Claim management in EPC-Projects

A case study of claim causes and claim management during plant installation

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Abstract

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When several parties are involved in a construction project are conflicts inevitable, and when one party feel that another party are not following their work according to the agreed contract, can they issue a claim. Claim management and causes of claims has been addressed by previous research, but there is lack of attention to study claim management specifically in EPC-projects.

The purpose of this thesis is to shed some light on claim management and identify cause of change claims, specifically in the context of EPC-projects. A case study was conducted within an organisation that executes complex plant EPC-projects, where several parties are involved. This thesis has applied tools of root cause analysis in order to identify the causes of change claims, and conducted focus groups and semi-structured interviews to better understand problems associated with claim management and how the relationship between two parties affects claims.

The thesis concludes that the most common root causes to sub-contractor change claims are related to design where not enough information for design input has been provided, or related to installation where sub-contractors issue change claims in order to fix conflicts caused by themselves. Other major root causes are related to insufficient instructions provided by the principal organisation or requests of changes by one party. The thesis also concludes that claims during plant installation are avoided since more time is required for settling an official claim. Poor documentation is a major reason why the settlement of official claims requires more time. Further does this thesis conclude that the relationship between two parties does not affect claims, and in contrast might the relationship benefit from claims if causes are treated properly.
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Popular science summary

Conflicts are inevitable in human relationships, thus also in construction projects where many interacting actors are involved. If any party feel that another party are not following their work according to the agreed contract, they can issue a claim. Claims in large-scale construction projects are undesirable since they require significant time and resources to solve. The key objective of the claim management process is to resolve a certain problem in an effective and efficient way in order to avoid any further disputes. Claim management is however not always considered as management function, and is lacking attention.

The purpose of this thesis is to shed some light on claim management and identify cause of change claims. A case study was conducted within an organisation that executes complex plant EPC-projects, where several parties are involved. Causes of sub-contractor change claims where reviewed by applying methods of root cause analysis involving different experts. Focus groups and interviews were conducted with relevant parties to the plant projects, in order to better understand the claim management process. This thesis has also reflected on how the relationship between two parties affects claims.

Identified root causes for sub-contractor change claims are mostly related to design and sub-contractors themselves. Whereas major root causes are sub-contractor who issue change claims in order to fix conflicts that are caused by themselves, and insufficient information about the site and existing plant needed as design input. Claim management was identified to be avoided since the settlement through an official claim is considered to be too time consuming during conflicts needs to be solved as fast as possible, whereas project teams instead communicate conflicts directly with external parties. Lack of information that would provide the external parties with an understanding of the situation does further extend the settlement. Settling conflict in this manner, miss out an important aspect of claims inform of possible quality improvement. Claims does not lead to major disputes according to this case study, neither does the relationship affects claims. In contrast were claim management identified to be an important tool for quality improvement, which in turn have positive effects on relationship between two parties, given that claims lead to preventive actions and quality improvements.
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1 Introduction

Conflicts are inevitable in human relationships, thus also in construction projects where many interacting actors are involved. Conflicts can arise both internally, and the potential conflict can be magnified if an additional subsystem is added to the interaction (Kumarswamy, 1997). The construction industry suffers from the conflict of interests between different actors, and during the construction process does changes and other circumstances require flexibility and sound judgement (Abdallah et al., 2013). If one party feel that another party are not following their work according to the agreed contract or have not met the contractual agreements, can one party issue a claim. A claim by definition is “A request, demand, or assertion of rights by a seller against a buyer, or vice versa, for consideration, compensation, or payment under the terms of legally binding contract, such as for a disputed change” (Project Management Institute, 2013).

Any major event or a series of minor events in the project operation may create problems that could become construction disputes (Cheung and Yiu, 2006). The basic relationship for claims is that a claim is the sources of some sort of conflict, while the outcome is either settlement or dispute. The key objective of the claim management process is to resolve a certain problem in an effective and efficient way in order to avoid any further disputes (Enshassi et al., 2009). However, does not claim management receive much attention, and in some cases is claim management not recognised as a management function that require human expertise to give continues attention for claim-relevant matter throughout the project (Vidogah and Ndekugri, 1998). The production of claims and management of claims in acceptable detail and with sufficient supporting documentation involves great deal of effort (Vidogah and Ndekugri, 1998), whereas claims in large-scale construction projects are undesirable since they require significant time and resources to solve (Hadikusumo and Tobgay, 2015, p. 49). Claim management does not only require time and expertise for settlement of conflicts, but also the settlement of costs to be compensated. The cost of settling a claim or dispute can be considerably high, not only the money paid out in settlement but also the transaction cost incurred for the resolving (Lu et al., 2015, p. 711).

There are numerous different types of construction projects and the contractual arrangement can be done in several ways. Previous research seem to focus on traditional construction projects when addressing claim management. Compared to traditional design-bid-build, are
main-contractors under EPC contract responsible for all of the activities ranging from engineering, procurement, to constructions based on basic specifications provided (Pal et al., 2017). Not much attention in previous research is given to claim management in EPC-projects where the main contractor is responsible for several outsourced activities, hence also responsible for the conflicts that arises from the outsourced activities. Whereas the main-contractor has to manage and solve conflicts that arise “internally” without creating conflicts between main-contractor and client.

Project participants should strive to avoid and minimize problems that could lead to claims in projects, which should be done in a proactive manner or as respond to the problem before it gets out of hands (Enshassi et al., 2009). As one of the best ways to avoid or minimize claims is to determine the primary sources or causes of the claims (Hadikusumo and Tobgay, 2015). A root cause is the most primary reason for an unwanted situation or problem, and if the root-cause is treated properly, it could solve the problem permanently (Rosenfeld, 2014). It would be important to identify the common sources of disputes in construction, so as to isolate and control the root causes (Kumarswamy, 1997). Existing research have addressed the causes of claims and conflicts in different ways, whereas the list of different causes is extensive. Some attempts to identify root causes in existing research has been made (Rosenfeld, 2014), however mainly focusing on potential root causes and not focusing on actual causes. Previous research has neither directly acknowledged the claim causes specifically for EPC-projects, and addressing causes of claims that occur within the EPC-organisation where a main-contractor is ultimately responsible for outsource activities.

1.1 Background

This research has been carried out within a company that will be anonymous and referred to as “principal organisation”. The principal organisation delivers complex construction projects to various places around the world which can be categorized in plant or factory section in the construction industry. These plants are delivered, depending on scope, in various forms from basic equipment delivery to “turn-key plants” or so-called EPC projects. In the EPC projects is the company responsible for the major parts of the projects as engineering, procurement and construction. A major part in the projects, especially EPC projects, is the construction or installation phase. In this phase is the whole plant constructed and installed, which requires that planning and design must be correct in order to complete the project without further complications. What characterises the projects from traditional
construction projects is that several parts of the plant are pre-fabricated and the parts are assembled during construction and installation.

In the case of the principal organisation for this thesis, are some parts and tasks of the project outsourced which leads to that more parties are involved in the projects. In many cases does the principal organisation outsource tasks such as design, manufacturing of parts and construction. The outsourced part of design usually includes detailed design, whereas the engineering company is responsible for the detailed design. Principal organisation usually source a local contractor, who construct and install the plant with supervision by the principal organisation. In addition to design and construction, does the plants include several different parts and components which are scoured from different manufacturers and suppliers. As a result, does the projects include many different organisations who under a sign contract are oblige and responsible for different tasks and act as sub-contractors. However, the principal organisation is ultimately responsible for the overall project, with a signed contract to the client.

Since the projects, as described above, include many parties who under signed contracts are responsible for different tasks might conflicts arise during the plant installation where the results from previous tasks comes together. Conflicts during plant installation typically lead to that some change needs to be made in order to complete the installation. Whereas the sub-contractor identifies the conflicts and might issue a change claim to fix a conflict due to e.g. design mistake, which leads to an extra cost. If a change is needed due to design mistake, can the principal organisation issue a claim against the engineering company for compensation of extra cost due to the extra work.

Solving conflicts and managing claims during plant installation should be done without causing any delays to the overall project. Any delays may cause high penalties for the principal organisation, or in turn to an external party who is considered to be responsible for the conflict.

1.2 Purpose

The purpose of this thesis is to shed some light on claim management process, and provide some contrast to existing literature by studying claim management in EPC-projects. During the phase of plant installation are parts from several external parties installed under usually
tight schedule. In this context would proper claim management be needed in order to avoid further disputes or delays.

Since claims are between two parties where the relationship may continue in future projects, it would be important that claims does not affect the relationship. It was identified from the literature that the relationship may affect claim submission. Whereas this thesis will study how the relationship affects claims in projects where many external parties are indirectly involved in the plant installation.

Another purpose of this thesis is to deeply study the causes of sub-contractor change claims and provide understanding of actual root causes for conflicts. Since in the context of this research are sub-contractors responsible for the plant installation and may identify conflicts that needs to be fixed in order to complete the installation. These conflicts might lead to claims and needs to be solved during plant installation. Due to the tight schedule, is the underlying cause not usually investigate deeply. This thesis will make the attempt to apply tools of root cause analysis in order to identify the underlying causes of conflicts. Some previous research has reflected on the causes of claims but this thesis will provide some contrast to the existing research by deeply study actual conflicts in a plant EPC-project.

There is also some confusion in the terminology between authors (Sun and Meng, 2009, p. 560). The term claim is often related to concepts disputes and conflicts. Additionally does much literature also relate claims to changes in a project, as claims often arise from change orders or vice versa (Levin, 1998). A clarification and distinction between different terms related to claims would be needed, whereas this thesis will also try to distinguish and clarify the different terms and concepts relevant to claim management.

1.3 Aim

The aim for this thesis is to provide an understanding of claim management in plant EPC-projects and how claims are manged during the installation where conflicts should be solved as fast as possible. From a research perspective will this thesis aim to provide contrast to existing research and insight on how claims are managed in inter-organisational EPC-projects during critical phases of the projects. From the perspective of principal organisation will this thesis aim to provide insight from different internal and external actors, aiming for a general understanding of the process and problems related to it, with discussion of possible improvements. The aim is also further to provide insight on how the relationship affects
claims, which would further develop understanding to existing research, in a different context.

Another aim for this thesis is to identify actual root causes for conflicts and claims and providing deep understanding of the underlying causes to actual conflicts to existing research, while also provide knowledge of conflicts during plant installation. For the principal organisation is the aim to provide deep analysis of actual conflicts, which would be valuable information for further improvements and projects.

1.4 Research questions

This thesis has mainly focused on two different aspects regarding claim management. Firstly, addressing causes of sub-contractor change claims, with the purpose to identify the root causes of change claims. Secondly, much related to the sub-contractor change claims, has the focus been on the claim management process. Additionally, has this thesis studied how the relationship affects claims. Following research questions were set up which have guided the research:

1. What are the root causes for sub-contractor change claims in EPC-projects?
2. What are the problems associated with claim management in inter-organisational EPC-projects?
3. How does the relationship between two parties in EPC-projects affect submission of claims?

The research questions has been addressed and answered using a case study with an abductive approach and by gathering qualitative data. The first research question was answered by deeply investigating actual conflicts from a project together with different experts while applying tools of root cause analysis. For the second and third research question was qualitative data gathered from different perspectives, both internally and externally, using focus groups and semi-structured interviews. For all research questions has also internal documents been used as a source of data.

1.5 Delimitations

This thesis will focus on claim management during plant installation, and delimitations are drawn to only focus on claims that are issued by the principal organisation. Whereas claim management of claims issued towards the principal organisation is not considered.
For the root cause analysis will this thesis only focus on the underlying cause of conflicts and not consider how the conflicts were solved. Neither will this thesis consider the impact or consequence of the conflicts. Even though impacts and consequences are important aspects when issuing claims, is this not considered relevant for the purpose of identifying the root causes.
2 Theory

In this theory section is existing research and theory presented related to the topic of this thesis. Firstly has his thesis looked into research around construction projects and EPC-projects to better understand the context. Secondly, is the term “claim” presented and defined, together with distinction of relevant terms and concept, followed by research around claim management and problems related to claim management in construction projects. Since one purpose of this thesis was to identify root causes of conflicts and claims, is the concept or root causes and different tools used for root cause analysis presented. Causes of claims from existing literature has been identified which will be compared and discussed to findings in this thesis.

2.1 Construction projects

Construction projects are highly complex, involving many different activities and actors. Any major events or a series of minor events in the project operation may create problems that could become construction disputes (Cheung and Yiu, 2006, p. 459). Construction projects usually face enormous uncertainties, and the contract is unavoidably incomplete in terms of the inability to plan for all the possible contingencies (Cheung and Pang, 2013). High complexity and enormous uncertainties may increase with new technologies and requirements. "Construction projects are becoming more and more complex due to new standards, advanced technologies, and owner-desired additions and changes" (Abdul-Malak et al., 2002, p. 84). There are many factors making construction projects more complex than other projects. The projects are not only affected by internal risks, but also external risks as weather and site conditions. While the external factors are difficult to prevent and predict, these have to be dealt with and remain a high risk. Peckiene et al. (2013) describes the complexity that the contractor has to deal with as: “Construction projects have an abundance of risk. Contractors cope with it and owners pay for it. The construction industry is subject to more risk than any other industries. This process requires a multitude of people with different skills and interests. Construction projects are also influenced by a number of external, uncontrollable factors”

2.2 EPC-Projects

A construction project can be contracted in different ways, but all of them face uncertainties. The amount of uncertainties, and thereby risks, could be considered greater in Engineering,
Procurement and Construction (EPC) projects. Comparing traditional construction projects to EPC projects does Pal et al. (2017) describes this difference as; “Compared to traditional design-bid-build contract model where the project owners provide the engineering design and the contractors solely carry out the construction activities, under EPC contract model the main contractors are responsible for all of the activities ranging from engineering, procurement, to constructions based on basic specifications provided”. The main contractor is arguably responsibly for more activates in EPC project. Even though some activates can be outsourced and the risks are in one sense shifted to sub-contractors, is the main contractor affected by the risks indirectly. A brief description of a project organisation in EPC-projects that is typical for the principal organisation in this thesis could be described as in Figure 1, where a client or project owner contracts a main contractor for executing a project, e.g. delivery of a fully functional plant. The main contractor can in turn hire sub-contractors for different activates, however the sub-contractors are not (usually) directly in contact with the project owner and only responsible for assigned activities. The organisation as proposed in Figure 1 is very much generalised and only including the main parties. Other parties and actors such as consultants may also be included in EPC-project organisations.

![Figure 1: General EPC organisation](image)

As mentioned, does the principal organisation usually contract a local sub-contractor, local by the definition that the sub-contractor is located in same country/area in which the plant is constructed. The sub-contractor(s) are contracted to construct and install the plant, which is one of the last and most critical phases of the plant delivery. During the installation does most of the other phases of the project come together as a fully functional plant.
The location of EPC projects also affects the uncertainties involved. Since it is not uncommon that EPC projects are located abroad from the main contractor, does the main contractor face greater challenges in negotiation and managing often unpredictable durations of work carried out by multiple subcontractors (Pal et al., 2017). This is also the case for the principal organisation, where most of the projects are executed abroad in many cases developing countries and/or even in extreme conditions.

Even though EPC projects involves great amount of risk for the main contractor, can EPC projects lever a contractor to fulfil different activities simultaneously which can achieve cost saving and reduced duration (Shen et al., 2017).

2.3 Claim definition

There are several relevant terms and definitions that will be used in this thesis which are closely related. Clear distinction is needed between these terms and concepts, whereas this first theory section makes the attempt to define the terms in a context that is useful for this thesis.

The term “claim” can be confusing and the term itself can have several meanings, (Cambridge English Dictionary) gives two examples of definitions as: (1) to say that something is true or is a fact, although you cannot prove it and other people might not believe it or (2) to ask for something of value because you think it belongs to you or because you think you have right to it. This general definition of the term “claim” will not be useful in the project context nor in this thesis, whereas a more specific definition is needed. There is also some confusion in the terminology between authors and in research around the topic (Sun and Meng, 2009). According to Project Management Institute (2013), is claim defined as:

“A request, demand, or assertion of rights by a seller against a buyer, or vice versa, for consideration, compensation, or payment under the terms of legally binding contract, such as for a disputed change.”

