

**KEYWORDS** ■ contracting process ■ grounded theory ■ fixed price contract  
■ time and material contract ■ PS 2000 contract

# GROUND THEORY STUDY OF THE CONTRACTING PROCESS IN AGILE PROJECTS IN NORWAY'S SOFTWARE INDUSTRY

✓ **Lubna Siddique**

University of Oslo Norway, PhD student  
Department of Informatics  
lubnas@ifi.uio.no

✓ **Bassam A. Hussein**

Norwegian University of Science and Technology  
Trondheim, Associate Professor  
bassam.hussein@ntnu.no

## ✓ ABSTRACT

This paper provides practical insights into the challenges associated with the contracting process in agile projects in the Norwegian software industry. We conducted interviews with 32 agile practitioners from 25 different software development organizations in Norway. The data were analyzed using grounded theory. This analysis found several concepts that gave rise to two core categories, namely challenges involved in the contracting process and contracting process management. We used Glaser's six Cs coding family to represent the data analysis. The findings revealed the causes of the challenges related to the contracting process. The consequences are also discussed in the paper. Based on the interview data analysis, we present contracting process management strategies to overcome the challenges related to the contracting process.

## 1. Introduction

Contracting is considered to be a complicated process in software development because of the high levels of uncertainty and complexity inherent in software development [1]. According to Coldeway [2], "poorly constructed contracts have the potential to nullify any business objective the project has." Most of the standard software contracts were designed on the basis of "the principle and philosophy of waterfall projects" [3]. These contracts are based on the waterfall approach of long delivery cycles, distinct development, and sequential phases. This philosophy has led to the assumption that suppliers will follow all the steps in sequence and any failures that occur are the supplier's fault [3].

Agile project contracts and traditional project contracts are similar in their structural and legal aspects. The two areas in which they differ are the "approach to" and "understanding of operational process and delivery and how this is captured in or intersects with contract" and the fact that agile contracts are written with elements of collaboration, learning, and evolution [4]. Agile software projects put special emphasis on customer collaboration over contract negotiation [4].

In traditional projects, contracts are written to contain every detailed specification of the requirements before the contract is signed.

Contracts written in this way are associated with increased project risk [1].

In software projects, requirements can change during the development process; therefore, it is not possible to state the exact scope of the work at the start of the project. Agile methodologies were introduced in response to this unpredictable nature of software projects. Agile proponents believe that software projects have an inherently unpredictable nature, which makes it hard to fix everything at the start and to avoid failures. However, if a failure occurs, both parties need to fix it in a time- and cost-effective way to minimize the loss for both parties. Although development methodologies are adopted to work in an agile way, other relevant processes are not updated accordingly. One such process area is contracting.

To identify the challenges associated with the contracting process, we decided to conduct a grounded theory study of the process. The findings and analysis are based on interviews with 32 agile practitioners from 25 different software development organizations in Norway. Of the 32 participants, 26 were project managers (*19 project managers were from the supplier side, 4 were from the customer side, and 3 were project managers of companies conducting in-house development*), 4 were developers, and 2 were solution architects. Their organizations varied from consulting organizations to in-house development organizations. The interview analysis was performed using grounded theory. Through our analysis, we found challenges concerning the contracting

process and how contracting process management should be conducted. The interview findings showed that four types of contracts are mostly used in agile projects in Norway's software industry. Before we present our findings, the different types of contracts that are referred to in our findings are briefly presented. These are fixed-price contracts, time and material (*T&M*) contracts, target cost contracts, and PS 2000 contracts.

1.1 Fixed-Price Contracts

Fixed-price contracts mean price, scope and time contracts. These types of contracts are favored by customers because they provide them with all the incentives. In these types of contracts, all the risk is on the supplier side [5]. Fixed types of contracts are usually used by public companies and are granted through a bidding process, which itself involves considerable risk for the supplier [5].

1.2 Time and Material

In time and material (*T&M*) contracts, the supplier is paid for the amount of time that it spent on the project. In this type of contract, most of the risk lies on the customer side. Although this type of contract handles the uncertainties and complexities that are inherent in software projects well, convincing customers to use this type of contract is very difficult and a large amount of built-in trust is required [5].

1.3 Target Cost Contracts

This type of contract lies in between the previous two types of contracts. In fixed-price contracts, the supplier takes all the risk, and in time and material contracts, the customer takes the risk, while in target cost contracts, the risk and the obligation to achieve the project goal are shared between the two parties. A target cost contract needs both parties to understand that software project requirements are uncertain and that they must work collaboratively to attain the goals. If the price of the project exceeds the estimated price, the two parties will share it, and if there is profit in the project (*by delivering it for less than the agreed cost*), it will also be shared between the customer and the supplier [5].

- Poppendieck and Poppendieck [5] presented two models:
- 1) Cost plus fixed fee. This means that if the supplier fails to deliver the project at the agreed cost, he will be paid an additional fee along with the original project cost.
  - 2) The supplier will reduce the rates if the project cost exceeds the target cost.

Target cost contracts can help to foster collaboration between parties [4].

1.4 PS 2000 Contract

This contract has two variations:

- 1) PS 2000 Standard (Version 3.1)
- 2) PS 2000 Agile (Version 3.1)

The PS 2000 contract is a software development contract designed for iterative development based on integrated cooperation between the customer and the supplier. The main focus of the contract is on the process rather than on deliverables. PS 2000 contracts lie in between fixed-price and time and material contracts. They are closer to time and material than fixed-price contracts. The contracts include the following important parameters, which can be adjusted according to the needs of the project:

- target price
- delivery time
- incentives and penalties.

