Master thesis

Selection of contract type in construction contracts: Lump-Sum, Target-cost and Cost-plus contracts

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Abstract

The construction contract is a document which governs the business relationship of Contractor and Employer for the duration of a construction project. However, the selection of the contract type for the project tends to be performed too shallowly. The present thesis aims to analyse how the contract type is chosen among the three paradigmatic contracts considered here: lump-sum contracts, target-cost contracts and cost-plus contracts. The basis of the study is a case study performed on Project X, a large mine construction project in Western Europe. The relevant literature to the subject was reviewed, mainly the principal-agent theory, literature on risk allocation and on contract selection. After identifying several factors which may influence the contract selection in the literature and in a preliminary interview, a survey was conducted to assess their relative influence in general and in particular for the Project X. The survey was responded by a small sample of highly qualified and experienced managers and was complemented with in-depth interviews with the majority of them. Some research on the project and on contract documents of the NEC standard contract was also performed in order to provide a context of the characteristics of Project X. The findings of the three sources made it possible to confirm the influence on the selection of the contract type of many of the factors proposed. It was possible to shortlist a small number of factors which influenced the most the selection of the contract type for Project X. These were the preferred risk allocation by the parties, the ability to adapt the contract to scope changes, the knowledge of each contract type by the contracting parties, the improvement of the project delivery by the contract type and the aim to enhance cooperation between the parties. Factors not present in previous research were also discovered, such as the different financial costs of the contract types and the requirement of financial information by the funders of the parties. The very different opinions of the respondents to the survey and interviews regarding the selection of the contract type confirm that the parties should consider in more detail that complex process, because by now the parties are not really sure why they are choosing a certain contract type. Further research should be performed in the future to analyse the factors which influenced the contract type selection in other projects. The projects could also be analysed during their whole duration. Other contract types or variants of the three contract types studied in this thesis could also be added to the analysis.

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1. Introduction

A construction contract is the commercial arrangement which governs the relationship between the Employer or Owner and the Contractor during a construction project. The contract specifies what is to be built, for which price, under which payment terms, how the Client is to monitor the Contractor’s performance and how contingency events are to be dealt with (Ward & Chapman, 1994). The Contractor is the firm or individual responsible for performing the works on behalf of the Employer (be it a private company or a public institution), who usually owns the completed work and compensates the Contractor for it.

Before starting a construction project, both Employer and Contractor agree on the type of contract they want to enter and on the conditions, among others the risk allocation and payment terms of the contract. Owners are usually very careful when choosing the Contractor and negotiating the contract price. However, the selection of the contract type is too often done rather superficially (Russell, n.d.). This can be an important mistake, as the contract allocates responsibilities, risks and rewards and impacts the Contractor’s performance and thus the project outcome in terms of quality, time and cost (Russell, n.d.) (Lewendon, n.d.). The type of contract influences extremely their future relationship, the risk allocation and the financial outcome for both of them, especially if some of the risks materialize (Russell, n.d.). Thence, an important question is the selection criteria which the Employer and Contractor use to choose between different contract types for international construction projects. There are many international standard forms of contracts, which can be divided mainly into lump-sum, target-cost and cost-plus contracts (Russell, n.d.) (Institution of Civil Engineers, 2013) (Suprapto, et al., 2016).

Therefore, the main purpose of this master thesis is to investigate the factors that affect the use of one or the other type of contract and the suitability of using them under certain conditions. The literature on risk-allocating and the principal-agent theory already predict that the risk characteristics of the project, the risk aversion of the parties and the need to provide incentives to the Contractor will play a role in contract selection. Many other factors, such as the uncertainty of the project scope, the desire to improve cooperation during the project or the familiarity of the company or managers with a contract type may influence the selection process.

I focus specifically on different international construction contract paradigms, i.e. contracts in which the Employer, the Contractor or the job site are situated in at least two different countries. To achieve this, a practical case is investigated: the selection of contract type of a design-and-build contract between a Contractor (private Joint Venture Y) and an Employer (private company Z) for Project X, a representative large construction project. The Project X consists of the construction of the access shafts for a new mine in Western Europe. The Client is a new entrant to the mining industry who is building its first mine. The Contractor is a joint venture composed by German and Canadian firms.
Two types of contracts were proposed for this Project: at first, a lump-sum contract was drafted; afterwards, a cost-plus contract with incentives (or target-cost contract) has been discussed. Hence, the problem of the selection of contract type is already subjacent in the Project X.

The selection factors are investigated by means of a survey and several interviews to highly qualified and experienced managers involved in the contract negotiation of Project X. The questions aimed primarily to find out their opinions of the selection factors for the different contract types (e.g. if they consider that one contract enhances cooperation between the parties more than others) and secondarily their views of the characteristics of Project X that might be relevant to these selection factors (e.g. if enhancing the cooperation in Project X was an aim of the parties). The results obtained are finally compared with the literature.

1.1. Background

The contractual relationship between Employer and Contractor marks the whole development of the project. Not only their financial results depend on the contract between them, but also the development and achievement of the goals of the whole project can be influenced by the type of contract used. For instance, the project value increases by avoiding moral hazard by the parties (such as quality loss in a fixed-price contract) and by generating an optimal risk allocation (allocating risks to the party that is able to deal with them at the lowest cost).

As the construction industry is characterised by traditional adversarial relationships between Employer and Contractor, who focus on their own success rather than on the project success (Chan, et al., 2012), it is likely that the use of one or the other type of contract is chosen by motives such as the desire to transfer risks to the other party or achieve a better economic outcome or lower contract price for themselves. Besides, people tend to find contracts types which they are familiar with more appropriate for any given project (Antoniou, et al., 2013b). However, the most suitable contract type should be chosen based on rational considerations and on the characteristics of the project and parties involved.

Project management studies separate contract types into traditional contracts (lump-sum and cost-plus contracts) and partnering contracts (target-cost contracts) (Suprapto, et al., 2016). These common contract types in construction can be sorted according to their risk allocation, from most certain outcome for the Employer to most certain outcome for the Contractor: the lump-sum or fixed-price contract, the target-cost or cost-plus-incentive-fee contract and the cost-reimbursable or cost-plus contract.

A lump-sum contract or stipulated sum contract will require that the Contractor agrees to provide the specified services for a stipulated or fixed price. In a lump sum contract, the Owner has essentially assigned all the risk to the Contractor, who in turn can be expected to ask for a higher mark-up in order to take care of unforeseen contingencies (Rodriguez, 2016). Target-cost contracts pay the Contractor his allowed expenses, a fee
to account for its overhead and profit and also an incentive which can be positive (if the actual costs are lower than the so-called target cost) or negative in the opposite case. The strength of the incentive depends on the percentage of the cost deviation that is paid/received by the Contractor, i.e. the sharing ratio. Cost-plus or cost-reimbursement contracts pay a Contractor for all of its allowed expenses, typically up to a set limit (Center for strategic and international studies, n.d.). Additionally, a fixed fee or a fee dependent on the costs (e.g. as a percentage of the costs) is paid to the Contractor for overhead and profit.

1.2. Problem discussion

The use of one or the other contract types and the adaptations to be performed are a matter of negotiation between the parties. However, it is unclear why some kinds of contracts are used in certain projects, as there does not seem to be clear rules or sophisticated methods for selecting the contract (Badenfelt, 2008).

The selection of the contract type seems to be rather complicated to explain, because it may be influenced by many factors. Factors present in the literature (see chapter 2) include the preferred risk allocation (relative risk aversion of the parties, ability to control risks), the Employer’s preferences (importance of schedule and quality, the desire to avoid moral hazard attitudes), the Contractor’s characteristics, the project’s characteristics (project complexity and definition) and the relationship between parties (desire to cooperate and be fair). Nevertheless, additional, less researched factors may influence the choice: the relative financial strength of the parties, the belief of the parties that the actual costs will be above or below the target costs, the degree of capacity utilization by the Contractor, the familiarity of the managers with the contract types, the amount of information asymmetry, the simplicity of implementing the contract and secondary costs, such as monitoring costs, financial costs and dispute costs.

The contract type influences the project outcome (Russell, n.d.). Thus, the question of the contract type selection is essential for a project. In fact, the contract type can shape the relationship between the parties, as well as the quality, budget and timely delivery of the outcome (Bajari & Tadelis, 2001). Selecting a contract which is not suitable for the project may have undesirable consequences, e.g. ending up in unnecessary legal procedures or delivering an untimely or defective product.

The risk distribution may be a determinant factor: the risk aversion of the Employer may incline him to issue a tender with a certain type of draft contract. The Employer can choose between taking all the risks himself (e.g. in a NEC3 standard contract Option E, cost-plus contract) or paying the Contractor (possibly indirectly, through the built-in contingencies that the Contractor includes in his bid price in a lump-sum contract or through the incentives in a target-cost contract, e.g. NEC3 Option A or C) to transfer some or even all of the risks to him.

Intuitively, it seems that an involved Employer, who is comfortable taking more risks and having a partnering relationship with the Contractor would probably select the
framework of a target-cost (Chan, et al., 2010) or cost-reimbursable contract, because in this case the Employer will be less prone to pay for transferring risks to the Contractor.

Finally, I believe that there is a gap in the literature in this respect. While some theories about how the contracts should look like are known (principal-agent theory, risk allocation literature, studies about the negotiation power of the parties or monitoring costs), there are few empirical studies on the factors that actually influence the selection of sharing ratios in target cost contracts (Badenfelt, 2008). Those studies have been reviewed and are presented in chapter 2. Moreover, according to an interview with a Client (Badenfelt, 2008), the sharing ratio is rather arbitrarily chosen and not based on any scientific evidence or formula. This is also confirmed by Hosseinian & Carmichael (2014). This matches the claim that insufficient attention is being paid to the selection of contract type (Russell, n.d.). The selection of sharing ratios can be generalized to the selection of a contract type, having lump-sum contracts a sharing ratio of 1, target-cost contracts between 0 and 1 and cost-plus contracts 0. The author has found even fewer in-depth studies of concrete projects regarding the actual choice between those contract types during his literature review.

In short, there are well-known theories about how a contract should be designed and there are some studies about what advantages every contract has, but there is a very small number of studies analysing what brings the parties to use one or the other contract type.

1.3. Problem formulation

The existing academic studies are rather theoretical, e.g. discuss which contract should be used under which conditions, which are the preferred contract types or the optimal risk allocation, but there are very few studies which look into the factors that actually influence the contract type selection in a concrete project. Thus, an in-depth case study based on the construction contract for the Project X, centred in the factors affecting the selection of the contract type (lump-sum, target-cost and cost-plus), would complement the literature.

Using one or the other contract type might be a matter of philosophy or personal preferences by the management of the Employer rather than a decision based on objective considerations about the suitability of the contract for the project (Badenfelt, 2008). It is unclear how a contract type is selected for a certain project, but certain factors must exist which direct the parties towards their decision to enter a contract type and not any other possible one. Therefore, the criteria which are used to select the contract type depending on the project’s characteristics make up the solution which is sought in this thesis. New factors relevant for the contract selection problem, which are still not dealt with in the literature, may come up during the case study.

The ultimate question that I would like to answer in this master thesis is “Why is a contract type selected, i.e. which factors affect the selection of the construction contract type (lump-sum, target cost contract or cost-reimbursable contract)?” I intend to
confirm the relevant factors taking as basis the case study of the construction contracts between the Employer Y and the Contractor Z for Project X.

1.4. Delimitations

The factors that influence the selection of a certain contract type will be studied, but the optimal type of contract and risk-allocation will not be discussed in detail.

The actual and optimal risk allocation of each risk in the project would also be a very interesting subject to study, but it is not done here. The actual risk preferences of the parties could be analysed based on the utility theory and their relative risk aversion. However, no analysis of the utility curves of the parties, as done e.g. in (Al-Harbi, 1998), will be conducted.

Moreover, the tendering or negotiating process and relative power of the parties are not within the scope of this master thesis.

The probable payouts of these contracts types for both parties for the Project X could be computed performing a statistical simulation of the materialization of the risks. However, the payouts are also not analysed in detail in this thesis.

There are many contract types which may be chosen for a project, apart from the three contract types considered in this thesis. Besides, even within one contract type, there are many possible variants and nuances, e.g. different standard contracts exist, such as FIDIC and NEC. Only NEC3 contracts were analysed in the thesis. Nevertheless, it was necessary to simplify the reality, centring the discussion in a small number of model contract types. Finally, in this thesis the contracts considered are those between Employer and Contractor for designing and building large construction projects. For other services, e.g. engineering or management services, different contract types and selection factors might have to be taken into account.

1.5. Structure of the thesis

The thesis is structured in several chapters: after the introduction, the theoretical context is presented in chapter 2, deriving possible factors influencing the selection of contract type. The research methodology used is described in chapter 3 and its reliability is discussed. The results of the research including survey, interview and document review results are presented in chapter 4. These findings are discussed and compared with the literature in chapter 5; where they are also applied to Project X. Finally, the conclusions and limitations of the thesis and the further research areas are extracted in chapter 6.

A glossary has been created for clarification of the technical terms in the thesis. Three appendices contain the questions of the survey and interviews and detailed additional data of the survey responses.
2. Review of theories on contract selection

A review of academic literature on how the contract selection and risk allocation should be performed is presented in this chapter. The principal-agent theory is introduced first. This theory seems to describe rather well how the moral hazard and risk transfer problems affect the selection of contract type. Then, studies were sought in which the actual selection factors were researched. Afterwards, the three model types of contracts considered in this thesis are presented, mathematically modelled and commented. I also reflect on further characteristics of the contract types, among others the relationship between the parties or the amount of secondary costs associated, which may be differentiating factors, such as the monitoring, financial and dispute costs. To conclude the chapter, the factors influencing the contract selection according to the literature are summarized. Some possible new factors are come up with.

The literature review was conducted searching for articles regarding these subjects in the library of the Blekinge Institute of Technology and in the databases of Taylor&Francis, Emerald, JSTOR and ScienceDirect. Other literature used during the course of the MBA programme has also been used. Additionally, the internet was searched when practical issues were considered. This provided another point of view, mainly from practitioners of the construction industry.

2.1. Normative theories on contract design

The choice of an appropriate contract with respect to the Contractor payment terms for the project is a crucial decision (Antoniou, et al., 2013a). Theories aiming to find the appropriate contract type are presented in this subchapter.

The literature tends to conclude that there is no contract type that stands out as the most suitable in all the different criteria (Fuller, 1920) (Antoniou, et al., 2013b). This implies that different contract types are probably more suitable than others depending on the project characteristics, but no contract type can be said to be better than others in general.

According to Ward & Chapman (1994), there are three main problems in Employer-Contractor relationships: moral hazard, adverse selection and risk sharing. Moral hazard can appear if the Client cannot tightly control the Contractor and verify the quality of the product he is delivering. An example of this is what may happen if the Client selects the least expensive Contractor for a lump-sum contract. After being awarded the contract, the Contractor may cut corners and reduce quality from the agreed standard in order to decrease the actual costs and gain a higher profit. Adverse selection happens when there is asymmetric information in a market. In the framework of a tendering process, it is quite difficult for an Employer to know who is the Contractor that will result in the less whole project costs (considering all costs and including factors such as schedule and quality, not only the tendering price). Contrastingly, the Contractor will have the information of how he plans to perform the works. Risk sharing relates to the appropriate risk allocation and is treated under subchapter 2.1.2.
If considered the bidding process, it seems that there is an additional trade-off between stimulating competition in the bid, avoiding increasing the costs for transferring risks to the Contractor and giving incentives to lower the costs (McAfee & McMillan, 1986). It is concluded that the optimal contract, considering the bidding process, is usually a target-cost contract and may also be a lump-sum contract, but it is never a cost-plus contract (McAfee & McMillan, 1986).

The complexity of the project may also play a major role for the contract type selection; projects which are complex from an organizational point of view are bound to favour the use of cost-plus or target-cost contracts (Nkuah, 2016). Finally, well-qualified Contractors should be able to use cost-plus contracts, under supervision of the Employer (Fuller, 1920).

### 2.1.1. Principal-agent theory: moral hazard, incentives and risk

“Agency theory provides a unique, realistic and empirically testable…” explanation on cooperative problems (Eisenhardt, 1989). The principal-agent theory states that a principal engages an agent to perform work on behalf of the principal. The agent is self-interested, rational and risk-averse (Eisenhardt, 1989). There may also be information asymmetry, where the agent has more information than the principal (Eisenhardt, 1989) (Hosseinian & Carmichael, 2014). Hence, this is applicable to the Employer (principal) – Contractor (agent) relationship in a construction project. Therefore, it is possible that the agent behaves in an opportunistic way, because the principal is not able to perfectly monitor the agent’s effort, which eventually leads to a certain outcome (Hosseinian & Carmichael, 2014).

As the effort causes costs to the agent, he will try to minimise it. Given these premises, agency theory states that outcome-based contracts can actually align the principal’s and agent’s interests, but with the disadvantage of transferring risks to the Contractor, who is usually more risk averse and thus requires a higher bonus than the Employer to bear the risks. The aim of the agency theory is to find an optimal contract in the framework of effort-based (behaviour-based) and outcome-based contracts for governing the principal-agent relationship (Eisenhardt, 1989).

An outcome-based contract is e.g. a lump-sum contract, where the principal will pay for the completed works, no matter how much effort (actual costs) the Contractor put into the works. Contrastingly, target-cost contracts or cost-plus contracts have characteristics of effort-based contracts, because the payments of the Employer are primarily related to the costs that the Contractor has incurred. Target-cost contracts have additionally some characteristics of outcome-based contracts (there is a target cost, independent of the effort) and there is an effort-dependent incentive.

