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DEVELOPING THE PROJECT FRONT END PROCESS IN COMPLEX DELIVERY PROJECTS

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ABSTRACT

Santtu Koskinen: Developing the Front End Process in Complex Delivery Projects
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As the complexity and size increase in projects, many of them suffer from the budget, schedule, or other performance issues. Many of the reasons for these issues have been traced back to the project front end. During the last couple of years, project management research has focused more on this area as the unanimity and commonly agreed definition has not been reached yet. Because in the project business the front end also includes the sales phase it has a significant impact on the projects the company gets and also the competitiveness of the company. A well-functioning front end has been identified as crucial for competitiveness and efficient execution of the projects in the case company. This research studies the front end's process, tasks, and impact on the project performance. Previous research has identified that execution experience is valuable in the front end and the project manager's value has been recognized in the case company as well. Thus, the project manager's role in the front end is also studied.

The study was done as a constructive qualitative case-study into the case company. The case company is a significant international actor in the energy industry carrying out large and complex projects. The study began with a literature review into previous research of the front end, its tasks, and the project manager's role in it. A framework was created for the front end's process and its tasks. In the empirical section, 13 semi-structured interviews were conducted, the internal operation manual and the example projects brought up in the interviews were studied. Tasks, impact, and project manager's role in the front end were analyzed from the empirical material. Previously created theoretical frameworks were utilized in the analysis. Lastly, empirical findings were compared to the literature review's recommendations, through which a combined framework and results were developed to answer research questions. The findings were validated in a workshop with case company representatives.

The study resulted in the creation of a new understanding of the front end in complex projects in project business. First of all, the study contributed to the definition of the front end from a supplier's perspective. Secondly, the study presented a new four-phased front end framework for project suppliers. The phases were defined as business planning and preparation, preliminary offer, bidding, and final negotiations. The phases are typically separated by review points. Thirdly, the focus areas of the front end were identified. In the front end, the supplier shall focus on creating a cost-effective and competitive offer that fulfills clients' needs in a value creating manner. In addition, the management of the front end should be based on project management methods focusing on flexibility. Fourthly, the project manager's role was defined in the front end. It is valuable for the project manager to get involved in the front end at the latest in the bidding phase. They have valuable skills and experience that can be utilized, for example, in project execution planning, risk management, reviewing the contract, and as a new finding supporting sales and negotiation. Lastly, the study confirmed previous findings of the supporting effect of the front end on the execution performance. In addition, a specific impact in the project business environment of the front end activities on the likelihood of sales was identified. Based on the findings it is recommended to ensure the project manager's attendance, utilize project management methodology, build governance framework, identify and focus on the key tasks, and base decision making on objective data in the front end.

Keywords: front end, delivery project, project business, sales phase, project manager

TIIVISTELMÄ

Santtu Koskinen: Projektin varhaisen alkuvaiheen toteutuksen kehittäminen monimutkaisissa toimitusprojekteissa
Diplomityö, 103 sivua, 8 liitesivua
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Projektien koon ja monimutkaisuuden kasvaessa moni projekti kärsii kustannus- tai aikatauluylityksistä tai muista haasteista. Moni näiden haasteiden taustalla olevista syistä on jäljitetty projektien varhaiseen alkuvaiheeseen. Viime vuosina projektinhallinnan tutkimus onkin suuntautunut tämän alueen tutkimiseen, sillä yhteisymmärrystä tai vakiintunutta käsitteistöä ei ole vielä saavutettu. Projektitoimittajilla varhainen alkuvaihe on myös projektin myyntivaihe, joten sillä on merkittävä vaikutus yrityksen saamiin projekteihin ja sitä kautta myös kilpailukykyyn. Tehokas varhainen alkuvaihe onkin todettu kohdeyrityksessä erittäin tärkeäksi kilpailukyvyn ja projektien tehokkaan toteutuksen kannalta ja siihen halutaan panostaa. Tässä työssä tutkitaan projektien varhaisen alkuvaiheen prosessia ja tehtäviä sekä vaikutusta projektien suorituskyvylle. Lisäksi tutkitaan, mikä on projektipäällikön rooli projektien varhaisessa alkuvaiheessa. Aikaisemmissa tutkimuksissa on havaittu, että toteutuskokemuksen tuominen projektien varhaiseen alkuvaiheeseen on arvokasta ja projektipäällikön arvo on tunnistettu myös kohdeyrityksessä.

Tutkimus toteutettiin konstruktiivisena laadullisena tapaustutkimuksena kohdeyritykseen. Kohdeyritys on merkittävä kansainvälinen toimija energia-alalla toteuttaen suuria ja monimutkaisia projekteja. Tutkimus aloitettiin katsauksella aiempaan tutkimukseen projektien varhaisesta alkuvaiheesta, sen tehtävistä ja projektipäällikön roolista. Projektien varhaisen alkuvaiheen prosesista ja tehtävistä muodostettiin viitekehykset, minkä jälkeen suoritettiin 13 puolistrukturoitua haastattelua, tutkittiin yrityksen sisäisiä ohjeita ja tutustuttiin haastatteluissa käsiteltyihin projekteihin. Materiaalia analysoitiin ja tunnistettiin varhaisen alkuvaiheen tehtävät, vaikutus ja projektipäällikön rooli hyödyntäen kirjallisuuskatsauksessa määriteltyjä viitekehyksiä. Lopuksi empiirisen tutkimuksen ja kirjallisuuskatsauksen tuloksia vertailtiin keskenään, minkä avulla luotiin lopullinen näkemys ja yhdistetty viitekehys. Löydökset validoitiin työpajassa.

Tutkimus luo uutta ymmärrystä varhaisesta alkuvaiheesta kompleksisissa projekteissa projektiliiketoiminnassa. Ensinnäkin tutkimuksessa autettiin tarkentamaan projektien varhaisen alkuvaiheen määritelmää toimittajan näkökulmasta. Toiseksi esitettiin uusi nelivaiheinen viitekehys projektitoimittajille. Määritellyt neljä vaihetta ovat liiketoiminnan suunnittelu ja valmistelu, alustava tarjous, tarjoaminen ja loppuneuvottelu. Vaiheita erottavat tyypillisesti päätöspisteet. Prosessin on tärkeä olla selkeästi ohjeistettu ja määritelty yrityksissä. Kolmanneksi, tutkimuksessa tunnistettiin varhaisen alkuvaiheen tärkeät aktiviteetit. Projektien varhaisessa alkuvaiheessa on tärkeä keskittyä luomaan kustannustehokas ja kilpailukykyinen ratkaisu, joka vastaa asiakkaan tarpeisiin luoden arvoa. Lisäksi projektien varhaisen alkuvaiheen johtamisen on hyvä perustua projektinhallinnan menetelmiin ollen samalla joustavaa. Neljänneksi projektipäällikölle määriteltiin rooli projektien varhaisessa alkuvaiheessa. Projektipäällikön on arvokasta tulla mukaan viimeistään tarjousvaiheessa. Heillä on arvokasta osaamista sekä näkemystä, jota voi hyödyntää esimerkiksi projektien toteutuksen suunnittelussa, riskienhallinnssa, sopimuksen katselmoinnissa ja uutena alueena erityisesti myynnin ja neuvottelun tukena. Viidenneksi, tutkimus vahvisti aiempia löydöksiä varhaisen alkuvaiheen merkittävyydestä projektin suorituskyvylle. Lisäksi tunnistettiin projektiliiketoimintaympäristölle ominainen vaikutus projektin alkuvaiheen tekemisen ja myynnin todennäköisyyden väliltä. Löydöksiin perustuen annettiin käytännön suosituksia varmistaa projektipäälliköiden osallistuminen, hyödyntää projektinhallinann metodologiaa, tunnistaa ja keskittyä avaintehtäviin ja perustaa päätöksenteko objektiiviseen dataan projektien varhaisessa alkuvaiheessa.

Avainsanat: Projektin varhainen alkuvaihe, toimitusprojekti, projektiliiketoiminta, myyntivaihe, projektipäällikkö.

ALKUSANAT

Diplomityön kirjoittamista on ollut ajatuksissa opintojen alusta lähtien. Nyt kun tutkimusprosessi ja opinnot ovat loppusuoralla, voi noita vuosien takaisia ajatuksia miettiä hymyillen. Työn tekeminen sisälsi ylä- ja alamäkiä, mutta sujui pääasiallisesti suunnitelmien mukaan noin 6 kuukauden aikana. Nyt on aika karistaa opiskelija status ja siirtyä täysimääräisesti työelämään.

Haluan kiittää työn ohjaajaa professori Miia Martinsuota erinomaisesta ohjauksesta ja hyvistä kommenteista sekä kehitysideoista läpi tutkimusprosessin. Kiitos myös työn toiselle tarkastajalle apulaisprofessori Tuomas Aholalle. Yhtä suuri kiitos kuuluu myös kohdeyrityksen työn ohjaajille Pekolle ja Antille avusta työn aiheen rajaamisessa, tuesta ja erinomaisista kommenteista sekä kehitysideoista läpi työn. Erityiskiitos myös kaikille haastatteluihin ja keskustelutilaisuuteen osallistuneille mielenkiinnosta, kommenteista ja erinomaisista näkökannoista. Kiitos kuuluu myös lähipiirilleni tuesta läpi opintojeni.

“We all need people who will give us feedback. That’s how we improve.”

- Bill Gates

Tampereella, 25.1.2021

Santtu Koskinen

SISÄLLYSLUETTELO

LIST OF TERMS AND ABBREVIATIONS

EPC	Engineering, Procurement, and Construction
EPS	Engineering, Procurement, and Supervision
FE	Front end
MoP	Management of Project (- model)
PM	Project manager
PMBOK	Project Management Body of Knowledge
SM	Sales manager
TOE	Technical, Organizational and Environmental (complexity factors)

1. INTRODUCTION

1.1 Background

Projects can be seen as processes consisting of independent sequential tasks. This means that projects have a certain life cycle. The phases are defined differently depending on the domain. In the project management literature, the phases are ideation, definition, execution, closing, and operation (Artto et al. 2006, Dinsmore & Cabanis-Brewin 2014; PMBOK 2012). In construction management literature, these are front end planning and design, procurement, and construction (CII 2015). In the sales and marketing literature, these phases are sales and execution (Skaates & Tikkanen 2003). However you look at it, as it is a flow of consecutive tasks it is quite natural that the earlier phases impact the latter ones, thus, having an effect on project performance (Williams & Samset 2010). As approximately 40 % of large capital projects suffer from overruns in budget or schedule (Hermanides et al. 2010) researchers have naturally tried to find reasons for these failures, recently from the early phases. According to Williams et al. (2009), many of the reasons behind the failures lie in the early phases of the project outside the typical scope of project management. Also, Wearne (2014) stated that many of the problems in projects could be mitigated by focusing more on the early phases of the project – the front end (FE). In addition, many studies have concluded that the FE has a significant impact on the project performance (Cano & Lidon 2009; Hermanides et al. 2010; Edkins et al. 2013; Collins et al. 2017).

During the last ten years, the focus in project management research has shifted more towards the FE tasks and their supporting effect on project performance. This is because the importance of these activites has been made increasingly better known (Williams & Samset 2010; Williams et al. 2019). The subject has long been underrepresented in this domain of literature due to the project management's special focus on the execution activities (Samset & Volden 2016; Williams et al. 2019). In the construction management literature, however, the FE has been a key subject much longer starting from the 90s due to the importance of thorough engineering early on. This has led to the formulation of formal FE processes and tools. (CII 1996; Kähkönen 1999)

Due to the fairly newly found nature of the FE, the definition for it is not stabilized in the research (Williams et al. 2019). Williams et al. (2019) define that the FE begins when project-related subjects are handled in the organization and ends when the implementing

organization is appointed. Another common definition is to define the FE to begin when the organization is sanctioned to spend resources on the project and end when a clear definition of a project is approved (Kähkönen 1999; Olsson & Samset 2006; Edkins et al. 2013; Dinsmore & Cabanis-Brewin 2014). The sales phase, which is similar to the FE, often officially starts with an official request for a proposal (Skaates & Tikkanen 2003; Cova & Salle 2005), which is often later than the sanction to spend resources. The sales phase ends with the signing of the contract (Turkulainen et al. 2013). In practice, these points in the project can be difficult to distinguish. In this study, FE is defined to begin when sanction to spend resources to develop a definition and an official offer is given. The FE ends when the definition of the project is approved, the contract signed, and the project is kicked off.