PS 2000 Agile (*Version 3.1*) contracts address issues related to complexity, uncertainty, and clear role descriptions. PS 2000 contracts focus on uncertainty management, close cooperation of the client and the customer, and a procedure for resolving conflicts [6].

The main advantages of PS 2000 contracts are that they contain elements that help to engender greater mutual trust between parties, handle change management, and include target cost elements. Their main disadvantage is that they require a large amount of upfront work, like fixed-price contracts. These contracts handle each iteration as a separate contract [6].

2. Methodology

We conducted interviews with 32 agile practitioners from 25 different software development organizations in Norway. These organizations varied from consulting organizations to in-house development organizations. The practitioners had long experience of working in the software industry, ranging from 3 to 40 years. Most of the software practitioners had been using agile methodologies since their inception or even started working with the methodology before it was named agile. The products and services offered by the practitioners' organizations include web-based applications, front- and back-office applications, and software development services. The interviewed practitioners include product owners, developers, a system developer, project managers, and a project architect. Through various media, including face-to-face, via email, and via Skype meetings, we conducted semi-structured interviews, which enabled us to view the research question from multiple perspectives.

Since the purpose of our study was to create an understanding of the contracting process in the real world of agile software projects, we chose to follow the inductive case study approach in accordance with the guidelines proposed in the literature [7]. The inductive approach allows "research findings to emerge from the frequent, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies" [9].

Inductive approaches help us to understand "meaning in complex data through the development of summary themes or categories from the raw data" [9]. We chose a descriptive case study for our research because this type of case study helps to describe a phenomenon in its real context. It also helps to develop informative conclusions [8].

We used the non-probability sampling technique for our research [10], specifically purposive sampling. This technique was selected in view of the purpose of the research. We deliberately contacted participants who had relevant experience related to the research questions. We searched for participants on the Internet, and after investigating their profiles, we sent them an invitation to take part in the study; individuals who were interested in participating in the research replied and accepted. After agreeing on the time and place of the interview, we conducted interviews of 20–25 minutes' duration. Data were collected over a period of almost 4 years from 2011 to 2014.

Our priority throughout this research was to ensure the anonymity of our interviewees and their organizations. Thus, we refer to the interviewees throughout this research as respondents AP1 to AP32.

This study presents limitations that affect its generalizability. This is because it is strongly context-specific, as it was mostly performed within the Norwegian context. Furthermore, we collected the data not with specific project cases in mind but rather based on the collective experiences of the informants.

2.1 Research Question

Although a common misconception about grounded theory is that there should not be a defined research question at the start of the research, it was necessary in this study because investigating a phenomenon requires an initial research question [11]. The purpose of this question is to identify the phenomenon, and the researcher should ensure that the question

remains at the descriptive level. To summarize how a research question should be defined in a grounded theory study [11], it should:

- Be open-ended
  - Look into the phenomenon and try not to make any assumptions about it
  - Never use existing theories as a basic construct
  - Investigate the action and process rather than the states and condition.
- Bearing the above-defined recommendations in mind, we defined the following research question:
- How does the contracting process work in agile software projects?
  - We limited the scope of our study, and the following parts of the contracting process are not covered:
  - Bidding process mechanism details
  - Legal complications (in the case that both parties fail to execute the contract according to the predefined terms and conditions).

2.2 Procedure Adopted for Interview Analysis

The research method that we used for our study is grounded theory, which we chose because it helps to generate an understanding of the phenomenon in the current scenario. After delving into the current scenario, different problems can be identified that make the process under study more problematic. Another purpose of using grounded theory is that it helps to develop a new theory [12].

The very first step is the collection of data, which was performed through interviews. After transcribing the interviews, an analysis was performed. We used open coding for our research. As codes are developed, they are compared with the previous codes from the same interview and from other interviews. This is called the constant comparison method for data analysis and it was used for grouping the codes into concepts. These concepts were then combined on a higher level of abstraction called categories [13] [14].

As a result of the analysis, the following concepts were generated: formal documentation, unequal sharing of risk, using agile with the waterfall mindset, a fixed scope versus fixed objectives, contract selection based on preferences, and inadequate customer collaboration. All these concepts formed the category of challenges involved in the contracting process.

The other set of concepts includes the factors to be clarified before writing a contract, trust, right selection of contract type, frequent-delivery option, replacing risk sharing with gain sharing, focusing more on functionality than on budget, customer involvement, and adopting strategies for avoiding conflicts. These concepts gave rise to a category called contracting process management.

Since contracting process management was an important category that affected the core category, we continued to code selectively for this category [15]. For insights into the categories developed from grounded theory data to emerge, Glaser [16] suggested using the six Cs coding family, which we use to present our data analysis results.

3. Results

In this section, we will present our theory. We used Glaser's six Cs coding family [16] to illustrate our theory of contracting process management (Figure 1).

The category lies at the center of the diagram. The relation of each of the six Cs to the category is represented in the diagram pointing towards its subsection (Figure 1).

Selected quotations from our interviews are presented in the following section to provide a better explanation of the concepts. We interviewed 32 practitioners, but due to the space limitation, we cannot discuss all the underlying points, concepts, or codes from the interviews that laid the foundation of the codes and categories.



3.1 Context

We conducted interviews with agile practitioners from different software development organizations in Norway. A detailed description is given in section 2.

3.2 Condition

Software development contracts are based on the “principles of waterfall projects, which are chronologically scoped in design and execution, with an agreed statement of requirements up-front, governed by change control” [17]. This waterfall-based nature of contracts generates many challenges when they are used for agile projects without making the necessary adaptation.