A more concrete and clear description of the definition would be as defined by Hadikusumo and Tobgay (2015): “When one party believes that the other party has not met the contractual obligations or expectations and that they deserve monetary and/or time compensation, they may submit a claim.” This description describes more simply the concept of claims in project context.
Claims are, and can often be related to a change or a variation in a project. When one party identify that a change is needed to the previous agreed scope, deliverables or specification, can they notify this by a change request. Project Management Institute (2013) defines the term “change request” as: “A formal proposal to modify any document, deliverable or baseline”. The distinction between claim and change is narrow, Levin (1998) even uses the term “claim” to cover both claims and change order situations in his book, stating that "claims often start out as change orders, or vice versa”. For the sake of discussion it would be needed to distinguish between the terms, whereas Mirza (2015) defines this difference as “What distinguishes a claim from a change is the element of disagreement between the parties as to what is due or whether or not anything is due. If agreement is reached, then the claim disappears and becomes a change”, based this definition is the level of agreement the determine factor of the two terms.

Considering the above defined terms, will this thesis define Claim as defined by Project Management Institute (2013). On the other hand, change request could be considered as one form of claim where one party claim another party that the contracted work can’t not be performed as previously agreed in the contract and a change is needed. This definition will become useful in this thesis since the focus will be on construction projects where a principal contract out parts of the project to sub-contractors. Due to this, will the previously mentioned “change request” be referred to as “change claim”. When a change claim is accepted by the principal party, does the Change claim become a Change order of which the sub-contractor is to be compensated for extra-work.

Other existing relevant terms that are often used as claim on in relation to claim are “dispute” and “conflict”. The inconsistent definitions of “dispute” between studies make research findings difficult to compare and generalise with other studies (Love et al., 2010). However, all the terms fall is into the same category in project context where one party have a different opinion or view of a matter than another party. In this thesis are all of the terms used, however the main focus will be on “claim”, while a “conflict” could be considered to build up to a “claim”, and “dispute” could be the result of a “claim”. The relationship of these terms can be seen in Figure 2 and in similar way in Figure 4.
2.3.1 Conflicts and claims in construction projects

A claim, as defined, is due to assertion of right by a party in a project. Large construction projects usually involve many stakeholders and parties, and the project can be executed involving many different organisations. Even though there is one client and one contractor who has signed a contract for a specific project, can these two parties or organisations outsource parts of their tasks, creating an inter-organisational project. Tensions are frequent in inter-organizational projects where the parties share uncertainty about many important changes that occur after the contract is signed (Badenfelt, 2011). The more parties in a project, the more relations, thus also more possible sources for conflicts which is illustrated in Figure 3, where conflicts arise between parties and the potential of the risk increases when a sub-system is added (Kumarswamy, 1997). In construction projects, can different parties experience additional costs due to the actions of the other party or parties involved, whereas claims and disputes arise over the right of compensations of time and money of the additional costs (Abdul-Malak et al., 2002).
Some claims are unavoidable due to the unforeseen changes in project conditions. Such claims are usually settled amicably. Example of such kind of claims could be weather conditions and unforeseen or unexpected changes in some geographical areas. However, earlier unhealthy conflicts can trigger unnecessary disputes in such situation (Kumarswamy, 1997). Whereas these kinds of conflicts are uncontrollable or unavoidable by stakeholders in a project, they still remain a risk, and can create unwanted tensions between parties if they occur. Conflicts, whether controllable or not, may lead to claims from one or more parties and should be avoided considering the overall project performance.

Some literature suggests that one source to a claim is more common than another. According to Kumarswamy (1997) does claims in construction projects usually arise as assertions for extra money or time. And are usually based on the contract itself, a breach of contract, a breach of some other common law duty, a quasi-contractual assertion for reasonable (quantum merit) compensation, or an ex-gratia settlement request. This is supported by Kadefors (2004) who states that “major sources of conflict in construction are contractors’ claims for additional payments for work resulting from changes, errors and omissions in the contract documents”.

Figure 3: Potential sources of construction conflict. (Kumarswamy, 1997)
Changes in construction projects are common and seems to be a major source to conflicts, but changes are sometimes needed in order to complete a project. From a project owner’s or main-contractor’s perspective, changes are undesirable, since changes have some indirect effects which ultimately have a damping impact on project cost and/or schedule (Sun and Meng, 2009). However, from a (sub)contractor’s perspective, changes are desired since contractors are considered to benefit financially from claims, and many contractors develop a critical stance towards the contractual documents (Kadefors, 2004, p. 179). This conflict of interest could be explained by agency theory or as opportunistic behaviour, which is presented in next section.

**Opportunism**

In the relationship between main-contractor and sub-contractors, can sub-contractors be considered as _Agents_ who are hired or assign by another organisation, considered as _Principal_. In this Principal-Agent relationship can the agent act according to self-interest and possibly not according in the interest of the principal, which is explained by Agency theory. Jensen and Meckling (1976) from whom the Agency theory has it origin defines following:

" [...] agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent. If both parties to the relationship are utility maximisers there is good reason to believe that the agent will not always act in the best interests of the principal" (Jensen and Meckling, 1976, p. 308)

This behaviour, also defined as opportunism, could potentially lead to unnecessary conflicts and claims where parties tries to maximize their profit and not working in the favour of principal’s interest. Opportunistic behaviour has been addressed in previous research in the context of construction projects. According to Cheung and Pang (2013) does the contractor “behave opportunistically in an attempt to recoup the deficit stemming from the cutthroat bids through post contract claims”. There are also cases where contractors may identify problems already in the tendering process, but are encouraged not to disclose while preparing their bid. By this, can the contractors reduce their tender to be more competitive and anticipate profitable change orders once the contract is signed, and since the contract is signed, is the contractor entitled to claim compensation for the re-work, disruptions and re-
planning of construction work (Kadefors, 2004). The opportunistic behaviour is indeed a problem in as already complex nature of construction projects. Abdallah et al. (2013) suggests that the opportunistic behaviour can be lessened by managing the relationship between the two parties through a contract that clearly specifies these factors.

In the context of this thesis does the sub-contractor identify conflicts that needs to be fixed or solved in order to complete the installation. The sub-contractor however profits from these changes since it provides extra work. The principal organisation could also act opportunistically by issuing unnecessary or false claims to and external party in the purse of some extra profit. Hence, it is important to understand the concept of opportunism and its relevance in construction projects, whereas it could potentially explain some behaviour of actors in this thesis.

2.3.2 Claim management

The term “claim” were defined in section 2.3 Claim definition and the basic relationship between conflicts, claims and outcomes was presented in Figure 2. Whereas it was identified that claims are the source of some sort of conflict, and that conflicts are often related to changes in the construction project. During the construction process does changes and other circumstances requires flexibility and sound judgement (Abdallah et al., 2013). And claims arises when one party to the contract has suffered a detriment for which that party should be compensated by the other party (Kululanga et al., 2001). Whereas claims should be managed before leading to disputes.

Following claims to disputes, does Acharya et al. (2006) argue that disputes cannot be managed with the statement that “Disputes require resolution; this means they cannot be managed.”. The chain of problems leading to disputes, as suggested by Acharya et al. (2006) in Figure 4 indicates that if claims are not clearly resolved it may lead to a dispute. Claim management is therefore important in order to avoid disputes and resolve conflicts, as suggested by Bakhary et al. (2015) “the key objective of the claim management process is to resolve certain problems in an effective and efficient manner”.
Since claims are problems in construction projects, should claim management and resolution of ongoing claims get more attention. However, this is not the case as stressed out by Kululanga et al. (2001), who argues as following:

"The management of construction claims is the greatest challenge that is facing contractors in today's vacillating business environment. [...] Although the construction business environment has moved toward partnering arrangements in recent years. The number of contractual difficulties continue to rise."

Claim management requires a considerable great amount of resources, and the production of claims in acceptable detail and with sufficient supporting documentation involves great deal of effort (Vidogah and Ndekugri, 1998). Good documentation by the parties is essential in avoiding unproductive confrontation (Enshassi et al., 2009). However, adequate documentation and record keeping is probably one of the most common problems facing proper management of claims, according to Hassanein and El Nemr (2007) who refers to findings from existing research, where the problem stems from the lack of weight that the contractor site representatives give to documentation management. Documentation is an important step in the claim management process where all the supporting documents should be compiled together. However, in reality, the importance of this step is not realised as much as it should be (Bakhary et al., 2015).

The lack sufficient documentation seems to be a major issue facing claim management, according to much previous research. In order to achieve proper documentation for claims does Bakhary et al. (2015) give some examples of supporting documents as: drawings, specification, written instruction, cost breakdown and measurement records.

Insufficient documentation is one of the problems identified in claim management. Further does not the process or management function itself receive enough attention during a
construction project. Claim management is not recognized as a management function that require human expertise to give continues attention for claim-relevant matter throughout the project, whereas claims are often investigated after practical completion (Vidogah and Ndekugri, 1998). However, solving and settling conflicts with claims should be done directly, whereas issuing a claim should be done by the contractor directly after the occurrence of the cause of the claim or soon thereafter (Abdul-Malak et al., 2002).

A problem related to that claim management is not receiving much attention during a construction project, is that the responsibility of handling claims is not clearly assigned. Vidogah and Ndekugri (1998) identified that the responsibility was often allocated to project owners architects and engineers even though they were not knowledgeable on the subject. Responsible personnel for claim management should have enough knowledge on the subject, not only in order to formulate a claim, but also when evaluating a claim. From the claimed party’s perspective is the evaluation of importance, since a well-prepared defense can disprove evidence and claim costs that are not supported by accurate records (Enshassi et al., 2009).

Considering the basic relationship in Figure 2 should claim management also focus on finding improvement from conflicts. As suggested by Kumarswamy (1997), does conflicts not necessarily lead to disputes but could potentially lead to improvements. Cross-fertilization of ideas between parties and actors considering design alternatives can lead to a better design. Identifying improvements is not directly the purpose of claim management, but could be more considered in relation to claim management.

To summarise the problems from existing literature associated with claim management in construction projects, are the major problems lack of attention and poor documentation. These two problems are further magnified when no responsible personnel with knowledge about the subject is assigned for claim management. From existing research it is quite clear that claim management is lacking attention. However previous research have addressed claim management in construction projects, with no clear distinction of the contractual form. Whereas this thesis will look into claim management specifically in EPC-projects.
2.3.3 Claims and relationships

Claims are issued by one party against another, whereas previous disputes could further trigger unnecessary disputes as identified by Kumarswamy (1997). Even though a project could be considered as a temporary organisation (Tonnquist, 2012), can the cooperation between different actors and parties continue in form of a new project. This is very much the case of the principal organisation is this research, since the sourcing of same suppliers and the partnership with engineering company is present in most projects. Sub-contractors are usually contracted locally, depending on where the plant is located, whereas the relationship is typically short. Abdul-Malak et al. (2002) identified that in some cases may one party decide not to issue a claim in order to maintain good relation to the other party. In this sense is the party that decides not to issue a claim, paying the costs of a conflict that another party have caused. As another aspect to relationship between two parties and claims, does Harmon (2003) argue that “the entity that controls the most resources can coerce the ‘weaker’ party to perform in the manner in which it desires” which was identified especially in the relationship between owner and contractor. Having a history of claims and especially lost disputes, could further affect the relationship whereas the main contractor preferably choose another contractor (Lu et al., 2015).

With regard to future projects it would be important to avoid any disputes or conflicts that could affect the relationship. From another perspective should also all parties have the right to compensation of a conflict caused by another party, without fearing that that relationships to be affected.

Considering potential source of conflicts in Figure 3, does Kumarswamy (1997) visualise conflicts between project teams (C1-C4) to be a potential source to conflicts. EPC-projects in the context of this thesis could be considered slightly different. Since the main contractor outsources activities, can not conflicts from designer and supplier related factors be raised against the client, since designer and constructor are working as a team under the main contractor (Shen et al., 2017). Hence, would an additional sub-subsystem needed where the principal organisation is responsible for the conflicts that arise related to out-sourced activities. The relationship between principal organisation and sub-contractors creates more potential sources of conflict. However, these potential sources are “internal” for the main-contractor and affects the relationship between principal organisation and client indirectly.
2.4 Root-causes

Conflicts, changes and claims are undesirable in construction projects causing delays and cost over runs, even though some are inevitable and necessary are many causes of some sort of problem. To improve project performance should problems be eliminated, also unnecessary and avoidable problems. Eliminating a problem, requires first to understand the problem. Andersen and Fagerhaug (2006) suggest two different characteristics or definitions of problem that are useful in the context of this thesis:

“Having a problem is by nature a state of affairs plagued with some difficulty or undesired status.”

“A problem represents a challenge that encourages solving to establish more desirable circumstances.”

When understanding the problem, it may be solved or eliminated. A problem is often the result of multiple causes at different levels. Some causes affect other causes that in turn create the visible problem according to Andersen and Fagerhaug (2006) who classifies causes into three different levels:

- **Symptoms**: These are not regarded as actual causes, but rather as signs of existing problems.
- **First-level cause**: Causes that directly lead to a problem.
- **Higher-level causes**: Causes that lead to the first-level causes. While they do not directly cause the problem, higher-level causes form links in the chain of cause-and-effect relationships that ultimately create the problem.

Below the above mentioned causes and symptoms lays the root cause, which is the real cause to a problem or as Andersen and Fagerhaug (2006) defines it; “The root cause is “the evil at the bottom” that sets in motion the entire cause and-effect chain causing the problem(s)”. Rosenfeld (2014) who refers to Andersen and Fagerhaug (2006) presents a slightly different classification and defines four different levels as:

- **Consequence**: A flaw, or a problem, or unwanted situation, or non-conformance to requirements.
- **Symptom**: A visible situation that usually emerges in conjunction with a flaw.
- **Direct cause**: The apparent or immediate reason for the symptom.
- **Root cause**: The basic reason for an undesirable consequence; its treatment/elimination will prevent the recurrence of the problem.

Without proper distinction of these concepts, might the case be that only the symptom or direct cause is treated, while the problem then most probably reappear (Rosenfeld, 2014). Wilson (1993) defines and addresses further the different levels of causes, in similar way as Rosenfeld (2014) identifying three different levels of causes to a problem:

- **Symptoms**: are the tangible evidence or manifestation(s) indicating the existence or occurrence of something wrong
- **Apparent cause**: represent the immediate or obvious reason to a problem
- **Root cause**: most basic reason for an undesirable condition or problem

Rosenfeld (2014) also stress the point that if only symptoms and apparent causes are treated, the problem or fault may reoccur. However, the apparent cause may in some cases be the root cause as well. It is important to distinguish symptoms from causes and apparent causes from root causes. This is why root cause analysis efforts often fail, due to the inability to distinguish between these levels (Wilson, 1993, pp. 9–10). By only eliminating the symptoms, the problem still remains but is no longer an easily recognised symptom that can be monitored. While this makes the problem less visible, it may as well worsen the situation. This may give some temporary relief to the causes, but the root cause will eventually find another way to manifest itself in the form of another problem (Andersen and Fagerhaug, 2006, p. 6).

There is however some criticism towards the concept of root cause, mainly as the term itself suggest, that there is only one underlying cause of something. Root cause analysis, by the name, implies that there is only one root cause. However the most problems are usually caused by a complex combination of several factors (Flaig, 2013). This view is supported by Mitropoulos and Howell (2001) who deeply analysed the data of 24 claims from 14 construction projects, where the analysis indicated that there was not one overriding factor as the critical cause of the disputes, but a combination of key factors. One could argue that there is no actual root cause, but many factors leading to a problem. But one could also take the approach that root cause is the primary factor for a problem. In this sense, is the root cause the primary factor that other factors can build upon and form a problem. This view would be similar as Rosenfeld (2014), who suggest that a root cause is the most primary
reason for an unwanted situation or problem. If the root-cause is treated properly, this could solve the problem permanently.