Companies conducting projects as their day to day business are in project business (Artto & Wikström 2005) and can be called project-based firms. These companies are built to conduct projects and thus have built the organization and practices around it. (Artto & Kujala 2008) These organizations often sell projects like products to other companies and for this have separate sales and execution organizations (Cova & Salle 2005; Turkulainen et al. 2013). This global project-as-a-product business is a relatively new and unresearched phenomenon that brings along new features, ways of organizing the business (Turkulainen et al. 2013), and a set of issues from organizational integration to resourcing (Cova & Holstius 1993; Cooper & Budd 2007; Turkulainen et al. 2013; Oh et al. 2016). In industrial construction applications, it is quite typical to have somewhat standardized product components that are specialized for each customer. The projects are often quite complex and have an extensive environmental impact. This means that the delivery projects in industrial applications demand lots of front end planning and effort. (CII 2015; Collins et al. 2017) The complexity has also been recognized as a feature with a possibly big impact on project performance (Bosch-Rekveldt et al. 2011).

The thesis is conducted to the target company's Energy business unit during the year 2020. The company has a long history and vast amount of experience from every kind of project delivery in the energy industry ranging from simple system deliveries costing tens of thousands to complete plant areas costing hundreds of millions. A typical way of organizing the project execution in the case company is to subcontract the construction and have the engineering, management, and manufacturing in-house. The projects are globally distributed over the world as is the organization. The delivery types are also ranging from simple EPS (engineering, procurement, and supervision) deliveries to large-scale EPC+ (engineering, procurement, and construction plus e.g open book) deliveries. Due to this, the projects can differ vastly from each other. The performance

of the project also varies a lot from poor to excellent. This thesis focuses on typical projects in the organization ranging from a couple of million to tens of millions. The company has a strong desire to minimize the variance and decrease the portion of poor projects and minimize their effect to drive competence and excellence in project business.

The front end in the case company is quite well described in the internal operation manual. The FE begins in the indicative proposal phase in which it is decided If the project is suitable for the organization and should be gone after and indication to the client is given about interest towards the project. The end of the FE is quite clearly defined to be the kick-off meeting for the execution, before which, the organization is nominated and the contract is signed. This operation manual describes the processes according to which the organization is supposed to work. However, in practice, the guidelines are on quite a general level allowing quite a lot of variance in the way things are implemented and executed. This variance complicates the development and management of the early phases and can lead to quality issues. The overall process also requires some scrutiny since it has been built over the years.

The tasks of the FE and project management's role in it are the focus of this thesis. This focus was selected since the company has recognized the importance and the effect the FE has on their business thus wanting to develop in this area. Also, the inclusion of project management into the FE is rather new for the organization. The organization has, however, recognized the project manager's (PM) value. Thus, the research into the FE and PM's role in it has been recognized valuable. During the research process of this thesis, the company has ongoing development projects, for example, in the sales phase and project management. This thesis can be seen as one part of this development project portfolio.

1.2 Research objectives and scope

In the project management domain of research, the focus has long been on the implementation of projects. The early phases of the project, the FE, has long been ignored as it has been considered to be outside of project management's scope. During the last decade, the focus has shifted and its value on project performance has been recognized. (Samset & Volden 2016; Williams et al. 2019) For example, Edkins et al. (2013) mention that everything related to the research of the FE can be considered relevant. In construction and engineering management research the area has been recognized longer and tools and processes have been developed. (CII 1996) Still, more research is needed, for example, into the definition of the FE, its impact on project

performance (Williams et al. 2019), how it is managed (Kähkönen 1999; Zwikael & Meredith 2019), and the role of a PM (Edkins et al. 2013; Zwikael & Meredith 2019). The front has room for improvement as often reoccurring mistakes are made which could be remedied (Samset & Volden 2016). Thus this study focuses on the FE process and its supporting effect on project performance. The new definitions also change the paradigm of project management meaning that PM's role has to be redefined. If the PM's role is seen only in the implementation phase the organization can lose a lot of potential, for the PM typically has a lot of practical experience which is valuable in the early phases of the project. (Morris 2013) Especially in the FE of complex projects the execution experience has been identified to be valuable (Turkulainen et al. 2019).

The scope of this study is limited to the FE of complex projects in the industrial construction industry taking the supplier's view. The project budget in the projects being studied is from a million to a hundred million. The case company's smallest projects are excluded and similarly the biggest multi-hundred million projects since the smaller and bigger ones have somewhat differing processes. The focus is on the typical project delivery of the case company. There is no limitation to project types (e.g. EPS, EPC) since they have little impact on the FE. The objectives are defined as follows:

1. Offer concrete and practical proposals to improve the front end in the organization to drive competitiveness.
2. Create a well-defined role for the project manager in the front end of the case organization.
3. Work towards the organization's strategic development targets to reduce projects' financial variance and thus create a competitive advantage.

To achieve these objectives the research questions are as follows:

- What are the steps, tasks, and process of project front end in complex delivery projects, and how does it support project performance?
- What is the role of a project manager in the front end of complex delivery projects?

First, a literature review was conducted to answer the research questions listed above. Three lines of literature were identified that handle this subject to get different views on the subject. However, the focus is mostly on the views of project management and sales and their interface. After this empirical research is conducted to answer the research questions. Comparing the theoretical and empirical findings conclusions and suggestions were drawn of the FE process and PM's role in it.

1.3 Structure

The study starts in chapter two with a literature review of the main themes of this thesis. First, the effect and nature of complexity, project business, and projects' lifecycle are considered in the first subchapter. The second subchapter dives into the FE first defining the typical features and nature of the FE, considering the FE from the supplier's perspective and lastly, the possible impact the FE has on execution. The third subchapter discusses the tasks that the literature has identified to be important and part of the FE. Lastly, the PM's role in the FE and previously discussed tasks are examined.

The third chapter represents the research methodology. First, the critically realistic nature of the constructive qualitative case study is discussed and after that, the research process from literature review to the empirical portion is discussed. The third subchapter introduces the case company and its organization in more detail. The next subchapters discuss the data collection with interviews and a workshop, the collected data and example projects, and the analysis methodology used.

The fourth chapter introduces the results from the empirical study. First, the overall FE process is discussed in the organization and how it is organized. The second subchapter discusses the tasks in the FE and is organized similarly to the literature review. The third subchapter examines the effect that the FE has on the execution of the projects and considers the evidence from example projects. The last subchapter introduces the findings of the PMs' role in the case organization.

The fifth chapter compares the theoretical findings and framework with the results from the empirical study. Differences and similarities are brought up considering the tasks, FE's impact, and the PM's role. A four-phased process for the FE is defined and key tasks are identified. The FE's impact on the execution is verified. The PM's role in the FE is defined. Lastly, recommendations are given for the case organization based on the findings from the theoretical and empirical studies. In the last chapter conclusions of the study are made. The theoretical contributions to front-end activities and the PM's role are discussed. Also, practical implications for managers are discussed. Lastly, the limitations of the study are discussed through credibility, transferability, dependability, and confirmability, and future research suggestions are given.

2. LITERATURE REVIEW

2.1 Complex project's life cycle in project business

2.1.1 Project business and project-based firms

Companies in project business, which differs from other types of business, are called project-based firms. Artto & Wikström (2005) define project business after an exhaustive literature study as "the part of the business that relates directly or indirectly to projects, with a purpose of achieving the objective of a firm or several firms". This definition includes project supplier's, client's, and broader stakeholders' views. Project business itself is defined by discontinuity from project to project, uniqueness of each project, and complexity especially in the network of operators (Tikkanen et al. 2007). Artto & Kujala (2008) define project-based firms as companies that conduct most or growing part of their business through projects and that have built an organization around project dimensions to sell and deliver projects. The companies have to balance resources in the stream of projects from sales projects to execution ones (Cooper & Budd 2007). This means that good performance and success in the projects are important for the continuity of the business (Tikkanen et al. 2007). The project-based firms can conduct two types of projects internal development or capital investment. The projects can be either bought or delivered (Artto & Kujala 2008).

The project-based companies carry out delivery projects with various contractual arrangements. Delivery projects deliver value to the client with solutions that answer the client's needs (Artto et al. 2006). Often they can be considered as projects as products for the companies delivering them since they are actively marketed to the customers and they are based on specific concepts the same way as typical products (Cooper & Budd 2007). The projects can be based on many kinds of contractual arrangements that define the responsibilities of the supplier. Typical ones include EPC and EPS deliveries. In these contract types, the supplier has a wide range of responsibilities including engineering, procurement, and construction or supervision (Back & Moreau 2000). A typical arrangement in projects as products contracts is that the supplier receives a lump sum in return for a solution to the client. The supplier is then responsible for the bulk of the execution and guarantees the performance. (Back & Moreau 2000; Pillai 2008)

Building on Artto & Kujala's (2008) view on the projects it is important to note that there is always a buyer and a supplier perspective to the same capital investment project. This has implications on how the companies should structure and conduct their business. This

study is conducted from the suppliers' perspective. This division means that the client has a huge impact on how the project is conducted. They define the boundaries for the project, for example, the level of requirements, the responsibilities, available time, and budget. In the sales project's case, this means that the client defines when the bidding starts, how it is arranged, how much negotiation and bidding rounds there are, and when the contract is signed and project execution started. (Cova & Holstius 1993; Cooper & Budd 2007) The client can also heavily affect the formulation of the project, thus limiting the project supplier's options to work freely in the FE and create an optimal project for themselves. This means that the supplier is often in a more submissive position. The processes can vary heavily depending on the industry and the company. (Cova & Salle 2005) Due to these features and to affect the project formulation in a positive manner, a good relationship with the client prior to the official call for tender is important. This role is in project sales and marketing. (Cova & Salle 2005) This also means that the supplier's processes have to be flexible to serve the customer (Olsson & Samset 2006; Turkulainen et al. 2013). In addition, to answer the client's needs the limited time forming a sound offer suppliers need readiness in basic processes, entrepreneurial qualities, and industrial linkages. (Cova & Holstius 1993)

2.1.2 Project complexity

Complexity is often regarded as a defining feature in the project business. Thus, it is a widely assessed issue in the project management literature (Tikkanen et al. 2007; Williams & Samset 2012). It has an impact on the project management practices and, for example, project budget and schedule performance (Bosch-Rekveldt et al. 2010; Hermanides et al. 2010; Edkins et al. 2013; Williams 2016). The higher the complexity the harder project management work becomes due to increasing uncertainties and risks. Increasing complexity also increases the difficulty of organizational learning and standardizing processes due to the perceived uniqueness of each project. (Hobday 1998) Complexity also increases the project's interdependencies making everything less well understood (Baccarini 1996; Williams et al. 2012; Chapman 2016). These facts imply that complexity can affect the business case, goals, and estimates of the project (Geraldi et al. 2011). In addition, complexity seems to be constantly increasing in projects due to growing project size and technically complicated systems (Williams et al. 2009). For these reasons, complexity is considered to be one of the key areas requiring attention in the FE (Williams & Samset 2010).

Despite the amount of research, a unified definition of project complexity has not been established. A definition of complexity is the interrelatedness of various parts which can be measured by differentiation and interdependency (Baccarini 1996). Another definition

of complexity is to consider complexity as uncertainty coming from a project and its context (Chapman 2016). In this study, complexity is defined to be the interrelatedness of its various parts and uncertainty stemming from this and project context. The complexity can be assessed, exampli gratia, with the TOE framework. The letters come from technical, organizational, and environmental complexity factors. (Bosch-Rekveldt et al. 2010) Another possibility is to use, for example, Geraldi et al. (2011) five types of complexity that they identified after an exhaustive literature review: structural-, uncertainty-, dynamic-, pace- and socio-political complexity. Frameworks can be used to understand and to mitigate complexity's impact better. Frameworks can also help to analyze possible issues and uncover challenges due to complexity and thus focus the resources on critical areas of the project. (Bosch-Rekveldt et al. 2010) It is also important to distinguish the complexities that the organization can control and the complexities outside of the project's control (Chapman 2016).