3.3 Causes

From the interview data, we identified the causes of problems in the contracting process. These include formal documentation, unequal shares of risk, using agile with the waterfall mindset, a fixed scope versus fixed objectives, contract selection based on preferences, and inadequate customer collaboration (Figure 1).

3.3.1 Formal documentation

The documentation requirement varies with the type of contract used. According to the respondents, fixed-price contracts require considerable upfront work, which is opposed to the agile philosophy. The respondents stated that PS 2000 contracts also require a great deal of work in advance. The interview findings suggested that PS 2000 contracts are the second most used type in Norway. They require every minor description to be written down. For large projects, it takes months to complete this preliminary work.

Another problem with using PS 2000 contracts is that “PS 2000 agile demands extremely professional management and involves scope management and architecture involvement whole way not user experience resources are extremely important” (AP26).

According to the respondents, PS 2000 contracts have the following drawbacks:

- 1. Many customers are not experienced and they do not know how the project will work when the contract is used.
- 2. From the documentation, it seems like the traditional way in which the price is given for the whole project.

3.3.2 Unequal sharing of risk

The interview findings suggested that T&M contracts are the most used type in agile projects, but its practitioners also perceived some drawbacks. According to the respondents, in T&M contracts, the supplier's incentives are not the same as the client's:

- The problem with time and material contracts is that it places all the risk on the customer side. (AP29)
- According to AP26, “if used correctly, PS2000 gives a fair share of risk.”

According to the respondents using PS 2000 contracts, this contract type gives equal shares of risk, unlike fixed-price contracts, but when it comes to the delivery part, the supplier still has a greater share than the customer, so the supplier has to conduct structured project management to ensure that delivery occurs in the time frame initially agreed.

According to the respondents, target price contracts provide some risk sharing:

- Target price is almost the same as fixed price except that you (both customer and supplier) have a share in the risk. (AP18)
- The respondents believed that the issue regarding contracts is to find the right balance in risk sharing. In their opinion, T&M contracts have very little risk (on the supplier side).

The interview findings suggested that most public organizations work with fixed-price contracts and the process of granting projects is based on the bidding process, but this process also has drawbacks. Since suppliers have to win a project through a bidding process, a considerable amount of risk lies on the supplier side.

3.3.3 Using agile with the waterfall mindset

According to the respondents, for fixed-price contracts, the specifications need to be made upfront, so the approach appears to be more like the traditional waterfall approach than the agile approach. For any kind of changes, change orders have to be made. The respondents reported that public organizations prefer to use fixed-price contracts, while practitioners find it hard to use these contracts with agile projects:

- Fixed-price contracts are a problem, especially if they want to have a fixed price, because if it is fixed price you will have fixed specifications and I do not think it is possible to have fixed specifications because they are changing all the time and especially you have discussions all the time. (AP18)
- With fixed price you can't do agile. (AP31)

The respondents considered that using fixed-price contracts makes companies prone to more conflicts:

- We have conflicts because we have more fixed-price contracts ... if it is fixed price fixed scope, I wouldn't say it is agile. In fixed price, the customer wants as much functionality as possible and the vendor is most likely to earn quite as high as possible. (AP29)

Public organizations grant projects through a bidding process, which is not an agile way of working. For time and material contracts, customers often want to know the price in advance, which is hard to calculate.

3.3.4 Fixed scope versus fixed objectives

According to the respondents, one of the issues that they encounter is that customers have fixed objectives but they often confuse them with a fixed scope:

- The main disadvantage of agile projects (and hence contracts which support them) is that they (customers) counter the intuitive idea that you have a fixed scope in mind when they purchase a project. Typically a customer has rather fixed objectives, but they are often confused with a fixed scope. So, communication and clarity issues are critical. (AP26)

The respondents' view about the disadvantage of target price contracts is that they limit the ability of the project to make use of experience as the project progresses. However, compared with fixed-price contracts, a typical target price contract leaves more room for interpretation.

3.3.5 Contract selection based on preferences

Both customer and supplier have personal preferences for certain types of contract and these are based on the advantages and disadvantages offered by that particular contract type. The interview findings revealed that the respondents from the suppliers' side prefer T&M contracts. The reason for this choice, according to them, is that T&M contracts are the most flexible for use with agile development and have the lowest risk for suppliers. Since most of the respondents were from the supplier side, our analysis concluded that T&M contracts are the most used type. The respondents thought that T&M contracts are mostly preferred in a situation in which customers have little idea of what they are having developed. However, if customers have worked with the target process first, they will prefer to use a target price contract, because it gives equal shares of risk to the two parties.

PS 2000 and incremental delivery contracts are the second and most used contract type, and fixed-price contracts are third, according to the respondents. Some companies use target price contracts.

- We [company] have a draft of an agile contract based on sequences of sprints with a stop clause for graceful shutdown of the project. (AP4)

The respondents reported that customer companies prefer to use contract types with which they already have experience. Practitioners believe that in target price contracts, the customer and the supplier have the same targets. If the supplier manages to deliver the final product more quickly and better than anticipated, then both the customer and the supplier will benefit.