If it is easy to measure the outcome, an outcome-based contract will probably be more suitable (Eisenhardt, 1989). Also, if the principal is informed about the behaviour of the agent, the agent is more likely to behave the way the principal wants him to. Thus, the more information the principal has, the more effective a behaviour-based contract will
be. In fact, easily programmable tasks can be governed by behaviour-based contracts (Eisenhardt, 1989). Also, in long-term relationships, the principal will get to know the agent, so he will be able to assess his behaviour more easily and a behaviour-based contract seems more suitable (Eisenhardt, 1989).

The Employer wishes to incentivize the Contractor to reduce the costs by transferring some risks to him. However, if the Contractor is more risk-averse than the Employer, which is actually often the case, the costs for bearing the risks will be larger than if the Employer borne the risks by itself. That is, projects with high outcome uncertainty should be governed by effort-based contracts rather than by outcome-based contracts (Eisenhardt, 1989). Then, with increasing risk-aversion of the agent, effort-based contracts rather than outcome-based contracts should be predominant. In this case, there is a trade-off between providing incentives (avoiding moral hazard on the part of the agent) and the costs of transferring risks (McAfee & McMillan, 1986).

### 2.1.2. Theories of risk-allocation in contracts

The risk allocation for the different risks (cost overruns, local political / cultural risks, geological risks, environmental risks, etc.) in the three contracts considered is quite different. According to the risk-allocation literature, the parties should choose a construction contract that allocates the risks in a suitable way. For instance, (Chan, et al., 2011) was consulted to look into the ideal risk allocation in construction contracts. According to their survey, done to contract and senior managers, certain risks should be allocated to the Client (e.g. a change in the scope of work), while others should be shared or be allocated to the Contractor.

Several risk-allocating rules, such as “Each risk should be allocated to the party who is best capable to manage it at the least possible cost” have been provided by the literature (Chan, et al., 2011). Therefore, the risk allocation should depend, among other factors, on the relative risk aversion of the parties. The risk-aversion can be varied, for instance a public Owner would probably be risk-neutral (Hosseinian & Carmichael, 2014), a private one may be rather risk-averse (Fuller, 1920). Other risk-allocation rules are discussed regarding FIDIC standard contracts in (Law Office Dr. Hök, Stieglmeier & Kollegen, 1999). Nonetheless, the risk allocation is very different in a lump-sum contract, where the Contractor takes nearly the whole risk in the project or in a cost-plus contract, where the risks are mainly with the Employer. Between them, there are several contracts which allocate a different amount of risk to the parties, such as target-cost contracts (Al-Harbi, 1998). As too little attention is being paid to the contract selection matter (Russell, n.d.), it seems unlikely that these contracts are optimizing the risk-allocation in the projects where they are used. For instance, the sharing scheme of target-cost contracts is often established in an arbitrary way, without a focused research on the matter (Hosseinian & Carmichael, 2014).

Risks are not allocated as preferred by the parties in the contracts (Hartman, et al., 1998), and it might also be the case that in practice the risks are not allocated according to the risk allocation rules presented in the literature either (Hanna, et al., 2013), but that
they are simply transferred to the party with the least negotiation power or that the risk-allocation is simply linked to the regular type of contract used in the industry, instead of thoroughly taking into account the risk aversion of the parties. Another possibility is that, in reality, the risks are allocated according to the type of contract initially chosen, without making significant amendments to the contract and without considering the optimal allocation at all. In fact, (Chan, et al., 2011) proposed further qualitative investigations to investigate the actual risk allocation in practice, which could be performed by means of in-depth case studies of projects. The effect of the risk aversion and preferred risk allocation on the contract selection is researched in the case study performed in chapters 4 and 5.

Risks should be allocated according to the following criteria (Lewendon, n.d.):

- Risks should be borne by the party best able to avoid their occurrence.
- The risk allocation should encourage good management to the bearer of the risk.
- Risks should not be allocated to a party who cannot resist their consequences, i.e. who could have financial distress if a reasonably probable risk materializes.
- Risks which cannot be influenced by the Contractor should generally be allocated to the Employer.
- If several parties bear the consequences of the risk, the distribution should reflect their ability to influence the likelihood of occurrence and the effects of the risk.

2.2. Studies on the actual contract selection

The type of contract determines the payment terms and is related to the risk allocation between Owner and Contractor and incentives to the latter. However, as already stated in subchapter 1.2, it is not quite clear how practitioners choose the contract for a certain project.

According to the theory of procurement with asymmetric information and moral hazard, (Laffont & Tirole, 1993), the Contractor and Employer should choose a contract from a wide spectrum of contracts, namely sharing ratios between 1 (lump-sum contract) and 0 (cost-plus contract), where, in between, target contracts are situated. However, the literature describing construction contracts suggests that most of the contracts chosen are in one of the extremes: they are either fixed-price or cost-plus contracts (Bajari & Tadelis, 2001). One reason for this may be that cost-plus incentive fee contracts are more difficult to implement in case of changes (Bajari & Tadelis, 2001). Antoniou, et al. (2013b) also report that contracts with incentives are seen as more difficult to implement. Furthermore, a fixed-price contract does not require the measurement of the actual construction costs by the Employer (e.g. through open-books policy), which means that it has an advantage with respect to any optimal contracts that are near the sharing ratio 1 (Bajari & Tadelis, 2001). In the other extreme of the spectrum, for contracts which would be optimal near the cost-plus contract, it may be better not to incentivize at all the reduction of costs, because this may lead to a reduction of the
quality (Bajari & Tadelis, 2001). However, these reasons do not seem as strong as to be able to overcome the use of all incentive contracts with sharing ratios between 0 and 1 (Bajari & Tadelis, 2001).

Target cost contracts are more complicated to negotiate because there are three parameters to be determined: the target cost, the fee (variable or constant with the costs) and the sharing ratio (Badenfelt, 2008). A risk-averse Contractor may accept a higher sharing ratio if he also gets a higher fee or if he expects a long-term, profitable relationship with the Employer (Badenfelt, 2008).

The value for money is another factor that was investigated in a survey to Greek and international managers (Antoniou, et al., 2013b). The results of the survey indicated that although fixed price and incentive contracts tend to be seen as providing more value, cost-plus fixed fee contracts closely followed. Regarding the timely delivery of the project, direct incentives to shorten the schedule are seen as highly effective. Additionally, incentive contracts (as target-cost contracts) are seen as better than others to improve the project schedule (Antoniou, et al., 2013b). With respect to the quality of the project outcome, the participants saw incentive contracts as clearly providing better quality than lump-sum or cost-plus contracts (Antoniou, et al., 2013b).

Another interesting outcome of the study of (Antoniou, et al., 2013b) is that participants are biased in that they find contract types with which they have been working more suitable than others which they are less familiar with. Thus, the lack of familiarity to a certain contract may generate some resistance to it (Chan, et al., 2010).

In the article of (Hartman, et al., 1998), the actual risk allocation in contracts and the preferred risk allocation by Owners, Contractors and Consultants were investigated by means of a survey. They concluded that although the parties tend to partially agree on how to allocate some of the risks, the risks are usually not allocated as preferred by them. The interpretation of the risk-allocating clauses was also investigated by them in (Hartman & Snelgrove, 1996).

The fairness of the various contracts and the primes paid by the Employer to transfer some risks to the Contractor (especially in lump-sum contracts) are also matters of interest for this investigation, as perceiving a contract as fairer may also affect the selection of the contract type. In fact, the parties interviewed in (Badenfelt, 2008) claimed to have aimed for a fair contract during the negotiations. The possible payouts are analysed in a theoretical article (Russell, n.d.).

Finally, the relative market power of the parties may also have an influence: low market power of one party may imply that that party cannot have a say regarding the contract type (Prasad & Salmon, 2013). Thus, the characteristics of parties not directly involved in the transaction, such as the Contractor’s competitors, may also influence the contract type selected (Prasad & Salmon, 2013). The degree to which a Contractor’s capacity is being utilized at the moment may also largely influence his negotiation power and thus the contract type he will enter with the Employer.
2.3. Main types of contracts

Contracts can be classified into three main types: lump-sum contracts, target-cost contracts and cost-reimbursable or cost-plus contracts (Suprapto, et al., 2016). These three types are sorted from the most risk borne by the Contractor to most risk being borne by the Employer. They are explained in the next three subchapters in more detail.

There are several types of incentives (Suprapto, et al., 2016): cost incentives (like in a target-cost contract), schedule incentives (common in all kinds of contracts), performance incentives (enforced through quality control) and safety incentives.

The different types of contracts, classified according to their risk-allocation, are shown in Figure 1. Cost-plus percentage of cost and cost-plus fixed fee are variants of the cost-plus contract. Target-cost contracts are also named cost-plus incentive fee contracts. The firm-fixed price contract is also known as lump-sum contract. Fixed-price incentive contracts would be somewhere in between the former.

Contractor’s Risk: Low  High
Employer’s Risk: High  Low

<table>
<thead>
<tr>
<th>Cost-Plus-Percentage of Cost (CPPC)</th>
<th>Cost-Plus-Fixed-Fee (CPFF)</th>
<th>Cost-Plus-Incentive Fee (CPIF)</th>
<th>Fixed-Price Incentive (FPI)</th>
<th>Firm-Fixed Price (FFP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost-plus</strong></td>
<td><strong>Target-cost</strong></td>
<td></td>
<td></td>
<td><strong>Lump-sum</strong></td>
</tr>
</tbody>
</table>

Figure 1: Existing types of contracts according to their risk-allocation, own elaboration and Al-Harbi (1998)

The characteristics of the two extreme contracts (fixed-price and cost-plus contracts) in the menu are summarized in Table 1. The target-cost contract has mixed characteristics between those two contracts.

<table>
<thead>
<tr>
<th>Risk allocation mainly on</th>
<th>Fixed-price contract</th>
<th>Cost-plus contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentives for quality</td>
<td>Contractor</td>
<td>Buyer</td>
</tr>
<tr>
<td>Buyer administration</td>
<td>Less</td>
<td>More</td>
</tr>
<tr>
<td>Good to minimize</td>
<td>Costs</td>
<td>Schedule</td>
</tr>
<tr>
<td>Documentation efforts</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Flexibility for change</td>
<td>Less</td>
<td>More</td>
</tr>
<tr>
<td>Adversarial relationship</td>
<td>More</td>
<td>Less</td>
</tr>
</tbody>
</table>

Table 1: Comparison of fixed-price and cost-plus contracts in construction (Bajari & Tadelis, 2001)

A better understanding of the contract types studied in this thesis can be gained by performing a mathematical analysis of the profits for the Contractor and of the actual costs. This should crystalize the paradigm contracts which we intend to compare. This analysis can be performed according to the model of Russell, (n.d.), slightly simplified here. The general equation is:

\[ P_A = (1 + p) \cdot C_A + p_T + b \cdot (C_T - C_A) \quad \{1\} \]
Selection of contract type in construction contracts
Blekinge Institute of Technology

With following secondary equations:

\[ P_T = C_T + p_T \] \{2\}
\[ P_A = C_A + p_A \] \{3\}

where:

\( P_A \) = actual price or final contract price paid by the Client

\( p \) = a percentage factor on actual cost, i.e. the mark-up for profit and overhead that is paid to the Contractor on top of its costs, \( 0 < p < 1 \)

\( C_A \) = actual Contractor cost for the project

\( pT \) = target profit (a negotiated value in cost-plus and target-cost contracts, but a proprietary value in a fixed-price contract)

\( b \) = Contractor’s cost-share rate, a negotiated or bid value (risk-sharing fraction), \( 0 \leq b \leq 1 \)

\( C_T \) = target cost (in a target-cost contract, this amount is negotiated and influences the payments to the Contractor)

\( P_T \) = target price (a negotiated or bid value)

\( p_A \) = actual profit (final realized profit by Contractor)

In principle, the fixed-price contract can be seen as a target-cost contract with a sharing ratio of 1. The cost-plus contract is equivalent to a target-cost contract with a sharing ratio of 0. Thus, fixed-price and cost-plus contracts are particular cases of target-cost contracts. The discussion of the selection of the sharing ratio is, in the limit, the discussion of which of the three contracts is to be used.

The mathematical model was applied to each of the contracts (see following subchapters) and the graphic in Figure 2 was created. Figure 2 shows very clearly the evolution of the profit achieved by the Contractor versus the actual costs of the works. It is apparent that in the lump-sum contract, the actual profit rises faster than in any other contract when reducing the actual costs; consequently, the Contractor has a very strong incentive to cut costs. On the contrary, for the cost-plus contract with a fee which is a percentage of the costs, the profit grows with the actual costs, which obviously gives the Contractor an incentive to increase the actual costs, which is normally not in the best interest of the Employer.
2.3.1. Lump-sum contracts

The Contractor is required to provide the services or products for a determined fixed price in the lump-sum contract. The practical totality of the risk is transferred through the contract to the Contractor, who will probably integrate a higher contingency mark-up in his bid to cover for the risk (Rodríguez, 2016). The contingencies have also been observed in real contracts (Fuller, 1920). A similar contract to the lump-sum contract is the unit-price or unit-rate contract, where the Contractor is paid a fixed price for each unit of work (WebFinance Inc., 2017a). Such a contract is easier to adapt than a lump-sum contract to changes in the quantities of work to be executed. According to the model of Russell (n.d.), explained in subchapter 2.3 above, the price paid by the Employer in a lump-sum contract can be modelled as:

\[ P_A = C_T + p_T \]  \hspace{1cm} \{4\}

Assuming there are no change orders or other factors which could affect the final actual price paid by the Employer, \( P_A = P_T \).

In a fixed-price contract, \( b=1 \) (the Contractor assumes all the risk according to the model) and \( p \) can be set to zero. Therefore, the price paid is fixed and is the target cost plus the target profit. Both are usually not known by the Employer or, even if the Contractor chooses to disclose them, they are not verifiable. It results hence from \{3\} and \{4\} that the actual profit of the Contractor is:

\[ p_A = C_T + p_T - C_A = P_T - C_A \]  \hspace{1cm} \{5\}
Thus, the actual profit of the Contractor depends on its bid price $P_T$ and on its capacity to sink the actual costs. The Contractor, who is supposed to be a profit-maximizer, has a very strong incentive to cut costs, because his profit is directly proportional to the cost reduction. Regarding non-economical requirements of the project, such as quality and safety, there is no direct incentive to improve them (Berends, 2000), so the Contractor may reduce them if it allows him to reduce his costs. The Contractor has an implicit incentive to shrink the schedule, because shortening the project time will usually reduce his costs (Berends, 2000).

### 2.3.2. Target-cost contracts

The actual allowed costs are reimbursed by the Employer, but there is a risk sharing fraction ($b$ in equation (6)) of the cost savings or cost overruns with respect to an agreed target cost. In this way, the Contractor shares the “pain” or “gain” caused by deviations from the target cost. The proportion of these deviations that the Contractor takes is the sharing ratio. Opposing to allowed costs, there may also be disallowed costs, which “are not justified by the Contractor’s accounts” or are other costs which the Contractor must bear by himself, e.g. overhead costs or the costs of correcting defects (Institution of Civil Engineers, 2013). Additionally to the cost reimbursement and the sharing fraction, the Contractor receives a fee (fixed or variable with his costs) for his services, in which the overhead and profit are supposed to be included. Another characteristic of many target-cost contracts is that there are a ceiling and a bottom to the payments to be made to the Contractor.

Target-cost contracts are becoming more common because of their several advantages compared to other contract types (Broome & Perry, 2002). These contracts are being increasingly used, as they are the preferred approach for partnering (Bresnen & Marshall, 2000) and specially, since there exists a standard set of conditions (standard contract template) by the New Engineering Contract (1993) (Perry & Barnes, 2000). Besides, they are considered to improve the trust and openness between Owner and Contractor (Badenfelt, 2008). An advantage of target-cost contracts is that they allocate some cost risk to the Employer, who is usually the party most capable of bearing the risk, while giving the Contractor, who is usually the party with the most management power for the risks, an incentive to decrease the costs (Berends, 2000). The incentive scheme has to be aligned with the quality, schedule and cost objectives of the Owner for the project (Berends, 2000).

On the one hand, this contract is said to make the Contractor work efficiently, achieve cost savings and possibly improve the quality of the works (Chan, et al., 2010). On the other hand, in high-risk construction projects, an inappropriate sharing scheme can cause disputes (Hosseiniyan & Carmichael, 2014). It has been found that the sharing ratio needs to be decreased and the fixed fee needs to be increased the more risk-averse the Contractor is. The same is true for increasing levels of uncertainty and for lower influence of the Contractor regarding the actual costs. Thus, a sharing agreement should
fairly distribute the risks and payouts between the parties (Hosseinian & Carmichael, 2014).

The major drawback of target-cost contracts may be the definition of the contract scope and consequent scope changes, including the update of the target cost during the project duration, to take account of scope changes (Chan, et al., 2010).

Target-cost contracts with linear risk-sharing or constant share ratio (the simplest way of risk sharing, the share ratio may not be constant in other contracts) can be modelled (Russell, n.d.) as:

\[ P_A = p_T + b \cdot C_T + (1 - b) \cdot C_A \]  \hspace{1cm} \{6\}

The Contractor’s actual profit is then:

\[ P_A = p_T + b \cdot C_T + (1 - b) \cdot C_A - C_A = p_T + b \cdot (C_T - C_A) \]  \hspace{1cm} \{7\}

Therefore, in this case the Contractor has an incentive to decrease the actual costs of the contract. The strength of the incentive depends on the risk-sharing ratio \( b \) and on the target profit and target cost. It has been claimed that Contractors should fix a sharing ratio in their tenders (Ward & Chapman, 1994). Utility theory may also be used to fix the sharing ratio (Broome & Perry, 2002). A scheme of the target-cost contract is illustrated in Figure 3.