Higher complexity requires new management tools, adaptation of processes, and focus on specific areas that are different from non-complex projects. This shift of focus can help to alleviate issues and formulate the project, for example, goals, budget, schedule, and requirements better (Baccarini 1996). Frameworks can be utilized to identify the factors of complexity helping to control it. Then the processes and activities should be adjusted and aligned to the complexity. (Geraldi et al. 2011) Hermanides et al. 2010 researched the effects of complexity on project success. Their findings proved that it is likely that complexity has a direct relationship to project success. Team building, constructability review, active monitoring of goals, and execution planning had the strongest correlation with the performance in battling complexity in their study. (Hermanides et al. 2010) Williams et al. (2012) support these findings claiming that complexity makes the goals more uncertain, processes messier, and teams more complex teams. Thus these should be focused on and clarified in complex projects.

2.1.3 Project life cycle – Three perspectives

One way to define projects is that they are sequential logical tasks with clear phases and thus decision points, and further, lifecycles. However, the phases often overlap and are somewhat iterative. The specific phases are usually defined by the organization to support the needs and nature of the projects. Some researchers are execution-oriented such as Project Management Body of Knowledge (PMBOK 2012). They define five process phases for the project life cycle: initiation, planning, execution, control, and closing of the project. PMBOK's definition of project management's goal is to meet the stakeholder requirements. This is a rather narrow definition that fails to describe where these requirements come from and how they are defined. (Kähkönen 1999; Morris 2013;

Dinsmore & Cabanis-Brewin 2014) Other researchers have a broader view on the lifecycle to include FE and operation after execution (Artto et al. 2006; Dinsmore & Cabanis-Brewin 2014) which this study also uses. Management of project -model (MoP) (Figure 1) is an example of this broader view of the lifecycle. MoP-model includes additional phases into the early phase of the project that are concept and feasibility. These, for example, strategizing, commercial- and organizational planning which are traditionally considered to be outside of the traditional scope of project management. The model also considers the operation and support after the execution providing a more complete view of the project's life cycle. (Dinsmore & Cabanis-Brewin 2014) Comparing this project life cycle to this study's definition of the FE, the early phases from the beginning of the MoP-model to the initiation phase, the definitional phase, are included in the FE (Kähkönen 1999; Campbell 2014; Williams et al. 2019).

Now that the project management's view on the project life cycle and FE has been examined it can be compared to construction management literature's view on the project life cycle. Kähkönen (1999) define the project life cycle to include five main phases from business planning to construction (Figure 1). Other construction management sources were vaguer and defined the phases basically as feasibility, concept, detailed scope and design, procurement, and construction (Back & Moreau 2000; George et al. 2008; CII 2015; Collins et al. 2017). The major difference in Kähkönen's model compared to the other models is the level of detail in the early phases. Kähkönen's model emphasizes the specific more engineering-oriented nature of construction projects better. In addition, Kähkönen recognizes the iterative and looping nature of this definitional phase which other sources do not depict in their frameworks. Comparing project management's lifecycle to the construction management sources the phases are basically similar, but feasibility and concept are the other way around. One interpretation of this is that the steps in the construction management's life cycle start later on when the basic limitations and resources for the project have been defined and the actual construction feasibility study and planning can begin. In Kähkönen's (1999) model the concept and feasibility phase of project management and some construction management sources are comparable to business planning and early strategic planning phases of project management models. Comparing the definition of project FE to the construction management model (Kähkönen 1999), the FE begins during the business planning phase as some of it can be prior to the official acceptance to formulate a bid. The end is clearer since detailed engineering and planning are outside of the FE's scope and more part of the execution requiring more resources.

From the sales and marketing literature's point of view, the projects are divided into two broader phases: sales and execution (Figure 1). The sales phase is further divided into the search, preparing for bidding, bidding, negotiation, and contract phases (Cova & Holstius 1993; Cooper & Budd 2007). Basically, the sales phase officially begins with an invitation to bid from the buyer (Cova & Salle 2005). This phase consists of defining the project with the client through offers and negotiation. At this point in the project business, the projects can be called sales projects. The sales phase ends in the acceptance of the definition and commitment to the project, ergo, signing of the contract or alternatively not getting the deal. If the contract is signed the project is kicked-off for project execution. The execution phase is similar to other bodies of literature consisting of, for example, planning, executing, commissioning, and handing the delivery to the client. (Turkulainen et al. 2013) The sales perspective brings a new limitation to the project execution and FE comparing to, for example, internal projects since after signing of the contract it is difficult to make changes to the project due to the binding nature of the contract (Tikkanen et al. 2007). Sales and marketing literature focuses more on the interactive, looping, and iterative nature of the FE. An important takeaway also is that the process typically follows the customer's lead during the sales phase and during the execution, the project supplier takes more of a lead.

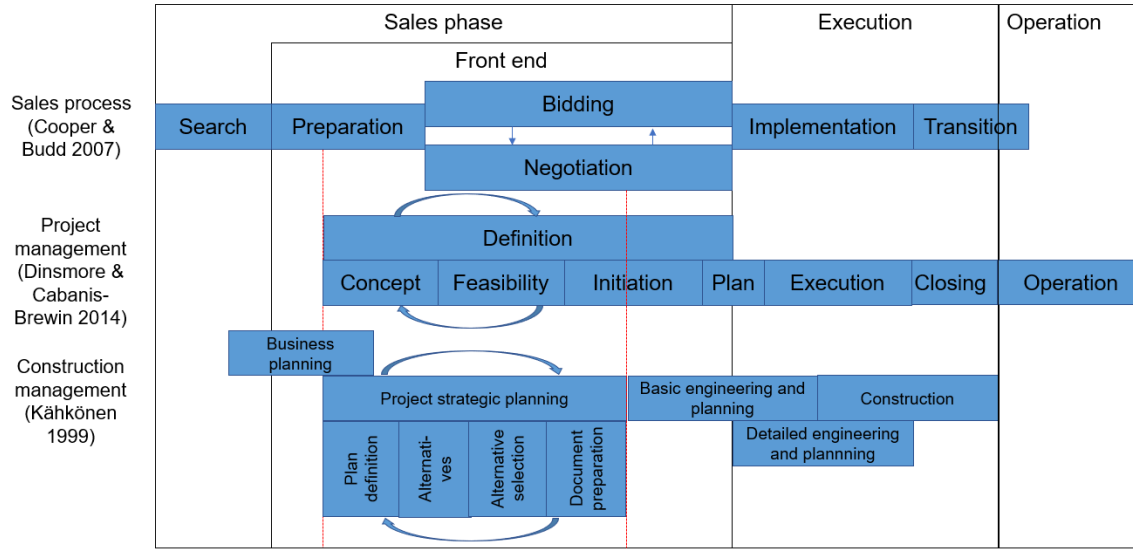

Figure 1: Comparison of sales, construction management, and project management views on the project lifecycle.

In projects of project business, the sales phase completely includes the project's FE. The definition for the ending of the FE is that the project's definition is agreed upon and the project is kicked off (Kähkönen 1999; Olsson & Samset 2006; Wlliams & Samset 2012; Dinsmore & Cabanis-Brewin 2014; Edkins et al. 2013) The signing of the contract, which is the end of the sales phase, is comparable to locking the definition of a project. Thus

the FE ends at the same time as the sales phase does. The beginning, on the other hand, is different since the searching for sales cases is outside of the specific project's scope. If the search phase and some of the early preparation are excluded, the definition of sales phase is in practice overlapping with our definition of project FE. This includes preparation, bidding, and negotiation phases.

2.2 Front end in complex projects

2.2.1 Features

The goals of the FE are somewhat different depending on the body of research. In the construction management literature, the purpose of the FE is defined as developing sufficient understanding and information about the project in order to commit resources and maximize the possibility for a successful project (George et al. 2008; Gibson & Bosfield 2012). The view of project management literature is quite similar as it describes it as developing the business case and concept for the project to get the approval for it and ensure successful execution (Williams & Samset 2010; Samset & Volden 2016; Zwikael & Meredith 2019). Also, the project's alignment to stakeholders' objectives is mentioned (Olsson & Samset 2006). Project sales and marketing literature view differ a bit from these as it names identifying potential projects, linking customer demand into operational capabilities, defining the scope, and negotiating a contract with the client as the main purpose (Cooper & Budd 2007; Turkulainen et al. 2013). To sum these views up, the purpose is to assess the viability of the sales case, sell the project (Cooper & Budd 2007; Turkulainen et al. 2013), laying down foundations for the project and its execution securing the projects long term success and establishing the project as a part of the organization (Williams et al. 2019).

To understand the nature of the FE better, a literature review was conducted and the features were collected into Appendix A. The most pronounced features of the FE compared to the execution appear to be its limitations in time (Bachy & Hameri 1997; Cova & Salle 2005; Collins et al. 2017), information (Skaates & Tikkanen 2003; Williams et al. 2009; Biesek et al. 2014), resources (Kähkönen 1999; Zwikael & Meredith 2019), uncertainty (Edkins et al. 2013; Flyvjberg 2013) and interaction with stakeholders (Cova & Salle 2005; Cooper & Budd 2007; Turkulainen et al. 2013). These features also mean that the FE is rather dynamic demanding more creativity (Christensen 2011; Gibson & Bosfield 2012). However, it is also quite typical to have predefined decision points (Collins et al. 2017).

The first clear defining feature is limited information. This limitation is because, for example, strategic, technical and other major decisions are open and everything is

constantly changing and valid information is hard to get (Cano & Lidon 2009, Williams et al. 2009; Williams & Samset 2012; Dinsmore & Cabanis-Brewin 2014; Samset & Volden 2016). Campbell (2014) described the early project phase as a phase in which the project goes from you don't know what and how to do it to knowing what to do but not how. This emphasizes the information collecting and refinement in the FE which consequently lowers the uncertainty (Figure 2). Paradoxically, it is typically easy to collect lots of information, but the actual difficulty is to discern valid and reliable information from the mass of information (Samset & Volden 2016). This phenomenon is called information overflow. Thus, it is important to focus on the quality of the information. (Samset & Volden 2016) In addition, there is often information asymmetry in the FE. The valid information might be available in the organization or client, but the decision-maker does not have it, for example, due to communication problems or organizational structure. (Williams & Samset 2012) Making things even more difficult is the short lifespan, halving time, of valid information since situations are constantly changing making the FE even more dynamic (Edkins et al. 2013). Some of the limitations of the information can be attributed to the complexity and uniqueness of the project (Cova & Salle 2005). Although, it is argued that projects are not often that unique and have a lot of common features between each other especially in project business (Williams et al. 2009).