Some respondents use a mix of fixed-price and time and material contracts. The respondents thought that target price contracts are difficult to administer:

- Going for a target price where you have goals to win if you

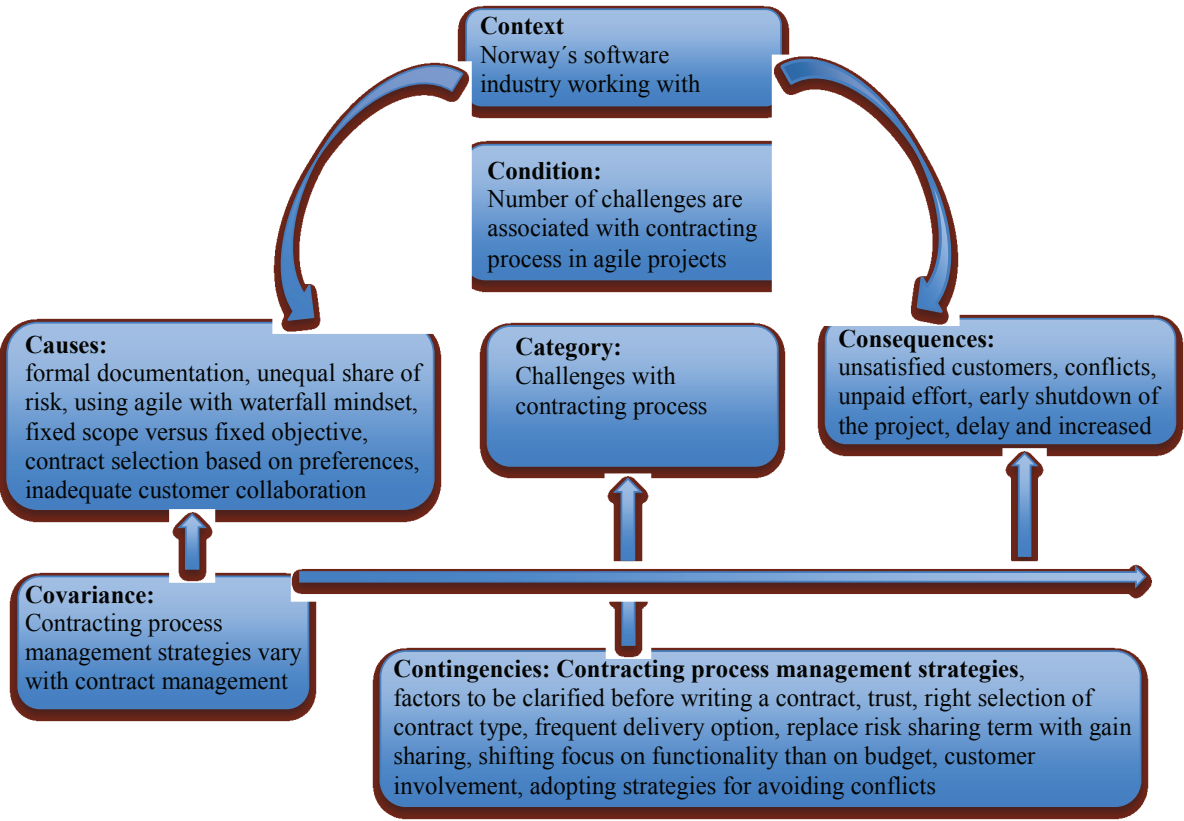


FIGURE 1: The theory of contract process management depicted using the Six C's model (Context, Condition, Causes, Consequences, Contingencies, and Covariance).

are under or over budget, that is a complex model; it's not many that are mature enough to have that kind of contract. Time and material and fixed price are familiar things. (AP27)

The respondents believed that target price contracts work better than fixed-price ones:

- Compared to fixed price, a typical target price contract leaves more room for interpretation. (AP9)
- Suppliers prefer the type of contract in which they have the least risk. Customers want contract types in which they have full control, since they are investing money. For example, one of the respondents reported that:
  - It depends on the customer which type of contract they want. A lot of public sector organizations we are working with require us to be totally responsible for the results; therefore, they want fixed price. This is because they want to have full control. If any change comes they are required to submit a change request. (AP27)

3.3.6 Inadequate customer collaboration

In agile projects, close customer communication and collaboration are needed. Most respondents had faced the problem that the product owner is not actively involved in the project.

- I think when a customer does not have time for us that is a problem, because the product owner is so busy working with other things, so then I (the project manager) have to act as product owner by proxy. (AP28)
- The respondents believed that having customer collaboration and communication in place during the development of the project can help to achieve successful deliveries.
  - If customers work in much more collaboration, then we have very good experience of delivering results using time and material contracts. (AP27)

According to the respondents, as long as the communication between the supplier and the customer works well, they do not face many problems regarding project development.

Inadequate customer collaboration can also cause delays in the project delivery:

- Customers often delay us and that is the challenge ... they (customers) don't really care because the only consequence for them is they pay less each hour, so we have to really push and make demands. (AP15)

3.4 Consequences

Not being able to manage contracts properly can have severe consequences for the successful delivery of the projects. The problems include unsatisfied customers, conflicts, unpaid effort, early shutdown of projects, delays, and increased costs (Figure 1).

3.4.1 Unsatisfied customers

Customer satisfaction is an important success criterion for any kind of project. According to some researchers, customer satisfaction is one of the most important criteria for a project [18] [19] [20]. Customers can be satisfied only if they

see that they are gaining more value for the money that they invested. If customers do not receive the required features, they will be unsatisfied.

3.4.2 Conflicts

If the contracting process is not handled properly, it can give rise to many conflicts between customers and suppliers that can prove to be disastrous for the future customer-supplier relationship. The respondents believed that trust plays an important role in winning a project.

One of the conflicts that quite often arise regards roles and responsibilities.

- We are using a PS 2000 contract in the current project. It is difficult because using that we have not been really agreeing on who should be responsible for what and how late in the process the customer can make changes. (AP15)

From the customer's point of view, if a project has a fixed-price or target price contract, any kind of change needs to be made through the proper change management process. The supplier accepts a change order, but since it is not part of the contract, the client has to pay extra.