2.4.1 Root causes of claims in construction projects

Research have addressed claims from various points of views such as: quantifying, preventing, managing and planning them (Rosenfeld, 2014). A typical approach in existing literature is categorisation of claims and trying to identify the most common sources to conflicts, claims and disputes. Much research has been focusing simply to identify factors or triggers that show some association with disputes. Even though the identification of such factors is useful, it does not explain the underlying causal nature of disputes (Love et al., 2010). A list of different causes and categories identified in literature which has been compiled by Kumarswamy (1997) and Love et al. (2010) is presented in Appendix 1. The categorisation and identification of cause to claims varies between authors, however some similarities occur. Hadikusumo and Tobgay (2015) categorised claims based on literature review (Change claims and Impact claims). And identified causes and grouped using case study: 1. Differing site condition 2. Delays of project participants 3. Changes in design and specification 4. Force majeure 5. Omissions/ambiguous contract provisions. Whereas this categorisation could be seen to cover most of the categorisation by other authors.

Many articles on conflicts and disagreements in the construction industry exclusively deal with the circumstances characterising a conflict and tend to ignore the causes therefore erroneously present relevant circumstances as causes (Mitkus and Mitkus, 2014). Acharya et al. (2006) used a questionnaire survey to collect professionals experience on conflicting activities, and face to face interviews to ratify the findings from the field survey. Related to EPC projects, did Shen et al. (2017) conceptualise causes of construction claims based on existing literature and empirically tested the causes with industry survey, structural equation modelling and case studies from the perspective of Chinese contractors.

Research seems to lack identification of underlying causes to claims and disputes using actual tools of root cause analysis. The factors identified and categorised by many authors may be only symptoms of the true underlying cause. While there is little doubt that construction claims are a burden on the industry, how a problem turns into a claim remains something of a puzzle (Mitropoulos and Howell, 2001).
Some attempts has been made in order to determine the underlying cause or root cause for disputes and claims using specific tools of root cause analysis. Rosenfeld (2014) used the method of event analysis to determine the root cause of construction cost-overruns. Even though costs-overruns are not directly claims or disputes, may the cost-overruns in construction project lead to claims and disputes. Rosenfeld (2014) applied the method of events analysis combined with expand-focus approach for assembling an inclusive list of 146 potential causes gathered from international professional literature and from local experts. The list was filtered and merged applying expand-focus into 15 independent universal root causes, which were further investigated through a cross-sectional survey among 200 local construction practitioners who ranked the 15 universal root causes according to their conceived local importance and influence on cost overruns. Based on the survey the three most prominent root causes are:

- Premature tender documents;
- Too many changes in owners’ requirements or definitions;
- Tender-winning prices are unrealistically low (suicide tendering)

Rosenfeld (2014) argues that the root causes for construction cost overruns identified in the article and listed above are universal and can be applied everywhere. The causes could however considered a bit broad, making them possible to apply everywhere. Compering the findings by Rosenfeld (2014) to findings by other authors in Appendix 1, are the changes from/by some party in the project a reoccurring cause. Premature tender documents could further be related to inadequate or inaccurate design information (Kumarswamy, 1997). The identified causes and root cause are much about categorisation and how the different causes are defined, whereas many cause or categories can be related to one another or even considered to be the same.

Another aspect is that the root cause identified in existing research may also be higher level causes related to the actual root cause. As an example, for the root cause “Too many changes in owners’ requirements or definitions” identified by Rosenfeld (2014), one could ask “Why?”. Answering this question would move a step closer to a possible source or root cause for the problem. However, by taking this approach would make the root cause specific for respective problem, making it more difficult to generalise and identify “universal” causes to claims and disputes.
The method using root cause analysis as Rosenfeld (2014) is, according to the author, not widely used in previous research and has not been used in the reference literature found the article. However the method of expand-focus is not directly a root cause analysis tool according to (Tague, 2005) who the author refer to, but rather an approach for the root cause analysis. The expand-focus approach is an approach of different periods of expanding and focusing the thinking. Whereas the expanding period is creative and can generate new and innovative ideas, and he focusing period is analytical and action oriented (Tague, 2005).

2.4.2 Methods for root cause analysis

There are a wide range for tools available for root cause analysis, but it is important to apply the most relevant. As mentioned, one of the first steps is to identify and understand the problem. Identifying the problem may be an easy task since symptoms are visible, but understanding the problem and the actually source to the causes may be more difficult. If done in a proactive manner, can the identification of problems be more difficult when no visible symptoms have yet occurred. However, root cause analysis is often utilized in the reactive mode, that is in response to an identified problem or symptom (Wilson, 1993, pp. 35–36). In that sense, by doing the root cause analysis in reactive response is the first step of identifying the problem already done, since the problem have already occurred.

One important aspect is that root cause analysis is a method usually used for problem solving after the actual problem have occurred, in that sense is root cause analysis a reactive response. However, thinking ahead and proactively prevent problems before they occur is more effective than solving problems afterwards when damage may have happened, this proactive problem prevention could render root cause analysis superfluous (Andersen and Fagerhaug, 2006). Different tools are more appropriate for different stages in root cause analysis, whether the analysis is done in proactive or reactive manner. The point is not to apply all tools in a root cause analysis, but applying the appropriate technique or tool to address a specific problem (Andersen and Fagerhaug, 2006).

Root cause analysis, is not a done by using a single tool or strategy, but rather a number of different tools which are used in combination. The term "root cause analysis" refers to a wide range of approaches, tools and techniques used to uncover causes of problems, and some tools are most appropriate for different steps which has been summarised by (Andersen and Fagerhaug, 2006) and presented in Appendix 2. The steps and tools suggested by Andersen and Fagerhaug (2006) are only some of the tools available, especially for root cause
identification are only four tools suggested. Tague (2005) on the other hand gives a more comprehensive and extensive list of tools and techniques for problem solving and quality improvement. Whereas the author suggests 13 different tools for the (root) cause analysis. The tools used in this thesis are described and presented in next section.

The previously mentioned expand-focus approach by Tague (2005) describes the approach of expanding and focusing the thinking when solving problems and identifying root causes. The author also classifies the different tools and methods in to the categories of expanding and focusing. With regard to the root cause identification tools in Appendix 2, does Tague (2005) define Cause-and-effect diagram and Fault tree analysis to be useful in the expansion phase, and Matrix diagram and Five whys to be useful in the focus phase.

**Cause-and-effect chart**

Cause-and-effect chart is a chart that analyses relationships between a problem and its causes. The main purpose of the tool is to understand what causes a problem and can be used to 1. Generate and group problem causes. 2. Systematically evaluate the causes and determine which are most likely to be root causes (Andersen and Fagerhaug, 2006, p. 119). Cause-and-effect tool is useful to identify many possible causes for and effect or problem, where the tool immediately sorts ideas into useful categories (Tague, 2005, p. 247).

The tool is a highly visual technique to define elements of a problem or event and determine how it probably occurred (Wilson, 1993, p. 195). Cause-and-effect chart is also called fishbone diagram or Ishikawa diagram after its inventor (Tague, 2005, p. 247).

Main steps in using Cause-and-effect chart according to Andersen and Fagerhaug (2006) are:

1. The problem should be clearly described for which causes are sought.
2. The problem can be drawn or stated on a large surface e.g. a whiteboard where an arrow is drawn.
3. The main categories of causes are identified and put on branches of the large arrow.
4. Brainstorming can be used to identify all the possible causes for respective main category, some causes may belong under more than one category and are to be written under all suitable.
5. The different identified causes are analysed and the most likely root cause is determined.
The different categories for the diagram can be identified and assigned differently depending of the case. However, a widely used set of generic categories is the five Ms: *Machines, Manpower, Materials, Methods* and *Measurement* (Tague, 2005, p. 251). Bergman and Klefsjö (2012) suggests two additional Ms for the categories as *Management* and *Mother Nature (Environment)*. Rosenfeld (2014) used a cause-and-effect to categorise and illustrate different causes of cost over-runs in constructions projects, see Figure 5. Form the figure can be seem that the tool highly visualises the different causes in different categories.

There are different types of Cause-and-effect chart, Andersen and Fagerhaug (2006) describes two different types:

- **Fishbone chart**, as described above and in Figure 5, which is the traditional method of constructing the charts and the final chart reassembles the shape of a fishbone.

- **Process chart**, is more directly focused on the analysis of problems inside business. For each step of the process that is believed to create problems, a fishbone chart is constructed to address all potential causes of less-than-expected performance. After individual charts are designed, a collective analysis is conducted to identify the causes of highest importance processes. (Andersen and Fagerhaug, 2006, p. 119)

![Figure 5: Division of the 15 causes into major categories (Rosenfeld, 2014)](image-url)
Five whys

The five whys tool’s purpose is to delve ever more deeply into the levels of causes. This resembles the wider concept of root cause analysis itself. The purpose is to constantly ask "Why?" for identified causes, and progress through levels toward the root cause. The tool can be used to reveal whether each cause is symptom, a lower-level cause or root cause, and for continuing searching for the root cause even after a possible cause has been found (Andersen and Fagerhaug, 2006). Small symptoms might be signs of a greater problem, and by asking "why" several times will dig down to the root cause of the symptom (Bergman and Klefsjö, 2012).

The steps in using five whys are according to Andersen and Fagerhaug (2006):

1. Determine the starting point of the analysis, either a problem or an already identified cause that should be further analysed.
2. Use brainstorming, brainwriting, and other approaches to find causes at the level below the starting point.
3. Ask “Why is this a cause of the original problem?” for each identified cause.
4. Depict the chain of causes as a sequence of text on a whiteboard.
5. For each new answer to the question, ask the question again, continuing until no new answer results. This will most likely reveal the core of the root causes of the problem.
6. As a rule of thumb, this method often requires five rounds of the question “Why?”

For this approach one however has to stop asking why at some point, since moving too far in the hierarchy of levels it can be very difficult to do anything about the causes (Andersen and Fagerhaug, 2006, p. 129).
3 Methodology

The fact that this research is carried out within the principal organisation sets the design of the research to be a case study. Bryman and Bell (2011) distinguishes case studies from other research designs as: “What distinguishes a case study from other research designs is the focus on a bounded situation or system, an entity with a purpose and functioning parts.” The entity to be studied in this case is the principal organisation and relevant parties within the EPC-projects. As identified from previous research and literature, does case studies provide in-depth information of a specific case. Sun and Meng (2009) who analysed existing research within a similar topic area states that: “documentation reviews and case studies offered a more in-depth analysis of the change causes in projects.” Case studies are often associated with qualitative research, but not limited to one type of research, however a case study design often favour qualitative methods (Bryman and Bell, 2011, p. 60).

However, choosing a case study design of the research, and choosing the specific case to be studied such as an organisation, will not simply provide data (Bryman and Bell, 2011, p. 41). In this sense it has to be set which methods are most appropriate to be used in order to provide the data needed. The specific methods that will be used in order to generate data will be discussed in this chapter.

3.1 Research strategy

When selecting a research strategy for this thesis there are two main research strategies within research, namely quantitative and qualitative strategy. Quantitative research is a strategy that that emphasises quantification and analysis of data with more focus on numbers, while qualitative research emphasises words rather than numbers (Bryman and Bell, 2011, pp. 26–27). The main difference of these two strategies are, as described, in the interpretation of data and emphasis on rather numbers or words. Other differences are the use of the different strategies based on the approach of the study, which will be described more closely in the next section. Qualitative research usually focuses on generating theories (inductive) rather than testing them (deductive), however neither strategy is limited to one approach (Bryman and Bell, 2011, p. 27).

One strategy for this thesis is not directly suitable for being limited to only one of the earlier mentioned strategies. Focus will however mainly be on a qualitative study for understanding the claim management process and the causes of claims. However, the purpose of
determining the root causes will include elements of quantitative research whereas the causes are presented quantitatively, but analysed qualitatively.

As this thesis mainly applies a qualitative strategy, but also using elements from quantitative research, it could be seen combining the two strategies. The strategy for this thesis could therefore be considered as a mixed methods research. Mixed methods research is research that combines methods from both qualitative and quantitative strategies (Bryman and Bell, 2011, p. 628). Not being limited to either one of the strategies can seem reasonable, this is also mentioned by Flyvbjerg (2016) who states that: “Good social science is problem driven and not methodology driven in the sense that it employs those methods that for a given problematic, best help answer the research questions at hand. More often than not, a combination of qualitative and quantitative methods will do the task best.” Taking the strategy of mixed methods research will be useful since it does not limit the research to either one, and gives the possibility to use elements from both research strategies.

3.2 Research approach

Two common approaches in research are deductive and inductive approach. In a deductive approach the theory guides the research, and the researcher tries to deduce a hypothesis with empirical findings. While in an inductive approach is the theory an outcome of the research, and the researcher tries to draw generalisable inferences out of observations. (Bryman and Bell, 2011, pp. 11–13).

In addition to the two main research approaches there is also an abductive approach, which can be an alternative to the two main approaches. In an abductive approach does the reasoning comes from empirical facts, much similar to an deductive approach, however an abductive approach does not exclude theoretical concepts and is in that sense more closer to an inductive approach (Alvesson and Sköldberg, 2008, p. 55). Alvesson and Sköldberg (2008) describes the research process when taking an abductive approach as: “During the research process there is altering between (previous) theory and empiric, whereas both successively are reinterpreted in the light of one another”. For this thesis an abductive approach is seen most suitable since previous research provide theories and findings of claim management in construction projects and several findings of claim causes which can be interpreted with empirics in this thesis, and provide understanding of the topic in a different context.
3.3 Methods

The research strategy of this thesis is set to have a mixed research strategy, whereas combination of different methods is not limited to one strategy. More focus will be on the qualitative data, hence more leaning towards methods usually applied in qualitative research. Methods that usually are applied within qualitative research are semi- or un-structured interviews, participant observations and focus groups.

This thesis could be divided into two slightly different objectives, firstly identifying the root causes of sub-contractor change claims where methods of root cause analysis based on documents available and the expert’s knowledge. This first objective can be consider as an emic research approach, Chandler and Munday (2016) defines emic approaches as “[..] those based on the description of the frames of reference of insiders within a culture”. While the second objective of studying claim management, could the approach be consider more of an etic approach, which is according to Chandler and Munday (2016) “[..] those based on the observer’s application of broader theoretical models (an outsider’s view)” and the use of qualitative data will be more important. Additional for the second objective it is important to gather qualitative data from external parties to the principal organisation as well. In order to get a more general understanding of the claim management process, it should be seen from different perspectives and how other parties perceives the problems associated, and not only from the principal organisation. Since the process and concept of claims involves two or more parties, are the other parties´ perspective important.

3.3.1 Focus groups

Focus group is a method of interviewing more than one interviewee. A focus group usually consists of at least four interviewees, and is run by a moderator who are supposed to guide the session but not be too intrusive. The original idea of the focus group is that people with certain experience could be interviewed in a relatively unstructured way about that experience. In a normal interview the interviewee is often asked for the reasons of holding a certain view, but the focus group allows people to probe each other’s reasons for holding a certain view. This approach may give arose to other answers than in a normal interview, for a person when he or she listens to another person’s answers and wants to qualify or modify the view. This makes focus groups helpful to bring out a wide variety of views of a particular issue. (Bryman and Bell, 2011, pp. 502–505).
The choice of using focus groups has the primary intention to enable the dynamics of the group in order to produce new (innovative) ideas and answers. As Bryman and Bell (2011) defines the dynamics in a focus group: “The dynamics of group discussion could lead individuals to define business problems in new and innovative ways and to stimulate creative ideas for their solution”. The purpose of focus groups will be to understand the general claim management process and problems associated with it. Thereby the method of using focus groups is seen to be most appropriate.

Conducting focus groups outside the principal organization does not only give perspective to the claim management process, but also understanding how the important parties perceives the process. One dilemma encountered in the literature review and also considered in the use of focus group methods, is that the context of claims could be viewed as sensitive between the parties and limiting the participants to speak freely when personnel from the principal organization are present. Love et al. (2010) conducted focus groups in similar manner in order the identify dispute causation in construction projects, and the authors identified following: “It was perceived that the presence of senior managers hindered interviewees from “speaking freely” because of the commercial sensitivity that may have been associated with a dispute that the organisation had or was currently involved with”.