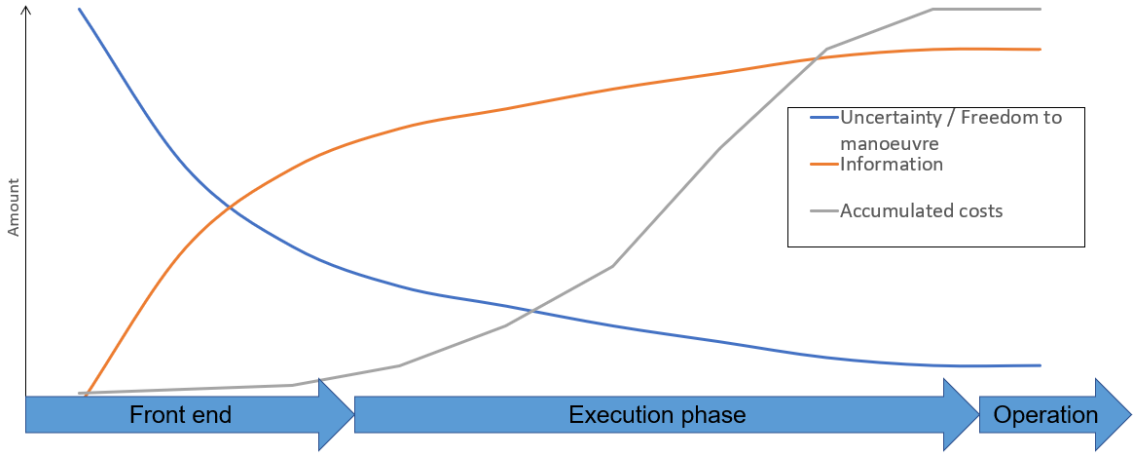

Figure 2: Uncertainty and information in relation to project progress (adapted from Olsson & Samset 2006 and Campbell 2014)

Project FE is also defined by high uncertainty. In the beginning, it is very high and decreases the further the project goes (Figure 2). This is also visible in Campbell's (2014) description of the FE. This means that the FE is typically noticeably more turbulent than the execution phase (Williams et al. 2009). Williams & Samset 2012 took this further describing the FE fuzzy. This definition implies that the organization is not fully aware of what is in progress and happening in the project. However, Williams et al. (2019) noted that the more used the organization is to deal with projects the clearer the FE typically is

which makes it easier to navigate the uncertainty. The uncertainty and fuzziness stem from, for example, limited information, few locked decisions, and changing stakeholder expectations (Williams et al. 2009; Samset & Volden 2016). The uncertainty in this phase is emphasized, also, by the complexity and uniqueness of projects as it is rather difficult to fully grasp all the interconnections early on (Cova & Salle 2005). On the flip side, the little amount of commitment means that the FE is flexible and big changes are rather easy and cost-effective to make. Thus, there is great potential for improvements and profits for the execution phase during the FE. (Samset & Volden 2016)

A defining feature for the FE is the limited resources. In comparison to the execution phase, the FE has often significantly less resources available. For a large project, the average amount of core personnel in the FE is around 6 persons. (Elearn 2007) It is considered important that the team would be cross-functional and cover all of the important functions of the organization. With smaller teams, this is quite difficult. (Cova & Holstius 1993) The limited resources are an issue also because the FE has a long list of important tasks that require a wide range of skills (Edkins et al. 2013). Subsequently, the cost of the FE is quite low when calculating from the total project cost, around 3-6 %. Interestingly the larger the project the smaller the percentual amount is. (Kähkönen 1999; Yun et al. 2012) These numbers can be regarded as quite low when considering the importance and impact of the FE to the projects' success and performance. However, when the organization has a risk of not getting the project in the sales phase it has an incentive to keep the cost down and tied resources limited. Prioritizing the tasks and projects becomes thus crucial.

The third major limitation in the FE is time (Appendix A). This is mentioned by many researchers (Elearn 2007; Williams & Samset 2012; Collins et al. 2017). The limited-time is often since the supplier is in a more submissive position during the FE and the buyer defines the pace and schedule (Cova & Salle 2005). Also, as time is money in business the schedules are kept tight (Morris 2013). Especially smaller industrial projects (worth under 10 million dollars) suffer from limited time and other resources in the FE as the preparation is not considered that important and the FE is neglected when comparing to larger projects (Collins et al. 2017). These observations support the conclusion that the tasks in the FE need to be carefully prioritized. It also means that organizations have to have efficient processes and organization to be able to successfully navigate the FE in a limited time.

One of the most recognized features in the FE is the interaction with various stakeholders (Appendix A), especially with the client and subcontractors. Interaction and negotiation with the client and other stakeholders are present in almost all of the FE tasks because

a common understanding of the goals, requirements, limitations, and so on have to be agreed on (Cova & Holstius 1993; Cooper & Budd 2007; Turkulainen et al. 2013). In addition, there are often differing views and motives internally and externally in the FE which have to be aligned and dealt with (Edkins et al. 2013). This highlights the importance of team building and stakeholder management (Turkulainen et al. 2013). Thus FE demands good interpersonal relations, skills, and understanding of relationships both internally and externally. When comparing to the execution, most of the project definitions are locked by the contract, teams are established, and the relationships should be more established which means that less negotiation and relationship building skills are required. (Cova & Holstius 1993; Skaates & Tikkanen 2003; Tikkanen et al. 2007; Cano & Lidon 2009)

As established, the FE is uncertain, information and resources are limited, and the project definition is not locked. This means that there are problems to solve. Thus, the FE is more explorative and informal in nature. Supporting this view Cano & Lidon (2009) described the FE as a wicked problem. Edkins et al. (2013) emphasized this fact by stating that the FE requires more intellectual work than the other project phases. This implies that a narrower skill set might not be enough in the FE since experience and a wide knowledge base help and support creativity and problem-solving. (Morris 2013) The FE can have specialized personnel just for these tasks. It also helps if the personnel is more senior and experienced. This feature also demands a bit different and more flexible organizational structures that support creativity.

The uncertainty, fuzziness, turbulence, and explorative nature lead to the FE being less structured compared to the execution phase. The execution phase typically is more straightforward with clear processes and goals. (Christensen 2011; Edkins et al. 2013) Organizations' have to rely more on intuition in navigating through the FE (Morris 2013). The dynamism also calls for more flexible management and organization structures. Despite this, the FE often has a rather clear process to navigate in a tight timeframe. In practice, there are decision points and set criteria to get the management approval to continue or discard the project. (Gibson & Bosfield 2012; Samset & Volden 2016; Zwikael & Meredith 2019) In sales projects client often defines clear sales milestones and dates which create natural decision points for the process (Cova & Salle 1993).

2.2.2 Process of the supplier

As the project business, complexity, project life cycle, and the FE's features are now defined the FE process (Figure 3) as sequential tasks can be defined. The phases are roughly business planning and preparation, initial concept creation, bidding and

negotiation, final negotiations, and execution preparations. This follows the typical main phases of the sales process (Williams et al. 2009). In addition, the Management of the FE is added to the process. The sequential nature of the FE is seen as an important factor as each phase builds on the previous one and provides information to the next ones. (Cova & Holstius 1993) It is important to understand that although the process is represented in quite a linear fashion the FE is very iterative (Williams et al. 2019). These phases are defined from the supplier's perspective. However, as discussed earlier it is important to acknowledge that the client has a big impact on the FE defining, for example, the requirements, schedule, and framework for the FE. This means that the FE framework has to be flexible (Cova & Holstius 1993) limiting the project supplier's options to work freely in the FE (Cova & Salle 2005). To answer these limitations and the features of FE and project business companies need to have strong business processes, relationships, and readiness to form a sound offer to the client in a limited time. (Cova & Holstius 1993)

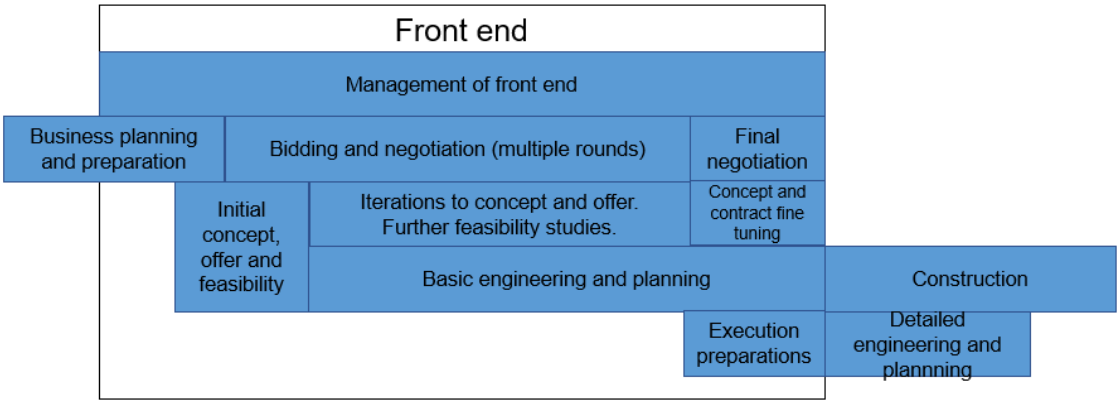

Figure 3: Front end framework in the sales and delivery projects of the construction industry.

The front end from the supplier's perspective typically starts when the client begins to define the initial specification for the project prior to the official request for proposal. At this point, the commercial justification for the project has to be established. The first task is to establish a basic business plan, decide if the project is worth bidding, and prepare for the offer (Kähkönen 1999; Williams et al. 2019). Business planning quantitatively and qualitatively justifies the project for the organization. It should be done early on in the project and updated during the project when the information is more accurate. (Williams et al. 2019) As part of business planning, it is also important to establish a basic strategy for the project to align it with the organization's goals (Tikkanen et al. 2007).

The second phase in the FE after the official request for proposal is the preparation of the initial offer and studying the feasibility of the case further. This includes the client exchanging information with the supplier about the specification and often also some

negotiation about the specification (Cova & Holstius 1993; Cooper & Budd 2007). This interaction with the client is important to acquire extra information and possibly sway the client's requirements and expectations (Skaates & Tikkanen 2003; Williams et al. 2009). The initial offer is typically rather general and indicating the technology and price.

After the initial offer and discussions with the client the third phase – bidding, concept creation, and further feasibility assessment begins. For example, the technology, execution solution, and organizational plan are selected (Dinsmore & Cabanis-Brewin 2014) which are then put into the official offer to the client (Cova & Holstius 1993; Cova & Salle 2005). When choosing the initial concept for the project it is important to consider alternative concepts to find the best solution since after this phase it can be costly and difficult to change (Kähkönen 1999). The bidding phase is typically an adaptive working phase in which the standard processes, templates, et cetera, are adapted to the requirements of the client (Skaates & Tikkanen 2007). This process is usually iterative because often after the initial offer there are second, third, and possibly fourth, and further bidding rounds. The further into the bidding rounds the project is the more detailed and specific the offers are as the concept gets fine-tuned and developed further according to the buyer's demands (Cooper & Budd 2007; Dinsmore & Cabanis-Brewin 2014; Williams et al. 2019). This process requires the whole organization's skills and effort to ensure that, for example, risks, uncertainties, complexity, and other aspects are taken into account and that the contract for the project will be acceptable for the company.

The second to last phase at the FE of delivery projects is final negotiations with the client. More specifically fine-tuning and finalizing the project concept and the contract terms (Turkulainen et al. 2013). After this, the project concept and other aspects are basically locked in and changes become difficult and costly (George et al. 2008; Pillai 2008; Williams et al. 2019). It is thus important that prior to the signing of the contract the risks, uncertainties, requirements, feasibility, et cetera are fully understood and acceptable. As the last phase, possibly ongoing parallel to final negotiations, the preparations for the execution are started. This enables basically an efficient start for the execution. This includes, for example, the appointment of the executing organization, team building, project governance setup, and project kick-off (Williams & Samset 2010; Williams & Samset 2012; Turkulainen et al. 2013). Lastly, the project is transferred into the execution phase starting with detailed engineering (Kähkönen 1999; PMBOK 2012).

The process requires also a couple of supporting processes. The management process is the first one of this throughout the FE. This is because management is considered a critical task (Edkins et al. 2013; Zwikael & Meredith 2019). The management process

includes using similar methods to project management, for example, scheduling, budgeting and resourcing (Morris 2005; Olsson & Samset 2006), team building (Hermanides et al. 2010; Edkins et al. 2013), assuring the quality of the decisions and documents (Flyvjberg 2013) and managing cooperation inside the organization (Turkulainen et al. 2013). In construction and engineering projects the second supporting process is basic engineering and planning throughout the FE. The engineering and planning are necessary for defining the project and the offer. (Kähkönen 1999) The framework for the FE (Figure 3) provides a way to examine the tasks and responsibilities in the FE systematically. This also creates quite natural decision points for the FE supporting management (Samset & Volden 2016).