Two of the project managers shared their experience in which the project manager (*from the customer side*) was not particularly involved; therefore, they faced conflict situations regarding product delivery. Both hired an external party to solve the conflict. This example shows the effect of a lack of close customer collaboration.

One of the project managers asserted that among the challenges involved in contracts is the fact that they do not contain information about the detection of responsibilities in the case of failure:

- One of the risks for which a contract contains no details is what happens if we don't deliver or if the customer is not happy with the end project results. The second thing is detection of responsibility in the case of failure. (AP8)

3.4.3 Unpaid effort

According to the respondents, a great deal of effort is exerted to prepare to enter bids for projects in government organizations and this effort is unpaid if the supplier loses the contract.

PS 2000 contracts require a very detailed description of the project, which also takes considerable time, but all this effort is unpaid and the supplier has to bear the cost.

3.4.4 Early shutdown of projects

If customer involvement or cooperation is not handled properly, it can result in unhappy customers, which in turn can call for early shutdown of the project.

- Close customer collaboration is necessary to run a project smoothly. If customers don't cooperate, it doesn't have good after effects. We (the supplier) might lose the project before we reach the end. (AP29)

3.4.5 Delays and increased costs

The respondents believed that government organizations involve a large amount of bureaucracy, which causes delays in the project delivery. Sometimes supplier companies have to wait for days before they receive approval for any changes requested by the customer. According to the respondents, although they charge this waiting time to the customer, sitting and doing nothing gives a poor impression.

- When there is a change request, there is always a lot of bureaucracy connected to it; bureaucracy around changes is cost and in our case we charge that cost to the customer, so it will be an increase of cost to the customer. (AP19)

3.5 Contingencies: Strategies for Contracting Process Management

We have discussed the causes and consequences of the challenges associated with the contracting process. Based on our interview data, we will now describe some strategies for contracting process management. Some practitioners are currently using some of these strategies. These strategies could help to overcome the challenges produced by the contracting process. They are all based on our interview data and include the factors to be clarified before writing a contract, trust, right selection of contract type, frequent-delivery option, replacing the risk-sharing term with gain sharing, focusing more on functionality than on budget, customer involvement, and adopting strategies for avoiding conflicts.

3.5.1 Factors to be clarified before writing a contract

The very first step before starting any project is to make sure that the customer and his needs are well understood. The respondents gave varying views about the factors that need to be clarified before writing a contract. As the first step, some respondents felt that it is important to make the customer understand the agile methodology, its benefits and drawbacks compared with the waterfall approach and the change process associated with the methodology. Other important issues that the respondents believed should be clarified at this stage include the customer vision, business goals, cost of the project, software specification, role of the customer and the degree of involvement and steering required, response times required by the organizations, and the jargon/language used for reporting and understanding the status of the project. Sometimes, technological restrictions also need to be known along with the scope of the work.

3.5.2 Trust

According to the respondents, if there is enough trust between the supplier and the client, there is less need for documentation. According to the respondents, if two parties have trust, they do not need a contract.

- I suppose even though it's not that conscious, it's

all about trust. If you (both parties) have unlimited trust, you do not need a contract. (AP23)

- At the beginning there was high tension on the vendor side, but as time went on, trust built up and then we had the contract but we had developed more trust to solve the conflicts. (AP31)

According to one of the respondents:

- It is important to achieve a good relationship based on mutual trust. (AP3)
- The respondents believed that trust is even more important when using T&M contracts. Establishing enough trust is difficult in situations in which supplier and customer companies come together for the first time.
  - T&M contracts work to a certain extent but there has to be a lot of trust. It is natural since two organizations are about to work together for the first time. There are chances that it will not work. (AP21)

3.5.3 Right selection of contract type/mixing different contracts for different parts of a single project

Mixing different types of contracts is an option used by some of the respondents. One of the project managers working on the supplier side told us that the company had used T&M contracts for three sprints before it started using target price contacts. One of the project managers described his experience as follows:

- We used fixed price with parts of projects but not with the whole project. We try to use time and material for initial phases then we can use target price for the rest of the project. (AP28)
- The type and size of the project also play a vital role in the choice of contract type:
  - For small projects, we usually use a fixed price. Sometimes, we have a fixed price and then combine it with a target price. We also use a combination. (AP32)

3.5.4 Frequent-delivery option

Delivering in iterations can help to obtain continuous feedback from customers, which in turn will ensure the project's final success. Continuous feedback from customers also helps suppliers to understand how customers perceive success, which can assist them in making improvements to their strategies for successful delivery of the project.

- It is very important to deliver in iterations. Only then you are able to know that what you delivered and the customer can give feedback on your deliveries. (AP28)

3.5.5 Replace the risk-sharing term with gain sharing

The respondents said that the term gain sharing should be used instead of risk sharing. Gain sharing is a more attractive and proactive term.