![Figure 3: Schematic overview of a target-cost contract (Chan, et al., 2010)](image)

In target-cost contracts, the difference between actual cost and target cost is shared between the Contractor and the Employer. In addition to researching which risks should be allocated to which party, scholars have also investigated which fraction of the cost overruns or savings should bear each party. This subject is discussed in (Al-Harbi, 1998). The Employer and the Contractor will try to be allocated a risk sharing fraction which depends on their perception of the possibility of cost overruns and their risk-aversion (Al-Harbi, 1998).

However, there should be an optimal risk-sharing fraction that incentivizes the Contractor to work efficiently, while avoiding the need of a large contingency due to him taking excessive risk (Fuller, 1920). The sharing ratio for the Contractor should not be less than 50% according to (Perry & Barnes, 2000) so as to ensure that the incentive is strong enough. Badenfelt (2008) found in a survey in Sweden that sharing ratios usually range from 0.3 to 0.7.
2.3.3. Cost-plus contracts

Under a cost-plus contract, the Contractor is entitled to be reimbursed for all the allowed costs (Center for strategic and international studies, n.d.). Additionally, there is usually a fixed fee or a percentage of the direct costs to be paid for overhead costs and for the Contractor’s profit. The fee might (in cost-plus percentage-of-cost contracts) or might not (in cost-plus fixed fee contracts) depend on the actual costs. For the sake of the comparison, the cost-plus-percentage-of-cost contracts, which are the most risk-free contracts for the Contractor, are modelled here according to the equation in Russell (n.d.):

\[
P_A = (1 + p) \cdot C_A = C_A + p \cdot C_A \quad \{8\}
\]

Using \{3\}, the Contractor’s actual profit is derived:

\[
p_A = (1 + p) \cdot C_A - C_A = p \cdot C_A \quad \{9\}
\]

This makes clear that, as the Contractor’s profits are a percentage of the actual costs, he has an incentive to raise the actual costs (Fuller, 1920), which can be a source of conflict with the Client. This effect is stronger in cost-plus percentage of cost contracts than in cost-plus fixed fee contracts (see Figure 1).

An advantage of cost-reimbursable contracts is the possibility of reducing the financial costs, such as those caused by the issuance of performance and retention bonds in the framework of a lump-sum contract. Additionally, cost-plus contracts are claimed to improve team working more than fixed-price contracts (Golestani & van Zwanenberg, 1996). In order to understand better cost-plus contracts, some of their pros and cons are presented below.

Summary of advantages of cost-plus contracts (Fuller, 1920):

1. The work can start at any time, without the design being completed, i.e. even if there is a certain scope uncertainty.
2. The Owner may increase or decrease quantities during construction (no negotiation is required).
3. The Owner may change the type of construction during the works, the contract is flexible.
4. The Contractor will not try to make savings that could endanger the quality of the work, because the Contractor does not increase his profit in that way.
5. There is less need for accurate previous estimates, as the payments are dependent on the actual costs, not on the forecasted costs.
6. The works have to be highly specified for a lump-sum contract, which may lead to variations and claims, which is not the case in a cost-plus contract.
7. Savings regarding contingencies for risks, stock and financing by the Contractor.
8. Simpler contract, less specifications needed.
9. Cost-plus contracts tend to promote cooperation between the Owner and the Contractor.
Summary of disadvantages of cost-plus contracts (Fuller, 1920):

1. The cost outcome for the Employer is undefined a priori (the Employer bears more economic risk).
2. Competition is very much reduced (the Contractor has no incentive to become more efficient to reduce costs, once he has the contract).
3. Easier opportunity for favouritism from the part of the Owner representative (during tendering).
4. If the Contractor is working in several projects, the best personnel and machinery resources will be assigned to projects governed by lump-sum and incentive contracts and the worse resources for the projects under cost-plus contracts.
5. The Contractor is tempted to be less thorough in his work when he knows that there will be no comeback.
6. High amount of clerical work for both parties due to open books accounting.
7. The Contractor may delay the works (or raise the actual costs of the works) because the additional costs due to overhead caused by delays are not incurred by him.

In order to avoid some of these disadvantages, it is proposed to set a fixed fee (instead of a percentage fee on the costs) or at least a maximum limit to the fee dependant on the costs (Fuller, 1920). Target-cost contracts avoid also the incentive to augment costs implicit in the cost-plus contracts (Fuller, 1920).

2.4. **Further differences between contract types**

In this chapter, other differentiating facts between the contract types are presented. These facts may also be the reason for choosing them in some cases.

2.4.1. **Relationship between the parties**

The type of relationship (competing versus cooperating relationship) between Employer and Contractor in lump-sum and cost-reimbursable contracts are likely to be quite different. The intent to influence the behaviour of the other party may also be a reason for choosing between the contract types. For example, a lump-sum contract requires the Employer to exert a lot of control with respect to the quality of the works and a very large effort regarding the management and approval of change orders (supplementary amendments to the contract). Contrastingly, the Employer-Contractor relationship in the framework of a target-cost or cost-reimbursable contract is closer and more cooperative (Chan, et al., 2010). The Employer is much more involved in the project in this case; he has more to say in the decisions and in the execution of the works and has usually access to the open books of the Contractor, which improves the financial transparency (Chan, et al., 2010). Thus, the Employer needs to possess more complete in-house capabilities (Suprapto, et al., 2016). However, Antoniou, et al. (2013a) report that all contracts seem to need similar resources to supervise or manage the contract.
Therefore, the probability of dispute in a project governed by a target-cost or cost-reimbursable contract may be lower, because, as the Contractor applies open-books accounting, there is much lower information asymmetry during the execution of the project between the Employer and the Contractor regarding the actual costs of the works.

The Employer and the Contractor having a prior, successful relationship may favour their trusting each other and thus the use of target-cost contracts (Badenfelt, 2008) (Suprapto, et al., 2016).

2.4.2. Contracts required in projects with high scope uncertainty

Fixed-price contracts tend to need a more complete design of the works, because an incomplete design gives origin to change orders, which are expensive to negotiate, i.e. the lump-sum contract is rather inflexible (Bajari & Tadelis, 2001). On the other hand, a low-incentives contract like a cost-plus contract is more easily adapted when changes arise (Bajari & Tadelis, 2001). That implies that a cost-plus contract may be signed and the construction started before the design is completed, thus producing advantages for the schedule of the project (Fuller, 1920). Incentive contracts or unit price contracts, in which the Contractor is paid fixed prices for pre-specified units of work, may be another alternative to lump-sum contracts when the scope is uncertain (Antoniou, et al., 2013b).

2.4.3. Costs of contract monitoring and control

A contract serves as “legally binding, enforceable, and reciprocal commitment governing the collaboration between Owner and Contractor” (Suprapto, et al., 2016). The Client assesses the fulfilment of the contract by the Contractor through different management control systems. The costs of monitoring the Contractor’s performance differ in the contracts analysed.

Management control systems can be divided into four main types (Merchant, K. A., Van der Stede, W. A., 2012): result controls, action controls, personnel controls and cultural controls. Personnel and cultural controls are rather difficult to implement in the relationship, although a Client may also pre-filter the bidders according to their corporate culture, nationality and so on. Thus, Clients can control Contractors in two main ways: action controls and result controls. These two philosophies are present in the article of Ward & Chapman (1994). They explain two main approaches to controlling moral hazard and adverse selection: investing in information systems to control the actions of the Contractor and influencing the Contractor via the contract conditions, which includes action controls and result controls.

In cost-reimbursable contracts, Employers have two main worries: the final cost of the project is quite unpredictable and the Contractor may have no incentives to decrease it, because increasing the costs does not decrease his profits (Nkuah, 2016). Therefore, the Employer must closely monitor all the costs incurred by the Contractor, which usually means an open-books policy by the latter. The definition of costs which will be
reimbursed has to be clear, e.g. through a detailed cost breakdown structure (CBS). Action controls are probably very important in a cost-plus or target-cost contract, where the Client is much more involved in the decisions and wants and is able to control the performance and actual expenditures of the Contractor, because they influence the Employer’s costs. Thus, monitoring the accounting books of the Contractor is a cost for the Employer in those types of contracts, but it may not be necessary if there is enough trust between the parties (Badenfelt, 2008).

On the contrary, in a lump-sum contract, the Client is mostly interested in controlling the results in terms of schedule and quality, as the price to be paid is fixed. The Owner is less involved and therefore has less administrative burden (Suprapto, et al., 2016). If the relationship of Employer and Contractor is governed by a lump-sum contract, the Employer will also be worried about possible bonuses or risks and will have to deal with the Contractor’s claims for contract modifications. As the price to be paid by the Employer is fixed, the actual costs of the Contractor will be of little interest to the Employer.

Therefore, it may be probably the case that the Employer will desire to be much more involved in the decisions of how to perform the works in a cost-reimbursable contract than in a lump-sum contract (Suprapto, et al., 2016), where he is mostly interested in the final quality and the on-time finalization of the works.

### 2.4.4. Financial costs of construction contracts

The Employer needs to be protected against non-performance by the Contractor, which is why the Contractor generally provides bonds to the Employer in return for the Employer’s payments. They are issued by a surety (bank or insurance company), which makes a payment to the Employer in the event of non-performance of the Contractor. Afterwards, the surety would try to recover the amount from the Contractor.

In a lump-sum contract, there are often advance payments by the Employer, e.g. to cover the mobilization costs of the Contractor. The Employer requires a guarantee for his payments against the Contractor’s default, which is given by the Contractor by means of an advance payment bond. A performance bond is meant to insure the Employer against non-performance by the Contractor. It can amount to 10% of the contract value and cost about 1-2% of it (Rodríguez, 2016).

The Employer usually retains a part of the payment of the certified works (e.g. 5%) in order to ensure that defects will be corrected and that the Contractor will stick to the warranty. Alternatively, a retention bond, which also involves costs, can be issued. There are still other types of bonds, such as adjudication bonds and off-site materials bonds.

The surety takes interest on the bonds until they are cancelled. This interest varies with the current interest rate, but can amount to a 3-5% of the project value, especially in long, large projects lasting several years. The financial costs of these bonds are usually
borne by the Contractor, who passes them to the Employer by including them in the tender price.

Target-cost and cost-reimbursable contracts do not usually require performance or advance payment bonds because the actual costs and fee are usually paid by the Employer right after the Contractor has proven them. Therefore, these financial costs are spared by the Employer.

### 2.4.5. Dispute costs in construction contracts

Among other factors, the definition of the project scope, the contract and project type and the risk allocation have an influence on the probability of disputes (Diekmann & Girard, 1995). Anyway, it seems that the management ability of the Owner, Contractor and the project’s complexity have an even larger influence than these other factors (Molenaar, et al., 2000).

I focus here only on the factors that are defined in the construction contract and thus may have an influence on the selection of contract type. For instance, the scope, the technical specifications and operating procedures need to be appropriately defined.

Scope changes may be the source of disputes and expensive negotiation costs for change orders in lump-sum contracts (Fuller, 1920). Regarding risk allocation, all the parties should have participated in the planning phase, identified the risks and properly and clearly allocated them in the contract (Diekmann & Girard, 1995). Finally, the contractual obligations need to be practical and realistic (Diekmann & Girard, 1995). It often occurs that at the time of signing the contract both parties find their obligations realistic, however, after a while, some risks may materialize, making one of the parties feel mistreated. This can be the case in lump-sum contracts, where the Contractor bears most of the risks and may start producing loses if they materialize, which in turn makes him more prone to generating disputes (Diekmann & Girard, 1995).

The fact that the Employer and Contractor work more closely together in target-cost contracts than in lump-sum contracts also reduces the probability of disputes (Suprapto, et al., 2016). Target-cost contracts can be seen as partnering contracts, changing the adversarial relationship to a more collaborative one (Suprapto, et al., 2016). However, cost-plus contracts do not appear to be more collaborative than lump-sum contracts (Suprapto, et al., 2016). Projects with a cost-reimbursable contract with incentives (target-cost contract) seem more likely to perform better due to better relational attitudes and team-working quality (Suprapto, et al., 2016). Furthermore, if the Contractor has an open-books policy, there is a much lower information asymmetry, which should enhance trust from the Employer’s side. On the contrary, Antoniou, et al. (2013a) report that the surveyed respondents tend to rate incentive contracts as producing a higher number of claims.
2.5. Factors possibly affecting the selection of contract type

As already presented in the introduction, the selection of contract type is the main subject of the master thesis. Literature regarding this subject has been researched accordingly and is presented in the previous subchapters. It is usually not easy for any of the parties to know which is the most appropriate contract, because there is uncertainty in the project as to what the actual costs will be (Weitzman, 1980). However, consciously or not, they select a contract type according to certain criteria.

The choice of the share profile (i.e. the function allocating different sharing ratios for different amounts of cost under- and over-run in a target-cost contract) should be performed in a way that aligns the motivations of the parties, in order to maximize the likelihood of achieving the project objectives, considering the constraints, risks and opportunities in the project and the strengths and weaknesses of the parties (Broome & Perry, 2002). It appears reasonable to assume that similar factors should be taken into account for the choice of contract type.

Some selection criteria for contract types have been already identified in e.g. (Antoniou, et al., 2013b), (Antoniou, et al., 2013a) and (Fuller, 1920). Other possible selection factors considered here are present in the literature as advantages or disadvantages of the contracts. Additional factors have been identified mainly for the selection of the sharing ratios in target-cost contracts (Badenfelt, 2008), (Hosseinian & Carmichael, 2014); this can be generalized to the selection of a contract type (see subchapter 1.2). The literature mainly analyses the moral hazard, risk-sharing and incentives problems.

Nevertheless, other factors which may be at least as crucial have not been studied in the literature in detail yet, such as what determines the risk attitudes of the parties, the effect of the belief of the parties about the actual costs being higher or lower than the target-cost, the effect of the familiarity with the contract, the amount of information asymmetry and the different financial, monitoring and dispute costs of the contracts. The influence of the criteria found in the literature and of criteria that have not been extensively studied will be investigated in the case study in chapters 4 and 5.

In a preliminary interview with a financial manager of the Contractor, who was in charge of the contract negotiation for Project X, some factors arose. These included the risk distribution between the parties, the savings of financial costs and the importance of using a contract which supports the rapid completion of the project.

The possible selection factors, of which many of them have been already commented above, based literature and own elaboration, are presented in Table 2.
<table>
<thead>
<tr>
<th>Selection factor</th>
<th>Treated in chapter</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td><strong>Economic Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Relative risk aversion of Employer and Contractor (Contractor and Employer</td>
<td>2.1.2</td>
<td>Al-Harbi, 1998</td>
</tr>
<tr>
<td>diversification and size, project size for the Contractor)</td>
<td></td>
<td>Chan et al., 2011</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preliminary interview</td>
</tr>
<tr>
<td>2. Public Owner, probably risk neutral, or private (risk averse) Owner</td>
<td>2.2</td>
<td>Fuller, 1920; Hosseinian &amp; Carmichael, 2014</td>
</tr>
<tr>
<td>3. Relative financial strength of the parties (ability to bear risks if</td>
<td>2.1.2</td>
<td>Lewendon, n.d.</td>
</tr>
<tr>
<td>materialized)</td>
<td></td>
<td></td>
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<tr>
<td>4. Expected profit by the Contractor in the Project (more profit implies more</td>
<td>2.2</td>
<td>Badenfelt, 2008</td>
</tr>
<tr>
<td>risk tolerance by Contractor)</td>
<td></td>
<td></td>
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<tr>
<td>5. Contractor’s ability to foresee and control costs (the Contractor should</td>
<td>2.2</td>
<td>Lewendon, n.d.</td>
</tr>
<tr>
<td>bear cost risk if he can control the costs)</td>
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<td>Weitzman, 1980</td>
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<tr>
<td><strong>Employer’s preferences and characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Value for money (no significant difference between contracts)</td>
<td>2.2</td>
<td>Antoniou et al., 2013b; Ward &amp; Chapman, 1994</td>
</tr>
<tr>
<td>7. Schedule criticality (the more critical the schedule, the more likely some</td>
<td>2.2</td>
<td>Antoniou et al., 2013b; Bajari &amp; Tadelis, 2001</td>
</tr>
<tr>
<td>kind of cost-plus or target-cost contract is to be used)</td>
<td></td>
<td>Nkuah, 2016; Preliminary interview</td>
</tr>
<tr>
<td>8. Quality criticality (the more critical the quality, the more likely is that</td>
<td>2.1; 2.2</td>
<td>Antoniou et al., 2013b; Bajari &amp; Tadelis, 2001; Ward &amp; Chapman, 1994</td>
</tr>
<tr>
<td>some kind of contract with quality incentives or with lower economic incentives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>is chosen)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Owner in-house capabilities (the Owner needs more resources to be involved in</td>
<td>2.4.1</td>
<td>Suprapto et al., 2016</td>
</tr>
<tr>
<td>a target cost contract than in a lump-sum contract)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Belief by the Employer that the Contractor’s Bid price is under/above the</td>
<td>2.3.2</td>
<td>Al-Harbi, 1998</td>
</tr>
<tr>
<td>future actual costs (if the Employer believes the bid price is under the actual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>costs, he will tend to lump-sum, in the opposite case he will choose cost-plus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or target-cost contracts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Desire to influence the Contractor’s motivation and avoid moral hazard</td>
<td>2.1.1</td>
<td>Badenfelt, 2008</td>
</tr>
<tr>
<td>attitudes (e.g., a cost-plus contract does not motivate the Contractor to lower</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the costs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contractor’s characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Qualification of the Contractor</td>
<td>2.1.1</td>
<td>Fuller, 1920</td>
</tr>
<tr>
<td>13. Negotiation power and degree of capacity utilization of the Contractor (if</td>
<td>2.2</td>
<td>Own</td>
</tr>
<tr>
<td>the Contractor has no work, he has to take whatever contract type the Employer</td>
<td></td>
<td>Prasad &amp; Salmon, 2013</td>
</tr>
<tr>
<td>proposes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Project’s characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Unclear definition of the project scope</td>
<td>2.4.2</td>
<td>Antoniou et al., 2013b</td>
</tr>
</tbody>
</table>
Selection of contract type in construction contracts
Blekinge Institute of Technology