2.2.3 Support for the performance of projects

To understand the possible effect of the FE to the project, first, the project success has to be defined. Project success is a broad term and a subject itself for academic studies. The basic definition by project management for project success is meeting the requirements of the stakeholders (PMBOK 2012). Going a step further project success can be divided into strategic and tactical success (Olsson & Samset 2006) or delivery and outcome success which captures the supplier and the client perspective better (Williams et al. 2019). Tactical success is related to the traditional project management goals cost, time, and quality. Strategic success on the other hand measures the relevance, sustainability, and effectiveness, in other words, how the project adds value for the stakeholders of the project. (Olsson & Samset 2006) Understanding this division is important since it is typical and easy to focus on the short term, tactical, success and forget the longer term, strategic, success (Samset & Volden 2016). A project can by this definition be successful in the eyes of one stakeholder and unsuccessful in the eyes of the other (Hermanides et al. 2010). Hence, it is important to find a balance between all of the success criteria and try to prioritize and meet the most important ones.

To assess the possible supporting effect on the performance of the project is analyzed in Appendix B. The results verify that the FE has an impact on the performance of the projects in multiple ways. The FE is stated to be the most impactful activity in the management of construction projects (Flyvjberg 2013; Collins et al. 2017). Morris (2013) stated that the FE is a critical activity for project success and that project management in particular can have a major impact on it. Multiple studies have identified a linkage between the FE and overall project success. (Flyvjberg 2013; Samset & Volden 2016; Williams et al. 2019). Notably, Hermanides et al. (2010) in their quantitative study of the effects of the FE activities, identified four tasks in the FE directly and five tasks indirectly improving the performance of the complex projects. Kähkönen (1999) and Cano & Lidon

(2011) also identified the FE to be the biggest factors affecting project success, especially in more complex projects. In addition, more than often the reasons for project success or failure can be traced back to the project FE (Edkins et al. 2013). Williams & Samset (2010) studied the issues in the FE and found out that projects with well-executed FE had a success rate of 80 % compared to 25 % of the ill-executed FE. Both tactical and strategic effects were found in the literature. It is quite intuitive that well-defined projects with clear objectives are more successful than ill-defined ones (Elearn 2007). Another factor behind this effect is the rather linear nature of projects in which previous phases create the base for the next ones. Still, more research is needed in this domain (Williams et al. 2019).

The literature confirmed that the FE can have a supporting effect on the project's schedule and budget performance. According to Williams & Samset (2010), it is typical to underestimate costs in the FE, and as the execution begins, the costs jump to the actual levels. This can be attributed to for example strategic underestimation ergo, for example, sales organization trying to maximize the opportunity to get the project. In addition, there can be a bias to overestimation of benefits. This can lead to a "double-dip" when there is also a cost overrun in the execution phase and thus having a major negative impact on the performance. (Williams & Samset 2010) The effect of successfully executing the FE can be in the range of 5-20 % cost improvements and similar improvements to schedule performance (CII 1996; Collins et al. 2017). The effect is typically bigger for smaller projects since more focus and resources are often given to larger rather than smaller projects (Collins et al. 2017). The performance improvement also means less variance and cost changes in the execution phase (CII 1996; George et al. 2008). A statistically significant difference for smaller projects is harder to find since a short delay of a day can be a major delay in small projects with shorter overall schedules. It is important to note that project business organizations have lots of projects so even small improvements can make a big difference on the organizational level. (Collins et al. 2017)

A good FE improves team performance in projects. Successful FE creates better team cohesion and teamwork which helps to battle issues and complexity in the project (Hermanides et al. 2010; Williams & Samset 2012). As a result of a well-executed FE, the project team has clearer objectives and the team is aligned to them. If the goals are uncertain it is unlikely that the team will perform that well. The team is also typically better selected for the project improving performance. (Edkins et al. 2013; Dinsmore & Cabanis-Brewin 2014) Especially trust built in the FE helps the project performance during the construction (Mesa et al. 2016). Well executed FE can create a committed,

well communicating, and trusting core team which helps the project to perform better (Williams 2016). In addition, according to Turkulainen et al. (2013), a well-executed FE enables a good transfer of information for the executing team.

Successful FE supports the value creation for both client and supplier. One identified way is to by creating flexibility to the project which can create value by decreasing the cost of changes in the execution or even during the operation increasing profitability and, further, customer satisfaction (Biesek et al. 2014). Building this flexibility in the FE is possible because the flexibility in the FE is high and the cost of changes low (Williams et al 2009; Olsson & Samset 2006; Williams & Samset 2010). The investment in the FE also results in better quality in the FE reducing costs for the project and increasing customer satisfaction (George et al. 2008). Good FE also takes into includes benefits management for the client and delivering organization. This helps to assure that both are satisfied with the results of the project (Edkins et al. 2013). Good benefits management can help to better differentiate between the needs and wants of the client and thus focus the efforts in important areas. This means that the client's needs are understood beyond the stated initial requirements. This process can also help the client to better understand the delivery thus increasing satisfaction and delivery acceptance. (Neal 1995; Williams & Samset 2012) A better FE also typically leads to better-defined deliverables and thus clear requirements to be met. Well defined deliverables between the supplier and client increase the chances of project delivery success. However, strictly defined deliverables can also become an issue for the supplier if the requirements cannot be met. (Elearn 2007)

Better FE leads to better-managed risks in the execution. The FE is defined by uncertainty and risks but the cost of making changes is minimal compared to later phases when commitments have been made. (Williams et al 2009; Olsson & Samset 2006; Williams & Samset 2010; Samset & Volden 2016) Thus, one of the main purposes of the project FE is stated to be managing the risks and reducing them to an acceptable level. The investment of time and money in the FE decreases the risks and incurred costs in the execution phase creating value (Gibson & Bosfield 2012; Williams & Samset 2012; Edkins et al. 2013).

Better FE also reduces changes throughout the project. This means fewer change orders and less unnecessary work overall (Collins et al. 2017). Oh et al. (2016) also confirm this concluding that due to the better FE there are less rework and changes in the projects. In addition, better cooperation with the customer and understanding the requirements and needs of the client, surprises are minimal and fewer changes are needed. In addition, the project is better defined and understood. (George et al. 2008; Collins et al.

2017) This means that a well-executed FE reduces risks and unnecessary work in the execution phase, in turn, decreasing the extra costs for the project.

To conclude, focusing on the nature of the FE, example gratia, limited information, uncertainty, and communication with stakeholders, has the potential to support project performance. For example, focusing on validating information inside the organization and with the client reduces risks and thus improves the tactical performance. The focus on serving the client, on the other hand, supports the strategic performance.

2.3 Front end activities

2.3.1 Establishing business case and strategy

To get a good understanding of the tasks in the FE, a literature review was conducted. Three perspectives were included: project management, construction management, and sales and marketing. Project management literature focuses on the successful execution and delivery of the project (Williams et al. 2019). The inclusion of the sales and marketing literature brings up especially the interaction between the client and how this interaction affects the activities in the FE (Cova & Salle 2005; Cooper & Budd 2007). The construction management literature introduces engineering and construction project-specific aspects to the FE (George et al. 2008; Gibson & Bosfield 2012; Edkins et al. 2013). The results of this review can be seen in Table 1 and more thoroughly in Appendix C. The findings are in-line, for example, with the exhaustive study of Williams et al. (2019) from project management's perspective. The major difference is that Williams et al. (2019) approach is more general compared to the focus of this study on industrial construction projects and sales projects in project business. In the next paragraphs, the tasks will be gone through systematically.

One of the project sales organization's main tasks and the most used tools in the FE is the business case. This was found in, for example, a comprehensive literature review and interviews in established project organizations (Cooper & Budd 2007; Zwikael & Meredith 2019). The business case should be formed and assessed with the support of the execution organization in the early FE before committing further resources (Williams et al. 2009). According to the results of a comprehensive 2-year study involving 5 companies from heavy industries, creating the business case is not a one of task but an iterative process throughout the FE. This is due to the uncertain and continuously changing nature of the FE which means more accurate information is available as the project progresses. The business case has to be reassessed whenever big changes or alternatively multiple smaller ones have been done, or alternatively enough new information has been received. (Kähkönen 1999). On a conceptual level, the assessment

of the business case, and further, decision to commit more resources are often tied to the decision points of the FE between which the business case is iterated and developed (Cooper & Budd 2007; Williams et al. 2019). The formulation of the business case includes a wide range of tasks from reasoning for taking the project, benefits analysis, risk-analysis, basic cost, and schedule drafting to assessing assumptions (Zwikael & Meredith 2019). Basically, the goal is to create early estimation and justification quantitatively and qualitatively how and with what limitations the project is profitable and thus acceptable to go after (Williams et al. 2009; Williams et al. 2019). The early iterations of a business case can be considered to be similar to a feasibility study presented by construction management literature.

Table 1: The front end tasks colored based on the relative number of mentions (red – little mentions, green – a lot of mentions).

Business case and strategy	Business case
	Project strategy
Setting project goals and objectives	Stakeholder management
	Requirements management
	Goal setting and alignment
Formulation of offer and concept	Project concept
	Offer formulation
	Negotiation
	Technical solution selection
	Basic design (engineering)
	Project execution planning
	Subcontractor management
Offer and concept formulation support t	Constructability/feasibility review
	Value and benefits management
	Risk & uncertainty management
	Information gathering and processing
	Lessons learned
	Change management
Execution preparations	Contract formulation and finishing
Front end management	Project management methods used
	Governance set up
	Team building
	Internal integration
	Project quality control

Establishing project strategy early in the FE is, according to the project management literature, an important task in the early FE. Olsson & Samset (2006) found in multi-case research into public projects that successful projects are characterized by clear and well-founded strategy. According to Artto et al. (2008) comprehensive literature review, project strategy defines how the project is directed to contribute to the success of the project in the environment. Basically, project strategy establishes the mechanisms of how the project is guided towards and can reach a favorable result for the organization and stakeholders. In the project business context, it is important to understand how the

project benefits the delivering organization's strategy and align the project strategy to support this (Tikkanen et al. 2007). The alignment includes fitting it to the organization's culture and ensuring that the project can be executed in a preferred way for the delivering organization (Williams et al. 2019). It has been determined in the context of multi-case public project study that due to the turbulent and uncertain nature of projects the project strategy should support dynamism and flexibility. This is because flexibility has been identified as a defining feature of successful projects. (Olsson & Samset 2006; Williams & Samset 2012) Project strategy should be differentiated from project execution strategy for it is more focused on the overall business result in the environment (Artto et al. 2008). If project strategy and project execution strategy are used interchangeably it misses the point of dynamism and uncertainty in the FE (Edkins et al. 2013). Project execution strategy is discussed in a later chapter.

2.3.2 Setting project goals and objectives

Stakeholder management is identified widely in the literature as one of the most important tasks in the FE (Williams & Samset 2012; Williams 2016; Zwikael & Meredith 2019). There are multiple reasons behind the importance of stakeholder management in the FE. Firstly, stakeholder management enables organizations to understand the key players in the project better which has been established in many industrywide studies (Hermanides et al. 2010; Edkins et al. 2013). This includes identifying stakeholders, assessing their power, position, involvement, and influence. (Edkins et al. 2013; Campbell 2014) The knowledge with good communication strategy and relationship building skills in turn help to build cooperative and trust-based relationships. These help to avoid short-term opportunism minimizing the risk for rapid changes. (Cova & Salle 2005; Tikkanen et al. 2007; Cano & Lidon 2009) The situation can be turned so that the organization can foresee and possibly alter the expectations and requirements of the client in a favorable manner (Olsson & Samset 2006; Edkins et al. 2013). Secondly, broad and in-depth case studies have determined that stakeholder management helps with the uncertainty and has the potential to reduce challenges in the FE (Edkins et al. 2013; Biesek et al. 2014). Thirdly, stakeholder management can relieve the complexity in the project during the FE which was noticed in the case study into the process industry. This is because stakeholders are often seen as one part of the complexity in projects and thus better understanding and management of stakeholders relieves it. (Bosch-Rekveldt et al. 2010) Key stakeholders in the FE are the subcontractors, the client, and players around the client (Cova & Salle 2005). Lastly, by involving external stakeholders as part of the team building in the FE and using them as a resource for the definition of the project they can better understand the requirements of the project (Hermanides et

al. 2010). This helps to better meet the needs and requirements of the stakeholders (Samset & Volden 2016).