- I would say instead of using the term risk sharing use gain sharing because risk sharing is a kind of passive term whereas gain sharing is its proactive counterpart. It sounds similar but it really makes a big difference. If



you look into it, it would be my starting point is to have a focus on sharing gain rather than risk sharing. (AP23)

3.5.6 Shifting the focus to functionality rather than budget

The respondents believed that the way in which public companies conduct business is more waterfall than agile. They have a considerable focus on price. Therefore, projects are selected through a bidding process and these projects have a fixed price, with all the disadvantages that fixed-price contracts entail. According to the respondents, fixed-price contracts are not an agile way of working and this needs to be changed. One of the respondents stated:

➤ I think it needs to change how government agencies do their budgets, meaning how they order new software, because now it is so focused on price. (AP19)

3.5.7 Customer involvement

In agile projects, continuous interaction with the customer throughout the development life cycle makes it easier to obtain customer feedback about the project. Another way to involve customers in the process is to deliver in iterations. This helps to gain continuous customer feedback, which is necessary for final project success. One of the respondents shared his experience about the way in which his company involves customers:

➤ We invite them to demos and we make them participate in the development process and most of the time they are eager and want to participate. (AP17)

3.5.8 Adopting strategies for avoiding conflicts

Different strategies can be adopted to avoid any kinds of conflicts. The interview findings suggested that the most common type of conflict relates to roles and responsibilities. One of the project managers shared his experience of handling conflicts:

➤ The first thing we did was that we sat with the customer and agreed upon what is their responsibility and how we define agile and when change requests should be used: how far in the construction phase you (the customer) are allowed changes. We also worked very hard to establish trust. (AP15)

The respondents believed that it is very important to make a clear distinction of responsibilities because this can help to avoid conflicts in the later phases of the project. According to one of the project managers:

➤ I think it's very important to agree in the bidding phase, when you sign the contract, to be very specific about what are the customer's responsibilities and what are the supplier's responsibilities. (AP15)

3.6. Covariance

Covariance means that a change in one category affects the other categories. From the interview findings, we found that the categories related to the challenges involved in the contracting process (*formal documentation, unequal*

*sharing of risk, formal documentation, using agile with the waterfall mindset, a fixed scope versus fixed objectives, personal preference for the contract, and inadequate customer collaboration*) and the categories related to contracting process management strategies (*the factors to be clarified before writing a contract, trust, right selection of contract type, frequent-delivery option, replacing the risk-sharing term with gain sharing, shifting the focus to functionality rather than budget, customer involvement, and adopting strategies for avoiding conflicts*) have an effect on each other and vary accordingly. In the contracting process, all the categories are very closely knit together and a change in one category can have a profound impact on the other categories.

4. Discussion

In this section, we will describe the related work, the implications of our results for theory and practice, and the limitations of the study.

4.1. Related Work

The interview findings suggested that fixed-price contracts are not the preferred choice of suppliers for agile projects, while customers favor their use. Customers want to have control over the contracting process and fixed-price contracts offer them this control. These findings are in accordance with Fowler and Highsmith [21]. However, the suppliers felt that it opposes the agile manifesto of “customer collaboration over contract negotiation” [21]. The respondents, based on their experience, asserted that most public companies prefer to work with fixed-price contracts, and this is in accordance with Fulgham et al. [22], who stated that the way in which public companies practice contract handling are much more traditional than the agile way of working. The reasons behind clients’ preference for fixed-price contracts are that they are simple to handle and that the risk lies mostly on the supplier’s side. Another reason is that many customers want to know the exact budget for the project to make go or no go decisions. Therefore, they require a complete contract written with a full specification and details of the cost, time, quality, risk, and so on [22] before they decide whether to proceed.

The interview findings suggested that T&M contracts are the most used contracts in agile projects. The respondents believed that T&M contracts put most of the risk on the customer side and this type of contract does not provide any incentives for suppliers to boost their productivity.

According to Eckfeldt et al. [23], it is very hard to convince customers to use T&M contracts; therefore, they suggested that T&M contracts should be used for smaller projects and for suppliers with the greatest degree of trust. For larger projects, customers prefer to use fixed-price contracts. This finding is contrary to the finding of Zijdemans

and Stettina [24], who suggested using fixed-price contracts for smaller projects.

The respondents reported that T&M contracts can only be used when a high level of trust exists between the supplier and the client, and this is in line with Poppendieck and Poppendieck [5].

According to Eckfeldt et al. [23], target cost contracts are more suitable for agile projects. This type of contract handles scope changes in a similar way to fixed-price contracts, but it shares the risk equally between the supplier and the customer. Target price contracts are said to give a fair share of risk and profit to customers and suppliers [25].

The respondents believed that using agile in government organizations produces many challenges, and this is in agreement with Thamhain [26], who stated that in such organizations the “overall requirements and project scope must be established up-front and become the basis for performance measurements throughout the project life cycle.” Therefore, it is more challenging to work in an agile way in such organizations.

Trust is considered the most important success factor for any business [27]. Trust and risk are crucial in situations that do not involve simultaneous exchange [28]. Trust helps to save time and effort in the contracting situation [29] [30]. According to Coldeway, “agile development is about building mutual trust between the business experts and the software people” [2].

The respondents’ opinion about trust is in accordance with Boehm and Turner, who stated that “for a project to succeed, the stakeholders must trust that the developing organization will perform the needed work for the available, agreed-to resources” [31].

Although formal documentation will help to reduce uncertainties, it can lower the performance and hinder the effectiveness of the project [32].

Customers’ involvement plays an important role throughout the software development process in agile software projects. Customers are represented by the product owner, and if he is too busy with other tasks, he will be unable to allocate an appropriate amount of time to the project. The respondents had often experienced the problem of product owners who were too busy, and as a result the supplier could not obtain feedback on time. These findings are in accordance with Hoda et al. [33]. The role of the product owner and his responsibilities need to be defined clearly when writing the contract, which can help to avoid any kind of conflict in the future [3].

The respondents’ opinion about frequent deliveries is in line with Bird and Bird’s report [3], which suggests that agile projects require more frequent deliveries. These deliveries could be in the form of small features and according to the specification defined in the contract [3]. Another option, suggested by Subramaniam and Hunt [34], is that “agile practitioners should offer to build a small portion of the system on a trial basis. After the end of the iteration, the customer will have the option to continue or cancel the contract.