This aspect has been considered in this thesis when conducting focus-groups with external parties, whereas the external focus groups has been conducted without any personnel from the principal organisation present. Only the author could be seen to be from within the principal organisation, but will function as the moderator and take a neutral point in guiding the discussion. This was also stressed out to the participants when the focus groups were conducted.

3.3.2 Semi-structured interviews

Qualitative research tend to be less structured than quantitative research, and the emphasis on greater generality of the research idea and interviewee’s perspective (Bryman and Bell, 2011, p. 466). According to Bryman and Bell (2011), there are two major types of qualitative interviewing where in both types the process is flexible and the focus is on interviewee’s view and understanding, the authors defines following:

- **Unstructured interview**: the interviewer only uses a small set of questions or notes for him or herself to be brought up during the interview. The interviewee is allowed respond freely to and the interview take much form of a discussion.
- **Semi-structured**: the interviewer has a list of questions which act as an interview guide, but interviewee has great freedom of how to reply. Interesting things that the interviewer picks up during the interview can be brought up as additional questions.

Semi-structured interviews will be a good way to gather qualitative data in this thesis when focus groups are not possible or difficult to conduct. Since the purpose is to gather qualitative data of certain questions but also to include some dynamics and flexibility into the interviews where interesting topics and discussion can be brought, are semi-structured interviews seen as a good complement if focus-groups can not be conducted.

### 3.3.3 Sampling

For this thesis has purposive sampling been used when selecting participants for focus groups and semi-structured interviews. Purposive sampling is a non-probability form of sampling, where the researcher does not select participants on random basis (Bryman and Bell, 2011, p. 442). The context in this thesis is claim management during plant installation, whereas relevant teams and parties were selected. Relevant external parties were selected with focus on that they supply project specific material, and further that they are dependent of one another. Whereas Engineering company provide detailed engineering and specifications for the selected suppliers.

In purposive sampling are participants selected in a strategic way so that those sampled are relevant to the research (Bryman and Bell, 2011, p. 442). Whereas participants with knowledge of claim management from the different teams and external parties were selected. The different teams and participants are presented in Table 3 in relation to the empirical material.

The project and sub-contractor change claims which has been studied in this thesis has been assigned specifically to the researcher by the principal organisation. What characterises the project is that the scope of the project were relatively small, but many change claims from sub-contractor occurred during plant installation.

### 3.3.4 Root cause analysis

This thesis has applied methods of root cause analysis in order to produce the data which will be the centre of analysis and discussion for research question 1, even though root cause analysis is not directly a research method. Considering the data available and the situation
of the case, was the root cause analysis done in a reactive manner. As earlier mentioned, when doing a root cause analysis in a reactive manner the problem is already known. The ground source of the material available is a report provided by the sub-contractor including 233 modifications. The report includes a brief description of the modification and indicating the problem, however the report does not clearly indicate the cause of the problem, and more specifically not the root cause.

The individual tools of root cause analysis can be used by one single person, however the outcome is usually better when the tools are applied by a group of people who work together to find the problem causes (Andersen and Fagerhaug, 2006, p. 19). Due to this statement and the limited technical knowledge by the author, a group of experts were gathered for “expert´s workshops” in order to determine the root causes, see next section for more details. The dynamics and the purpose of the expert´s workshops could be considered much similar to focus groups, where the participants can challenge others views and statements which will be useful when determine the root cause.

Considering the timeframe of this research project, were the tools of root cause analysis chosen which were not too time consuming, but would still be useful in order to identify the root cause. Another aspect taking the expand-focus approach in consideration was that the tools needs to be usable in the focus phase, since the purpose was to focus on each individual change claim. Tague (2005) provides a list of tools available and indicates whether they are to be used during expand or focus phase. The tool of five why´s were found to be most suitable and not too time consuming. However, during the workshops, the method was not performed completely according as described in the theory chapter. Due to the limited time, each “why” were tried to be answered through discussion whereas the author took notes of the discussion. It where however difficult to answer five different “whys” for each change claim, and typically was the root cause determined based on answering 2-3 “whys”.

For some of the change claims it were difficult to identify the root cause using the tool of five why´s, due to lack of material or evidence available. In this case the method of brainstorming were used, which is also a tool for root cause identification according to Tague (2005), where to most possible cause where tried to identified.

3.3.5 Expert´s workshops

Since the knowledge of the author is limited with regards to the technical and other aspects relevant of the projects executed by the principal organisation, were expert’s within the
principal organisation involved in the root cause analysis. The root cause analysis was done during different session which were called *Expert’s workshops*. The changes claims were reviewed during different sessions and the root cause identified according to the experts. The experts involved in the sessions were:

Main participants:

- *General Manager, Mechanical Engineering*
- *Engineering Manager, Mechanical Engineering*
- *Senior Development Engineer*

Additional information gathered from:

- *Chief Project Engineer*
- *Project Engineer*
- *Engineering Manager, Engineering*

Some cases required knowledge from other than the main participants, this knowledge was gained from other relevant persons outside the workshop sessions, mainly from above mentioned persons. The expert’s present at the workshops have good experience from projects and engineering aspects, which made it possible to determine the root cause from the principal organisations perspective. A similar method, of using expert’s workshop, have been applied by Rosenfeld (2014), which according to the author gives some contrast to previous research of most common root causes for cost over runs and claims in projects, since much previous research have tried to create a list, or "pool" as defined by the author, based on previous publications. Rosenfeld (2014) applied expert´s workshop to the method with the intention to create totally new and independent pool of root causes, whereas experts within the field participated and were asked to cite possible causes. The approach taken in this thesis is however slightly different, whereas Rosenfeld (2014) expert´s workshops focused on possible or potential causes, and this thesis has focused on actual causes.

3.3.6 Documents

As an additional source of data, were different documents within the principal organisation reviewed. Organisational documents such as company newsletters, memos, manuals and company regulations, can provide valuable information about the company (Bryman and Bell, 2011, p. 550). These documents are available at the principal organisation´s intranet, to which the author have had access, but are not publicly available. Documents from within
the company are likely to be authentic and meaningful, while organisational documents that are public may not be an accurate representation of how different actors perceive the situation and organisation (Bryman and Bell, 2011, p. 550). The documents are however confidential to the public and can only be used within the organisation. This is one aspect that has to be taken into consideration while presenting the results and other relevant cases in this thesis.

The purpose of using documents as a source of data were mainly for the root cause analysis, whereas the documents were used as information in order to determine the root cause. Documents such as drawings, 3D-models, orders, specifications and e-mails had a vital role in sense that they provide evidence of facts that can be used to determine the root causes. Documents as a source of data does not only give valuable information about the company and evidence to the root cause, but also a better understanding of why the different subcontractor change claims happened. As defined by Bryman and Bell (2011): “documents can offer at least partial insights into past managerial decisions and actions”. Together with knowledge by the experts present at the workshops and documents as evidence, the actual root causes were determined. However, the documents and expertise by personnel is limited to what is available, and the fact that the change claims occurred roughly one year ago from doing this research project, not all aspects could be taken into consideration. Thereby the root causes have to be determined based on the data available from the expert’s (thereby the principal organisation) understanding. Another aspect related to that a cause is a cause of something else and so forth, is that the causes cannot be traced back too far based on the material available. A decision had to be made of what is the primary reason for respective change claim, and is thereby set as the root cause.

3.4 Validity

Validity refers to the integrity of the conclusions that are generated from research (Bryman and Bell, 2011, p. 42). In other words, how believable are the measurements and conclusions made in a research. There are some main types of validity according to Bryman and Bell (2011), who describes the different types as following:

- **Measurement validity**: Whether a measure really measure what is supposed to me measured. "Is IQ a measurement of smartness?"
- **Internal validity**: Whether a conclusion that is made based on causal relationship holds water. "Does X really cause Y?"

- **External validity**: Whether the results and conclusions can be generalized to a broader context beyond the specific research.

Based on the three above mentioned types of validity and this thesis, are there some aspects considered. Firstly, that this thesis is a specific case study of a specific (inter)organisational entity which makes the external validity lower in general terms of construction projects. Considering claim management process in construction projects and more specifically EPC plant projects, could the external validity could be argued to be higher. Secondly, the same applies to the root causes of claims, whereas the root causes a very specific for individual causes and external validity is considered low. However, when putting the causes in a general context of categories as the most common causes, could the external validity be considered higher.

Regarding the internal validity and measurement validity, can these two types of validities be considered to be relatively high. Since this thesis is a qualitative study of the claim management process and qualitative data is gained mainly through peoples understanding of the specific topic. The fact that this thesis incorporates perspectives from other parties than the principal organisation, makes the qualitative data or measurement more valid, also the internal and external validity cold be considered higher when more parties are involved. Regarding the causes of claims, is the measurement and internal validity consider relatively high since the analysis is based on documents as evidence and expert’s opinions. However this makes the external validity low since the causes are only evaluated by personnel within the principal organisation.

One could argue that generalisation through case studies cannot be made since the focus is on a specific case or entity. However, case studies are good contribution to accumulate knowledge that can be generalised. Flyvbjerg (2016) argues for this and summarises a correction to the misunderstanding as: “One can often generalize on the basis of a single case, and the case study may be central to scientific development via generalization as supplement or alternative to other methods”. Too much focus should not be put on generalisation, but the uniqueness of a specific case. A case study should focus on the uniqueness of a case while developing a deep understanding of it complexity (Bryman and Bell, 2011, p. 61)
3.5 Bias

Personal values and beliefs may affect research and the conclusions drawn, this likelihood of a research to be biased is an important consideration. Research and social scientists should be value free and objective in their research, whereas one could argue that heavily biased research could not be considered valid and scientific (Bryman and Bell, 2011, p. 29). Factors affecting the research to be biased should be taken into consideration and should be prevented. Specially in qualitative research applying participant observations, can the researcher develop a close affinity with the people studied, whereas the research can find it difficult to detach their stance as a social scientist from the studied person's perspective (Bryman and Bell, 2011, p. 30).

With regard to the purpose of this thesis and the methods of how data have been gathered, could the results of claim management process be considered less biased. Since the claim management process have been studied by involving perspectives from other parties as well, which would make the results less biased. The results of root causes for sub-contractor change claims, could be considered more biased since data were gathered through experts within the principal organisation. Further has this thesis been carried out within the principal organisation, and one could argue that it is biased. However, according to Flyvbjerg (2016), does case studies not contain any greater bias toward verification of researcher's preconceived notions than any other methods, rather does case studies contain greater bias toward falsification of notions. By taking an abductive approach in this thesis, can previous empiric and theories be used in order to understand the different concepts together with new findings from this research. Case studies generates deep understanding in a specific case, whereas researchers generate deep understanding of the case they deem to cast off preconceived notions and theories in order to understand the specific case (Flyvbjerg, 2016, p. 236). With this in mind, should one not consider case studies to be any more biased than any other types of research, since case studies generate deep understanding of a specific entity.

3.6 Ethics

In research there are some ethical principles that should be taken into consideration, the principles can be broken down into four major categories according to Bryman and Bell (2011) as following:
*Harm to participants:* Any form of harm to participants is unacceptable, whether it is physical, psychological and can affects the participants future career or/and development.

*Lack of informed contest:* Whether participants in a study knows that they are studied, and could thereby refuse to participate. Covert observations usually involve this ethical dilemma.

*Invasion of privacy:* The right to privacy should not be interfered even though a participant is given informed contest. Whereas certain things can be considered sensitive to the participants, and should be respected.

*Deception:* Whether the researcher represent their research as something other than it is. Some research might want to limit participants understanding in order to get more naturally responds.

In this thesis, have the above ethical principles been taken seriously, since the research involve great amount of organisational internal information and the fact that the topic of claims could be viewed as sensitive. Related to harm to participants has the anonymity been taken seriously, whereas no names of persons or organisations are mentioned in this thesis. Companies are referred to as a company performing a certain activity in the context of this research, e.g. Engineering Company. When referring to persons, are only the job titles of respective person mentioned. When conducting the study in this thesis were all persons involved informed about the research and could thereby refuse to participate, and the researcher were not presenting the research as something else of what it is, to participants.

One ethical dilemma may however arise related to invasion of privacy. The researcher has been granted access to all internal documents available within the principal organisation, and is thereby not invading privacy in that sense. Some of the internal documents could however be considered sensitive to some persons, whereas the issue of invading privacy could be considered present. This one important consideration to have in mind while presenting the results.
4 Empirical material

The empirical material is presented as two separate parts, whereas the first part focus on the empirical material generated through the expert´s workshops regarding sub-contractor change claims, and the second part presents empirical material from focus groups and semi-structured interviews regarding the claim management process.

4.1 Expert´s workshops

As being a tool for identification of the underlying causes to an event, was root cause analysis applied during expert´s workshops in order identify the root causes of sub-contractor change claims from a specific project. Using the tool of five whys allowed the expert´s to move closer to the root cause every time answering why. This was however difficult to do in a reactive manner whereas not all factors could be taken into account causing a certain event. The concept of root cause itself also sets some limits of how to interpret the cause as a root cause. With regard to the tool of five why´s, one could always ask “why” one more time, which would lead to causes that are not controllable for the principal organisation. Therefore were the root causes determined as a root-cause that can be controllable according to the experts. In some cases, it were not possible to answer and validate the first “why” due to lack of information, in these cases the first “why” were answered by brainstorming.

All the change claims are related to one specific project, where a sub-contractor had been contracted to install the plant, and during installation the sub-contractor claim to have identified conflicts whereas they had to make some changes or modifications in order to complete the installation, and of which they claim compensation. In the report the total amount of 233 cases were reported, which all were reviewed and the root causes according to experts were identified. For every modification a small failure description was made which explains the root cause. Based on the failure description the different causes were coded, which will be explained in next session.

In order to understand and be able to present the results for all 233 root causes simultaneously, the root causes had to be coded, or in other words give a label to the root cause. Since every modification is specific, the failure description that will explain the root cause is also specific. However, it won’t be possible to present every specific case in this research, since the research would be too extensive and also due to the sensitive information that is needed to give the failure description.
The different root cause codes that were identified are presented in Table 1, including a small description of the code in order to give the reader some better understanding of each code. The codes have also been tried to be defined so that they would give some understanding of the cause. Some of the root causes were not possible to locate or validated due to lack of information, these have been given a separate code which is indicated with “*”.

Table 1 – Root cause codes and descriptions

<table>
<thead>
<tr>
<th>Root cause</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not enough info about existing plant</td>
<td>Not enough information about the existing plant needed as input for planning/design</td>
</tr>
<tr>
<td>Installation mistake</td>
<td>Direct installation mistake</td>
</tr>
<tr>
<td>Design mistake</td>
<td>Direct design mistake</td>
</tr>
<tr>
<td>FA not noted</td>
<td>Field adjustment in drawings and specifications has not been noted during installation</td>
</tr>
<tr>
<td>Not clear instructions</td>
<td>Drawings and specifications does not provide clear instructions for installation</td>
</tr>
<tr>
<td>Principal request</td>
<td>A modification that is requested by the principal organisation during installation</td>
</tr>
<tr>
<td>Not needed modification</td>
<td>A modification made by the sub-contractor which should not have been needed, according to design and specifications</td>
</tr>
<tr>
<td>Design coordination</td>
<td>Indirect design mistake due to input between engineering company and supplier’s own designers</td>
</tr>
<tr>
<td>Supplier mistake</td>
<td>Direct supplier mistake</td>
</tr>
<tr>
<td>Design improvement</td>
<td>Modification as a direct improvement of the design during installation. The design is not incorrect, but improved</td>
</tr>
<tr>
<td>Supplier coordination</td>
<td>Indirect supplier mistake due to input between suppliers</td>
</tr>
<tr>
<td>Client request</td>
<td>A modification that is requested by the client during installation</td>
</tr>
<tr>
<td>Site tolerances</td>
<td>Tolerances (of dimensions) in drawings and specifications, have caused “a chain reaction” and the installation in the end needs to be modified.</td>
</tr>
<tr>
<td>Incorrect modification</td>
<td>Modification that interfere with design and specifications</td>
</tr>
<tr>
<td>Installation improvement</td>
<td>Direct modification to ease installation</td>
</tr>
<tr>
<td>*Not possible to locate</td>
<td>Not possible to locate the modification based on report</td>
</tr>
<tr>
<td>*Not possible to validate</td>
<td>Not possible to validate the modification based on report</td>
</tr>
</tbody>
</table>
4.1.1 Root causes for sub-contractor change claims

By coding the root causes it will be possible to present the result from expert’s workshops and root cause analysis. The results are presented in Table 2 in form of number of different root cause codes and the percentage of total, and visualised in a chart in Figure 6. According to the empirical findings, is the root cause to most of sub-contractor’s changes claims that the principal organisation didn’t have enough info about the existing plant which were needed as design input whereas design has been incorrect and the material has been procured and manufactured accordingly. The sub-contractor then had to make modification to fix the conflicts and complete the installation. This type root cause is however very specific for this case, since the plant EPC-project is an extension of an existing plant. And this could not be the root cause in a project which is not an extension. A closer analysis of the different root causes cause is presented in the analysis section.