Requirements management is often considered as one of the most important FE tasks (Edkins et al. 2013; Morris 2013; Dinsmore & Cabanis-Brewin 2014). First of all, this is because PMBOK (2012) defines project management's goal as meeting the project requirements. Secondly, Requirements create a baseline for the technical solution, execution approach, and, overall, for the concept. This means that requirements guide many of the other FE activities and further execution. (Dinsmore & Cabanis-Brewin 2014; Campbell 2014) Particularly defining, understanding, and steering the major requirements in project business has to be done in the FE (Williams et al. 2009) as these are then written in the contract and locked in making changing them very difficult (George et al. 2008; Pillai 2008; Turkulainen et al. 2013). It has been observed important in the case of studies from multiple industries to differentiate between the needs and wants of a client and understand the client's expectations. Simpler requirements and a better understanding of them make clarify success criteria for the project. Lastly, good requirements management usually leads to fewer changes and reduces the need for flexibility in the project. (Artto et al. 2001; Olsson & Samset 2006) Requirements management is also an ongoing task throughout the FE until the requirements are locked in (Skaates & Tikkanen 2003).

Defining goals and objectives in the FE is important since they guide the project and thus support the project performance. For example, Yun et al. (2016) identified a strong correlation between goal setting and monitoring and project performance in their construction industry-wide survey of 419 projects. Especially monitoring goals enables to better achieve them (Hermanides et al. 2010). The goals and objectives have to be defined in the early phases of the project because they have to be clear and explicit before starting the work. In the project business, this means in the FE. (Williams et al. 2009; Hermanides et al. 2010; Samset & Volden 2016; Zwikael & Meredith 2019) Particularly, it has been observed in studies that in the FE of complex projects it is important to dedicate resources to the formulation of goals since they are considered to be one element affecting the complexity. This effect is due to the need to compromise between the positive and negative side effects of each goal. (Bosch-Rekveldt et al. 2010) Traditionally projects objectives are mainly considering the schedule, budget, and quality. However, as earlier defined project success and thus objectives can be broadened to strategic goals opening the view beyond the traditional approach (Samset & Volden 2016). These are especially important in project business since they affect more on how satisfied the customer and other stakeholders will be in the long term

(Williams & Samset 2016). Thus the objectives and goals should be aligned with all the supplier's and stakeholders' and, especially, the client's goals as then they are more likely to be met according to study in complex construction projects (Mesa et al. 2016). This was also confirmed by Williams (2016) in a case study on real estate constructor.

2.3.3 Formulating project concept and offer

The literature identifies a need for creating a formal general level definition of a project – a concept – in the project FE. This formal definition provides a common ground, an internal definition, for an organization to understand and work on the project (PMBOK 2012; Campbell 2014). Samset & Volden (2016) consider creating the concept as one of the main targets for the FE. This is a separate document from the offer to the client containing more detailed information, especially from the supplier's internal perspective. Kähkönen (1999) in their broad study scheme into various industries defined that it encompasses the basic idea for the project including background, scope, vision, mission, objectives, risks, technical solution, execution strategy, and feasibility study. Gibson & Boschfield (2012) added basic design and contract strategy to this in their survey in the construction industry. In project management literature also a business case, commercial aspects, stakeholder management, how the customer needs and requirements are met, and what the overall project strategy is, are mentioned (Williams & Samset 2010; Morris 2013; Samset & Volden 2016). Many of the aforementioned subjects are discussed separately in this study due to their important nature in the FE and that they have to be dealt with in more detail before adding them to the project concept on a more general level.

From a sales and marketing perspective formulation of an offer starts in the bidding phase when an invitation to bid is received. This offer provides a solution for the client's request. From the project management perspective, this invitation is not a significant milestone but from the sales perspective, it is an important and formal trigger to start the activities (Cova & Salle 2005). This is one of the key tasks and goals in the FE of project business (Cova & Holstius 1993; Cova & Salle 2005). Project management literature does not identify offer formulation as such. However, the formulation of the concept is a comparable task that is more internally focused. Thus the offer should be based on the concept. Offer formulation and bidding continues throughout most of the FE work. Thus, the offer formulation is a task that triggers a lot of other tasks in the FE. According to a survey in marketing projects in Finnish export firms, it is typical to have multiple rounds of bids and offers each round being more specific. During the process, the buyer typically adapts and changes the demands based on the information they have received in earlier bids. This is also affected by the interaction with the client through negotiation. The

negotiation requires utilizing the gathered information together with technical knowledge and understanding of the operational capabilities of the company. (Cova & Holstius 1993; Turkulainen et al. 2013) The importance of interaction with the client is also supported by the previously addressed importance of stakeholder management. (Cooper & Budd 2007) The client highly affects the framework for the offer formulation defining due dates and requirements limiting the room for maneuvering for bidders. The nature of the bidding process also means that the offer can change quite a lot during the FE requiring flexibility. According to a case study into a system supplier, the offer formulation ends in the signing of the contract or not getting the project (Turkulainen et al. 2013).

An important part of the project concept and offer is the formulation and selection of technical solution suitable for the requirements provided by the client. The technical solution is often one of the main aspects that the client assesses in the offer since it defines the performance and has an impact on the costs. Hermanides et al. (2010) identified it in their survey into the Dutch process industry as a value improving practice in the FE. Also, construction management research recognizes its importance in the FE. However, overall, there are rather few mentions about the technical solution selection in the literature as the sales literature dismisses the subject completely. The selection of technical solution includes analyzing alternative solutions to find the most suitable one for the project (Olsson & Samset 2006; Williams et al. 2009) Settling for the initial solution has been, however, regarded to be rather typical (Kähkönen 1999). In complex projects, the selection and formulation of the technical solution often requires basic engineering, for example, technical drawings, process diagrams, and engineering specifications. This basic engineering serves as a foundation for detailed engineering in the execution phase. (Kähkönen 1999; George et al. 2008; CII 2015) It is important to do the engineering properly during the FE since after the signing of the contract the framework for basic design is basically locked (Turkulainen et al. 2013). In addition, in a study into production plant projects, basic engineering was found to clarify the project both helping identify real options and estimate risks and costs better (Artto et al. 2001).

Another key part of the project concept and the FE is the project execution plan and strategy. This is the second aspect that the client typically compares in the offers since it basically defines the tactical performance of the project (Dinsmore & Cabanis-Brewin 2014). This is further confirmed by Hermanides et al. (2010) comprehensive study into the complex projects of the Dutch process industry that found well-performing execution planning being connected to the project success. In the construction industry, it is typical to have at least basic level execution plans as a part of the contract (George et al. 2008). Thus, basic level execution planning is quite unanimously seen as a part of the FE

activities as Appendix C implies. However, Turkulainen et al. (2013) had a bit conflicting view stating that only after won contract the specification is processed for executing organization which implies that most of the planning is not done in the FE. The FE execution planning includes preliminary scheduling, organization defining, estimating costs and labor hours, quality and safety planning, defining deliverables, and sequenced task lists. In the construction industry, the execution planning includes also site planning for how the activities on the site are managed including work breakdown structure. (George et al. 2008) Execution planning shall consider contractual and other limitations, dependencies, and constraints for the project (George et al. 2008; Dinsmore & Cabanis-Brewin 2014). Edkins et al. (2013) study into a wide variety of project firms found out that an important part of the execution planning is also procurement planning since sub-suppliers are a key part of projects especially in construction projects, this will be discussed further in the next paragraph. The execution planning is strongly linked to, for example, requirements management (George et al. 2008) and risk management (CII 2015).

Subcontractor management is a crucial part of FE in project business. This is because the project-based firms are increasingly outsourcing more and more work to subcontractors making them crucial for cost, quality, and timely delivery of the project (Tikkanen et al. 2007). It is also important for the reputation of the company since the ultimate responsibility of the delivery and risks is born by the main contractor although the risks are seemingly contractually transferred to subcontractors (Dinsmore & Cabanis-Brewin 2014). Tightly integrating the subcontractor in the formulation of the offer to the client can according to a case study into a real estate constructor in the UK help to set the expectations and goals right from the get-go, thus improving commitment and respect between the parties and ultimately improve project performance through better integration (Williams 2016). In large projects, there are typically multiple different main subcontractors. Due to these factors, subcontractor management, including contracting strategy and plan, are important tasks to start early on in the FE (CII 2015). Project sales and marketing literature does not only identify this matter as part of the FE but recognizes that these relationships should be cared for even outside the project's scope as part of the milieu (Cova & Salle 2005). Interesting to note, however, is that this issue is not discussed in many studies despite its estimated importance. Subcontractor management is defined in the literature as the definition of goal and scope, verification of competence and capacity, and establishment of the leadership of the subcontractors (Williams & Samset 2012). If the subcontractors are not involved with the formulation of an offer to the client, at a minimum screening of potential subcontractors, their abilities to perform

according to the given criteria should be assessed (George et al. 2008) and negotiation with selected subcontractors should be started (Kähkönen 1999).

2.3.4 Supporting tasks for concept and offer creation

Feasibility and constructability studies are identified as important tasks in the FE of construction projects. Especially in the FE of complex projects, they were found to correlate with the success of the project (Hermanides et al. 2010). The purpose of these tasks is to reveal issues with the design, solutions, or the whole project, and assess the overall feasibility of the project avoiding major issues and minimizing risks (Campbell 2014; CII 2015). These tasks can help to identify, mitigate, or completely avoid possible problems before committing to the project. Thus, during the FE, these have an important role in deciding whether and with what limitations to commit resources for a project. It is recommended widely in the literature that feasibility studies should also be conducted later and more thoroughly throughout the FE. (CII 1996; Dinsmore & Cabanis-Brewin 2014; CII 2015; Williams et al. 2019) Feasibility studies can include various activities from workshops, checklists, force field analysis, resource analysis to business analysis (Elearn 2007; Gibson & Bosfield 2012; CII 2015).

Value and benefits management are key tasks in the FE to answer the client's needs. This is important since the satisfaction of the stakeholders was found to be vital for achieving success in projects and further in project business in a study into 9 project-based organizations (Edkins et al. 2013) which can be achieved with value and benefits management. Establishing benefits and value in the FE enables the project to focus on important areas from the start. This has been verified in studies covering various project organizations. (Edkins et al. 2013; Zwikael & Meredith 2019) These practices are used in engineering and construction-based industries. Value management is concerned with seeking out the value at all times and improving organizational performance. (Williams et al. 2009) Benefits management is a newer approach stemming from the IT industry and concerned with meeting the reasons why the project is done. (Edkins et al. 2013) Benefit management has however been used in public projects for longer (Christensen 2011). The activities define and manage the practices that are needed to deliver the expected benefits and value to the customer. Value management can be, for example, building real options into the project or otherwise ensuring that the project parts have a purpose delivering value to the client. (Biesek et al. 2014) Both practices can be conducted as part of other FE tasks or separately, for example, as a series of workshops reviewing the mission and strategic fit, project scope and defining performance elements, and testing design options. (Williams et al. 2009) The value and benefits management processes include defining goals and measures and then tracking progress and

changes. The value and benefits measures can be, for example, efficiency or other performance measures that the organizations value. In addition to specific value and benefits management tasks, a culture of seeking value and benefits for the stakeholders in the project at all times should be built. (Edkins et al. 2013; Zwikael & Meredith 2019) Thus, managers need to nurture this culture during the FE.