<table>
<thead>
<tr>
<th>and methods (this is a reason for using cost-plus or target-cost contracts)</th>
<th>2.3.3</th>
<th>Bajari &amp; Tadelis, 2001 Fuller, 1920</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Organizational and technical project complexity (this may be a reason for choosing cost-plus or target-cost contracts)</td>
<td>2.1</td>
<td>Molenaar et al., 2000 Nkuah, 2016</td>
</tr>
<tr>
<td>16. Duration of the project relationship (having a long relationship may be a reason for using target-cost contracts)</td>
<td>2.1.1 2.2</td>
<td>Badenfelt, 2008 Eisenhardt, 1989</td>
</tr>
</tbody>
</table>

| Relationship between parties |
|---|---|---|
| 17. Willingness to cooperate (this may be a reason for using target-cost and cost-plus contracts) | 2.3.3 2.4.1 | Chan et al., 2010; Fuller, 1920 |
| 18. Desire to avoid claims and improve working relationship (this may be a reason for using target-cost contracts) | 2.3.3 2.4.3 2.4.5 | Chan et al., 2010 Hosseinian & Carmichael, 2014 Antoniou et al., 2013b |
| 19. Prior relationship (trust and commitment) (this may be a reason for using target-cost contracts) | 2.1.1 2.4.1 | Badenfelt, 2008 Eisenhardt, 1989 Suprapto et al., 2016 |
| 20. Considerations of fairness (intend to choose a fair contract) | 2.2 2.3.2 | Hosseinian & Carmichael, 2014 Badenfelt, 2008 |
| 21. Amount of information asymmetry previous to the contract (high information asymmetry may be a reason for using target-cost or cost-plus contracts to reduce it) | 2.4.1 2.4.5 | Own |

| Knowledge and implementation of contract type |
|---|---|---|
| 22. Familiarity and previous experience with the contract type (managers may be biased towards known contracts) | 2.2 | Antoniou et al., 2013b Chan et al., 2010 |
| 23. Simplicity to implement contract (lump sum contracts seem easier to implement) | 2.2 | Antoniou et al., 2013b Bajari & Tadelis, 2001 |

| Secondary contract costs |
|---|---|---|
| 24. Costs of controlling the project development, monitoring the Contractor’ efforts (higher in contracts with open books) | 2.4.3 | Suprapto et al., 2016 |
| 25. Financial costs (higher in lump-sum contracts) | 2.4.4 | Own Preliminary interview |
| 26. Dispute costs (lower in target-cost contracts) | 2.4.5 | Suprapto et al., 2016 |

Table 2: Possible factors for contract type selection
3. Methodology

The research method to be chosen depends on the type of question posed in the thesis (Yin, 2009). As a “why” question is being dealt with in the present thesis, an experiment, a history or a case study could be applicable. To answer the questions posed in subchapter 1.3 it is not required to set up a controlled situation, instead, observing the events in reality should provide the data, so no experiments are needed. These questions focus naturally on contemporary contracts, so a history is discarded. Therefore, it seems suitable to use a case study as the research method.

The design of the case study will be a single-case one. There will be just one unit of analysis, which is the selection of the construction contract for Project X. No embedded units of analysis have been identified in the case. A multiple-case design, which could be done researching other projects, will not be performed due to time limitations for the study.

Multiple sources of evidence were used in order to contrast and complement the findings. In fact, this will be achieved by performing a survey and interviews to several managers, who may have different subjective opinions or ideas about the selection factors for the contract type. The internal validity will be supported by considering competing explanations (e.g. different factors that may explain why a certain contract type was chosen in Project X) and analysing the convergence of the evidence from different sources. The different sources are the different managers responding to the survey, the later follow-up interviews and the documents reviewed by the author.

The interviews are designed to dig out the reasons for the survey results not matching the literature review. Moreover, the questions where the range of answers was very varied are also looked into in more detail during the interviews.

The theories and past research stated in chapter 2 will allow to generalize the results, providing external validity. To improve reliability, the survey, interview and answers to the survey are provided in Appendices 1, 2 and 3, respectively.

Document research is performed to provide some objective context about Project X, which should help to understand some of the responses to the surveys and interviews. Moreover, the analysis of the contract documents was planned in order to match the contract type paradigms described in chapter 2 with the real contracts being used for Project X. Nevertheless, the contract documents are not available at the moment of finalizing this thesis, so the standard NEC contracts, on which the contracts for Project X were supposed to be based, are analysed instead.

3.1. Case study question

The question of the thesis in subchapter 1.3 is “Why is a contract type selected, i.e. which factors affect the selection of the construction contract type (lump-sum, target
cost contract or cost-reimbursable contract)?” The aim is to answer that question for the Project X and also in general.

### 3.2. Reasons for choosing Project X as unit of analysis

The Project X has been chosen for the case study because it is a very large construction project and is a relevant example of its kind, being therefore suitable for a case study (Yin, 2009). The contract negotiation is a subject for itself and quite a lot of managers, who are potential respondents, are involved in it. These people have already some knowledge of the contract types and are open to collaborate with the study, providing data if necessary. Therefore, this facilitates the study. Besides, several contract types were proposed during the contract negotiation, so the question of why one and not the other contract type is chosen had already arisen. However, the main reasons for choosing the contract type may be seen differently by the several managers/parties, and may in turn be others than those proposed in the literature. This raises the interest of the study.

Then, the project and the constellation of companies involved are typical for a large construction project: there is an Employer, who has to maximize the payback from his investment in the mine, and there is a Contractor, who designs and builds the mine shafts, and who will tend to maximize his own profit.

The facts that the project is located in Western Europe, and that the parties are from developed countries, eliminate influences which might be important in projects in developing countries, such as government interferences, political instability, much higher risks or corruption. This makes the project more representative for studying projects in developed countries.

Mining construction projects such as the Project X are usually high-risk projects. For instance, sinking a shaft can be considered as one of the most complex tasks in civil and mining engineering. The reason for this is the highly unknown geology of the layers to be traversed, the relatively large dimensions of the works (e.g. 6-8 m diameter shafts are quite common) and the long lifetime required, which may be over 50 years. The construction works have a rather long duration for a construction project (about four to six years). These characteristics increase the importance of the selection process for the contract type.

### 3.3. Data collection

Data from four sources has been collected: literature regarding contracts for projects, a survey to managers of the Contractor and Client, posterior interviews and the review of the documents of the project and of the standard NEC3 contracts.

The preferred source of information is the survey and subsequent interviews. This seems to be the most appropriate way to find out which factors influence the contract selection, rather than investigating in detail the contracts used in Project X themselves,
which may provide very specific information about the actual contracts, but would probably not be very effective in terms of discovering why that contract type was chosen.

A large amount of detailed information can be extracted from a survey focusing on the selection factors and their influence in the case of Project X. Then, more in-depth information regarding the reasons for the answers to the survey may come out during the interviews, which may help to understand and analyse the survey responses even without having a large sample. The direct communication in the interview is also very valuable to further understand the respondents (Anon., n.d.).

Some surveys and interviews with managers responsible for negotiating the construction contract have been performed. The survey intends to find out how the respondents see the three different contract types and to better understand the conditions of the Project X which may have an influence on the contract selection.

The aim of the interviews is to clarify points of the survey which may be unclear from the responses, clarify the reasons for the answers and the dispersion of some of the responses. Besides, some answers to additional questions which may have come up due to the survey responses, are sought. The main subject of the interviews are the causes that led the respondents to choose between the different types of contracts and to understand which type of contract they prefer, especially for Project X, and why.

Direct observation by the author has also been performed, in this case by researching general information about Project X and the payment terms of three standard contracts. The payment terms of the contracts are analysed to make sure that they correspond to the paradigms of the three contract types that have been presented in the thesis.

3.4. Population and sample for the survey and interviews

The subject of the thesis is rather specific, thus, not every employee is sufficiently qualified and experienced to be able to understand and respond the survey appropriately. There are not a large number of people who are involved with contract negotiations and with Project X, making the population available for the survey quite reduced. This implies that the sample for the survey and interviews cannot be large.

The survey was sent to all managers who were supposed to possess sufficient knowledge to answer it and who were available to the author. Many of them are involved in the process of negotiating the contract. The respondents were selected taking into account the necessity of having answers from commercial, technical and legal managers because people with different backgrounds and roles may have different views of the contract selection. Moreover, the respondents are employed by different parent companies of the joint venture which is the Contractor, Thus, the survey was sent to a total of ten managers of the Contractor. Additionally, a representative of the Employer was contacted and asked to participate. Therefore, the managers are highly
qualified and experienced to answer the survey, so the responses should be of high quality.

The answers from five respondents of the Contractor, respondents 1 to 5, were received. Respondents 2 and 5 are commercial managers, respondents 1 and 3 are technical managers and respondent 4 has legal background. Respondents 1, 2 and 3 are employed by German contractors and respondents 4 and 5, by Canadian ones. The Employer declined to participate due to the sensitivity of the ongoing negotiations.

The author is aware that a small sample can have some issues regarding representativeness of the results and difficulty of applying statistics to it. Thus, the results of the survey will also be analysed qualitatively. Additionally, performing the follow-up interviews with some of these respondents can solve some of those possible issues. All the respondents of the survey except respondent 2 were available for the interviews. Additionally, it was possible to perform one extra interview to another technical manager, respondent 6.

3.5. Survey design

The survey is divided into four thematic blocks. The first part of the survey is composed of general questions in order to be able to interpret the role of the respondent in the contract negotiation and his/her knowledge of the contract and of the project boundary conditions. Most of the selection factors identified in subchapter 2.5 were addressed in block 2, so that the responses can be analysed to determine the influence of the factors on the contract type selection.

In the third block of questions, the questions address the project characteristics, focusing on the importance of each of those selection factors of subchapter 2.5 for the Project X.

At the end of the survey, respondents are asked to suggest any other factors that they consider key for the contract selection but that were not included in the survey. Besides, their opinion was asked regarding why a certain contract type is to be used for Project X.

The survey questionnaire is presented in Appendix A.

3.5.1. Design of survey questions

Before designing the survey, research regarding the possible factors influencing the contract type selection was performed. This is described in chapter 2. Moreover, a preliminary interview was conducted with the financial manager from one of the parent companies of the Contractor, who was in charge of negotiating the contract. The information from those two sources was used to create a list of possible factors influencing the contract selection in subchapter 2.5. A similar approach was followed, for example, in (Chan, et al., 2012).
Most of the survey questions (nearly all, except the ones that are used to characterise the respondent) are specially designed to find out if one of the selection factors summarized in subchapter 2.5 has an influence on the contract selection and how far that influence goes. For example, question 2.1 of the survey, “How is the degree of fairness of the risk distribution between Employer and Contractor in the contract?” is designed to find out what is the respondent’s view of the fairness of each contract. If there are differences between the assessments of the fairness for the three contract types, the fairness may be a factor which is considered when selecting the contract type. The complementary question to this one is question 3.15, “How is the degree to which the party you belong to (Employer/Contractor) has considered the fairness of the different contracts?”. The answers to this question should provide a measure of the importance of the selection factor “fairness” when the contract for Project X was selected. A small number of the selection factors present in subchapter 2.5 were not included in the survey due to the impossibility of asking sensitive questions, e.g. regarding the profit expected by the Contractor.

Similarly to the questions seeking to assess the influence of the factors already present in the literature, other questions were designed to find out if the factors which came up during the preliminary interview have an influence or not, e.g. question 2.4 “How high/low are financial costs (costs of advance-payment bonds, performance bonds, retention bonds, off-site materials bonds…) when using this type of contract?” If the answers point out that these financial costs are significant, then it can be concluded that there will be a tendency to use contracts with low financial costs.

3.5.2. Measures to improve survey reliability

The survey questions were designed by the author and rechecked for bias and clarity issues. Literature regarding survey design was reviewed and applied.

All the survey questions except the ones in the fourth (last) block have closed, multiple-choice answers. This requires less time and effort by the participants, which should improve the response rate (Fan & Yan, 2010).

Dichotomous responding (e.g. Agree/Disagree, Yes/No) and Likert-type rating scales are frequently used for closed questions. Dichotomous responses have been widely criticized, as tend to be less reliable (Simms, 2008) (Clark & Watson, 1995). Thus, Likert-format answers have been chosen for this survey. This type of answers requires more time from the respondent; the respondents were kindly asked to take the necessary time to respond. Besides, the survey length has been kept under 20 minutes, so the respondents should be have enough time to answer it.

The questions have been formulated as simple and short as possible, using a language understandable for the target respondents, as advised in (Hinkin, 1998), (Clark & Watson, 1995), (Simms, 2008) and (Gehlbach & Brinkworth, 2011). Neutral language has been used to formulate the questions, avoiding colloquialisms, as recommended in (Clark & Watson, 1995). Leading and double-barrelled questions have been avoided,
because they may bias the answers (Hinkin, 1998), (Simms, 2008). Reverse-scored items have not been used, in order not to confuse the respondents.

The reliability of Likert scales has been proved to increase when using up to five points, however, too many points do not necessarily increase accuracy (Hinkin, 1998) (Clark & Watson, 1995). Hence, in the survey, five points, as recommended in Hinkin, (1998) and in Gehlbach & Brinkworth, (2011), were used. In this case, an odd number of possible responses allows the respondent to choose a neutral response (Simms, 2008). Verbal labels for the points have been chosen, avoiding numeric labels, which enhances reliability, as recommended in Gehlbach & Brinkworth, (2011). Agree/disagree response anchors have not been used, because rating their level of agreement seems to be demanding for the respondents (Gehlbach & Brinkworth, 2011). The questions have been checked to ensure that they apply to every respondent.

The questions of the second and third blocks have been adapted so that all of them can be answered using the same Likert scale, similarly to (Chan, et al., 2012) and (Antoniou, et al., 2013b). The response options (based on degree and rated as Very low, Low, Moderate, High or Very High) have been adapted to the formulation of each question, as recommended in (Simms, 2008). The points in the Likert scale have been reviewed to ensure that they are equally spaced.

The clarity of the questions has been checked. Technical terms, such as “information asymmetry” or “moral hazard” have been paraphrased other vocabulary easier to understand. In one of the first surveys, the author sat together with the respondent, so that the author was able to identify questions that may have not been entirely clear. In this way, a second, improved version of the survey was created and sent to the remaining respondents.

3.5.3. Survey administration

The survey was performed in April and May 2017.

The survey questions were integrated into a PDF questionnaire with easy-to-fill dropdown menus in order to minimize the effort of the respondents for answering the questions. The survey duration has been estimated according to Puleston (2012) to be about 10-15 minutes.

The questionnaire was sent per email to the selected respondents, presenting the involvement of the author with the MBA programme, explaining the need and aim of the survey and assuring them the anonymity of their responses. They were also invited to distribute the survey to other managers, whom they may consider capable and interested in responding to the survey. The respondents were requested to answer it within a week. A reminder was sent after two weeks, again stating the importance of their contributions and asking them to answer the survey in another week.
3.6. **Interview design**

Interviews have been performed to further understand the reasons for some of the answers to the survey. For example, quite different answers appeared in the survey regarding the fairness of the various contracts, so the respondents were asked in the interviews “Why did you rate the fairness in this way? Which is the most balanced contract?”.

Moreover, the respondents were asked about some additional subjects, which came up during the surveys in the open responses to block 4. For instance, one respondent suggested in the survey that the equity and debt funders of the Employer may desire to have financial information of the project, so this factor was further investigated in the interviews with the question “Could it be that the information needs of the funders push towards an open-books policy?”.

A list of open questions for the interview was put together after analysing the results of the survey. The questions were personalized to the answers of the respondent to the survey, focusing on their most interesting responses and on questions where the respondents answered very differently. Especially, all the respondents were asked the questions in the last page of the interview, which are questions directly asking the respondent for his opinion regarding the influence of the selection factors. These questions are mostly related to the last block of the survey. A sample interview questionnaire is attached in Appendix B. As explained, not all the questions there were asked in that form to all of the respondents.

3.6.1. **Conduction of Interviews**

The unstructured interviews were performed in April and May 2017 by the author to four of the respondents to the survey and to an additional technical manager. The interviewee was left quite a lot of freedom to response to the designed questions or to provide other backup information of interest. His answers to the survey were taken to the survey so as to have them present during the discussions. If necessary, the author led the responses or asked secondary questions. Care was put not to bias the respondent towards certain responses, but the possible bias of the author cannot be completely discarded. The interviews lasted between half an hour and an hour, depending on how much time the respondents had available for the interview. Some of the survey responses were reviewed by the respondents after the interview questions made them rethink them in more depth.

3.7. **Documents reviewed**

Some general documentation about Project X was researched so as to provide a framework for the later analysis of the project. This information can then be contrasted with the information about Project X from the interviews and survey. Besides, some of the characteristics of Project X discovered during this research may influence the selection of the contract type.
As the contract is still not final, there is a limited amount of documents available to the author at the time of finalizing the thesis. The payment terms of three NEC3 standard contracts (lump-sum, target-cost and cost-plus) are to be reviewed instead of the contract documents for Project X. This review is performed in order to ensure that these contracts correspond to the paradigm contracts referred to in the present thesis.

3.8. **Analysis method**

The answers to the survey are analysed statistically, but considering the reduced sample, a qualitative analysis is also performed. The answers are compared among themselves and contrasted with the predictions of the literature, confirming or denying the literature sources. The data from the survey will be evaluated considering the background of the respondents (commercial, technical or legal) and their region of activity (Europe or America).