4.2. Implications for Theory

The agile methodology’s main focus is on “customer collaboration over negotiating contracts,” but the interview data suggested that customers prefer fixed-price contracts. The respondents (*from the supplier side*) believed that it is not possible to use agile with fixed-price contracts and that public companies’ way of working is not agile. Different contracts can be used for different parts of the projects to obtain the desired result. Fixed-price contracts, as they grant projects through bidding, involve many challenges. One of the implications of theory developed using grounded theory is that this theory can be applied to software projects other than agile ones.

4.3. Implications for Practice

4.3.1 Right mix of contracts

Different kinds of contracts can be combined, keeping in view the nature and type of projects. Using the right mix of contracts instead of only one type can help to attain the desired project result.

4.3.2 Close customer collaboration

Close customer collaboration is a key for delivering successful projects. Customer satisfaction is one of the important success criteria of agile projects. To attain customer satisfaction, it is very important to involve the customers in each and every stage of the project.

4.3.3 The frequent-delivery option

Suppliers should make frequent deliveries. These will help to gain continuous feedback from customers, which in turn will ensure the final success of the project. Continuous feedback from customers also helps suppliers to understand how customers perceive success, which can help them to make improvements to the product quality.



4.3.4 Responsibilities matrix

A responsibility matrix should form part of the contracting process. This matrix should represent the overall view of the role and responsibilities of the different stakeholders involved in the project. It should provide a clear description of who is responsible for what, which can help to avoid conflicts and misunderstandings about roles and responsibilities.

4.4. Limitations

Theory developed using grounded theory is said to be context-specific. Since codes and categories are generated from data, they have direct relevance to the context.

When it comes to software projects, a number of factors could play a pivotal role in making them a success or a failure, but the very first step of any project is to make arrangements that could lead to successful project delivery. Therefore, contract management is a very important part of the project, and the key aspects that we found from contracting situations, such as trust, close customer collaboration, and equal sharing of risk, play a vital role in a project's success or failure. We interviewed 32 professionals, more than 50 percent of whom were from the supplier side; due to this, we feel that in our study the customer perspective on the contracting process is not represented properly.

If more participants are involved in the study, there are more chances for evaluating the results by comparing them with each other, hence helping to combat bias in the study [35]. For our study, we chose 32 participants, and using this large number of interviewees helped us to compare the results.



### authors



■ **Lubna Siddique** is studying for a PhD in agile software project management from the University of Oslo, Norway. Her research interests include working with agile methodologies, agile software project management, working within agile software teams and software process improvement.



■ **Bassam A. Hussein** is an Associate Professor at the Norwegian University of Science and Technology (NTNU) Trondheim, Norway. His interests include application of gaming simulations, e-learning, requirements management, and organizational learning. He teaches project and requirements management and has been involved in the design, development, and implementation of a wide range of customized education programs in project management.

4.5 Validity and Reliability Issues

Validity measures how accurate the research findings are [36]. To determine the accuracy of the research findings, researchers have to measure them. This research was conducted with 32 practitioners in 25 different organizations, and the participants were chosen according to their suitability for the study. We also made sure that the participants had enough experience and knowledge of the subject under study. We asked the practitioners multiple questions to obtain the desired information.

Reliability measures the consistency of research. We ensured consistency by cross-checking the results of different participants and found them to be reliable. After transcribing the interviews, they were sent to the concerned informant to check for any omissions.

4.6 Future Work

To make the contracting process work more effectively in agile software projects, we suggested using different types of contracts for different parts of the project. Achieving the right mix of contracts is a challenge. Future studies could find a method in which the right mix of contracts can help in agile projects. Therefore, we intend to present a model for this as part of future research. We also suggested the use of a responsibility matrix to provide clarity regarding roles and responsibilities. The evaluation of projects that use such a responsibilities matrix can also help to generate a useful perspective as a future study.

5. Conclusion

To investigate the challenges associated with contracting, we conducted a grounded theory study. We interviewed thirty-two professionals from twenty-five different organizations. We presented our data using Glaser's six Cs model. The interview findings revealed a number of challenges associated with the contracting process. These involve formal documentation, unequal sharing of risk, formal documentation, using agile with the waterfall mindset, a fixed scope versus fixed objectives, contract selection based on preferences, and inadequate customer collaboration. Based on the interview findings, these challenges have several consequences. These are unsatisfied customers, conflicts, unpaid effort, early shutdown of projects, and delays and increased costs. From the interview findings, we produced contract management strategies. These include the factors to be clarified before writing a contract, trust, the right selection of contract type, a frequent-delivery option, replacing the risk-sharing term with gain sharing, shifting the focus to functionality rather than budget, customer involvement, and adopting strategies for avoiding conflicts. We also discussed the implications of our results in theory and practice.

[1] T. Arbogast, C. Larman, and B. Vodde. Agile Contracts Primer. 2012. available at <http://www.agilecontracts.org> (accessed on 10.08.2015).

[2] J. Coldeway. Contracting agile projects. Agile Project Management Advisory Service, Executive Update, 2006, Vol. 7, No. 17. available at [Cutter Consortium, www.cutter.com](http://www.cutter.com) (accessed on 15.08.2015).

[3] Bird and Bird. Contracting For Agile Software Projects. 2012, 2016. available at (accessed 7.7.2015).

[4] E. Wrubel and J. Gross. Contracting for Agile Software Development in the Department of Defense: An Introduction. 2015, Software Engineering Institute, Carnegie Mellon University.