Risk and uncertainty management is recognized widely by the literature as one of the more important tasks in the FE. It is even stated as being paramount (Cova & Holstius 1993; Pillai 2008). It was found to be especially valuable in technically complex process industry projects (Hermanides et al. 2010). It is also included in some of the formal definitions of the FE (George et al. 2008; Gibson & Bosfield 2012). Edkins et al. 2013, for example, define the FE's purpose to be lowering the risks and uncertainty to an acceptable level. This task should also include opportunities identification (Olsson & Samset 2006). There are multiple other arguments to manage risks in the FE as well. Firstly, projects' whole lifecycle from conception to closure is based on assumptions and estimations containing uncertainty and risks (Elearn 2007). As established the uncertainty and flexibility are the highest in the FE, hence, risk management early on enables the organization to act on the risks early on. This is often more effective. It also means that the cost of actions increases the further the project has proceeded. Thus, the theoretical potential for reducing risks and uncertainty is the biggest in the FE. (Samset & Volden 2016). Secondly, in a typical project lifecycle, the estimations and assumptions get built in the project definition including execution solution, technical solution, budget, and schedule during the FE (Edkins et al. 2013). This is especiallyt the case, in lump sum projects because the risk of execution is on the supplier and the risks are priced in and locked which means that the risks are hard to effectively manage during the later phases. Thirdly, it was found typical to consider risks too late in a study into Norwegian public projects which means that the risk management activities have fewer opportunities to affect the project design which causes issues later on (Olsson & Samset 2006). This issue was found in construction industry research to be present especially in smaller projects. In addition, with smaller risks it is not considered to be of value. It is important to understand that even small risks can have major cumulative effects when looking at the organizational level over many projects. (CII 2015) Lastly, as risk and uncertainty were defined to be part of the complexity, risk management can help to alleviate complexity according to a case study in the process engineering industry (Bosch-Rekveldt et al. 2010).

Risk management should be considered as an integral part of the FE. This is because many of the tasks in the FE need to consider risk and uncertainty (Kähkönen 1999; Morris

2005; Edkins et al. 2013; Biesek et al 2014). For example, in execution planning considering different scenarios on how the project could play out can in some cases help to mitigate risks (Morris 2013). In addition, Edkins et al. (2013) found out that risk management works in tandem with requirements management. A better understanding of the risk enables to mitigate and avoid the risks in negotiations with the client (Edkins et al. 2013).

As a part of the concept creation and the FE, collecting, and processing of relevant information about the project is a crucial part of them and built into many of the tasks. This is for one because of the limiting nature of information in the FE relieving which mitigates uncertainty and creates value. The key role of information gathering and processing is displayed in some of the definitions of the FE. For example, according to Gibson & Bosfield (2012) FE is seen as a process of developing sufficient strategic information. A survey in the sales and marketing field recognized especially the sharing of information with the client and stakeholders as an important task (Cova & Holstius 1993; Skaates & Tikkanen 2003). The information-gathering process requires focus also because the information in the FE can become irrelevant rather quickly, relevant information can be hard to get, and information is linked since different activities provide information for each other. (Williams et al. 2009) It is thus considered most valuable to focus on collecting a critical amount of information for the key decisions and uncertainties. (Williams & Samset 2012; Samset & Volden 2016) This way costs can be kept lower, information is more relevant and information overflow can be avoided creating value (Williams et al. 2009). In addition, Flyvjberg (2013) found that not enough focus and an unsystematic approach to information gathering rather easily lead to biases.

Lessons learned should be a task in the FE. Lessons learned have been found in surveys in the construction industry to be a valuable source of information for the FE (George et al. 2008; McClory et al. 2017). Relevant lessons learned and earlier experiences are often quite an easy way to obtain valuable insight that can not be obtained elsewhere. This insight can be utilized to support many of the FE tasks. (Williams et al. 2009; CII 2015; Williams et al. 2019) Williams et al. (2012) found in their case study that utilizing lessons learned can also help to detect early warning signals of issues thus decreasing risks (Williams et al. 2012). Hermanides et al. (2010) found that lessons learned have the potential to add value in the FE if done systematically. However, they also found that the more technically complex the project is the less value lessons learned have. A study into the lessons learned process found that a significant positive impact on project

performance can be had if lessons learned are utilized on an organizational level systematically. (McClory et al. 2017)

Change management should be a key tasks in especially more technically complex projects. This is because changes in these complex projects are quite regular and easy to lose track of creating major issues (Hermanides et al. 2010). Especially in complex projects changes can have unexpected effects through interdependencies. At a minimum, monitoring changes is important. (Hermanides et al. 2010) Due to the turbulent and uncertain nature of the FE changes are often unavoidable and thus change management can create value (Turkulainen et al. 2013). In smaller projects change management is easily disregarded and thus causing issues. (Collins et al. 2017) Sales and marketing literature identifies the needs for change management in the negotiation process of the contract. In this context, changes should be handled jointly by sales and executing organizations to avoid problems and understand the interdependencies better. (Turkulainen et al. 2013) Change management typically includes tracking and having the necessary approvals and checks for changes. Good change management can reduce the risk of costly rework, disputes, and other issues in later phases. (CII 2015)

2.3.5 Final negotiations and setting up the project execution

The bidding and negotiation phase ends when the buyer selects the supplier. Typically at this point, final negotiations and the final formulation of a contract are done. These lock the project definition and concept making them an important milestone and task. It is important to note that the contract formulation is not limited to the end of the FE but it is an ongoing activity throughout the bidding phase. The process just culminates in final negotiations fine-tuning and finishing the contract terms. (Cova & Holstius 1993; Turkulainen et al. 2013) The focus of project management literature on contract-related activities is on the delivery system and scope selection. The fairness of the contract for both parties enabling efficient and cooperative execution of the project is also identified as a key focus area at this point. A suitable contract strategy also has to be selected, for example, how flexible or strict the contract is and how aggressive one should be with the contract. (Williams 2016; Williams et al. 2019) A fair contract is important since in the construction industry it has been found that it correlates with better project performance (Wiliams 2016). Compared to project management literature construction management literature has different key focus areas when formulating the contract. These are the technical solution, requirements, and the concept (Kähkönen 1999; CII 2015).

View of sales and construction management literature on contract formulation differs also from project management literature. The sales literature mainly focuses on the

negotiation and formulation of contract terms and getting a good deal (Skaates & Tikkanen 2003; Turkulainen et al. 2013). It was found in a case study into global project company that both sales and executing organization should jointly take part in formulating the scope and contract terms to avoid issues with changes (Turkulainen et al. 2013). Different parts of the organization, for example, engineering, project management, and sales have different kinds of roles in the formulation of the contract. Each has to take part and focus on their area of expertise in the contract terms. Upper management has the role of making the contract uniform and managing the overall strategy for it.

Before the FE is completed there are important steps to prepare for the execution. However, there are only a few mentions of this transitional phase and its tasks in the literature. One mentioned item was establishing and selecting, project organization and functions especially in complex projects. (Williams et al. 2019) After the selection of the project organization, the execution team building begins. This is important for battling the complexity of the project (Bosch Rekveldt et al. 2010; Williams & Samset 2012). Early team building also helps to align the team to the project, transfer the knowledge, and establish good practices (Dinsmore & Cabanis-Brewin 2014). After the team selection, the project execution starts with a kick-off meeting which is prepared based on the information from the FE (Turkulainen et al. 2013). It was found valuable that subcontractors are involved in this phase if already selected to establish relationships, good practices, and leadership (Williams & Samset 2012). This can help improve commitment and project performance (Williams 2016).

2.3.6 The management of the front end

Lastly, it is important to consider how the FE should be managed. The research into the internal management and organizational aspects of the FE is rather limited since the focus is mostly on the execution phase. This is interesting because the management of the FE was found to be critical in a multi-case study into various industries (Edkins et al. 2013; Zwikael & Meredith 2019). However, the articles have some mentions of applying similar methods and practices as in project management of the execution phase (Morris 2005; Olsson & Samset 2006). These practices should be used to control cost, quality, and progress – tactical performance of the FE (Olsson & Samset 2006). However, according to Edkins et al. (2013) FE requires a wider range of management skills than the execution phase ranging from financial to technical skills. This is supported, for example, by Dinsmore & Cabanis-Brewin (2014) who state that due to the uncertain and more undefined nature including a smaller team in the FE, the management is more organic and flexible compared to the execution phases well-defined processes. Also,

Williams et al. (2019) confirm this in a broad literature review stating that the management cannot be similar.

The management of the FE needs to take into account the nature of the FE. There are differing opinions on what the focus areas should be. Identified focus areas are, for example, team building, the definition of clear goals, managing complexity (Hermanides 2010), managing risks (Edkins et al. 2013), and both gathering and processing information (Gibson & Bosfield 2012). In addition to different focus areas, there appears to be two paradigms in the management of the FE. The first one is the previously referred organic approach typical in smaller organizations. The second one more mechanical well-defined process. The latter is used in more stable environments with stable technologies. The organic approach is suitable for environments with trust in the key players and their abilities. The process also has to be very people lead. (Edkins et al. 2013) Case studies and surveys have concluded that this mechanical approach is typical in project business. This approach can include, for example, decision points and basic processes. (Christensen 2011; Edkins et al. 2013) The more systematic approach can be, also, for example, Cano & Lidón's (2009) systematic and goal-oriented framework for the FE known as the Logical Framework Approach.

Project governance is identified by project management literature to be an important part of Management of the FE. This is for one since it supports the FE performance. In simple terms, project governance is defined as establishing the principles on which the management operates (Dinsmore & Cabanis-Brewin 2014), for example, how projects are monitored, values maintained, objectives and strategy created and expectations established (Morris 2013). Also, it can also consider which the roles are and how the management processes work. It helps to ensure that the project management structures are sufficient for the completion of the project. (Williams & Samset 2010) Project governance also provides a framework on how the organization makes the decisions during the project's whole lifecycle (Williams & Samset 2010). The focus is mainly on the process-oriented elements of governing the projects and making sure that the projects are successful especially strategically (Samset & Volden 2016). The governance practices are also an important link between the project and the permanent organization and, as such, should be aligned to support the organization's goals (Williams et al. 2019). According to a broad literature, review projects can be anything from subordinate to almost independent from their parent organization. (Artto et al. 2008) It is thus important to establish the relationship correctly during the FE (Dinsmore & Cabanis-Brewin 2014). The complexity and dispersion of projects and projects' teams globally affect the governance practices (Williams & Samset 2010). A typical setup for project governance

is to have clearly defined decision points between the phases according to the typical life-cycle of projects. Also, senior management can arrange steering and review meetings and provide ad-hoc support. This is a goal-oriented system that establishes the project and the goals at the FE. Other typical features for project governance are formality in decision making and roles, contracts and sign-offs, and clear quality assurance. (Williams & Samset 2016)

Team building is mentioned by multiple authors as a value-adding management activity in the FE. Especially in complex projects correlation has been found between a cohesive and well-functioning team and project performance. (Hermanides et al. 2010; Edkins et al. 2013) Williams (2016) also found in their case study that good team building and establishing performance measures help the team to work more efficiently towards a shared goal. Team building can also help to address the complexity since project teams are seen as one part of project complexity in a case study into the process engineering industry (Bosch Rekveldt et al. 2010). The teams in the FE can vary from ad-hoc to dedicated teams (Edkins et al. 2013). Research into global project organizations found that the teams should be cross-functional and include people from executing and sales organizations to improve performance. This is because it creates flexibility that is needed in today's uncertain and complex projects. (Turkulainen et al. 2013) The team building can include the definition of the key roles and responsibilities in the FE, aligning the team's objectives with the FE's, and building on these establishing good practices (Dinsmore & Cabanis-Brewin 2014). The team can also have internal kick-offs in the FE (Turkulainen et al. 2013).

The front end requires cooperation – internal integration – which needs to be managed throughout the organization. It is especially important between the sales and executing organizations (Edkins et al. 2013; Turkulainen et al. 2013). This is because a successful FE requires a wide range of skills, experience, and information (Cova & Holstius 1993; Cooper & Budd 2007) and often in project-based companies these can be found from the separate sales and execution units with separate tasks and little overlap (Cova & Salle 2005; Cooper & Budd 2006). Secondly, the sales and marketing function acts as a linkage between the demand and the organization's delivery capabilities, in other words, the execution organization. The execution organization in turn understands the organizational capabilities the best. (Turkulainen et al. 2013) Thus, the cooperation helps to control resources and avoid overwhelming the execution organization with projects (Cooper & Budd 2007). Thirdly, Cooperation can help alleviate biases that the sales organization can have in the estimations when trying to close the sales (Pillai 2008; Williams & Samset 2010). Interestingly only construction management and sales

literature have identified this need for integration. Making the cooperation more challenging is, the physical distance between different organizational parts and thus strong organizational silos (Cova & Holstius 1993; Cooper & Budd 2007; Turkulainen et al. 2013; Oh et al. 2016).