Table 2 - Number of different root causes for sub-contractor change claims

<table>
<thead>
<tr>
<th>Root causes of change claims</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not enough info about existing plant</td>
<td>56</td>
<td>24,0%</td>
</tr>
<tr>
<td>Installation mistake</td>
<td>39</td>
<td>16,7%</td>
</tr>
<tr>
<td>FA not noted</td>
<td>30</td>
<td>12,9%</td>
</tr>
<tr>
<td>Design mistake</td>
<td>29</td>
<td>12,4%</td>
</tr>
<tr>
<td>Principal request</td>
<td>13</td>
<td>5,6%</td>
</tr>
<tr>
<td>Not clear instructions</td>
<td>13</td>
<td>5,6%</td>
</tr>
<tr>
<td>Not needed modification</td>
<td>12</td>
<td>5,2%</td>
</tr>
<tr>
<td>*Not possible to locate</td>
<td>7</td>
<td>3,0%</td>
</tr>
<tr>
<td>Client request</td>
<td>6</td>
<td>2,6%</td>
</tr>
<tr>
<td>*Not possible to validate</td>
<td>6</td>
<td>2,6%</td>
</tr>
<tr>
<td>Design coordination</td>
<td>5</td>
<td>2,1%</td>
</tr>
<tr>
<td>Supplier mistake</td>
<td>4</td>
<td>1,7%</td>
</tr>
<tr>
<td>Design improvement</td>
<td>4</td>
<td>1,7%</td>
</tr>
<tr>
<td>Supplier coordination</td>
<td>3</td>
<td>1,3%</td>
</tr>
<tr>
<td>Site tolerances</td>
<td>3</td>
<td>1,3%</td>
</tr>
<tr>
<td>Incorrect modification</td>
<td>2</td>
<td>0,9%</td>
</tr>
<tr>
<td>Installation improvement</td>
<td>1</td>
<td>0,4%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>233</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
4.2 Claim management in plant EPC-projects

Before the empirical material from interviews is presented it will be useful to first conceptualise the claim management process and the different actors in this case study, with reference to table Table 3. The focus will be, as earlier mentioned, on claims arising during the installation phase of plant EPC projects. This is the phase when all planning, design, procurement, manufacturing and other phases come together as a whole, fully functional plant. Other factors that make this phase critical is that the plants are typically constructed and installed in difficult conditions in remote places, under a certain schedule, whereas delays can cause expensive penalties to the principal organisation. Thus, it is critical that the plants are constructed and installed without further conflicts and complications.

During installation does the result of many previous phases and tasks come together, where some of the previous phases has been outsourced. If any complication is identified during installation that can be considered to be the cause of another party it may be claimed. Many of complications are usually identified during the installation, since different parts are put together as a whole plant.

If a conflict is identified during installation, it first has to be documented and communicated to the project team who is responsible for the project. The project team, decides whether this
conflict caused by another party is to be claimed or fixed in some other way. If the project team decides to claim the responsible party, they in turn notify the non-conformity team who will formulate an official claim to the responsible party. A general overview of how a conflict at site during installation is transferred to the responsible party is presented in Figure 7. The different team’s and stakeholder’s tasks and perspectives in relation to this process is more closely presented under respective section in the empirical material.

**Figure 7 - General process of claim identification and notification**

Focus groups and interviews were conducted both within the principal organisation and external parties. As earlier mentioned, claims involve more than one party and it was identified that qualitative data was to be gathered from external parties as well. Focus groups and semi-structured interviews with external parties were conducted with the engineering company and two suppliers, see Table 3.

**Table 3 - Participants in focus groups and interviews**

<table>
<thead>
<tr>
<th>Internal (Principal organisation)</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-conformity team</strong></td>
<td><strong>Engineering company</strong></td>
</tr>
<tr>
<td>Focus group:</td>
<td>Focus group:</td>
</tr>
<tr>
<td>- 1 Non-conformity Manager</td>
<td>- 1 Project Operations Manager</td>
</tr>
<tr>
<td>- 1 Senior Non-Conformity Engineer</td>
<td>- 1 Senior Project Manager</td>
</tr>
<tr>
<td>- 2 Non-conformity Engineers</td>
<td></td>
</tr>
<tr>
<td><strong>Project team 1</strong></td>
<td><strong>Supplier (pipes)</strong></td>
</tr>
<tr>
<td>Focus group:</td>
<td>Focus group:</td>
</tr>
<tr>
<td>- 1 Project manager</td>
<td>- 2 Project specialists/salespersons</td>
</tr>
<tr>
<td>- 2 Chief project engineers</td>
<td></td>
</tr>
<tr>
<td>- 1 Project Controller</td>
<td></td>
</tr>
<tr>
<td><strong>Project team 2</strong></td>
<td><strong>Supplier (steel structures)</strong></td>
</tr>
<tr>
<td>Focus group:</td>
<td>Semi-structured interview:</td>
</tr>
<tr>
<td>- 1 Project manager</td>
<td>- 1 Key Account Manager</td>
</tr>
<tr>
<td>- 1 Chief project engineer</td>
<td></td>
</tr>
</tbody>
</table>
Since focus groups involves many people, they are difficult to arrange. This was found problematic for focus groups that were conducted with external parties. Even though the focus groups had been communicated with participants, some people could not eventually attend at the focus group. Table 3 shows participants for the different sessions, no names are disclosed and the persons are referred to their job title. Only two people, in addition to the researcher, were present for focus groups with engineering company and pipe supplier. One could argue that the focus group sessions conducted with external parties are not considered as focus groups due to few people participating, with reference to Bryman and Bell (2011) who consider a focus group to consist of at least four interviewees. The sessions with two participants could however be considered more as a paired interview, whereas paired interviews can be categorised between one-on-one interviews and focus groups (Wilson et al., 2016). Considering one purpose of a focus group, more specifically to enable discussion between participants, is this also one purpose of paired interviews. Paired interviews unfold as the interviewees interact with each other, optimally should both the interviewees participate in the discussion as equitably as possible (Wilson et al., 2016). Whether the sessions conducted can be considered a focus group or not, they created the wanted dynamics of group discussion which produced empirical material of how the external parties perceives and understand the claim management process.

4.2.1 Principal organisation

The focus in this thesis is on claims and claim management process during installation, whereas the principal organisation is in most cases the party that issues a claim. Considering the project and installation that is usually performed under a tight schedule, it is critical that the eventual claims are solved as fast as possible. As mentioned in the conceptualised process of claim management in Figure 7, are conflicts identified at site of which the project team is notified, whereas the project team is responsible of the project and further decides whether a claim will be issued. The non-conformity team then opens and formulates an official claim which will be sent to the external party, in this case and context different suppliers. The empirical material presented in below sub-sections is based on the research’s understanding of the qualitative data gathered from focus groups and interviews.

Non-conformity team

Non-conformity team, referred to as NC-team, is responsible for formulating an official claim based on the information provided from site through project team. Considering the
process, this is where claims becomes official once non-conformity team opens a claim and notify the party. The team is a support function to the project team and project management, and handles possible claims from all plant projects within the principal organisation.

The team consist of four non-conformity engineers and one manager. According to the NC-manager, with these resources can they handle all claims currently and are not lacking man-power resources. The number of claims from one project depends much on the project and the project team. According to the NC-team does certain project teams issue more claims and some less.

Once the NC-team gets a notification, they formulate an official claim based the description provided by site personnel and project team. The description should include the basic information about the project and the conflict, failure or defect. Examples of the typical information is; project number, failure description, and some reference to drawings or serial numbers of related parts. The notification should be as simple as possible according the NC-team, whereas they prefer e-mails.

“That is kind of the idea... you (project team) just send an e-mail. We want to keep it as simple as possible. [...] if we would have some fancy procedure... I think people would not use it that easily...” - NC-Manager

The word “fancy” in above comment was further discussed, whereas the NC-manager refers to complicated. The information that the NC-team get is usually sufficient, this however varies between the different project teams, whereas some teams know exactly what to include in the notification and some not that good. However, the NC-team can always ask for more information from site or project team. As a complement to above mentioned basic information, the team also think that pictures and measurements are good to include. If the project team knows who the claimed party is, such information can also be included. However, it is the task of the NC-team to direct the claim to correct party.

The official claims are opened in SAP, in which the NC-team fills in an official failure description with relevant references to drawings, pictures and specifications that claimed party receives in the official claim. According to the team, the use of SAP is kind of “old-fashioned” and not that flexible. In SAP the NC-team “code” the claims, which means that some fields are filled in as codes, whereas a certain code refers to certain description. The failure description is filled in manually by typing the text. From this system the team can generate an official claim that is sent to the claimed party.
Following the argument that the process should be fast, did the team further discuss that other parts of the organisation or external parties don’t really understand the critical situation when a conflict is identified during installation.

“What the rest of the organisation and external parties don’t seem to understand is that when we are in a hurry, we really are in a hurry” – NC-Manager

“We (referring to the organisation and projects) can face high penalties if the plant installation is delayed” – NC-Engineer 1

Since the stakes are high in the project, should any conflict should be solved as fast as possible. Project teams are aware of this critical factor, whereas they can be in direct contact with the suppliers themselves and not notifying the NC-team. The NC-team identifies some problems by project teams communicating directly to suppliers.

“As rough estimate I would guess that about 30% of the conflicts are reported to us” – NC-Manager

“Then same issues will repeat at every site because we don’t get input” – NC-Engineer 1

Claims are as defined in the literature a way of getting compensation for any complication caused by another party. This is also recognised by the NC-team, however they point out that by reporting conflicts will not only lead to compensation of any “harm” caused but also to possible quality improvements.

“The target of our team is not to bring in as much money (compensation) as possible... that is something that we do as a side-effect... the target is to get the quality in the right direction and improve the quality” – NC-Manager

However, the team further discuss that one of the biggest problems with claims from site is the cost-follow up, or getting the indirect cost for any conflict included in the claim settlement. As an example, if some material e.g. a pump that has been delivered from supplier is defect, it need to be replaced. The cost of a new pump itself is relatively easy to get compensation of (supplier will supply new pump). But the cost of replacing pumps and any delays that may be related to the conflict, are usually not included. The NC-team agrees that this is one big problem, especially when the project team is communicating with the supplier directly, and they settle the conflict by new pump delivery with the supplier. Another problem with claims related to costs, is when the cost of some material is small, claims are usually not made. The team discuss that the process of issuing and settling a claim
has a certain cost, and where the cost of the material is lower it is not feasible to make a claim. This once again leads to that the conflicts are not reported and same problems may repeat themselves. The NC-team further relate the problem of cost follow-up to this, since the indirect costs are not usually included the conflicts involving small cost in form of material are not considered feasible to claim.

The NC-team thinks that the claim management process could be simplified a lot. Since the conflict is happening at site, the information needs to be sent to the NC-team, who in turn “codes” the information to an official claim. This might cause that the NC-team codes the information wrong. When discussing this, the team feels that this could probably be done with today’s technology and digitalisation.

How the relationships affect issuing a claim was brought up to discussion, whereas the NC-team agrees that the relationship or partnership does not affect claims. All conflicts should be reported and the external parties or supplier usually want to help and fix the caused conflicts. Claims are therefore not seen as something sensitive or offending, however not directly preferred either.

**Project teams**

Focus groups with two project teams were held, both are executing plant projects in different countries and had worked as teams for several years. Project teams are responsible for the project, hence they are the first to contact if any conflict occur at site. Project teams are located in the office of principal organisation and not at site. Since project teams are responsible for the projects, they also decide how the project is managed and executed. Conflicts at site are communicated to project whereas they evaluate if an official claim is issued or not.

**Project team 1**

The team recognise the process to involve non-conformity team if a conflict is considered to be caused by another party, and that this process should be preferred. However small and urgent conflicts are usually settled directly with supplier. The team also have good relationship with some suppliers and prefer to contact them directly and sort out conflicts.

“Involving non-conformity team is the correct way... however contacting supplier directly is sometimes easier” – CPE 1
The team discuss that one should also have some awareness of which conflicts are project specific. Conflicts that are directly related to components, could repeat in other projects if the conflict is not documented properly in from of a claim. Since every project is different, are conflicts that are project specific more difficult to get rid of. However, the team recognise that these kind of issues should be reported as well.

“Reporting everything on paper (formally), takes long time... and we have to fix problems directly [...] the tools of reporting should be the correct so that they are usable in the timeframe of the project as well” -PM

“In one case we made an informal claim to the engineering company, informing that they have to fix the problem but no compensation is required... this became problematic whereas the information got stuck and sent back and forth, since the engineering company didn’t really know how to handle situation when it was not an official claim” – CPE 2

Regarding resources of handling claims, the team doubt that current resources would be enough if everything would be report officially, and referring to the non-conformity team. But agrees that with the current amount of conflicts where non-conformity team is involved, they manage to do it very well.

The team agrees that the information provided from site is sometimes lacking, whereas it is also a bit project team’s responsibility to gather relevant information. And that it is also important to know where in the plant the conflict is located and which system, since this would be important input for quality improvement. There are probably many templates available that site personnel could use in order to improve the input coming from site, but they should be better informed and the attitude towards reporting should be changed, especially with the older site personnel, according to the team.

According to the team, are most of the conflict settled without any further disputes. But if there have been more difficult cases, are these more easily settled if the non-conformity team is involved. The partnership does not affect whether a claim is issued or not. If it is a valid case then it should be reported despite how the claimed party is, according to the team.

Project team 2

Having the responsibility of the project, the team should be contacted of any issues of conflicts at site which could affect the project.
“we should be aware of everything that happens as site and informed of any issues so that we can decide what is the best way to solve the conflict [...] with regard to claims, are we usually more aware of the internal process of claim and knows what information is needed” – CPE

Not being located at site also affects the project team and they have to rely on the information provided from site. But project team have good understanding of the whole project and can link other relevant material or factors to the information provided from site. Since the information is sometimes not sufficient.

“the information provided from site (about a conflict) is in some cases not enough [...] sometimes we just get an photo with explanation that this thing is missing or broken... without any further explanation or indication [...] what we are trying to push and implement... since we have a template for reporting these kind of issues... is that the people at site would fill in this report directly at site and send it to us [...] if the template would be properly used, it would be easier to move forward with an official claim” – CPE

It was further discussed that one idea would be to require the site personnel to use the template. But since it is not required, everyone has their own way of working.

“it is of course difficult to get everyone to work the same and always use the template” – PM

“discussing and requiring this in a kick-off meeting with site people would of course be good” - CPE

The team recognise that conflicts are sometimes settled without contacting non-conformity team, and that this depends much of the situation and magnitude of the claim. However, the team also are aware of that all conflicts should be reported properly, with an official claim. Whereas the location of site and the type of site people further affects this.

“If the site is very remote, new material delivery can be complicated, whereas they fix problems at site [...] these older site guys also like to fix problems themselves without reporting” – CPE

The team didn’t not recall any case where a claim would have led to any major disputes. However, some type of conflicts are more problematic. When the material is stored for a
longer time after delivery from supplier, it might get affected by e.g. corrosion, then it is difficult to determine whose fault it really is.

It was further discussed about the information in claims, and the team agrees that if the information would be accurate the whole claim process could be faster, whereas the claim could move through the whole process at once without any further clarification.