The results of the interviews are compared and conclusions are extracted from them, supporting and completing the results from the survey.

Finally, the information from the survey, interviews and the document research is put together to strengthen the basis for the discussion and comparison with the literature.
4. Presentation of results

The results of the investigations performed are presented in this chapter. The results of the survey, interviews and document research are detailed in subchapters 4.1, 4.2 and 4.3, respectively.

4.1. Survey results

The statistical analysis of the survey has been limited to the evaluation of only a few statistical parameters of the sample answers. If a larger sample were available, an approach involving the calculation of the confidence intervals may have been useful. As explained in subchapter 3.5, there are four blocks in the survey with different thematic questions. In order to be able to apply statistics to the results, the answers to blocks 2 and 3 were codified with ciphers as follows: Very Low was substituted by 1, Low by 2, Moderate by 3, High by 4 and Very High by 5. The arithmetic average, corrected sample standard deviation and range were calculated for the answers of the five respondents of the sample.

The results of blocks 2, 3 and 4 of the survey are presented succinctly in the following subchapters. Block 1 contained only questions related to the characterisation of the sample, so that data was presented in subchapter 3.4. The complete responses of the five respondents can be found in tabular and graphical forms in Appendix C.

4.1.1. Results regarding the differences between contract types

Each question of the second block in the survey had to be answered for each of the three contract types. That is the reason why there are three statistical parameters (e.g. three different averages, deviations and ranges) for each question. The statistical parameters are presented in Table 3.

In general, target-cost and cost-plus contracts tend to be answered more similarly than any other two combinations of contracts, which means that they are probably the most similar pair of contracts of the three. Many of the averages are stepped, increasing or decreasing from the lump-sum contract to the target-cost contract and in turn to the cost-plus contract, e.g. answers 2.4 and 2.5. However, there are also quite a lot of answers in which the target-cost contract received the highest rating on average, which is usually the most positive one.

It can be observed that, due to the very reduced sample size, the standard deviation is quite high in relation to the average, typically between 25 and 50% of the average. The answers regarding the target-cost contract have smaller standard deviations in general, so the respondents seem to agree more on that contract. This tendency can also be seen in the range between the maximum and the minimum rating, which is smaller for the answers concerning the target-cost contract.
### Table 3: Statistical parameters for the answers to block 2 of the survey

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>AVERAGE Lump-sum contract</th>
<th>AVERAGE Target-cost contract</th>
<th>AVERAGE Cost-plus contract</th>
<th>ST. DEV Target-cost contract</th>
<th>ST. DEV Cost-plus contract</th>
<th>RANGE Lump-sum contract</th>
<th>RANGE Target-cost contract</th>
<th>RANGE Cost-plus contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. How is the degree of fairness of the risk distribution between Employer and Contractor in the contract?</td>
<td>3.00</td>
<td>3.60</td>
<td>2.00</td>
<td>1.41</td>
<td>0.55</td>
<td>1.22</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2.2. How is the degree in which the risks are distributed to the party which can best manage them at the least possible cost?</td>
<td>2.80</td>
<td>3.40</td>
<td>3.00</td>
<td>0.84</td>
<td>0.55</td>
<td>1.41</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.3. How high/low is the value received by the Employer for his money?</td>
<td>2.80</td>
<td>3.60</td>
<td>3.20</td>
<td>1.30</td>
<td>0.55</td>
<td>1.30</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2.4. How high/low are financial costs (costs of interest and fees of advance-payment bonds, performance bonds, retention bonds, off-site materials bonds...) when using this type of contract?</td>
<td>4.20</td>
<td>3.20</td>
<td>2.40</td>
<td>0.84</td>
<td>1.10</td>
<td>1.67</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2.5. How high/low is the probability the parties entering a legal process and how high/low would legal costs be in case of dispute when using this type of contract?</td>
<td>4.20</td>
<td>2.60</td>
<td>1.60</td>
<td>0.84</td>
<td>0.55</td>
<td>0.55</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.6. In which degree the use of this contract tends to speed up project completion?</td>
<td>2.80</td>
<td>3.80</td>
<td>2.60</td>
<td>1.30</td>
<td>0.45</td>
<td>1.34</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2.7. In which degree the use of this contract tends to improve the quality of the project outcome?</td>
<td>2.20</td>
<td>3.80</td>
<td>3.40</td>
<td>0.84</td>
<td>0.45</td>
<td>1.14</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.8. To which degree is the cooperation between Employer and Contractor enhanced by this contract?</td>
<td>2.00</td>
<td>4.00</td>
<td>3.20</td>
<td>0.71</td>
<td>1.00</td>
<td>1.10</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2.9. To which degree is this contract suitable for projects with technical/organizational complexity?</td>
<td>1.80</td>
<td>3.80</td>
<td>4.20</td>
<td>0.45</td>
<td>0.84</td>
<td>0.84</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2.10. How high/low was your knowledge of this kind of contract before being involved in the project?</td>
<td>4.20</td>
<td>3.80</td>
<td>3.60</td>
<td>0.84</td>
<td>1.14</td>
<td>1.14</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2.11. How high/low are the required trust and commitment between the parties before signing this contract?</td>
<td>2.80</td>
<td>3.60</td>
<td>3.60</td>
<td>0.84</td>
<td>1.14</td>
<td>1.67</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2.12. To which degree are adjustments to this contract easy?</td>
<td>1.40</td>
<td>3.40</td>
<td>4.60</td>
<td>0.55</td>
<td>0.89</td>
<td>0.55</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2.13. To which degree is this contract suitable when one party has more knowledge, e.g. of the costs or of other issues than the other?</td>
<td>2.80</td>
<td>3.40</td>
<td>3.40</td>
<td>1.10</td>
<td>0.55</td>
<td>0.89</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.14. To which degree is this contract easy to implement?</td>
<td>3.80</td>
<td>3.20</td>
<td>3.00</td>
<td>0.84</td>
<td>0.84</td>
<td>1.41</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2.15. How high/low is the percentage of the total risk assumed by the Employer in this contract?</td>
<td>2.80</td>
<td>3.00</td>
<td>4.00</td>
<td>1.30</td>
<td>0.71</td>
<td>1.22</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Very Low = 1, Low = 2, Moderate = 3, High = 4, Very High = 5
The most relevant results of the survey are highlighted in the following paragraphs.

The respondents know quite well the three kinds of contracts, which was expected from them, as they are highly qualified and experienced managers involved in contract negotiations. They tend to know slightly better the lump-sum contract.

The target-cost contract achieves the best average rating regarding the degree of fairness (although not by respondent 4), followed by the lump-sum contract. There is a high dispersion of the responses especially in the ratings of lump-sum and cost-plus contracts.

There are moderate differences in the ratings of the respondents regarding the risk allocation efficiency. Most of them coincide that the target-cost contract distributes the risks to the party which can best manage them. Respondents 3 and 4 have very contrary opinions regarding the cost-plus and lump-sum contracts. As expected, the lump-sum is seen as the contract allocating the most risk to the Employer, followed by the target-cost and cost-plus contracts.

With respect to the value for money, the answers converge regarding the target-cost contract, which is rated as providing the most value for money, followed closely by the other two. However, the respondents had very different opinions regarding the cost-plus and lump-sum contracts.

Respondents 1, 2 and 3 have the opinion that the financial costs are higher in lump sum contracts, which is what was postulated in 2.4.4, as lump-sum contracts have e.g. mobilisation and advance payments, which have to be covered by costly bonds. On the contrary, respondents 4 and 5 think that all contracts have similar financial costs.

Target-cost and cost-plus contracts seem to need the most trust by the parties, lump-sum not so much. The responses are quite similar, except for the respondent 4, who thinks that lump-sum contracts need more trust by the parties. The target-cost contract is also rated as enhancing cooperation the most, followed by the cost-plus contract. All the respondents clearly rate the lump-sum contract as the most prone to legal processes.

With respect to the project schedule, the target-cost contract is rated as clearly the most advantageous, having the other two similar low ratings. Target-cost and cost-plus contracts are similar rated in terms of project outcome quality.

Regarding the flexibility of the different contracts, all the respondents have the same tendency: they rate the lump-sum contract as the most difficult to adapt to changes in the project, the target-cost as being moderate to easy to adapt and the cost-plus as being very easy to adapt. The respondents rated target-cost and cost-plus contracts as very appropriate for complex projects, though cost-plus contracts were rated slightly higher. Lump-sum contracts were rated as being rather not suitable.
4.1.2. Results regarding the questions relating to the actual selection of contract type for Project X

The analysis has been performed analogously to the one in subchapter 4.1.1. The statistical parameters calculated for the answers to block 3 of the survey, which deal with the characteristics of Project X that may influence the contract selection, are presented in Table 4.

Similarly to the statistics in the previous subchapter, there is a high standard deviation, of the order of 25-50% of the average, which is a direct consequence of the reduced sample size. The ranges between the extreme answers are also quite large.
### QUESTION

<table>
<thead>
<tr>
<th>Question</th>
<th>Average</th>
<th>Typical deviation</th>
<th>Range max-min</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. How is the unwillingness to take risk of the Contractor relative to the Employer in this project?</td>
<td>3.80</td>
<td>0.84</td>
<td>2</td>
</tr>
<tr>
<td>3.2. How is the financial strength of the Contractor relatively to that of the Employer in this project?</td>
<td>4.00</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>3.3. How is the ability of the Contractor to estimate the costs in advance in this project?</td>
<td>3.20</td>
<td>1.10</td>
<td>2</td>
</tr>
<tr>
<td>3.4. How is the criticality of delivering this project on time?</td>
<td>4.60</td>
<td>0.55</td>
<td>1</td>
</tr>
<tr>
<td>3.5. How is the criticality of the quality in this project?</td>
<td>3.60</td>
<td>0.55</td>
<td>1</td>
</tr>
<tr>
<td>3.6. How are the in-house design &amp; control capabilities of the Employer?</td>
<td>2.60</td>
<td>1.14</td>
<td>3</td>
</tr>
<tr>
<td>3.7. How is your prediction of the actual future costs relatively to the Contractor's bid price?</td>
<td>3.80</td>
<td>0.84</td>
<td>2</td>
</tr>
<tr>
<td>3.8. How is the desire of the Employer to influence Contractor's motivation and avoid deceitful attitudes?</td>
<td>4.00</td>
<td>0.71</td>
<td>2</td>
</tr>
<tr>
<td>3.9. How is the qualification of the Contractor for the project execution?</td>
<td>4.40</td>
<td>0.55</td>
<td>1</td>
</tr>
<tr>
<td>3.10. How is the degree of utilization of the capacities of the Contractor now? (High utilization = there is work for all personnel)</td>
<td>3.20</td>
<td>1.10</td>
<td>2</td>
</tr>
<tr>
<td>3.11. How is the degree of definition of the project scope?</td>
<td>2.40</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td>3.12. How is the degree of complexity of the project from the organizational and technical points of view?</td>
<td>3.80</td>
<td>0.84</td>
<td>2</td>
</tr>
<tr>
<td>3.13. How is the willingness of the parties to cooperate with each other?</td>
<td>3.60</td>
<td>0.55</td>
<td>1</td>
</tr>
<tr>
<td>3.14. How is the frequency with which the parties had worked together before this project?</td>
<td>2.00</td>
<td>1.41</td>
<td>3</td>
</tr>
<tr>
<td>3.15. How is the degree to which the party you belong to (Employer/Contractor) has considered the fairness of the different contracts?</td>
<td>2.60</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td>3.16. How is the amount of superior knowledge by one of the parties, e.g. regarding project conditions, cost estimations, funding, authorities approvals, etc.?</td>
<td>3.60</td>
<td>0.89</td>
<td>2</td>
</tr>
<tr>
<td>3.17. How is the degree to which the easiness of implementing the contract has been considered?</td>
<td>2.80</td>
<td>1.10</td>
<td>2</td>
</tr>
<tr>
<td>3.18. How was your degree of involvement in the negotiation of the contract?</td>
<td>3.20</td>
<td>1.48</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Very Low = 1, Low = 2, Moderate = 3, High = 4, Very High = 5

Table 4: Statistical parameters for the answers to block 3 of the survey
The most relevant findings from the survey regarding the characteristics of Project X are presented below.

The respondents claim that the Contractor is much more to moderately more risk-averse than the Employer. The Contractor’s financial strength is rated as higher by all the participants.

With respect to the ability of the Contractor to estimate the costs in advance, there is quite a high dispersion of the results, ranging from high to low. This matter is investigated further in the interviews. The respondents seem to think that the actual costs will be similar to much higher than the bid price.

Regarding the importance of the quality in the project, the dispersion of the answers is rather low, the respondents rate it as moderate or high.

The respondents have similar opinions regarding the qualification of the Contractor: he seems to be highly qualified.

The parent companies of the joint venture Contractor seem to have a low to high amount of work, so it can be expected that they do have a certain negotiation power to influence the selection of the contract type.

The project scope appears to be quite uncertain and the project complexity was rated as moderate to very high.

The respondents answered that the parties are moderately to highly willing to cooperate. In general, the respondents believe that the Employer does have a high desire to avoid moral hazard by the Contractor.

The parties have not worked together before Project X, because the Employer is a quite young firm, new entrant to the mining industry. This is confirmed by the responses.

The fairness of the contract seems to have been moderately considered when negotiating the contract. Respondent 4 has a different opinion, that the fairness was not considered, which is asked in the interview.

The amount of information asymmetry is rated as moderate to very high. This dispersion will be further investigated in the interviews.

Three of the respondents think that the easiness of the contract implementation has been shallowly considered, whereas the other two believe that it has been considered in more depth. This will be further researched during the interviews.

The respondents have generally been moderately to very highly involved in negotiating the contract. However, all the respondents are familiar with the project and know the contractual boundary conditions quite in depth. The respondents have been working on the project already a considerable amount of time.
The last question of the survey aimed to clarify the priorities in the project. Four of the respondents answer that the schedule is the most important factor, ahead of budget and quality. Respondent 3 dissents and puts budget ahead of schedule. Respondent 5 also highlights the point that safety (which may be considered a part of the quality of the project) is essential for the project.

4.1.3. Responses to the open questions regarding other selection factors

At the end of the survey, in the questions in block 4, the respondents were asked to propose other factors affecting the contract selection in general and the main factors which affected the contract selection in Project X. Some of the responses revealed new factors which may affect the selection of contract type.

The dependence from the equity owner was claimed by respondent 3 to be a factor which has to be taken into consideration. For instance, a conservative equity owner of the Contractor will influence the management to opt for a contract which allocates less risk to the firm.

Then, the regional traditional preferences seem to play a role too: “the region drives initial selection by Client whether to go for LS (lump-sum), UR (unit-rate) or CR (cost-reimbursable) contracts”, stated respondent 4.

The certainty of the design and the ground conditions also need to be considered (claimed respondents 4 and 5), which are special cases of the “uncertainty of project scope” already present in the literature.

With respect to the reasons for using a target-cost contract for Project X, the respondents have opinions which vary extremely widely. Respondent 1 answers that unit rate contracts and incentive (target-cost) contracts are both quite common in mining projects. Respondent 2 claims that the Client wishes to “combine the (expected) low cost level from reimbursable approach with the performance of a lump-sum contract”. Respondent 3 links the contract selection to the desired risk and opportunities distribution between Employer and Contractor. The most significant answers from respondent 4 refer to the flexibility of the target-cost contract type for scope changes and enhancing cooperation and trust. Besides, he comes up with a new factor to project selection: information requirements by funders of the Employer. Respondent 5 also highlights the impossibility to provide a fixed price in a constantly evolving environment.
4.2. Results of the interviews

The most relevant information that came up in the five interviews performed is presented below.

4.2.1. Results regarding the differences between contract types

Regarding the fairness of the contracts, the interview with respondent 5 showed that lump-sum could be considered as unfair for the Contractor, because he is allocated the majority of the risks, but as he already introduces contingencies for the risk in the lump sum, it is not. The cost-plus contract leaves the Employer with nearly all the risk, but if the Contractor is conscious, that should not be a problem.

Respondent 5 stated that lump-sum and target-cost contracts are more efficient than the cost-plus contract because, as the latter contract does not give the Contractor incentives to sink the costs, the Owner needs to manage the Contractor in that case. Moreover, respondent 3 claims that the Contractor can better manage most of the risks, so he should be allocated them (i.e. using a lump-sum or at least a target-cost contract), nevertheless, the Client has to provide a compensation for the Contractor taking them. On the contrary, for respondent 4, the cost-plus has the most efficient risk allocation for underground mining projects, whose geological conditions are extremely unknown, because many of the risks need to be taken by the Employer.

When interviewed, respondent 5 claimed that contracts with incentives (explicit, as target-cost, or implicit, as lump-sum contracts) provide the Employer with more value. Respondent 3 thinks that lump-sum contracts give more value because there are no price increases. Nevertheless, as respondent 4 claims, that can be different if there are high contingencies in the bid price, claims and change orders.

With respect to the timely completion of the project, lump-sum and target-cost contracts seem to lead both to similar schedule gains according to respondent 3. Besides, directly incentivizing the earlier completion of the project through a similar scheme as the target-cost contract, with a target and a sharing ratio for delays or schedule reductions, seems to be very beneficial to reduce the schedule (respondent 6). Respondent 5 answered that cost-plus contracts do not incentivize the Contractor to be faster, because the more time the Contractor is on site, the more money he receives. A similar response was given by respondent 3, who stated that in a cost-plus contract, there is no motivation to be quicker or cut costs. This is also the reason that respondent 4 gave for cost-plus contracts with no incentives being quite unusual.