[5] M. Poppendieck and T. Poppendieck. Lean Software Development: An Agile Toolkit. Addison-Wesley Professional, 2003.

[6] The PS2000 Agile Standard Contract for Software Development. 1st ed. The Norwegian Computer Society, 2010.

[7] P. Runeson and M. Höst. Guidelines for conducting and reporting case study research in software engineering. Empirical Software Engineering, 2009, Vol. 14, No. 2, pp. 131–164.

[8] R. K. Yin. Case Study Research: Design and Methods. Sage Publications, 2013.

[9] D. R. Thomas. A general inductive approach for analyzing qualitative evaluation data. American Journal of Evaluation, 2006, Vol. 27, No. 2, pp. 237–246.

[10] P. Advice. Study design in qualitative research—2: Sampling and data collection strategies. Education for Health, 2000, Vol. 13, No. 2, pp. 263–271.

[11] J. Corbin and A. Strauss. Basics of Qualitative Research: Grounded Theory Procedures and Techniques, page 41. 1990, Londres Sage.

[12] Glaser, B. G. Basics of grounded theory analysis: emergence vs forcing. 1992, Mill Valley.

[13] S. Adolph, W. Hall, and P. Kruchten. A methodological leg to stand on: Lessons learned using grounded theory to study software development. In Proceedings of the 2008 Conference of the Center for Advanced Studies on Collaborative Research: Meeting of Minds, page 13. ACM, October 2008.

[14] B. G. Glaser and A. L. Strauss. The constant comparative method of qualitative analysis. Social Problems, 1965, Vol. 12, No. 4, pp. 436–445.

[15] K. Charmaz. Grounded theory as an emergent method. In Handbook of Emergent Methods, pages 155–170. 2008, Guilford Press.

[16] B. G. Glaser. Theoretical Sensitivity: Advances in the Methodology of Grounded Theory. Sociology Press., 1978.

[17] A. Bernstein. How to write supplier contracts for agile software development. Computer Weekly, 2016. Available at <http://www.computerweekly.com/feature/How-to-write-supplier-contracts-for-agile-software-development> (Accessed 13.11.2015).

[18] T. A. DeCotiis and L. Dyer. Defining and measuring project performance. Research Management, 1979, Vol. 22, No. 1, pp. 17–22.

[19] O. Pankratz and C. Loebbecke. Project managers' perception of IS project success factors – A repertory grid investigation. In ECIS. 2011.

[20] O. Pankratz, D. Basten, F. Pansini, M. Terzieva, V. Morabito, and L. A. Anaya. Ladder to success – Eliciting project managers' perceptions of IS project success criteria. International Journal of Information Systems and Project Management, 2014, Vol. 2, No. 2, pp. 5–24.

[21] M. Fowler and J. Highsmith. The agile manifesto. Software Development, 2001, Vol. 9, No. 8, pp. 28–35.

[22] C. Fulgham, J. Johnson, M. Crandall, L. Jackson, and N. Burrows. The FBI gets agile. IT Professional, 2011, Vol. 13 No. 5, pp. 57–59.

[23] B. Eckfeldt, R. Madden, and J. Horowitz. Selling agile: Target-cost contracts. In Proceedings of the Agile Conference, July 2005, pp. 160–166. IEEE.

[24] S. H. Zijdemans and C. J. Stettina. Contracting in agile software projects: State of art and how to understand it. In Agile Processes in Software Engineering and Extreme Programming, pp. 78–93. Springer International Publishing, 2014.

[25] M. Bresnen and N. Marshall. Motivation, commitment and the use of incentives in partnerships and alliances. Construction Management & Economics, 2000, Vol. 18, No. 5, pp. 587–598.

[26] H. J. Thamhain. Can we manage agile in traditional project environments? In Management of Engineering & Technology (PICMET), July 2014 Portland International Conference, pp. 2497–2505. IEEE.

[27] J. Glover. Profiting through trust. International Management, 1994, 38–40.

[28] F. L. Jeffries and R. Reed. Trust and adaptation in relational contracting. Academy of Management Review, 2000, Vol. 25, No. 4, pp. 873–882.

[29] K. Blomqvist, P. Hurmelinna, and R. Seppänen. Playing the collaboration game right—Balancing trust and contracting. Technovation, 2005, Vol. 25, No. 5, pp. 497–504.

[30] T. H. Chiles and J. F. McMackin. Integrating variable risk preferences, trust, and transaction cost economics. Academy of Management Review, 1996, Vol. 21, No. 1, pp. 73–99.

[31] B. Boehm and R. Turner. Observations on balancing discipline and agility. In Proceedings of the Agile Development Conference, June 2003, pp. 32–39. IEEE.

[32] S. Tursas. A Relationship-Oriented Viewpoint on Agile Software Contracting: A Multiple Case Study. Master's thesis, University of Oulu, 2007.

[33] R. Hoda, J. Noble, and S. Marshall. Negotiating contracts for agile projects: A practical perspective. In Agile Processes in Software Engineering and Extreme Programming, pp. 186–191. Springer, Berlin, Heidelberg, 2009.

[34] V. Subramaniam and A. Hunt. Practices of an Agile Developer. Pragmatic Bookshelf, 2006.

[35] T. Diefenbach. Are case studies more than sophisticated storytelling? Methodological problems of qualitative empirical research mainly based on semi-structured interviews. Quality & Quantity, 2009, Vol. 43, No. 6, pp. 875–894.

[36] J. W. Creswell. Qualitative enquiry and research design: Choosing among five approaches. 2007, pp. 35–41.