The team don’t recognise the partnership with an external party to affect whether a claim is issued or not. If the evidence and case is valid, it should be reported to the responsible party. And that the project team and principal organisation should consider what have caused this conflict firstly, possibly if they might have affected the conflict or made a mistake, before issuing a claim. By this the evidence is more accurate.

“If you claim, you should know what you are claiming [...] and you should be able to validate the claim. Otherwise it comes back like a boomerang” – PM

The biggest problem with the whole process is according to the team to get correct and enough information from site once, without having to ask for more. Another problem is when the conflict concerns small things and small compensation, it is usually not reported, whereas the tight schedule of installation affects this further. However small amounts can lead to large costs in the long run, especially if the indirect costs are not included.

The information about a conflict at site should not be left at site, whereas the culture within the principal organisation could be different and more reported. Since involving the non-conformity in the process works very well, and according to the team more project teams should be aware of this.

4.2.2 External parties

The external parties are an essential part in the context of this thesis, as they can be subject to claims where the principal organisation consider the supplier to have caused a certain conflict that is identified during installation. The external parties that are included in this thesis can all be considered as some form of suppliers, whereas the engineering company supplies parts of engineering and detailed design, and the other direct suppliers supply some form of material. Material in this context refers to any form of physical object that is needed in the plant, e.g. steel structure, pipe and pumps.
At the engineering company, the recently appointed Project Operations Manager (POM) is responsible and the contact person for claims coming from the principal organisation. POM and internal projects teams are often communicating with the principal organisation when a conflict has occurred at site, whereas any misunderstandings can be filtered out and unnecessary claims can be avoided. However, if the cause of conflict seems to be caused by the engineering company, an official claim is issued. The POM reviews the claims and contacts the responsible (engineering company) project team for further review, who in turn does an internal investigation and write a response, in some cases the engineering company needs to ask for further information. POM reviews the response and sends it back to principal organisation. In this way claims are usually settled and the costs for causing the conflict are later agreed, after that the claim is closed. Since the engineering company rely on inputs and specifications to design form principal organisation, can the internal investigation sometimes reveal that wrong input has been given. In these cases, can the engineering company reject the claim.

“our own project team reviews the claim and investigate the cause, were they review drawings and design input which can have caused the conflict [...] We later formulate a response of the cause, where we either accept to have caused the conflict or reject. This process is planned to take 21 days, but we are currently lacking recourses and is therefore longer” – POM

The lack of resources was discussed to be a problem within the engineering company. And that the process could be faster if more resources were available.

A good description of the failure, which will explain the conflict, is the most important information needed in a claim, according to the engineering company. Based on a good description it should be possible to understand the problem, and thereby be able to identify the cause. The participants agree that the information in claims could be better, since they have to ask for further information.

“We sometimes have to ask for further information... it would of course be very good if we never would need to do it” – POM
“The information should describe well what happened, and possibly why [...] this would save a lot of time when if we wouldn’t need to investigate ourselves” – Senior project manager

Another issue that was brought up when discussing the information in claims, was that the engineering company would like to get the information of a conflict as fast as possible, in that case it would be easier to fix.

“what maybe would be most important is that we would be notified about a conflict as soon as possible [...] since it is also our responsibility to fix it some way... in the best and cheapest way...” – Senior project manager

“...and the cheapest way would also be the faster we get notified” -POM

It is problematic when conflicts are fixed at site before or while the engineering company gets notified, since they might have another suggestion for the solution. Another aspect is that it is more difficult to further review the cause once the problems have been corrected.

All the actions taken in order to prevent conflicts is also important, whereas the engineering company needs correct and clear input for design. In this way some claims cloud be prevented.

“For us it is important to get correct input, which could prevent some claims [...] it is super important... if the input is not correct, complications will happen. [...] of course, there is still room for misunderstandings and human error” – POM

The responsibility or the risks that the engineering company takes are high, since they make the detailed design with all the specification which in turn will be input for procurement at the principal organisation. The engineering company thinks that the principal organisation should, not claiming that they don’t, identify mistakes during the procurement. Better communication would be needed between design status and procurement, since some changes can be made after the material already have been procured.
“any small mistake in a number or specifications may lead to that wrong material is procured, this in turn might lead to big conflicts from our perspective [...] better communication would also be needed where principal organisation would inform us what have been procured and when. Then we better would know the status and where changes can’t be done anymore” - Senior project manager

“Since the plant projects usually have a tight schedule, the principal organisation might want some input to procurement in an early stage... when some updates might still be needed” – POM

This is a known risk that the principal organisation takes in order to procure the material as fast as possible, since the engineering company usually informs that the design is not final and some changes might still be needed.

Some conflicts are also settled without an official claim, where the principal organisations project team communicate and settle the conflict with engineering company’s project team, and the POM is not informed. Another additional way is to only give feedback about some conflicts that have happened. The participants discuss that claims are in some cases unnecessary, when it considers only a small amount of material or cost. Then this could be fixed in some other way, since the cost of the process exceeds the cost that is claimed.

Claims are usually settled without any further disputes and settled well, however the participant mentions that there have been cases where they have to involve insurance company who in turn focus on legal aspects. But that that kind of situation is really rare, and usually concern claims with high cost.

Steel structure supplier

The steel structure supplier is a major supplier to the principal organisation, and have direct manufacturing based on the detailed design. The organisation of the steel structure supplier is small and the management level includes only few people, and less people involved in claim management, which is why one-on-one interview was conducted instead. It was further acknowledged that the steel structure supplier had recently employed a new quality manager who will be responsible for claim management, and has not gained experience yet in this matter. Therefore, the key account manager was interviewed who has been, and still is, responsible for handling the claims.
The purchase order made by principal organisation acts as a contractual agreement with the steel structure supplier. The steel structures are purchased based on specifications and drawings from detailed design by the engineering company. Whereas the supplier is obligated to deliver according to what is specified in the purchase order.

When receiving a claim, the responsible person document and review the claim and look for relevant internal material which can either accept or “disprove” the claim. Since the supplier is manufacturing the steel structure and use CNC machine, they can trace back the production relatively good. This enables the supplier to trace back production to their first phase of cutting and drilling the material.

*We have this cutting list (for steel bars) where we can see what has been cut, what length and how much. Here we can trace back the production and see what has been inserted into our machines. [...] Then the production moves to drilling machine where we also can trace the input.” – Key Account Manager*

The steel supplier believes that they in most cases can trace the source of the conflict to the roots based on the information provided in a claim, and their documentation of production. However, since the steel structures consists of many several parts that are manufactured and later assembled at site, there might also be cases where the claims refer to wrong drawings or parts. But it was further discussed that the information in claims is usually sufficient, and that the supplier can always ask for further information. The supplier thinks that a good objective description of the failure with reference to drawings is the best information in claims, and that pictures and measurements makes it easier to understand the failure and situation at site.

*“Sometimes when we get a claim, they refer to some steel bar that we have in turn manufactured several of... Indication in/to drawings is better so that we know which steel structure is meant... and could know how it has been manufactured” – Key Account Manager*

Since the Engineering company is responsible for the detailed drawings and manufacturing drawings, can the steel structure supplier identify and fix failures during manufacturing, and thereby avoid expensive claims for the engineering company. The failures are more easily to fix at this phase and less expensive. Usually does not the supplier require compensation for this, but do it as a service. The cost of scrapped material is usually not much, but the
indirect costs for identifying and communicating the problem are usually not included, which is one consideration the supplier have.

“We don’t do test assembly and that is not our responsibility. But we can sometimes identify failure of the whole structure while manufacturing the parts, like this will not be possible to install at site. [...] this is one important thing, we can identify conflicts in the steel structure already in our production. And the conflicts can be fixed before becoming a conflict at site”
– Key Account Manager

According to the supplier, are most of the claims coming from the principal organisation valid, and that no unnecessary claims are directed to supplier. And the claims are usually solved without any further disputes. One problem is however the cost of fixing failures at site, which is usually relatively expensive. The supplier would like to be given the possibility to send their own personnel to site and fix the problems. However, the great distances between supplier and site makes this problematic, since the problems needs to be fixed directly in order to avoid stand still at site.

The supplier thinks that all the steps in the claim management process are needed. But it could be faster and the supplier should be able to fix the problems themselves that they have caused. The supplier also identify that the conflicts are sometimes solved without contacting the NC-team, whereas the supplier is in direct contact with the project team and settles the conflict. These cases are often due to that some material is missing and needed fast at site. From a supplier´s perspective it is difficult to disprove these kind of conflicts, since the supplier don´t know the situation at site and only have the packing lists as evidence. Even though packing lists indicate that some material has been delivered, a human error may have caused that the material has not been packed in the delivery.

“For us it is difficult to find evidence to disprove these kind of claims, there is really nothing you can do without actually being on site. In most cases it is just best to send the missing parts... if it considers small amounts and costs [...] it is a way of putting out small fires” – Key Account Manager

The supplier identifies that official claims are made more often, than settling the conflict by communication, if the project has not been that successful. And while the project has been successful the need of an official claim is not that important, the supplier might only be notified about any complications.
“if the project has been successful, everyone is happy, and you have more lenience of any conflicts that have happened during the project” – Key Account Manager

The supplier don’t think that the relationship affects how claims are issued, and that it neither should. All conflicts should be solved and one should be able to accept that they have made a mistake. If however the same complications repeats in other projects, can the relationship be affected and tensions may arise.

“It is not something that you should be offended by... you should admit your mistake, fix it and move on” – Key Account Manager

Principal organisation’s orders makes up the most part of supplier’s production, whereas the supplier can’t really relate to other originations for any differences. But thinks that the principal organisation in most cases have good way of working and know when a claim is needed. Whereas the NC-team usually are very objective in their claims, according to the supplier. Which the supplier also think is one important thing in claim management, to be objective and that the people handling claims should not be involved in other tasks such as sales and project, which might bias their decisions. For the supplier’s perspective are claims also a good way to improve the quality and partnership, when problems are solved together.

Pipe supplier

The pipe supplier, similar to steel structure supplier, deliver project specific material based on detailed design. But as a contrast does the pipe supplier not have own production or manufacturing, instead uses sub-suppliers. The pipe supplier is also a major supplier of material to plant projects, and have a long relationship with the principal organisation. At the pipe supplier, the different salespersons are responsible for handling claims of their sold material.

Since the pipe supplier source their material, they are not responsible for any conflicts caused by defect material. And they in turn have to claim and ask for information from their sub-suppliers. Which makes the process long and time consuming, while the project is in hurry for new parts or corrective actions, which can be problematic from the pipe supplier’s perspective.

“We have our own suppliers, who we need to contact in order to get further information... and based on that we can agree of a settlement [...] but the parts are usually needed directly
at site once we get a claim [...] whereas our own suppliers don’t necessarily understand the
urgency of the situation” - Sales person 1

The supplier thinks that the information in claims are in most cases sufficient, but that further
information is sometimes needed whereas the supplier directly contacts the NC-team and
project team and involves them to get this further information. Photos are a good way to get
an understanding of the how the material looks at site, according to the team can photos
sometimes be more describing than a description.

According to the supplier, are some conflicts settled without an official claim. Usually this
considers smaller amounts of material or costs, and whereas it is seen to be more easily to
settle without a claim. And that this depends much of the project team, whereas some teams
settle conflicts by communication and others makes and official claim.

The supplier doesn’t identify any major faults or problems in the claim management process
with the principal organisation. Claims are usually settled without any further disputes,
where the project team is understanding and is striving for settlement. They also identify the
importance of taking preventive actions in order to avoid same conflict again.

“we are only humans, everyone can make a mistake [...] this is understandable form the
project teams side as well... and the claims are settled together” – Sales person 1

Due to the urgency, does the supplier usually agree with the project team for corrective
actions and agrees for a settlement. This might include sending the new material to site. The
official claim can then in turn be signed and settled later, and the NC-team gets this official
response when the conflict is settled. Whereas the supplier argues that they don’t get notified
once the official claim is closed, which is one improvement suggestion from the supplier
side.

“you sometimes get an unsecure feeling when you don’t know if the conflict is settled
properly, since we don’t get any response” – Sales person 2

“With project team we usually settle conflicts and knows that everything is fine... but for the
official claims it would be good to know once these are closed” - Sales person 1

The supplier thinks that claims are good way of solving conflicts and that one party should
not consider the partnership to be affected. Conflicts should be solved whereas the project
team is understanding, and claims leading further disputes couldn’t be recalled by any of the
participants.
5 Analysis

In this section the empirical findings are further analysed and discussed in relation to findings from literature. Firstly, the findings of root cause analysis is analysed, secondly findings from focus groups and interviews are analysed. The two parts are analysed separately, but later be discussed more in relation to one another.

5.1 Root causes

Much of the analysis in this thesis were done during the expert’s workshops where tools of root cause analysis were applied, focusing on specific conflicts. Based on the expert’s knowledge and understanding, were the root causes determined and coded as shown in Table 2 and Figure 6. During the expert’s workshop each individual change claim was analysed, using the tools of root cause analysis. The purpose of the Five why’s tool is to delve deeper into the levels of causes (Andersen and Fagerhaug, 2006). The different levels in literature varied slightly between authors, however could be generally explained as symptom, higher-level cause and root cause (Wilson, 1993; Rosenfeld, 2014; Andersen and Fagerhaug, 2006). Since the root causes were coded and root causes cannot be presented without presenting the whole description as mentioned in the empirical material, it won’t be possible to further analyse the levels based on the codes. Considering the purpose of Five why’s tool, were the analysis done during expert’s workshops. Since the expert’s typically answered “why” 2-3 times, simultaneously moving the through the different levels. An example of how the different levels of causes stands in relation to the root cause as identified during the expert’s workshops is shown in Table 4. The example in Table 4 does not show any specific example of a root cause, but a generalisation of an example.

<table>
<thead>
<tr>
<th>Level of cause</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom</td>
<td>Pipe is not possible to connect</td>
</tr>
<tr>
<td>Direct cause</td>
<td>Design incorrect</td>
</tr>
<tr>
<td>Root cause</td>
<td>Insufficient design input (Not enough info about existing plant)</td>
</tr>
</tbody>
</table>

Previous research have addressed different causes of claims, see Appendix 1, and some have claim to identified universal root causes (Rosenfeld, 2014). However, when coding or labelling the root causes as were done during expert’s workshops and as previous literature have done, will not explain the whole root cause. Since every root cause is specific must one provide the full description of the problem or conflict as well, in order to fully understand
the root cause. Hence, are the universal root causes identified by Rosenfeld (2014) only labels, which could be assigned to a various specific problems. The same could be considered for the other literature and empirical findings in this thesis. However, by coding or labelling the root causes it will be possible to present and further analyse several root causes a whole, which has been done in the next section.

5.2 Causes of sub-contractor change claims in plant EPC plant projects

The results of the expert’s workshop were presented in Table 2 and Figure 6. From the results can be seen that the most common root cause is the insufficient information about existing plant, followed by installation mistake. For the root cause of installation mistake, have the sub-contractor installed some other related material incorrect which have caused them to make some changes, based on empirical findings. These kind of change claims from sub-contractor should not be valid since the sub-contractor have caused the conflict themselves. This similar for FA not noted, since the sub-contractor have reviewed the drawings and specifications before the contractual documents were signed, should the sub-contractor be aware to the field adjustment in drawings. Design mistake were also a major root cause to sub-contractor changes claims, in these cases had the design been incorrect even though the input was correct. Other major root causes were requests by either client (end-user of plant) or principal, where the root cause is not directly a conflict but the sub-contractor claims for compensation of a modification that is requested by another party.