In the interview, respondent 3 stated that less bonds and insurance are required in target-cost and cost-plus contracts, which decreases the financial costs of the project. Contrarily, payments in the target-cost and cost-plus contracts are based on actual costs. This was also confirmed to a certain extent by respondent 4, who pointed out that, although they usually have lower financial costs, cost-plus projects may also need guarantees.
Respondent 5 explained that scope changes render the claim and change management very important in lump-sum and target-cost contracts, which naturally increases the probability that the parties end up arguing. Respondent 1 emphasized the extreme high amount of personnel for claim management present in another lump-sum project. Respondent 5 stated that the cost-plus contract is the easiest one to implement because in lump-sum and target-cost contracts change management is a major issue. He put the example of a previous project, where the parties were not able to agree who was responsible for the delays. As an example of a conflict that may arise in lump sum or target cost projects, the Employer may be responsible for providing access, power and water to the job site. If he is not able to provide any of them during a certain time period, the Contractor will not be able to work. The argument of how much work could the Contractor have done in that lost time, and how much it costs to retake the works again arises quickly and agreeing is difficult. On the contrary, in a cost-plus contract, the Contractor is just paid for his allowed costs, so there is no need to argue about who was responsible for the time losses and which consequences they had.

In the interviews, respondents 3 and 5 claimed that lump-sum is not very suitable for complex projects, because complex projects tend to have scope changes and the design is not ready, so using a lump-sum contract is bound to produce variations, change orders and the consequent disputes continuously.

Respondent 5 believes that the quality should be similar in all of the contracts, as the Contractor will try to avoid being instructed to rework. However, respondent 3 states that target-cost provides a better quality, because there is a goal to be achieved, whereas in the lump-sum cutting costs is the main concern of the Contractor and in the cost-plus there is no incentive for quality, budget or schedule.

Respondents 1, 3 and 5 coincided in the interview that the target-cost contract is the one in which the parties will cooperate the most. In the lump-sum contract, the Contractor just needs a scope and then he works very independently of the Employer, contrastingly, in the target cost both parties work together towards their goals and in the cost-plus contract there are no incentives whatsoever to cooperate, the Contractor is just a “hand of the Employer”, who will probably follow the Employer’s orders without discussion.

Respondent 5 claims that Clients usually distrust the Contractors, and as there are no incentives in the cost-plus contract, there must be much more trust. Respondent 3 adds that also in target-cost not everything is defined, so more trust is needed than in lump sum. However, respondent 4 stated that trust is also necessary in a lump sum or target-cost to agree on the change orders.

Thinking of the case where the Contractor has more information, respondent 5 responded that in any case, it should not matter because there is some competition in the market, which restraints the Contractors from bidding too high. He added that in a cost-plus contract, information asymmetry is not really important, but rather the actual costs. In any case, as respondent 3 claimed, target-cost and cost-plus should be more
adequate if there is high information asymmetry, because the open-books policy reduces the information asymmetry.

When asked if the familiarity and knowledge of a contract type to a manager could make him more prone to choose it for a project, respondent 5 responded in the interview with a very convinced “Definitely”. Respondent 3 answered in the same terms, giving the reason that being familiar with a contract, the manager is more comfortable and in control of all the “tricks” within it. In the same context, the interviews with respondents 1, 3, 5 and 6 clearly showed that there are differences between regions, the German and Canadian companies having different preferences for contract selection. Similarly, Employers from different regions in the world would select different contracts to start with.

The negotiation power (level of market activity and general situation of the company) was also cited as a factor. Respondents 3 and 5 both confirm that having too few projects may probably lead a Contractor to accepting work with nearly any contract type proposed by the Employer, even without achieving a profit, only to cover the fixed costs and avoid having spare resources.

4.2.2. Results regarding the questions relating to the actual selection of contract type for Project X

With respect to the risk allocation, respondent 3 claimed that, even if the Employer is less diversified because he has only Project X in his portfolio, he must assume some risks (typically scope changes and geological risks), because otherwise no Contractor will ever accept to enter the contract. There seem to be also differences between the risk aversions of different Contractors, some (European or German) willing to take rather lump-sum contracts in order to gain a higher profit, while others (American or Canadian) are more comfortable with target-cost contracts in order not to risk the whole company for the project.

Respondents 3 and 5 answered in the interview that, in principle, the Contractor is quite able to estimate the costs of the project, being as they are very experienced companies, except for scope changes desired by the Employer. However, shaft sinking is a risky activity and respondent 5 stated in the interview that if another construction methodology was used, which would provide more certainty regarding costs and schedule and would make them more controllable by the Contractor, the Contractor would be able to take more risks.

Respondent 3 confirmed that the beliefs of the parties of the bid price being higher or lower than the actual future costs may well influence the willingness of the parties to choose one or the other contract type. Respondent 5 claimed that, as the scope is not fixed yet, the previous bid price has to still be adjusted. However, the new price is based probably on the bid price, so this factor may still influence the contract selection.
Respondents 3 and 5 believe that the Contractor needs to be qualified and educated to understand the target-cost contract, otherwise this contract would not work properly.

The low degree of definition in Project X seems to be the main reason to avoid choosing a lump-sum contract for the project (respondents 4 and 5), in a smaller degree for respondent 3.

Both respondents 3 and 5 confirm that the high complexity of Project X is one of the reasons why a target-cost contract was chosen.

The Employer does seem to have rather low in-house design capacities, but he is supported by some external consultants, according to respondent 5. Respondent 3 believes that this situation should lead the project towards a lump-sum contract. Nevertheless, when asked about this factor, respondent 4 stated again that the scope uncertainty is the main reason to avoid using lump-sum contracts for Project X.

Respondents 4 and 5 affirm that both the Employer and the Contractor are trying to be fair and achieve satisfactory results for the other, so probably closing a balanced contract is also a concern. Respondent 5 claims that the Contractor would also not be deceitful in a lump-sum contract, because he has also a high financial incentive to avoid delays.

Both respondents 3 and 5 state that the effort to implement the contract was not considered when drafting the contract. Change management, which requires a lot of effort, is needed in both lump-sum and target-cost contracts (respondent 5).

When asked in the interview if the target-cost is the right contract for the Project X, respondents 3, 4, 5 and 6 answered affirmatively. Respondent 6 reasoned that because of the amount of unknown factors, cost-plus may also be a suitable contract, but it has the drawback that it does not provide the Contractor with either motivation or opportunity to perform better, aside from being micromanaged by the Employer.

The importance of providing information to the funders, which was suggested as a factor by respondent 4 in the survey, was also confirmed by respondents 3 and 5 in the interview.

Until now, stress was put in the thesis on finding out which factors influence the selection of contract type. However, the relative importance of those factors had not still been researched in detail. For this reason, the interviewees were asked to name the three factors that most influence the selection of contract type. The factors that came up most frequently were the scope uncertainty, the desired risk allocation, the need to incentivize the Contractor, the preferred contract type of the Employer, the desire to improve the cooperation between the parties and the possibility of improving the project schedule by starting working without a complete design.
4.3. Results of document research on the Project X and on NEC3 contracts

General information about the Project X has been researched in order to provide some context to the later discussion regarding the selection of the contract type. This information, presented in subchapter 4.3.1, may also confirm the claims of the respondents in the surveys and interviews.

In order to compare the three theoretical contract paradigms discussed in the thesis with real-life contracts, three standard contracts have been briefly analysed in subchapter 4.3.2.

4.3.1. Characteristics of Project X

The characteristics of Project X were investigated and directly observed by the author using different documents as sources, which are not cited here in detail to preserve the anonymity of the parties. Some of the sources were the Employer’s and Contractor’s websites, draft contracts and tender documents. Other statements are based on general mining or civil engineering knowledge. The circumstances in Project X that could lead to the choice of the contract type are presented here.

First, the Employer Y and the Contractor Z are private, therefore it can be expected that both are risk-averse. On the one hand, according to the website of one of the parent companies, the Contractor is a joint venture, so that the project risks are divided between the four partners. Besides, the joint venture members are somewhat diversified, in that the project value probably amounts to less than one half of their current order values. On the other hand, according to the information in his website, the Employer is a junior company, which has no mines at the moment, meaning that it does not receive any annual revenue, with no cash sources other than external financing. These facts point to a moderate risk-aversion on the part of the Contractors and a higher than average risk-aversion on the Employer’s side. The ability of the Contractor to bear the materialized risks is likely to be high, because of the joint venture structure. The cost variability could be borne by the Owner only by using its contingencies or asking for more resources in the financial markets.

The construction of a mine shaft is one of the most complicated and lengthy projects in civil and mining engineering. According to the Employer’s website, the duration of the Project X is 5-6 years. It involves challenging technical processes, a large investment and very specialized firms to execute it. Therefore, it can be seen as a high-risk project. Many of the risks and costs are difficult to be controlled by the Contractor (such as geological or force majeure risks), but he is able to control other risks (e.g. the efficiency of his personnel and subcontractors).

As the Owner has closed agreements with its funding institutions regarding the schedule of the project and the interest costs are quite high (around 8.5% for debt financing, according to an Employer’s presentation for investors), the duration of the project is
critical, probably even more important than the budget. Besides, the sooner the mine is completed, the sooner the cash balance will turn positive with the revenues of selling the mineral. This is one of the reasons why the design of the project may partly be performed parallel to the works to shorten the project schedule, which may lead to changes in the scope. Then, the quality of the works will play a role, as the Owner wishes to receive safe shafts, but other aspects like costs or schedule are likely to be more essential for the project than the quality.

In cost-plus and target-cost projects, the Owner is usually required to develop an infrastructure for monitoring and being involved in technical decisions. In this case, as the Owner is rather small, he may prefer to get the package done externally as a lump-sum contract. Another option would be to develop its in-house capabilities by hiring specialized personnel.

In the tender stage, a lump-sum contract was proposed by the Owner. However, afterwards, a target-cost contract is being offered.

There is quite large information asymmetry between Owner (young mining firm) and Contractor (experienced joint venture). The Owner may prefer a target-cost contract to be able to monitor the financial performance of the Contractor and to avoid the Contractor making a too high profit.

An important point seems to be linked to the financial costs associated with the lump-sum option. According to a tender document of the Contractor, using a target-cost contract instead of a lump-sum contract, the provisions for liquidated damages can be reduced from 10% to 5%, which can reduce the costs in about 9M€. Getting rid of the advance payment bond implies savings of 4.5M€. Reducing the performance bond from 10% to 3% of the project value saves about 6.3M€. Substituting the 3% retention bond with a 3% warranty bond leads to a saving of 2.7M€. All in all, the bid price can be reduced in 23.5M€. This represents approximately a 3% of the total bid price of about 780M€. The bid price can be decreased in further 15M€ if the insurance is provided by the Owner.
4.3.2. Review of NEC standard Contracts

The use of standard contracts is rather common in construction projects and consists of basing the contract on contract templates prepared by institutions of engineers, which are to be adapted by the Employer and Contractor to the concrete project. Several standard construction contracts are available and generally accepted in international project contracting. The most usual standard forms of contract are NEC3 (New Engineering Contract, Third Edition), under the influence of the Institution of Civil Engineers of the UK and FIDIC, edited by the International Federation of Consulting Engineers, based in the USA. NEC3 is said to be more flexible, clear and simple, besides stimulating good management (NEC, 2014).

There are several contracts within the NEC3 framework (e.g. The Engineering and Construction Contract with its six options, The Engineering and Construction Subcontract, The Engineering and Construction Short Contract, etc.). Here, only the first five options of the main contract of the family, which is the Engineering and Construction Contract (ECC), will be considered. This contract can be applied to large construction projects in which the same Contractor designs and executes the works, which is the case of Project X. The six main options of the ECC are (Lewendon, n.d.):

- Option A - Priced contract with activity schedule (fixed-price contract)
- Option B - Priced contract with bill of quantities (fixed-price contract)
- Option C - Target contract with activity schedule (target-cost contract)
- Option D - Target contract with bill of quantities (target-cost contract)
- Option E - Cost reimbursable contract (cost-plus contract)
- Option F - Management contract

Two NEC3 options had been proposed for the contract of Project X: first NEC option A (lump sum contract) and then NEC option C (target cost contract). It seems that the final contract will be a target-cost one. As the contract documents for Project X are not final, the NEC3 family of standard contracts will be studied instead, on which the future contracts for Project X may be based. The options A/B, C/D and E of the NEC3 contracts are analysed below to confirm that they match the contract paradigms presented in the thesis: lump-sum, target-cost and cost-plus contracts, respectively.

In lump-sum options A and B, the “price for work done to date”, which is usually the main part of the amount due to the Contractor, is defined as “the total of the prices for … the completed activities” (Institution of Civil Engineers, 2013). The prices are “the lump sum prices for each of the activities on the activity schedule/bill of quantities” (Institution of Civil Engineers, 2013). Thus, the prices are set beforehand, so the total price paid by the Employer is fixed, except for compensation events. Compensation events are for example changes to the works information, i.e. scope changes. These definitions suit the lump-sum paradigm explained in subchapter 2.3.1.

For the target-cost options C and D, the prices are defined similarly to the options A and B, as lump sums as per activity schedule or bill of quantities. Additional definitions
are present: defined cost is mainly “…the cost of components in the schedule of cost components... less disallowed cost” (Institution of Civil Engineers, 2013). Disallowed costs are e.g. not justified costs and costs of correcting defects (Institution of Civil Engineers, 2013). An important difference to the lump-sum contract is that the “price for work done to date” is defined differently than in the lump-sum contract options A and B. It is defined as “the total defined cost which the Project Manager forecasts will have been paid by the Contractor before the next assessment date plus the fee” (Institution of Civil Engineers, 2013). Thus, the Contractor is not paid for the predefined quantities in the schedule or bill or quantities, but for his actual costs. Finally, there is an additional clause regarding the Contractor’s share: “If the price for work done to date is less/greater than the total of the prices, the Contractor is paid his share of the saving/excess” (Institution of Civil Engineers, 2013).

The cost-reimbursable option E defines the “price for work done to date”, defined cost and disallowed cost similarly to the target-cost options (Institution of Civil Engineers, 2013). The difference is that the prices are directly “the defined cost plus the fee” and there is no “Contractor’s share”.

It can be claimed that the NEC3 options analysed match in essence the contract paradigms stated in subchapter 2.3. Naturally, they are real-life contracts, so they include more contractual details regarding e.g. when the amounts are to be paid or which costs are excluded from being paid to the Contractor (disallowed costs) in target-cost and cost-plus contracts. They also define the risk allocation for many concrete risks in the secondary clauses X1 to Z.
5. Discussion of the findings

The factors influencing the contract selection that were extracted from the literature and the preliminary interview in chapter 2 are compared in subchapter 5.1 with the findings from the survey, interviews and document research by the author. In this way, the theory can be contrasted with the reality of the actual contract selection for a real project and the opinions of practitioners on the different contract types.

The conclusions of the discussion regarding the factors influencing the contract type selection will be applied to Project X, considering its characteristics, which were outlined in subchapter 4.3.1. The contract type that should be selected by applying the selection criteria is derived in subchapter 5.2.

The triangulation of the findings from the different sources was useful to confirm the findings and improve their reliability. For instance, some of the interviewees did not either recall or understand in the interviews why they answered the survey in a certain manner, so they asked their survey answers to be corrected. The document research was able to support many of the claims stated in the surveys and interviews by the managers.

With respect to the influence of the country in which the respondents are employed, there does not seem to be significant differences in the survey responses of the managers employed by Canadian and German contractors. The differences between the technical and commercial or legal managers were also analysed, calculating the averages of the responses of the different groups. Significant differences were not encountered either. Nevertheless, the existence of such differences is extremely difficult to assess due to the much reduced samples of managers of each of the countries and types. Moreover, as there is not the same proportion of technical and legal managers of each of the countries in the sample (e.g. both Canadian managers are commercial), the influences of both characteristics cannot be easily separated. Differences could be identified in the interviews, where German managers tended more to lump-sum or unit-price contracts, whereas Canadians opted rather for target-cost contracts.

5.1. Discussion of the influence of the selection factors

The influence of different criteria for the selection of contract type are studied according to the results of the survey, interviews and document research performed.

The influence of the risk allocation is examined first. It was confirmed that the desired risk distribution by the parties is an essential point when choosing the contract type, as expected from the literature (Al-Harbi, 1998). Theoretically, the parties should possess sufficient financial strength to bear the risks (Lewendon, n.d.). This is however difficult to assess, as the responses of the survey and interviews might be biased because the financial strength is a sensitive subject. Nevertheless, this did not seem a primary concern, but rather the concern seems to be the ability of the own party (the Contractor) to withstand a project failure (interview with respondents 4 and 5). The influence of the expected profit by the Contractor was confirmed in the interview with respondent 3 in
the sense that some Contractors would accept higher risk (entering a lump-sum contract) if they expect more profit, building contingencies and a higher prime into the fixed price. Generally, the results of the survey match the literature regarding the risk allocation: cost-plus and target-cost should have the more efficient risk allocation, as they allocate more risks to the Employer, who is the party with the least risk aversion. Finally, the Contractor’s ability to control the costs does have an influence, e.g. respondent 3 stated in the interview that the Contractor should be allocated more risks, because in general he can control more risks than the Employer. As in Hosseinian & Carmichael (2014), the choice of the sharing ratio of 50% for Project X was not explained further than being half of the savings/excess for each party, so it seems to have been chosen rather arbitrarily, matching the findings of Badenfelt (2008).

Regarding the Employer’s preferences, it does not seem like the value for the Employer’s money would be a highly important factor for the selection, because the three contracts were similarly rated. This confirms the literature that also did not find significant differences in the contracts in this respect (Antoniou, et al., 2013b) (Ward & Chapman, 1994).

