DB and DBB, in order to ensure a facilitated design process and value for the customer.

Compensation formats

In both studied cases, the client chose to contract the design team on cost reimbursement in the front-end phase. Additionally, in St. Olav Hospital, they chose to supplement it with a bonus as incentive to prevent inefficiency that the compensation format may cause. The bonus depended on satisfactory work within milestones and budget. Thereafter, when entering the implementation phase, the two clients made different choices regarding the compensation formats for the design team. In New Østfold Hospital, the client chose to continue with cost reimbursement throughout the whole project. In contrast, the client in St. Olav Hospital changed it to lump sum after delegating the designers to the contractors.

During the interviews the informants explained that cost reimbursement is a preferred choice in the front-end phase, as it mainly are others than the designers who define the process and the environment they contribute in. The scope is generally weakly defined, and the process is iterative as the client constantly make changes in the planned solution, and the designers have restricted possibility to influence their time consumption. In contrast, lump sum seems to be a more reasonable choice in the implementation phase, where the scope usually are well defined, and the process is sequential.

TO WHAT EXTENT DO CONTRACT MODELS AND COMPENSATION FORMAT FACILITATE FOR THE ITERATIVE AND SEQUENTIAL DESIGN PROCESS?

According to the literature, the implementation phase normally contains sequential tasks for the design team. It is conceivable that this is true for processes where construction and design are sequential phases. However, in both cases in this study, the construction process and design process were parallel processes. The interviewees

argue that the contractor's economical focus, late contracting of suppliers, and late involvement of the users, created a process characterized by constantly new information requiring changes and modifications to the planned solution. Hence, the implementation phase contained iterative tasks for the design team. However, the iterative design process was not taken into account when planning the schedule of the implementation phase, and created an unfortunate situation for the design team. According to the designers, the schedule facilitated the sequential activities at the construction site. Consequently, they did not get enough time to communicate and coordinate within the design team, which they further argue, increased the likelihood of waste and reduced value for the client.

Contract models

In DB, the contractor controls who the designers are allowed to communicate with. The interviewed designers express that they lose contact with others in the project, as the contractor dissociate them from discussions with the client. The designers state that it is a disadvantage for collecting information and for the collaboration between project members. Similarly, these disadvantages may occur due to the contractor's schedule, according to the designers. The schedule is primarily adapted for production, and fails to facilitate the design process. The designers argue that the lack of facilitation entails risk in terms of poor collaboration, coordination and quality. The designers do not get enough time to gather information and check things that are necessary to perform their work. This may cause the designers making assumptions that may prove to be incorrect and thus lead to changes and iterations in later phases. This may further lead to unnecessary costs to the project. Given the lack of focus on maintenance and operational consideration, the client risks not getting the quality that he wants.

On the other hand, the contractor's possessions of the best and latest knowledge of construction methods give the designers unique opportunities to take into account information much earlier in the process. As a result, the uncertainty in the project may reduce and less assumption are necessary to be taken. This could lead to lower costs, as less modifications in the design are necessary, and hence fewer iterations are needed.

The designers state that they gain better opportunity to collect needed information to perform their tasks when responding to the client in a DBB-contract. The designers may have direct contact with the other participants in the project, which form good guidelines for the information flow in the design process. The interviewees also claim that it is easier for them to affect the schedule in a DBB-contract, which grant them good opportunities to plan their own work.

Compensation formats

When the designers give an offer on a lump sum contract, it is difficult to anticipate delays and deliveries of necessary documentation so early in the process. Therefore they must base the assignment on an ideal process. Consequently, in order to deliver in time and earn money on the assignment, it causes them making assumptions, and producing a product that only satisfies the minimal requirements.

The designers explain that the contracts strict schedule makes the designers little motivated for interaction. They are likely to get cynical about meeting, more focused on their own discipline, less flexible to look at other opportunities, and no one wants

to take the responsibility for the interfaces. The lack of focus on the totality may be at the expense of good solutions. In addition, it becomes very important for the designers to avoid performing tasks that are not included in the contract, as they risk not being paid for it. These tasks typically concerns interfaces. This results in a strict regime of variation orders. The designers must notify every time they believe that the task fall outside the contract to ensure being paid for the work.

Findings clearly show that lump sum create poor facilitation for the design process, as the designers focus against schedules and costs rather than collaborative working methods and the product as a whole. In addition to the client's value, the contractor's value may be at risk as the designers produces less, poor and incomplete drawings when they have reached their contract price.