To further analyse the root-causes and to better visualise all the root causes, will cause-and-effect tool be used. Since it is a highly visual technique (Wilson, 1993) and can be used to generate and group problem causes (Andersen and Fagerhaug, 2006). The method has also been applied by Rosenfeld (2014) in Figure 5. The root causes has been grouped into different categories, however the categories used by Rosenfeld (2014) are not to be suitable for this research. Neither are the generic categories of five M’s (machine, manpower, materials, methods and measurements) (Tague, 2005) found suitable. The categories of root causes in this research have been selected with much focus on type of change claim and responsible party, also reference has been taken from previous research, see Appendix 1, the result and categories is presented in Figure 8. It has to be stressed out once again that Figure 8 indicates the coded root causes, not describing different root causes.
From Figure 8 can be seen that most of the root causes to sub-contractor changes are related to design, whereas there has not been enough info about the existing plant which have caused incorrect design. Root causes related to sub-contractor and installation were also a major cause. Based on Figure 8 is the sub-contractor responsible for many of the root causes, and that the sub-contractor is seeking compensation to fix conflicts that they have caused themselves. This could potentially be explained as opportunistic behaviour which was identified in literature (Abdallah et al., 2013; Chang, 2002). Since the sub-contractor is claiming that a change is needed of which the party is to be compensated, thereby is the sub-contractor seeking to increase profit from the project. This was discussed during the expert’s workshops, and one could argue that the root cause is opportunism. However, it was not possible to validate that opportunism would be the cause of installation mistake, therefore the root cause was coded as installation mistake. On could also argue that root cause where field adjustment had not been noted (FA not noted) would be categorised under specifications. However, the field adjustment is indicated in drawings and specification, hence it should be noted by sub-contractor.

How the different categories are defined and how the different root causes are assigned under the categories will affect the results and which conclusions that can be drawn. Since there is no specific rule or methodology for the categorisation, could this be done in many different ways. Categorisation by Rosenfeld (2014) is very broad, by defining three different categories. Having broad categories will give not so specific results, whereas categorisation in this thesis have been made slightly more specific. Comparing the results from the cause-and-effect chart in Figure 8, to the results from previous research in Appendix 1, can some
similarities be found. Claims that are related to design is a reoccurring category in Appendix 1, which is also the case in this thesis. What the empirical findings in this research suggests is that another major root causes for change claims are related to installation or sub-contractor themselves, which is not a recognised category in Appendix 1. The insufficient instructions provided by the principal organisation were also a root cause of several change claims, whereas similar definition of “poor communication” can be found in Appendix 1.

5.3 Claim management in EPC plant projects

Claims are the source of some sort of conflict in the project, which is considered to be caused by some other party, and the other party seeks for compensation for this conflict. This means that the definition of a claim by Project Management Institute (2013) will give good explanation of the concept of a claim. Other relevant terms that were identified in the literature were also disputes and the previously mentioned conflict. Distinction between is to be made in order to understand the basic relationship. A conflict can be any kind of problem, defect, wrong delivery etc. that is identified and believed to be caused by another party. A conflict becomes a claim when the other party is formally notified with an official claim, were the needed actions, compensation and preventive actions are settled as suggested by Enshassi et al. (2009). Disputes can then arise if agreement is not reached, either of who have caused the conflict or the costs related to it. Whereas basic relationship by Kumarswamy (1997) in Figure 2, supports the findings.

Claim management in projects is lacking attention as argued by Vidogah and Ndekugri (1998), the empirical material in this research further validate this in the context of EPC projects as well. Firstly, that the non-conformity team in this case study is considered as a support function. And secondly that the non-conformity team are in many cases not involved to make an official claim. Project teams and external parties are aware of the claim management process and knows that non-conformity team can be involved which would result in official claims, but prefer to settle the conflicts themselves. A major cause of this is that the conflicts needs to be settled as fast as possible in order to continue the installation. Issuing an official claim is considered to take too long, since corrective actions needs to be taken immediately. Not only the process itself require more time for settlement as Hadikusumo and Tobgay (2015) suggests, but also formulating well defined claims as identified by Vidogah and Ndekugri (1998). Even though the empirical material and Bakhary et al. (2015) suggests that the information in claims should be kept simple, it still needs to
provide such a comprehensive understanding of the problem and situation at site so that the claimed party do their own evaluation of the situation.

Documentation is an important step in the claim management process, where all the supporting documents should be compiled together according to Bakhary et al. (2015), who further argues that in reality, the importance of this step is not realised as much as it should be. A contradiction in the empirical material and participant’s answers is identified in relation to documentation, since many participants agrees that the information is enough, but same participants further discuss that they sometimes have to ask for further information. When external parties have to ask for more information more time is required. Since the external parties (suppliers) are not located at site they have to rely on the material in claim, and the importance of this is not fully realised, as suggested by Bakhary et al. (2015). It is thus important to issue claims that provide such a good understanding of the situation at site so that the external party can do their own evaluation based on the material. This would also speed up the process when external party would not need to ask for further information and could respond within a smaller time frame.

From principal organisation’s perspective it is most important to complete the installation and project within schedule. This is also why conflicts are settled as fast as possible and issuing an official claim is usually not done. Since the change or rework caused by a conflict can have indirect effects which ultimately have a damping impact on project cost and/or schedule (Sun and Meng, 2009). Smaller conflicts where no compensation or replacement is needed are usually fixed at site. When compensation or replacement is needed, the external party is usually contacted and the conflict is settled preferably through communication between project team and external party, or in a not so preferred way through an official claim. In that sense, there are mainly three different paths how a conflict is settled from the principal organisations perspective:

1. Fixing the conflict at site without any further notification
2. Conflict and settlement is made between project team and external party
3. An official claim is made by informing non-conformity team who settle the conflict with external party

An alternative is that the conflict first takes second path, and the final settlement of costs related is made later through the third path of non-conformity team.
Some conflict of interest regarding claim management is identified between internal stakeholders. Project team prioritise the project performance and avoid any form of delay, whereas they prefer to settle conflicts as fast as possible. Non-conformity team focus both on that conflicts are settled that the preventive actions would lead to quality improvements. However, both recognise and understand each other’s perspective. Whereas project teams understand the importance of a claim and non-conformity team understand the urgency in project installation.

From an external perspective it is most important to get information of a conflict as fast as possible, in form of communication or an official claim. And this is usually done, as mentioned, by project team contacting the external party directly which is also preferred by the external parties. By getting the information directly can the external parties get an overview of the situation almost as it happens, whereas they could have the possibility to come up with corrective actions or fix the conflict themselves. This would be supported by Abdul-Malak et al. (2002) who suggest that issuing of a claim should be done directly after the occurrence of the cause of the claim or soon thereafter. However, claims are sometimes issued some time after the conflict, then it is difficult for the external party to get an understanding of what happened.

External parties recognise the urgency in projects and wants to help and fix any conflict they have caused, however they still have to do their own evaluation of the claim which takes time. This problem is even greater with suppliers who have many sub-suppliers, since they in turn might have to contact or claim the sub-suppliers, whereas the whole process of settling the claim between principal organisation and supplier become even longer. Even though the external parties think that most of the claims coming from principal organisation are valid, they still have to do their own evaluation and/or investigation to determine what impact the conflict could have had, and if the claimed costs are valid. As suggested by Enshassi et al. (2009) “A well-prepared defense quickly demolishes evidence and claim costs that are not supported by accurate records”. By doing this can the external parties avoid unnecessary claimed costs, however this was not identified to be a problem.

Previous research address much that dispute in construction projects are common (Cheung and Pang, 2013; Love et al., 2010; Mitropoulos and Howell, 2001). Empirical material in this research however suggest that disputes are not a problem, and that claims are usually settled without disputes. The context in this case study might however affect this
contradiction, since this research have focused on claims to extremal parties such as suppliers, and the claimed compensation is usually relatively small. Another factor to this contradiction could be that conflict are usually settled through communication, whereas no claim is issued which could lead to a dispute.

5.4 Claims and relationships

It was identified from the literature that the relationship might affect the submission of a claim (Abdul-Malak et al., 2002; Lu et al., 2015). Based on the empirical material, does not the relationship affect the submission of a claim. The parties in this research agrees that if there is a valid conflict, it should be claimed, despite the relationship. And that valid claims are a good way to improve the quality and thereby relationship. However, if the similar claims are repeated in other projects and the claimed party have not taken preventive actions that would prevent a conflict of happening again, can the relationship be affected.

Putting the resources into perspective of the different parties in this research considering the claim management process, does the principal organisation obtain the most resources followed by engineering company, pipe supplier and then steel structure supplier. With regard to (Harmon, 2003) can the party with most resources control the others. This was not directly identified in the empirical material. However, some indication of that external parties might go for a settlement even though they might not be responsible in a conflict. On the other hand, does these kind of cases concern small conflicts that are settled without a claim. Further does most of the engineering company’s and steel structure supplier’s production go to the principal organisation, hence it would be a priority to maintain good relationship.

The conflicts between principal organisation and sub-contractors or suppliers are tried to be settled as fast as possible. With reference to Figure 1 is the principal organisation responsible for the out-sourced activities (Shen et al., 2017). The more relationships, the more potential sources of conflict (Kumarswamy, 1997), and in this context is an additional sub-system added and presented in Figure 9. Hence should he principal organisation solve these “internal” conflicts in the sub-system, before they becomes conflicts between principal organisation and client. Since the consequences of conflict between principal organisation and client are much higher.
Figure 9 - Potential sources of conflicts in EPC-projects
6 Discussion

The findings in this research will be discussed in relation to the research questions that have guided the research. Discussion is made based on findings and analysis in previous sections.

1. What are the root causes for sub-contractor change claims in EPC construction projects?

Root causes to sub-contractor change claims during plant installation are mostly related to installation and design. Where a major root cause in this case study were that not enough information about the existing plant have had been obtained which was needed for design input. Other major factor where that sub-contractor was responsible for many of the root causes and in that sense themselves causing the change claims to fix conflict that they have caused. This could be considered as opportunistic behaviour, but not identified as a root cause. Some root causes of sub-contractor change claims are also due to insufficient instructions provided by the principal organisation. Further are changes requested by some party causing the sub-contractor to issue for compensation in form change claims.

As already discussed in the literature, have previous literature identified causes and root cause for claims, see Appendix 1. Whereas the results are somewhat similar, but the matter of defining the cause and categorisation determines the results. Hence one could argue that the findings in this thesis are not much different to previous research, since the underlying conflict are not known, neither the chain of events causing the conflict. However the findings of that sub-contractors issue change claims in order to fix own problems provides some interesting and deep understanding of an underlying problem that has not been addressed much in previous literature.

Coding or labelling causes makes it possible quantify and present the results statistically, however does not usually provide understanding of the underlying conflict. And whereas understanding the problem is the first step of root cause analysis (Andersen and Fagerhaug, 2006), should the specific problem be presented as well. This is however problematic, and in this thesis not possible, since sensitive and internal information would be needed to describe the whole concept of specific root cause.

The costs related to sub-contractor change claims due to design mistakes where the sub-contractor is compensated to fix small design mistakes at site are typically relatively small. And when the information in reports of sub-contractor changes is lacking, as it was identified
during the expert’s workshop, are the cost difficult to be claimed to external party due to lack of evidence. It was further discussed during that the expert’s workshops that the plants are complex in design and human error is always involved, hence designing a plant without any mistakes at all would require much time and resources. More time and resources would of course be costlier, hence it might be more beneficial to correct these small design mistake at site. It has to be stressed out that this of course concern small design mistakes. This dilemma however leads to another dilemma when the conflicts are not reported, there is less likelihood of that the small design mistakes corrected.

2. What are the problems associated with claim management in inter-organisational EPC-projects?

A major problem with claim management in plant EPC-projects is that the process is considered to be too time consuming, especially during plant installation. Project teams who are responsible for projects choose to settle conflicts as fast as possible, much due to the tight schedule for plant installation and high penalties for delays. Thus, are conflicts settled either at site directly or between project team and external party, and official claims are avoided. However, the internal process of claim management considered to be sufficient, if an official claim is issued is the settlement done correctly by the non-conformity team.

Problems however arise when the claim reach the external party for two main reasons, firstly does the external party have to do an own evaluation of the claim and sometimes contact their own suppliers whereas a response and settlement can take too long during plant installation. Secondly, does the external party often have to ask for more information regarding the claim and conflict, which further extends the claim settlement.

The conflict is happening at site and project team, non-conformity team and external parties are located in offices, usually far from the site. Hence, does these teams have to do their own evaluation based on descriptions provided from site. To avoid the problem of that parties have ask for more information, should the description in a claim be so comprehensive that an evaluation of the situation can be done. The information in a claim should in a sense be able to “recreate the scene” for any party afterwards. A good description with photos and reference to material should be gathered at site where the conflict has occurred. The
description and formulation in a claim should also be objective, which would further enable the external parties to do an evaluation of the situation based on unbiased information.

Claim management is also lacking attention, even though the principal organisation has a separate team for handling claims and project teams are aware of that the non-conformity team can be contacted, are direct contact to external party usually preferred. External parties don’t have separate assigned teams or personnel for claim management, with exception of the engineering company in this case. Since people handling claims are assigned to other related tasks as well, might make the claim handling less objective. Claim management should be objective, whereas the conflicts should be settled without any further preferences such as project performance or increased margins.

Since most conflicts are settled without an official claim, does not the conflicts lead to disputes. The claims to external parties in this case study are also relatively small, which might further support settlement without disputes. However, in most cases are not all the indirect costs related to a conflict included, which could ease the settlement. From a principal organisation perspective could these costs be compensated if the follow-up would be done properly. Once again, it would it be important to document and provide such a comprehensive description of the situation when the conflict is happening, so that related costs could be assessed later as well. From an external perspective are these indirect costs to be avoid, whereas external parties should be given the possibility to fix the conflict themselves. In order to do so, should the conflict be communicated to external party directly after occurrence. It is however problematic and time consuming for an external party to send own personnel to site and fix the conflict, and this is not in some cases even possible. But the external party should be given the possibility of assessment of the situation directly.

It is also much of the attitude within the principal organisation why claims are not issued. Since many conflicts are settled or solved by fixing problems directly at site. This attitude is much present at the site, an especially by the older employees. As a contrast does the younger generation report and issue claims more easily. By fixing conflicts at site, leads to that the knowledge of existing conflicts are left at site. If the conflict instead is reported in form of a claims does the information of existing conflicts reach the responsible party. Hence are claims an important tool of quality improvement, and the likelihood of improvements are higher if conflicts are claimed.
Based on the above discussion does this thesis argue that the basic relationship of conflicts, claims and disputes and possible outcomes proposed in by Kumarswamy (1997) in Figure 2 is different in the context of EPC-projects. The differences are that conflicts does not lead directly to disputes, but has to become a claim first. Conflicts does neither lead directly to improvements. Conflicts that are fixed at site could be considered as temporary fixes or work-arounds since the conflict is not settled with responsible party. If the conflict is claimed, there is a greater likelihood for improvements. Thus, does this thesis propose a basic relationship in EPC projects as presented in Figure 10.

![Figure 10 - Basic relationship of conflicts and outcomes in EPC-projects](image)

A claim should also be settled and closed properly, whereas the claimed party is properly informed about. This is also a way of giving the external party a good understanding even after the conflict.

Conflicts that concerns small amounts of compensation, e.g. some bolts are missing, and reporting these kinds of conflicts could be more costly than the compensation, given that the conflicts does not lead to much indirect costs. Which is another dilemma identified in this thesis. Since same conflict might get repeated in another project, where the consequences could be higher. One solution would be to inform the external party about the conflict by only communication, however then it is less likely that preventive actions will be taken.
3. How does the relationship between two parties in EPC-project affect submission of claims?

The relationship and future partnership does not affect the submission of a claim, given that the case is valid. If the claim and conflict is valid, it should be solved. However, if claims does not lead to preventive actions and same kind of conflicts occur in other projects, might the relationship get affected. Moreover, could claims lead to better relationship if conflicts are solved properly and responsible party takes preventive actions to fix the source of the conflict. If conflicts are not claimed, there is less likelihood for the source to be fixed, whereas same kind of conflicts needs to be solved in future projects, which might create unhealthy tensions between two parties.

The threshold and attitude towards reporting a conflict could be better, since external parties wants to help and solve conflicts that they are responsible of, but needs to have a proper understanding of the situation. Thereby should conflicts be reported as they happen and not afterwards, this is much done by that the project team when settling conflicts directly with external party. However, solving conflicts in that manner, will not document the conflict and it is less likely that preventive actions will be taken, not to mention all related costs that principal organisation could get as compensation.