Target-cost contracts seem to lead to a quicker completion of the project, because there are incentives for the Contractor to be faster and the project can start with a preliminary design, which is in concordance with the findings of Antoniou, et al. (2013b) and Fuller (1920). Regarding the other two contract types, the respondents have quite different opinions, but the lump-sum is slightly quicker on average. This contradicts the literature stating that cost-plus contracts tend to speed up the project because of the possibility of doing design and execution parallel (Bajari & Tadelis, 2001). However, it could be explained by the Contractor’s incentive to reduce costs in the lump-sum contract, which directly depend on the duration of the works (Berends, 2000).

According to the responses of the survey and interviews, it appears that cost-plus and target-cost contracts enhance the quality of the project outcome more than lump-sum contracts. Target-cost contracts are rated as being slightly better than cost-plus ones in this respect, which confirms the findings of Antoniou, et al. (2013b) and Chan, et al. (2010), who report that the quality tends to become better using target-cost contracts. Bajari & Tadelis (2001) also claim that cost-plus contracts provide better quality than lump-sum ones.

The Owner’s in-house capabilities seem not to be a major obstacle for using target-cost or cost-plus contracts in Project X, as the Employer is supplementing his capabilities by engaging external consultants. However, the opinion of respondent 3 in the interview is that this fact should incline the contract towards a contract with less Employer involvement, such as a lump-sum contract, supporting the argument that the Owner needs a larger team to supervise target-cost and cost-plus contracts (Suprapto, et al., 2016). The influence of the larger monitoring costs of the cost-plus and target-cost contracts by the Employer could not be analysed in detail because only managers from the Contractor’s side were available for the study.
It is extremely difficult to assess the influence of the beliefs of the parties regarding the bid price and actual costs, because the author had only access to the Contractor and this is also a quite sensitive subject in an ongoing project. Nevertheless, as discussed with respondent 3 in the interview, it may well be the case that this factor influences the contract type selection. The desire of the Employer to avoid moral hazard from the Contractor is definitely a factor for selecting a contract with incentives and avoid a cost-plus contract (interviews with respondents 1, 3, 4 and 5), which confirms agency theory (Eisenhardt, 1989) and Fuller (1920).

Concerning the Contractor’s characteristics, having a qualified Contractor seems to be required for target-cost and cost-plus contracts (confirmed by interviews with respondents 3 and 5), as predicted by Fuller (1920). The negotiation power of the parties appears to have an influence (confirmed by interviews with respondents 3 and 5), but rather in the case of a very unbalanced negotiation situation, partly confirming the hypothesis in Prasad & Salmon (2013).

The project’s characteristics should naturally determine some part of the selection of contract type. Cost-plus contracts and, to a lower extent, target-cost contracts, were rated in the survey as easier to adjust than lump-sum contracts. This is bound to have an influence in the contract selection for contracts which are foreseen to undergo major changes, which was underlined by all the interviewees. The literature claims that cost-plus and target-cost are easier to adapt when changes arise (Bajari & Tadelis, 2001) and is thus clearly confirmed by the results of the survey and interviews. A similar analysis can be done regarding the suitability for projects with organizational and technical complexity, which tend to suffer more changes than simpler projects. Moreover, the uncertainty of the project scope was clearly identified by the respondents in all the interviews performed as a factor to choose the more flexible contracts. These findings agree with the claims of Nkuah (2016) that cost-plus and target-cost contracts are most suitable for complex projects.

The target-cost contract is rated as clearly more cooperative than the other two. Still, the cost-plus contract is rated as quite cooperative, in contrast to the lump-sum contract. This matches the literature research which claims that target-cost and cost-plus contracts enhance cooperation (Chan, et al., 2010), but the results of the present survey highlight that the cooperation in the target-cost contract is significantly better than in the cost-plus contract, similarly to the findings in Suprapto, et al. (2016). Trying to achieve a fair and balanced contract may also influence the contract selection, as already found by Badenfelt (2008). In general, the target-cost is seen as fairer than the other two by the respondents. Some academic articles claim that trust between the parties favours the use of target-cost contracts (Badenfelt, 2008) (Suprapto, et al., 2016). Interviewee 4 partly contradicts this, saying that even more trust is needed for negotiating the change orders in lump-sum contracts.

On average, target-cost and cost-plus contracts are similar and more suitable than lump-sum ones when there is information asymmetry in the project. These findings
support my hypothesis that target-cost and cost-plus contracts should be used in that case, because they tend to reduce the information asymmetry.

Regarding dispute costs, all the respondents clearly rate the lump-sum contract as the most prone to legal processes, as it is very difficult to agree on change orders or responsibility for delays. This is in concordance with the literature in Suprapto, et al. (2016), which states that lump-sum contracts create a more adversarial behaviour than other types of contracts and more dispute costs. On the contrary, this does not support the findings in the survey of Antoniou, et al. (2013b) that incentive contracts tend to create more disputes.

The familiarity with the contract type has been confirmed to be a major factor to select a contract, with important regional differences in preferences, thus confirming Antoniou, et al. (2013b) and Chan, et al. (2010).

The respondents (except for respondent 4) tend to agree that lump-sum is the easiest contract to implement. However, frequent claims and change orders can render its implementation inefficient. This is in line with the literature, which claims that cost-plus and target-cost contracts are more difficult to implement (Bajari & Tadelis, 2001) (Antoniou, et al., 2013b).

5.2. Discussion of the contract type to be selected for Project X

The analysis of the Project X characteristics and their possible influence on the selection of the contract type for this project is performed in this subchapter.

The Contractor seems to be more risk-averse than the Employer, which implies that, in principle, the risks in Project X can be borne at a lower cost by the Employer (Eisenhardt, 1989). Thus, without considering moral hazard, target-cost or cost-plus contracts are more suitable than lump-sum contracts for this project. However, moral hazard is the reason why a cost-plus contract has not been selected for Project X: according to the interviews and to the principal-agent theory (Eisenhardt, 1989), the Contractor can be motivated by transferring some of the risks to the agent, which implies using a lump-sum or target-cost contract. The target cost contract creates a compromise, allocating some risks to the Contractor to prevent moral hazard but not too many to avoid excessive contingencies in the price (Berends, 2000). This confirms the finding of McAfee & McMillan (1986) that the optimal contract is usually a target-cost contract.

The information from all the three sources indicates that the Contractor's financial strength is higher than that of the Employer. This implies that the Contractor may be able to absorb more negative consequences of risks materializing than the Employer, so some of the risks should probably be borne by the Contractor (Lewendon). Nevertheless, the Employer may rather assume some risks in order not to pay the high mark-up that a risk-averse Contractor would introduce in his lump-sum price.
The results from the survey and interviews show that the Contractor has a moderate control of the costs and can estimate precisely some of the costs (machinery, personnel) but not others (e.g. those related to geological conditions or issues with the permissions from the authorities). Thus, the Contractor should be allocated the risks on which he can exert at least some control Lewendon, (n.d.). Anyway, specific risks, such as the geological risk, may stay with the Employer in any of the contract types, because the Contractor would normally not accept them.

It can be concluded with high certainty that the schedule is the most crucial factor in the project, so the proposed target-cost contract with important schedule incentives seems therefore very appropriate (Antoniou, et al., 2013b) (Berends, 2000).

The scope uncertainty makes the cost-plus or target-cost contracts more attractive, because they are more easily adaptable in case of changes, which was repeatedly claimed in the interviews, supporting Bajari & Tadelis (2001) and Antoniou et al. (2013b). However, a very changing environment could become a problem for the target cost contract, because the target needs to be updated, which may create conflicts according to the interviews and to Chan et al. (2010).

As stated in subchapter 4.3.1 and in the survey results, the project is quite complex, so contracts suitable for complex projects should be used, such as cost-plus or target-cost contracts Nkuah, (2016).

The quality does not seem to be a major reason in the project to choose a certain contract.

The Employer has low to moderate design capabilities, which would speak for a lump-sum contract according to the interviews and to Suprapto et al. (2016).

Actual costs are believed to be higher than the bid price, so a target-cost or cost-plus contract type would be most beneficial for the Contractor in this respect. If the Employer believed the same, he may have chosen a lump-sum contract for the project, so that cost overruns are borne only by the Contractor. Anyway, the actual beliefs of the parties regarding this are very difficult to assess in a project with ongoing negotiations. One reason for changing from the originally proposed lump-sum contract to the target-cost contract could be that the Owner believes that the Contractor’s bid price and bid schedule are conservative. If this is in fact the case, the Owner would have his share of savings, whereas in a lump-sum contract only the Contractor would profit of the cost savings.

As a joint venture of leading shaft sinking companies, the Contractor is very experienced and qualified. This fact makes it easier to enter target-cost or cost-plus contracts (Fuller, 1920), which coincides with the results of the interviews.

According to the information from the survey and document research, the Contractor’s capacities seem to be moderately utilised. The Employer is a junior miner, who needs to keep Project X running. These factors suggest that the negotiation power should be
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balanced and that both parties can steer the contract type to a certain extent. Thus, in this case the negotiation power should not be a major factor in the selection of the contract type.

The parties appear ready to cooperate, which is a condition to use a target-cost or cost-plus contract, in which the parties are more in contact with one another than in a lump-sum contract (Chan, et al., 2010). The Owner seems to trust the Contractor, so very strong incentives (such as in a lump sum contract) may not be required. Considering the long duration of the project of five to six years, a collaborating approach given by a target-cost contract may be more suitable for a long term relationship (Eisenhardt, 1989). This may have been a reason for choosing the target-cost contract for Project X, although none of the interviewees cited it.

The interviewees confirmed that the parties are seeking a fair contract for both parties, similarly to what Badenfelt (2008) found. This may lead them to use a balanced contract, such as the target-cost contract.

The influence of having a prior relationship in order to enter a target cost contract does not seem to be high, for instance, in Project X, the parties had never worked with each other and are foreseeing to enter a target-cost contract. This seems to contradict the findings in the literature (Badenfelt, 2008) (Suprapto, et al., 2016), although it may simply be the case that there are other more important factors in Project X that outbalance this one.

Regarding information asymmetry between the parties, there are many sides to the information, so it is very difficult to rate which party has access to more important information and if this fact influenced the contract selection.

In the interviews it was confirmed that the familiarity with the contract type surely influenced the contract selection for Project X, as each party firstly proposed a contract with which they were familiar. For instance, if the Contractor would be another company, it is probable that they would have other preferences and the project may end up with another contract type.

The easiness of contract implementation was apparently not considered in Project X, contradicting Antoniou et al. (2013b), who proposed that the difficulty to implement the contract could be a selection criterion.

According to the document research and the interviews performed, the financial cost savings in this project were rather high, because being the project timeframe long (5-6 years), the accumulated interests of the bonds to be provided for a lump-sum contract were high. Thus, these savings were a strong reason for the use of a cost-plus or target-cost contract in order to reduce the funding requirements for the project significantly.

Another factor that had not been proposed in the literature but which came up in the survey and interviews is the possible requirement of the equity owners of the Employer
to provide them with detailed information regarding the project costs. This would push the contract selection towards a contract with open books, which can provide the desired information. As explained in chapter 2, only target-cost and cost-plus contracts are usually performed with open-book accounting.

Considering the different sources, it is possible to recognize a small number of factors that seem to have had a larger influence than the others on the contract selection of Project X. These are the preferred risk allocation of the parties, the large scope uncertainty, the familiarity with the contract types of certain companies and managers, the high priority of the project schedule, the desire to create a cooperative environment and the important savings regarding financial costs. Most of the selection factors evaluated for Project X, based on their influence discussed in the previous subchapter, point towards selecting a target-cost contract with strong schedule incentives, which is the contract that has been actually selected for the Project X. Nevertheless, there are significant differences between the respondents with respect to the factors that have inclined the project towards the target cost contract, which confirms the argument that the contract selection is usually done rather superficially (Russell, n.d.) (Badenfelt, 2008).
6. Conclusions and implications

The factors that influence the selection of the contract type for international construction projects have been researched in this thesis. A thorough literature review and a preliminary interview were performed to find out possible factors influencing that choice. Normative theories on contracts, such as the principal-agent theory and theories on the optimal risk-allocation were considered. Furthermore, studies on the actual contract selection were reviewed. Then, a survey, several interviews and document research were performed. Some of the questions were intended to find out the differences between contract types that may have an influence on the contract selection in general. Additionally, project-specific questions were posed to assess the influence of those factors on the specific contract selection process for Project X. Document research was executed in order to contextualise the findings of the survey and interviews and to compare the three model contracts considered in the thesis (lump-sum, target-cost and cost-plus contracts) with real-life contracts that may be used in actual projects.

It can be concluded that many of the factors present in the literature are confirmed to have influence on the contract selection. The risk distribution desired by the parties is surely one of them. However, the effect of the risk allocation is quite complex, because the Employer may be less risk-averse, but the Contractor may be able to better manage most of the risks, so it is not clear who should be allocated the risks according to the theory. The improvement of the schedule by the target-cost contract has been confirmed. However, the cost-plus contract seems to lead to a slower project outcome than the lump-sum contract, which contradicts some of the literature sources. The cooperation between the parties seems clearly higher and dispute costs lower in target-cost contracts than in the other two model contracts studied, so this is likely to be a motive for selecting target-cost contracts. Also, aiming for a fair contract for both parties may direct the negotiation process. Other factors seem to matter less for the contract selection: the monitoring costs and in-house capabilities of the Employer and the easiness to implement the contract do not seem to be an essential factor. Interestingly, the value for money of the three contract types studied seems to be similar and thus should not affect the selection of contract type to a high extent.

From the proposed factors, some of them had a clear influence on the selection process for the contract of Project X. For instance, the preferred risk distribution, the high scope uncertainty, the distinct knowledge of the contract types, the desire to enhance the cooperation between the parties and the importance of a fast project delivery were assessed as the most determinant factors. New factors not actively present in the previous studies have also been identified as having an influence for Project X: the financial costs are higher in lump-sum contracts; the equity owners may require information regarding the costs, which implies using a contract with open-books accounting, and the negotiation power of the parties may influence their ability to negotiate the contract type.
Furthermore, it needs to be highlighted that the high variability of the respondents’ answers confirms our argument in the introduction chapter that the selection of the contract type is not being given the deep consideration it deserves by the contracting parties. The main implication for the parties is that the selection process should be analysed in more detail. The various factors have to be taken into account in a cooperative way between Employer and Contractor, so as to arrive to a satisfactory contract which is adapted to their characteristics and to those of the project.

An limitation of this thesis is the fact that one single project was researched. The characteristics and circumstances of each project are distinct, so the factors may have different influence in the selection of the contract type for different projects or there may even be new factors which play a major role. The simplification of considering only three paradigmatic contract types is also a limitation to the thesis. For these reasons, new studies could consider more types of contracts or variants of the three contracts considered here. The small number of respondents available for the research and the fact that all of them belong to the Contractor’s side are also limitations of this study.

Finally, the selection of contract type is a subject that has not been sufficiently explored by economic scholars, so it is recommended that further research is performed. This may be done by investigating the selection factors in various projects and companies. Studying a construction project from the tender phase, during project execution and up to its completion could also shed more light over the selection criteria that are actually used for contract selection. Moreover, studying in detail how the sharing ratio is chosen for a target-cost contract is also worth being performed.
Glossary

Allowed costs: In a cost-plus contract, these are the costs that the Contractor can claim to be reimbursed for.

Bid: The bid is the offer made by the Contractor to perform the works, including the financial and other conditions, such as schedule and availability.

Bid price: Budget for which the Contractor offers to perform the works.

Contractor: Party involved in the contract who is responsible for performing the works. He may perform some parts himself, while subcontracting others. He receives a compensation for his work from the Employer.

Cost-plus contract: A cost-plus or cost-reimbursable contract is a contract in which the Employer pays the Contractor his actual allowed costs and a fee to cover overhead and profit. In principle, no direct incentives are included.

Design-and-build contract: A design-and-build contract is a contract in which the Contractor will be the principal designer for the works and will also perform the works.

Dispute costs: Costs which arise if a dispute between the parties happens. Dispute costs can comprise costs of legal procedures, delay costs due to lack of agreement, negotiation costs of claims, etc.

Incentives: An incentive is a mechanism that encourages the Contractor to behave in a certain way, e.g. to reduce costs for the Employer or to deliver the project faster or with a better quality.

Information asymmetry: Information asymmetry implies that one of the parties has more relevant knowledge than the other.

Lump-sum contract: A lump-sum or fixed-price contract is an arrangement in which the Contractor agrees to provide the works for a stipulated fixed price (Rodríguez, 2016).

Monitoring costs: Costs incurred by the Employer in order to control and monitor the Contractor’s behaviour.

Moral hazard: Moral hazard is the risk that one of the parties does not act in good faith. In the principal-agent problem of construction contracts, moral hazard occurs if the Contractor acts in a way that increases his profits but which is not optimal for the Employer.

Owner or Employer: The Employer is the Contractor’s client, who engages the Contractor to perform work for him and compensates him for it.

Performance bonds: Bonds issued to the Employer to protect him against the non-performance of the Contractor. In case of non-performance, the Employer would receive a certain amount as compensation from the bank or insurance company.
Principal-agent theory: the principal-agent theory applied to a construction contract examines the relationship of Employer (principal) and Contractor (agent) in an environment with moral hazard and information asymmetry, which could be exploited by the Contractor to profit at the expense of the Employer.

Risk allocation: Distribution of the project’s risks between the parties.

Risk aversion: Tendency of the Contractor or Employer to avoid bearing risks.

Scope of works: The scope of works is the total amount of works to be performed by the Contractor, usually subdivided and scheduled.

Standard contract: Template contract drafted by recognized institutions which can serve as a start point for the negotiation of a contract. Usual standard contracts for construction projects are NEC3 and FIDIC contracts.

Target cost: Cost agreed by the parties as goal for the project. Actual costs higher than the target cost will be considered as having produced excess expenses, a share of which will be paid by the Contractor. Lower costs than the target lead to sharing the savings.