In St. Olav Hospital, the client chose to contract the designers on a lump sum contract in the implementation phase. To ensure a well-coordinated process, the client introduced a collaborative phase with both the contractor and the designer. The client wanted to clarify the building and the deliveries with all parties, to make sure they understood the assignment. This enabled the contractor to influence and adjust the product, and thereby made the implementation phase less uncertain and more predictable for the designer. However, according to the interviewees, the design process still contained iterative tasks as new information and changes in the planned solution still occurred. As a result, the client were unable to get rid of the disadvantages related to the lump sum.

Unlike lump sum, cost reimbursement create a good basis for collaborative working methods, and ensures good quality, according the interviewees. To reduce their uncertainty and increase their profit, using enough hours to ensure a good and valuable product is essential. The designers request more information instead of making assumptions, which may lead to fewer changes, modifications, and iterations in the later phases. They focus on the interface between the disciplines and perform good quality assurance. According to the interviewees, this compensation format makes the best guidelines for facilitating the iterative design process.

The disadvantage with cost reimbursement is the risk of abuse of the contract, as the designers may work inefficiently to secure more hours spent on the project. This could further provide a more expensive product for the owner. In St. Olav Hospital, the client tried to avoid this by giving the designers an incentive. The result of this was successful. The designers managed to stay within budget, thereby preventing the downside the compensation format may entail.

CONCLUSION

This paper is limited to consider compensation format and contract models in the design process. The investigated cases have used cost reimbursement and lump sum as compensation format. Of contract types for design, the cases have used Prime Contract and Multi-party contract. Further, considering the facilitation of the design process, it emerges that the most important main distinction in contract models are between DB and DBB. In the two investigated case studies it appear that the compensation format is more crucial than the contract model to ensure value for the client.

For the iterative front-end phase, the interviewees argue that DBB complemented with cost reimbursement, is the most appropriate to use, ensuring a good design

process and value to the client. At the same time, the interviewees state that DB appear to be the best to facilitate the implementation phase, as the contractor may serve the design team with valuable information earlier in the process. The literature shows that the implementation phase have less uncertainty, making the lump sum a good choice, as shown in the theoretical situation in Figure 2a. This would provide value for the client in terms of effective production keeping the budget and schedule in focus.

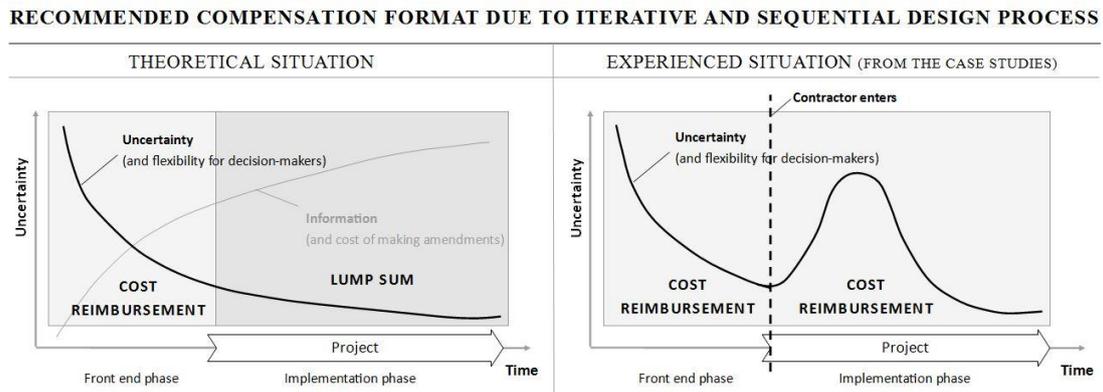


Figure 2 a and b: Theoretical situation based on Samset, 2008. Experienced situation based on qualitative, empirical data.

However, the case study shows that changes and constantly new information still characterizes the process, as shown in the experienced situation in figure 2b. This paper argues that cost reimbursement is the most appropriate compensation format to use, as it gives the designers the ability to manage the iterative design process and create value for the client.

In sum, the answer to what is the best choice of contract model and compensation format to maximize value for the client and minimize waste in the design process, depends on the project type.

The result is more appropriate to the case studies than to the context. Different project contexts and indeed diverse types of projects and clients would suit diverse types of contract and compensation modes. It is very hard to justify the generalisation being presented based on two Norwegian cases only. However, the result could be useful for those who are contracting designers to their construction projects.

We have covered a part of the knowledge gap, but for further work, we recommend to look at the limitation of this paper and expand the research to include more compensation formats and contract types, e.g. partnering and IPD. We also recommend to look closer at project organization due to contract models and expand the research to include more cases in order to include quantitative data.

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