Claim management is a great tool for quality improvement, and the documented claims acts as data. With regard to quality improvement and concepts of total quality management, the fundamental part of any improvement is data. Gathering, structuring and analysis of data is the first step of quality improvement, and gives a solid base decision making of which quality improvements to make. Gathering data is important, but gathering right kind of data is more important (Bergman and Klefsjö, 2012). Claims are documented cases of conflicts, and if the quality improvement should be made by an external party, are claims a way of providing the data for quality improvement to an external party.
7 Conclusions

In this research the purpose was to identify root causes of sub-contractor change claims and claim management in plant EPC-projects. The research has been conducted within an organisation that delivers plant solutions in form of EPC-projects, where several different parties and stakeholders are involved. The focus has been on claim management during plant installation, which is the critical last phase of plant delivery and involves sub-contractor installing material delivered from different parties. Causes of sub-contractor change claims were studied applying methods of root cause analysis involving different experts. Focus groups and interviews were conducted with relevant parties to the plant projects, in order to better understand the claim management process. Further has this research studied how the relationship between two parties affects claims.

The list of claim causes is extensive from previous literature, whereas some categories and themes are more common than others. In constructions projects are much of the causes of claims related to design and changes by either different conditions or requests by a party in the project. Root causes of change claims in plant EPC-projects indicated the same understanding. Many root causes for sub-contractor change claims are related to design, either by insufficient design input or direct design mistakes. Other major root-cause are related to installation and sub-contractors, whereas sub-contractors have either made some mistakes during installation or have not noticed the field adjustment in drawings and specifications. Further are sub-contractors requesting compensation for fixing conflicts caused by themselves. Thus, are opportunism considered to be present, whereas sub-contractors are responsible for the plant installation and makes the attempt to increase the profits. However, opportunism can not be validated as a root-cause, but is supported by previous literature and empirical findings in this research. These conclusions are based on empirical findings and analysis to previous literature, where it was further identified that the different definitions and categorisation of causes, has an major impact on the results and conclusions that can be drawn.

Claims are undesired in the construction industry and disputes are common in construction projects according to much previous literature. This thesis argues for a different understanding. In the context of plant EPC-projects where a main contractor sub-contracts and outsource parts of the plant delivery are claims not a problem and less of the claims are leading to disputes. Even though claims and disputes are not considered to be a problem, are
small conflicts still present during plant installation. However, the small conflicts during plant installation are settled by communication between the two parties, and official claims are avoided mainly due to the tight schedule of plant installation and much of the “fixing it yourself” attitude. Since conflicts are settled in this manner, does the conflicts neither result in a claim. The process of issuing an official claim during plant installation is considered to be too time consuming during a critical phase where delays may have higher consequences, and project teams are responsible for solving and settling conflicts as fast as possible during plant installation. The “internal” relationships between principal organisation and sub-contractors are solved before coming conflicts between principal organisation and client, see Figure 9. Which is further why conflicts are settled as fast as possible, since the consequences of a conflict between principal organisation and client are higher.

Formulating an official claim requires more resources and considering that the external party have to evaluate the claim, leads to that the settlement takes longer than direct communication. The lack of information provided from site is a major contributing factor for the delay in settlement. Hence, is the process of settling a conflict through an official claim avoided, even though the principal organisation have resources and personnel available to issue and settle an official claim. External parties, who usually are subject to claims in this context, have less resources available which further delays the settlement. External parties are willing to help and solve conflicts they have caused, and prefer to settle claims as fast as possible in order to avoid any further costs of delays. However, many of the indirect costs are typically not included in the compensation due to the lack of cost follow-up by the principal organisation. Often is the settlement of final compensation done afterwards, when it is difficult to get an understanding of a conflict that have happened earlier, and it is difficult to include all the costs afterwards.

Relationship between two parties does not affect issuing a claim nor the settlement, given that the claim is valid. Claims are valid, documented cases of a conflict that should be settled. None of the parties in this case studies identified that claims would affect the relationship, since when an official claim is issued, it is based on a valid conflict. Further are the communication and settlement without an official claim a way of filtering out many of misunderstandings and invalid cases. However, if claims does not lead to preventive actions by the claimed party may the relationship be affected. In the context of this thesis does the relationships typically continue between the involved parties in future projects, hence it is important for the external parties to take preventive actions to avoid further conflicts. The
organisation who is the main-contractor are providing the projects to external parties by outsourcing different tasks, whereas the external parties prefers to maintain the partnership for future projects, whereas they may go for settlement more easily concerning small claims.

7.1 Practical implications

This thesis provide contrast to existing research by contributing to the understanding of causes to claims and claim management in the context of plant EPC-projects. Based on the findings should better supervision of sub-contractors be needed in order to avoid invalid claims of conflicts, whereas the compensation to sub-contractors could be reduced. Good planning and design of the plant is also needed in order to avoid conflicts. However, an equilibrium between design costs and sites cost should be in mind. Whereas costs of fixing small conflicts at site can be more beneficial than spending major resources on a prefect design, however same kind of conflicts may lead to greater consequences in future projects.

When the priority is to complete a plant project without any delays, are conflicts settled by communication. Parties involved in the conflict prefer to settle conflicts as fast as possible to avoid any extra costs. Conflicts that eventually becomes claims are typically settled without further disputes. When an official claim is issued it is of most importance to provide such a good description of which an external party can make an own evaluation of the conflict. Tools of root cause analysis is a good way to identify the underlying cause to a conflict but requires a good understanding of the problem, whereas a good description of the conflict is further needed.

The threshold of reporting conflicts to non-conformity team should be low, of which more cases would be reported and the awareness of conflicts provided to external parties, who in turn could fix the sources to conflicts, given that the source at the external party. Official claims are a great tool for quality improvement, however the external parties should be given data for quality improvement, whereas claims are one formal way of providing data.

7.2 Theoretical implications

This thesis applied tools of root cause analysis, and addressed the concept of root cause. It was identified that when quantifying root causes, one has to generalise or code the root causes which will not explain the specific root causes. Since every conflict specific, so also the root cause. To fully understand or present a root cause of a problem, one has to present whole chain of event from problem to the root cause. Due to this should research with the
purpose of identifying root cause focus on one small problem and not quantifying several causes. In contrast to referenced literature, has this research focused on actual causes and applied tools of root causes analysis with different expert’s knowledge, providing more deep analysis of causes to claims.

Tools of root cause analysis are great tools for analysing events and causes deeply, which can be used in research purpose, and more practically at site. However, when conducting root cause analysis and applying different tools in reactive manner for research purpose, can the root cause only be determined based on material available. Whereas root cause analysis is most suitable to be used in the same place and same time of a problem occurrence.

The complexity and limits of root cause was identified during this research. Considering the tool of Five why’s one could always ask “Why” one more time, whereas theories suggest that the root cause is identified when “Why” cannot be asked further. This thesis also argues that if a root cause cannot be validated it is a potential root cause, which is much of the purpose foe cause-and-effect tool. The purpose cause-and-effect tool is to identify potential root causes in different categories, and will only provide potential root causes. But in order to eliminate a problem one should know the actual root cause. Whereas cause-and-effect tool is more suitable for visualising and presenting several different root causes for a broader problem.

This thesis does also argue of a different understanding for the basic relationship of conflicts, claims and disputes, as proposed by (Kumarswamy, 1997) in figure Figure 2. Conflicts are the source for claims, whereas conflicts are any kind of problem identified during the project. And conflicts lead to claims, however not directly to disputes as suggested by (Kumarswamy, 1997). Further is the likelihood for improvements greater if an official claim is issued, since this will document the conflict and require the claimed party to take responsive actions. A new basic relationship in the context of plant EPC-projects is proposed in Figure 10.

7.3 Ethical implications

Some literature suggests that claims can be considered sensitive, since one party is claiming another party to be responsible of a conflict. This research suggest that claims are not to be taken as something offending, rather as data for quality improvement. However, in the context of this thesis it could be suggested that smaller external parties that are sub-
contractors for the main-contractor, are more likely to settle the smaller claims without further evaluation and defence in order to maintain the relationship. Ethical dilemmas can arise of whether one party should settle more easily in conflicts in order to maintain the relationships.

Even though claims were not identified as sensitive or offending, has this thesis taken the anonymity of involved parties and participants seriously and not disclosing any information that could invade someone’s privacy. However, the perspective of sub-contractor is not included during the root cause analysis, whereas this could be an ethical consideration. On the other hand, have the sub-contractor provided their perspective of the conflicts in the report, and the conclusions and identified root causes are based on the expert’s view within the principal organisation who should solve conflicts correctly and identify responsible party.

7.4 Limitations

This thesis has focused on claim management based on qualitative data from within in the principal organisation and three external parties. However, some important actors relevant to the claim management process are not included in this study due to accessibility, mainly site personnel and sub-contractors. Gathering qualitative data from these actors would give an even better understating of the whole claim management process, and also provided better understanding of how the conflicts are solved and managed at site.

Presenting the material from root cause analysis without disclosing sensitive information also sets some limitations on the empirical material of which conclusions can be drawn. The time and scope restrictions of the research further set some limits for the root cause analysis. Analysing several actual conflicts during Expert’s workshops required significant time, whereas it would be possible to analyse each case more deeply and also gather knowledge from relevant external experts and actors, within a longer period of time.
References


## Appendix 1

### Claims and disputes in construction

Source: (Love et al., 2010), (Kumarswamy, 1997)

<table>
<thead>
<tr>
<th>Author</th>
<th>Factors contributing to claims/disputes</th>
</tr>
</thead>
</table>
| Yiu and Cheung (2007)         | Significant sources  
                                 Construction related: variation and delay in work progress  
                                 Human behaviour parties: expectations and inter-party problems |
| Killian (2003)                | Project management procedure – change order, pre-award design review, pre-construction conference proceedings, and quality assurance  
                                 Design errors – errors in drawings and defective specifications  
                                 Contracting officer – knowledge of local statues, faulty negotiation procedure, scheduling, bid review  
                                 Contracting practices – contract familiarity/client contracting procedures  
                                 Site management – scheduling, project management procedures, quality control, and financial packages  
                                 Bid development errors – estimating error |
| Mitropoulos and Howell (2001) | Factors that drive the development of a dispute:  
                                 Project uncertainty  
                                 Contractual problems  
                                 Opportunistic behaviour |

*Continued.*
<table>
<thead>
<tr>
<th>Author</th>
<th>Factors contributing to claims/disputes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kumaraswamy (1997)</td>
<td>Five common categories of claim:</td>
</tr>
<tr>
<td></td>
<td>1. Variations due to site conditions</td>
</tr>
<tr>
<td></td>
<td>2. Variations due to client changes</td>
</tr>
<tr>
<td></td>
<td>3. Variations due to design errors</td>
</tr>
<tr>
<td></td>
<td>4. Unforeseen ground conditions</td>
</tr>
<tr>
<td></td>
<td>5. Ambiguities in contract documents</td>
</tr>
<tr>
<td></td>
<td>Five common causes of claims:</td>
</tr>
<tr>
<td></td>
<td>1. Inaccurate design information</td>
</tr>
<tr>
<td></td>
<td>2. Inadequate design information</td>
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<tr>
<td></td>
<td>3. Slow client response to decision</td>
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<td></td>
<td>4. Poor communication</td>
</tr>
<tr>
<td></td>
<td>5. Unrealistic time targets</td>
</tr>
<tr>
<td>Colin et al. (1996)</td>
<td>Six key dispute areas:</td>
</tr>
<tr>
<td></td>
<td>1. Payment and budget</td>
</tr>
<tr>
<td></td>
<td>2. Performance</td>
</tr>
<tr>
<td></td>
<td>3. Delay and time</td>
</tr>
<tr>
<td></td>
<td>4. Negligence</td>
</tr>
<tr>
<td></td>
<td>5. Quality</td>
</tr>
<tr>
<td></td>
<td>6. Administration</td>
</tr>
<tr>
<td>Sykes (1996)</td>
<td>Two major groupings of claims and disputes:</td>
</tr>
<tr>
<td></td>
<td>1. Misunderstandings</td>
</tr>
<tr>
<td></td>
<td>2. Unpredictability</td>
</tr>
<tr>
<td>Bristow and Vasilopoulos (1995)</td>
<td>Five primary causes of claims:</td>
</tr>
<tr>
<td></td>
<td>1. Unrealistic expectations by parties</td>
</tr>
<tr>
<td></td>
<td>2. Ambiguous contract documents</td>
</tr>
<tr>
<td></td>
<td>3. Poor communications between project participants</td>
</tr>
<tr>
<td></td>
<td>4. Lack of team spirit</td>
</tr>
<tr>
<td></td>
<td>5. Failure of participants to deal promptly with changes and unexpected outcomes</td>
</tr>
<tr>
<td>Diekmann et al. (1994)</td>
<td>Three main dispute areas:</td>
</tr>
<tr>
<td></td>
<td>1. Project uncertainty</td>
</tr>
<tr>
<td></td>
<td>2. Process problems</td>
</tr>
<tr>
<td></td>
<td>3. People issues</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Author</th>
<th>Factors contributing to claims/disputes</th>
</tr>
</thead>
</table>
| Heath et al. (1994)        | Five main categories of claim:  
1. Extension of time  
2. Variations in quantities  
3. Variations in specifications  
4. Drawing changes  
5. Others  
Seven main types of dispute:  
1. Contract terms  
2. Payments  
3. Variations  
4. Extensions of time  
5. Nomination  
6. Re-nomination  
7. Availability of information                                                                                                         |
| Rhys-Jones (1994)          | Ten factors in the development of disputes: 1. Poor management  
2. Adversarial culture  
3. Poor communications  
4. Inadequate design  
5. Economic environment  
6. Unrealistic tendering  
7. Influence of lawyers  
8. Unrealistic client expectations  
9. Inadequate contract drafting  
10. Poor workmanship                                                                                                                     |
| Semple et al. (1994)       | Six common categories of dispute claims:  
1. Premium time  
2. Equipment costs  
3. Financing costs  
4. Loss of revenue  
5. Loss of productivity  
6. Site overhead  
Four common causes of claims:  
1. Acceleration  
2. Restricted access  
3. Weather/cold  
4. Increase in scope                                                                                                                     |
| Watts and Scrivener (1992) | Most frequent sources of claims:  
Variations  
Negligence in tort  
Delays                                                                                                                                          |
| Hewitt (1991)              | Six areas:  
1. Change of scope  
2. Change conditions  
3. Delay  
4. Disruption  
5. Acceleration  
6. Termination                                                |
References to list in Appendix 1


## Appendix 2

Tools for different steps in problem solving (Andersen and Fagerhaug, 2006)

<table>
<thead>
<tr>
<th>Steps</th>
<th>Purpose</th>
<th>Tools</th>
</tr>
</thead>
</table>
| Problem understanding  | Methods that help get to the bottom of a problem. This phase focuses on understanding the nature of the problem, and is a first step before starting the analysis. | - Flowchart  
- Critical incident  
- Spider chart  
- Performance matrix |
| Problem cause brainstorming | Generic tools that can be applied at different stages in the analysis. Brainstorming can help generate ideas about possible causes. Since the analysis normally is carried out in groups, methods that help you arrive at consensus solutions are also useful. | - Brainstorming  
- Brainwriting  
- Is-is not matrix  
- Nominal group technique  
- Paired comparisons |
| Problem cause data collection | These generic tools and techniques are used to systematically and efficiently collect data related to a problem and its probable cause. | - Sampling  
- Surveys  
- Check sheet |
| Problem cause data analysis | Tools used for making the most of the data collected about the problem. When analysing the same data from different angles, different conclusions might emerge. Some conclusions may not uncover the problem’s causes, so it is important to have several data analysing tools available. | - Histogram  
- Pareto chart  
- Scatter chart  
- Problem concentration diagram  
- Relations diagram  
- Affinity diagram |
| Root cause identification | The heart of root cause analysis. Root cause analysis is not one single approach, and neither is this group of tools. You can use these tools to more deeply analyse the problem’s root cause(s). | - Cause-and-effect chart  
- Matrix diagram  
- Five whys  
- Fault tree analysis |
| Root cause elimination | Devising solutions that will remove the root cause and thus eliminate the problem. | - Six thinking hats  
- Theory of inventive problem solving (TRIZ)  
- Systematic inventive thinking (SIT) |
| Solution implementation | Techniques and advice to aid the change process of implementing the solution. | - Tree diagram  
- Force-field analysis |