Target-cost contract: A target-cost contract is an arrangement in which, apart from the actual costs and the fee received by the Contractor in a cost-plus contract, there is an incentive to decrease costs. Thus, a target cost is defined and the actual costs are compared with it. The difference (savings or excess expense) between them is shared between the parties.

Tender: Offer or bid submitted to the Employer, containing detailed information on conditions associated with a potential contract (WebFinance Inc., 2017b).

Unit-price contract: A unit-price contract a type of contract in which there are fixed prices, which include usually overhead and profit, to be paid for each unit of work. The project price can be adapted to the amount of work to be performed (The Project Definition, 2015).
Reference list


NEC, 2014. A comparison of NEC and FIDIC, s.l.: s.n.


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APPENDICES
Appendix A: Survey questionnaire
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Survey for MBA Master Thesis

Important: Please read these notes before starting the survey.

**NOTES**
The survey and the whole project will be anonymized in the master thesis. The answers to the survey will only be used for the purpose of research and writing the master thesis. If you do not know how to respond to a question, you may leave it unanswered.

**Definitions:**
- **Contractor:** Joint Venture of shaft sinking companies
- **Employer:** Client, future mine owner
- **Lump-sum contract:** A lump-sum contract or stipulated sum contract will require that the Contractor agrees to provide specified services for a stipulated or fixed price.
- **Target-cost contract:** Target-cost contracts pay the Contractor its allowed expenses, a fee to account for its overhead and profit, plus an incentive which can be positive (if the future costs are lower than the target cost) or negative (in the opposite case).
- **Cost-plus contract:** these contracts pay a Contractor for all of its allowed expenses plus a fee for overhead and profit.

<table>
<thead>
<tr>
<th>Block 1: Introductory questions</th>
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<tbody>
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<td>Please choose the most suitable answer</td>
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<table>
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<tr>
<th>QUESTION</th>
<th>ANSWER</th>
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<tbody>
<tr>
<td>1.1. Are you employed by the Contractor or by the Employer?</td>
<td></td>
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<tr>
<td>1.2. What is your area of expertise: Technical/Commercial/Legal?</td>
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### Block 2: General Questions About Contract Types

Choose your preferred answer for each contract type (lump-sum, target-cost, cost-plus, if you have experience with them) between: Very High, High, Moderate, Low, and Very Low. If you are answering on paper, you may abbreviate the answers as VH, H, M, L, VL.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>ANSWER 1 (Lump-sum contract)</th>
<th>ANSWER 2 (Target-cost contract)</th>
<th>ANSWER 3 (Cost-plus contract)</th>
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<tbody>
<tr>
<td>2.1. How is the degree of fairness of the risk distribution between Employer and Contractor in the contract?</td>
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<td>2.2. How is the degree in which the risks are distributed to the party which can best manage them at the least possible cost?</td>
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<tr>
<td>2.3. How high/low is the value received by the Employer for his money?</td>
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<td>2.4. How high/low are financial costs (costs of interest and fees of advance-payment bonds, performance bonds, retention bonds, off-site materials Bonds...) when using this type of contract?</td>
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<td>2.5. How high/low is the probability the parties entering a legal process and how high/low would legal costs be in case of dispute when using this type of contract?</td>
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<td>2.6. In which degree the use of this contract tends to speed up project completion?</td>
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<td>2.7. In which degree the use of this contract tends to improve the quality of the project outcome?</td>
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<td>2.8. To which degree is the cooperation between Employer and Contractor enhanced by this contract?</td>
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<td>2.9. To which degree is this contract suitable for projects with technical/organizational complexity?</td>
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<td>2.10. How high/low was your knowledge of this kind of contract before being involved in the project?</td>
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<tr>
<td>2.11. How high/low are the required trust and commitment between the parties before signing this contract?</td>
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<td>2.12. To which degree are adjustments to this contract easy?</td>
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<td>2.13. To which degree is this contract suitable when one party has more knowledge, e.g. of the costs or of other issues than the other?</td>
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<tr>
<td>2.14. To which degree is this contract easy to implement?</td>
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<tr>
<td>2.15. How high/low is the percentage of the total risk assumed by the Employer in this contract?</td>
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</table>
### Block 3: Questions regarding the Project X (anonimized project in the thesis)

*Choose your preferred answer between: Very High, High, Moderate, Low, Very Low. If you are answering on paper, you may abbreviate the answers as VH, H, M, L, VL.*

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>ANSWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. How is the unwillingness to take risk of the Contractor relative to the Employer in this project?</td>
<td></td>
</tr>
<tr>
<td>3.2. How is the financial strength of the Contractor relative to that of the Employer in this project?</td>
<td></td>
</tr>
<tr>
<td>3.3. How is the ability of the Contractor to estimate the costs in advance in this project?</td>
<td></td>
</tr>
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<td>3.4. How is the criticality of delivering this project on time?</td>
<td></td>
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<td>3.5. How is the criticality of the quality in this project?</td>
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<tr>
<td>3.6. How are the in-house design &amp; control capabilities of the Employer?</td>
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<td>3.10. How is the degree of utilization of the capacities of the Contractor now? (High utilization = there is work for all personnel)</td>
<td></td>
</tr>
<tr>
<td>3.11. How is the degree of definition of the project scope? (The scope is very defined if the design is complete and clear.)</td>
<td></td>
</tr>
<tr>
<td>3.12. How is the degree of complexity of the project from the organizational and technical points of view?</td>
<td></td>
</tr>
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<td>3.13. How is the willingness of the parties to cooperate with each other?</td>
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<td>3.17. How is the degree to which the easiness of implementing the contract has been considered?</td>
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<td>3.18. How was your degree of involvement in the negotiation of the contract?</td>
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</tr>
<tr>
<td>3.19. How is the amount of time that have you been working in this project?</td>
<td></td>
</tr>
</tbody>
</table>
Final Block

These are open answer questions; please answer them in the space provided below the questions.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>ANSWER:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1. Do you wish to add any other factors which may be relevant to the selection of the contract type that are not included in this survey yet?</td>
<td>(Open answer, answer below)</td>
</tr>
<tr>
<td>4.2. Usually, mining projects are performed on a lump sum (or unit price) basis, which reasons have caused the change from a lump sum to a target cost contract?</td>
<td>(Open answer, answer below)</td>
</tr>
<tr>
<td>4.3 Which is the order of the priorities in the project: budget, schedule and quality?</td>
<td>(Answer ordering the three, answer below)</td>
</tr>
</tbody>
</table>

ANSWER:
Appendix B: Interview questions
### Interview for MBA Master Thesis

#### QUESTIONS TO BLOCK 2

**Why did you rate the fairness in this way? Which is the most balanced contract?**

**Why did you rate the risk allocation in this way?**

**Why did you answer that contract type X gives the most value?**

**Why did you answer that? Do lump-sum contracts imply less financial costs?**

**Why are legal costs higher with lump-sum contracts?**

**Why is target-cost contract quicker, and why is lump-sum quicker than cost-plus or otherwise (according to the interviewee)? Two contrary arguments: cost-plus can be entered before design is complete, but lump-sum implicitly incentivizes quicker completion.**
Why do cost-plus and target-cost improve quality? Which improves quality more, cost-plus or target-cost and why?

Why do cost-plus and target-cost improve cooperation? Which improves cooperation more, cost-plus or target-cost and why?

Why are target-cost and cost-plus more suitable for complex projects?

Do you think being familiar with a contract may make you more prone to choose it for a project?

Why does lump-sum does not need so much trust?, for respondent 4: why does lump-sum need more trust?

Are unit price contracts significantly easier to adapt than lump-sum ones?
Why are target-cost and cost-plus more suitable when one party has more knowledge? Or lump-sum, if answered that.

Why is lump-sum easier to implement? Is target-cost significantly more difficult to implement than cost-plus?

Why lump-sum and target-cost allocate similar risk for Employer (respondents 3 and 5)?
Respondent 4: why lump-sum leaves the Employer with very high risk?

QUESTIONS TO BLOCK 3

Why is the Contractor more risk-averse than the Employer (he is e.g. more diversified!)?

Why did you rate the ability to estimate costs as...?

Would the low design capabilities of the Employer not speak for a lump-sum contract? Can the Employer follow the Contractor's design? Can the Employer control the accounting books during construction?
Could the beliefs of the parties about the bid price and actual cost be a factor for being willing to use a certain contract?

Does the desire to avoid deceitful attitudes conduct to using a target-cost contract?

Does the fact of having a qualified Contractor make it possible to use target-cost or cost-plus contracts?

Can the capacity utilization influence the negotiation power of the Contractor and oblige him to accept the contract type desired by the Employer?

Does the low degree of definition make a target-cost or cost-plus contract more attractive?

Did the project complexity play a role in the selection of the target-cost contract type?
<table>
<thead>
<tr>
<th>Is the fact that the parties had not worked together an obstacle for a target-cost or cost-plus contract?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is achieving a fair contract for both parties a concern?</td>
</tr>
<tr>
<td>Is the fact that both parties possess similar knowledge about the project a factor to use a lump-sum, target-cost or cost-plus?</td>
</tr>
<tr>
<td>Was the easiness to implement the contract considered? (Very diverse answers in the survey)</td>
</tr>
</tbody>
</table>

**QUESTIONS TO BLOCK 4**

Can you comment on these possible factors for contract selection: level of market activity, region (drives initial selection of contract type by Client), ground conditions, certainty of design?

Do you think the selected contract type (target-cost) is the right one for the project? Could it be that the information requirements of the funders push towards an open-books policy?
According to the survey responses, the target-cost is probably a good contract if the schedule (or quality) is the priority rather than the budget, is that right?

Which are the three factors that most influence the selection of contract type?
Appendix C: Survey responses database
<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Respondent 1</th>
<th>Respondent 2</th>
<th>Respondent 3</th>
<th>Respondent 4</th>
<th>Respondent 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. How is the degree of fairness of the risk distribution</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>between employer and contractor in the contract?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2. How is the degree in which the risks are distributed to the party</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>which can best manage them at the least possible cost?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3. How high/low is the value received by the Employer for his money?</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2.4. How high/low are financial costs (costs of interest and fees of</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>advance-payment bonds, performance bonds, retention bonds, off-site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>materials bonds...) when using this type of contract?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5. How high/low is the probability the parties entering a legal</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>process and how high/low would legal costs be in case of dispute when</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>using this type of contract?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6. In which degree the use of this contract tends to speed up project</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>completion?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7. In which degree the use of this contract tends to improve the</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>quality of the project outcome?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.8. To which degree is the cooperation between employer and contractor</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>enhanced by this contract?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.9. To which degree is this contract suitable for projects with</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>technical/organizational complexity?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.10. How high/low was your knowledge of this kind of contract before</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>being involved in the project?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.11. How high/low are the required trust and commitment between the</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>parties before signing this contract?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.12. To which degree are adjustments to this contract easy?</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2.13. To which degree is this contract suitable when one party has more</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>knowledge, e.g. of the costs or of other issues than the other?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.14. To which degree is this contract easy to implement?</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.15. How high/low is the percentage of the total risk assumed by the</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Employer in this contract?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Selection of contract type in construction contracts

**Blekinge Institute of Technology**

**Master Thesis Diego Sancho Calderón 82**

### QUESTION

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Respondent 1</th>
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<th>Respondent 5</th>
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<tr>
<td>3.1. How is the unwillingness to take risk of the contractor relative to the employer in this project?</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3.2. How is the financial strength of the Contractor relatively to that of the Employer in this project?</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3.3. How is the ability of the contractor to estimate the costs in advance in this project?</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3.4. How is the criticality of delivering this project on time?</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>3.5. How is the criticality of the quality in this project?</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
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<tr>
<td>3.6. How are the in-house design &amp; control capabilities of the Employer?</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3.7. How is your prediction of the actual future costs relatively to the Contractor's bid price?</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
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<tr>
<td>3.8. How is the desire of the Employer to influence Contractor’s motivation and avoid deceitful attitudes?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
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</tr>
<tr>
<td>3.9. How is the qualification of the contractor for the project execution?</td>
<td>4</td>
<td>5</td>
<td>4</td>
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<td>5</td>
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<td>3.10. How is the degree of utilization of the capacities of the contractor now? (High utilization = there is work for all personnel)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3.11. How is the degree of definition of the project scope?</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3.12. How is the degree of complexity of the project from the organizational and technical points of view?</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3.13. How is the willingness of the parties to cooperate with each other?</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.14. How is the frequency with which the parties had worked together before this project?</td>
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<td>1</td>
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<tr>
<td>3.16. How is the amount of superior knowledge by one of the parties, e.g. regarding project conditions, cost estimations, funding authorities approvals, etc.?</td>
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<td>3</td>
<td>3</td>
<td>4</td>
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<td>3.17. How is the degree to which the easiness of implementing the contract has been considered?</td>
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<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3.18. How was your degree of involvement in the negotiation of the contract?</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3.19. How is the amount of time that have you been working in this project?</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
## QUESTION 4.1. Do you wish to add any other factors which may be relevant to contract

<table>
<thead>
<tr>
<th>Respondent 1</th>
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<th>Respondent 3</th>
<th>Respondent 4</th>
<th>Respondent 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td>-</td>
<td>The general situation of the company plays a role (complete capacities utilised = Strength for negotiation; no)</td>
<td>Level of market activity, region drives initial selection by Client whether to go for LS, UR or CR</td>
<td>Scope of project continues to change, thus providing a fixed price bid is impossible</td>
</tr>
</tbody>
</table>

4.2. Usually, mining projects are performed on a lump sum basis, which

<table>
<thead>
<tr>
<th>Respondent 1</th>
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<th>Respondent 4</th>
<th>Respondent 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I disagree, many mining projects in Europe are performed under a unit rate contract, and internationally on a target price contract, as he tries to combine the (expected) low cost</td>
<td>The Client has chosen to go for a target price approach, as he tries to combine the (expected) low cost</td>
<td>Unit price contract (lump sum) = large risk, large profit</td>
<td>Target cost contract = small risk, small profit</td>
<td></td>
</tr>
</tbody>
</table>

4.3. Which is the order of the priorities in the project: budget, schedule, and quality?

<table>
<thead>
<tr>
<th>Respondent 1</th>
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<th>Respondent 3</th>
<th>Respondent 4</th>
<th>Respondent 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>schedule, budget, quality</td>
<td>schedule is the clear priority. Reason is the structure of financing in the background. They have to deliver the project on time.</td>
<td>Budget, schedule, quality</td>
<td>Schedule, budget, quality (although budget and quality is likely of equal importance on this project)</td>
<td>The client is pushing schedule, but without quality, which has a direct influence on safety, nothing else matters. This quality, schedule, budget (understanding that they all drive each other)</td>
</tr>
</tbody>
</table>
2.1. Degree of fairness

Degree of fairness of the different contracts

2.2. Degree of efficient risk allocation

Degree of efficiency of the risk allocation of the different contracts
2.3. Value for money

Value for money received by the Employer in the different contracts

2.4. Amount of financial costs

Amount of financial costs for the different contract types
2.5. Probability of legal process

![Probability of legal process graph]

Probability of legal process for the different contract types

2.6. Degree of speed up

![Degree of speed up graph]

Degree of speeding up the project for the different contract types
2.7. Quality outcome

Quality outcome for the different contract types

2.8. Enhanced cooperation

Enhanced cooperation by the different contract types
2.9. Suitability for complex projects

Enhanced cooperation by the different contract types

2.10. Knowledge of contract type

Knowledge of contract type by the respondents
2.11. Required trust and commitment

The chart illustrates the required trust and commitment to enter the different contracts by respondents. The contract types are LS, TC, and CP, and the respondents are labeled from 1 to 5. The chart shows the level of trust and commitment for each contract type, with different colors representing each respondent.

2.12. Degree of easiness of contract adjustments

The chart displays the degree of easiness of contract adjustments for the different contract types. The contract types are LS, TC, and CP, and the respondents are labeled from 1 to 5. The chart shows the level of easiness for each contract type, with different colors representing each respondent.

Degree of easiness of contract adjustments for the different contract types.
2.13. Degree of suitability in case of information asymmetry

2.14. Degree of easiness to implement
2.15. Percentage of total risk allocated to Employer

![Bar chart showing percentage of total risk allocated to Employer in different contract types.](chart1.png)

Percentage of total risk allocated to Employer in the different contract types

3.1. Contractor to Employer relative risk aversion

![Bar chart showing relative risk aversion of Contractor relative to Employer.](chart2.png)

Relative risk aversion of Contractor relative to Employer in Project X
3.2. Contractor to Employer relative financial strength

3.3. Ability of the contractor to estimate the costs in advance

Ability of the Contractor to estimate the costs in advance in Project X
3.4. Criticality of delivering on time

Criticality of delivering on time in Project X

3.5. Criticality of the quality

Criticality of the quality in Project X
3.6. In-house design capabilities of the Employer

In-house design capabilities of the Employer in Project X

3.7. Prediction of actual costs related to bid price

Prediction of actual costs related to bid price in Project X
3.8. Desire of the Employer to influence Contractor’s motivation

Desire of the Employer to influence Contractor’s motivation in Project X

3.9. Qualification of the Contractor for the Project

Qualification of the Contractor for the Project X
3.10. Degree of utilization of the Contractor's capacities

3.11. Degree of definition of project scope
3.12. Degree complexity of Project X

Degree complexity of Project X

3.13. Willingness of the parties to cooperate

Willingness of the parties in Project X to cooperate
3.14. Frequency of previous work between the parties

Frequency of previous work between the parties in Project X

3.15. Consideration of fairness

Consideration of fairness in Project X
3.16. Amount of information asymmetry

Amount of information asymmetry in Project X

3.17. Consideration of easiness of contract implementation

Consideration of easiness of contract implementation in Project X
3.18. Degree of involvement in the contract negotiation

3.19. Amount of time worked on the project