There are two approaches to managing internal integration. These are vertical and horizontal integration (Turkulainen et al. 2013). Vertical methods include, for example, standard practices, FE reviews, and a formal handover to execution. Horizontal practices are instead, for example, formal manager level cross-functional teams or in unique projects liaison persons. There can also be informal cross-functional kick-off meetings and teams for the FE. (Turkulainen et al. 2013) In addition, construction management literature identifies tasks that execution organization should be involved in, for example, constructability, planning, and installability studies. Construction organization can also help identify appropriate methods, risks, and give expert opinions for the execution. (CII 1996; CII 2015) In a wide study into the construction industry and case projects, it was found that execution organization can bring a second view to the FE validating the plans and minimizing the issues thus increasing chances for success (Oh et al. 2016).

As discussed in chapter 2.2.3, the FE has a supporting effect for the performance of a project and thus it is important to ensure the quality of it. Managing internal quality is a key management task in the FE. Its value has been recognized in the complex projects in a survey in the process industry (Hermanides et al. 2010). In a case study into a large construction project especially the quality of produced information and decision making are found to be important focus areas. Quality assurance can relieve bias from the estimates and information leading to better results (Pillai 2008; Flyvjberg 2013). Quality assurance in the FE often yields clearer decision-making criteria and focuses the efforts towards missing information and uncertainties better (Olsson & Samset 2006). A good example of a quality control framework for the FE is the construction Industry institute's (CII 1996; CII 2015) definitive checklists for the FE in industrial and construction projects. CII identified a clear correlation between the performance of the project and the score the project has gotten in its evaluation checklist. Good quality assurance is often tied to a good governance framework (Samset & Volden 2016; Williams et al. 2019).

Benchmarking and setting benchmarking metrics is recognized mainly by project management literature (Appendix C) and is found to be a key task and a tool to assess the project in the FE (Oh et al. 2016; Yun et al. 2016; Zwikael & Meredith 2019). Outside project personnel also can be used to assess the project and provide a more objective view on it (Olsson & Samset 2006; Flyvjberg 2013). Benchmarking includes comparing

the estimates and information gathered to similar cases thus providing a more objective look at the quality of the information (Williams & Samset 2012).

2.4 Role of the project manager in the front end

2.4.1 Point of involvement and value of project manager

The role of the PM in the FE is not well defined in earlier research. In addition, the specific point of involvement is established. Firstly, this is due to the fuzzy nature of the FE (Edkins et al. 2013). Secondly, there are differing views on the role of the PM. By a narrow definition of project management, the executing organization is appointed at the end of the FE it means that the PM is not appointed and thus does not have an official role in the FE. (Williams et al. 2019) This means that the executing organization is responsible for delivering the project following the agreed contract terms and satisfying the customer expectations (Turkulainen et al. 2013). However, another branch of research and organizations in practice have recognized the PM's value and potential in the FE. Thus, it is quite typical that the PM's responsibilities have been broadened to the FE (Cova & Salle 2005; Elearn 2007; Dinsmore & Cabanis-Brewin 2014; Morris 2013). Still, the sales organization is mainly responsible for the sales phase, for example, relationship management with the customer, negotiations, and defining the business case. The sales organization is also the one working mainly with the customer and thus has a big impact on customer expectations and requirements. (Cooper & Budd 2006)

Table 2: The number of mentions of the role of the project manager in each of the tasks of the front end (red – little mentions, green – a lot of mentions).

Business case and strategy	Business case	3
	Project strategy	3
Setting project goals and objectives	Stakeholder management	2
	Requirements management	2
	Goal setting and alignment	2
Formulation of offer and concept	Project concept	5
	Offer formulation	2
	Negotiation	1
	Technical solution selection	5
	Basic design (engineering)	1
	Project execution planning	4
	Subcontractor management	2
Offer and concept formulation supp	Constructability/feasibility review	1
	Value and benefits management	3
	Risk & uncertainty management	6
	Information gathering and processing	5
	Lessons learned	1
	Change management	2
Execution preparations	Contract formulation and finishing	5
Front end management	Project management methods used	4
	Governance set up	1
	Team building	2
	Internal integration	5
	Project quality control	3

The project manager can be valuable in many tasks of the FE. The attendance of the PM in the FE supports the project definition and ensures that both the customer's expectations and the organization's business goals are fulfilled. This is because PM can bring experience and understanding of the organization's execution capabilities and at the same time get a better understanding of the project. Also, some of the tasks suit PM's skillset very well since they are similar to the execution phase such as resourcing, procurement, risk management, and execution planning. (Morris 2013; Edkins et al. 2013; Wearne 2014) Some areas, such as the more supporting role in the more creative and informal FE can be away from the normal comfort zone of the PM (Dinsmore & Cabanis-Brewin 2014). Involving the PM in the FE typically creates a dilemma about how much resources can be diverted to the project prospects from execution projects. (Cooper & Budd 2007) Despite this, it has been noticed in case studies into various project organizations that the traditional perception of the PM's role affects them so that they do no try to affect the FE despite their skills and experience. Further, PM is not often asked to participate. (Morris 2013; Edkins et al. 2013; Wearne 2014) The findings from the literature on the PM's role have been mapped in Table 2 and more thoroughly in Appendix D.

2.4.2 Establishing the business case and strategy

The Project manager can be a valuable asset in the formulation of the project strategy and business case. However, this is still rather rare in practice (Morris 2013). The practical experience and view of the PM on projects can improve the value for both customer and the organization itself (Williams et al. 2009; Morris 2013). Helping in the strategic work also supports in establishing good relationships and practices with the upper management which has the potential to give meaningful value to the project later on (Hermanides et al. 2010; Dinsmore & Cabanis-Brewin 2014). In addition to strategy formulation, PM can support in defining the business case for the project (Williams et al. 2009; Edkins et al. 2013; Morris 2013; Campbell 2014). They can help identify reasons and ways to make a project more profitable or perhaps identify issues with the business case that can be fixed early on (Edkins et al. 2013; Campbell 2014). PM can thus provide valuable consultation in the early phases of the FE.

Stakeholder management is an important task for the PM to support. Three theoretical papers (Elearn 2007; Morris 2013; Campbell 2014) and two combined case and survey studies (Morris 2005; Edkins et al. 2013) into the construction industry confirmed this. This is because PM often has a very good understanding of the organizational capabilities, technical issues, social aspects of the stakeholders, and interfaces and interactions between these. With this knowledge, it is also easier to prioritize the key stakeholders and their needs in the FE. (Morris 2013) Utilizing this knowledge, establishing the relationships and practices in the FE was found to have a positive impact on project performance (Morris 2005).

The requirements definition is a task that PM should be involved in in the FE. Typically meeting the requirements is defined as the project management's goal and also they affect a lot how the project should be managed and executed (Dinsmore & Cabanis-Brewin 2014). Secondly, in some cases, it may seem easy to agree on requirements in the FE at the upper management level. However, the PM works on a practical level on which the requirements are much more difficult to agree and define since there are a lot of practical issues to be solved. (Campbell 2014) Thirdly, it has been found highly likely in in-depth case studies into project-based firms that the PM's involvement in requirements management makes the requirements more achievable since the PM can ensure that the organization has capabilities to meet the requirements thus increasing client satisfaction (Turkulainen et al. 2013; Biesek et al. 2014). Besides, the PM has a much better understanding of them if the project continues to the execution phase. Further, Edkins et al. (2013) found in their multi-case study into various industries that PM has a role and value in setting goals. Hermanides et al. (2010) also identified a

possible correlation between setting goals and ways to monitor them and the performance of complex projects. The attendance of the PM in setting goals for the project in the FE supports the PM' requirements management in the FE as the goals need to be aligned with the requirements early on (Elearn 2007; Campbell 2014).

2.4.3 Formulation of offer and concept

The project manager can be a valuable asset during the formulation and assessment of the project concept and offer. For one, the PM can give sparring, advice, and support in the overall concept (Edkins et al. 2013). This helps to establish a better understanding of the project in the organization. Secondly, the execution plan is something that the PM should participate in identified by four pieces of research. PM's execution experience is found to be a great asset in execution planning leading to better performance. PM is also responsible for the execution phase and, thus, it is natural that they are partaking in the formulation of the execution plan. It can also improve their commitment to the project. PM's expertise has also been found to help minimize issues, for example, in the budget, and schedule. (Morris 2005; Wearne 2014) Thirdly, as the PM has been involved in defining the project and will be responsible for the execution Turkulainen et al. (2013) found that they have the credibility and knowledge to be of value in the negotiations with the client. However, other authors did not recognize the PM's role in negotiations. The offer is typically based on the project concept which implies that the PM has a role in the formulation of the offer as well. In fact, Morris (2005) specifically recognized the PM's value especially in pricing

Closely related to execution planning is subcontractor management. It was identified by two studies as a FE task for PM. Edkins et al. (2013) found that building the relationship with subcontractors, establishing the practices, and recognizing the key players is valuable and helps the start and performance of the execution. Especially motivating the subcontractors and starting to build the team early on can create value later in the project (Elearn 2007). Morris (2005) found it especially important due to subcontractors' big role in the execution phase.

Depending on the PM's experience and skills they can be an asset on a general level in the selection and formulation of the technical solution. This was discussed by Morris (2013), Edkins et al. (2013), and Wearne (2014). Turkulainen et al. (2013) brought up in their case study into an automation supplier that PM is valuable in giving opinions on how technology affects the executability of the project. Artto et al. (2001) brought up that the PM should also take care that the entity's technical functionalities correspond with the requirements of the client. However, closely related to the technical solution is basic

engineering in which only Hermanides et al. (2010) recognized the PM's role. They stated that the PM can help to validate the designs in reviews. This is understandable since PM might not have the technical prowess to be of value.

2.4.4 Supporting tasks for concept creation and offer formulation

The most recognized supporting task for the PM was risk management. They can assist in identifying the possible execution-related uncertainties and risks better with their good understanding and experience of the execution phase (Edkins et al. 2013; Biesek et al. 2014; Campbell 2014; Wearne 2014). Williams et al. (2012) in a study into the projects of the construction industry around the world, recognized the value of a PM's intuition in detecting early warning signs of problematic. If used correctly this intuition can help avoid big problems in the projects. In addition, PM is typically held responsible for risks in the execution phase and thus it is natural that they help estimate these risks in the FE. The attendance can also counter the sales' possible bias to underestimate risks, (Elearn 2007; Morris 2013) As a continuation to risk management Hermanides et al. (2010) recognized PM's value in constructability and feasibility studies. With their experience, they can quite intuitively assess the feasibility and constructability and advise on how it could be improved especially from the execution point of view (Elearn 2007; Hermanides et al. 2010).

The project manager can have an important role in value and benefits management. The PM has the potential to improve value for both the customer and the organization itself (Williams et al. 2009; Morris 2013). Artto et al. (2001) found in their study that PM can help enhance the strategic value of the projects for the customers through better benefits management. This means that the PM establishes an understanding of the client's ultimate needs early on in the project and through their experience help to form the project to answer these needs. Yun et al. (2016) recognized PM's input as valuable to reduce overdesign thus better fitting the solution to the customer needs creating value for both parties. Olsson & Samset (2006) brought up the PM's role in monitoring that the value and benefit promises can be and are met. Involving PM can thus help to create value by drawing focus on important areas and help to make things more efficient.

The change management was brought up by literature as an important task for PM as well. As established earlier, the FE is turbulent and changes are frequent and they need to be managed. Turkulainen et al. (2013) stated that PM should attend the change management when the client wants to change something in the offer in the negotiations. This helps to avoid mistakes and especially in complex project unpleasant

consequences. Wearne (2014) brought up that the focus should be especially on what kind of risks in the execution the changes might cause.

The project manager has an important role in information gathering in the FE as recognized by five studies. This is because PM has experience, skills, and relationships that others do not have. For example, Edkins et al. (2013) mention that the PM can act as an internal consultant advising others and sharing knowledge based on previous experiences. They can also help to gather the required information and help to sort out the important aspects. Turkulainen et al. (2013), in addition, brought up PM's ability to connect experts from execution to the FE. However, only Zwikael & Meredith (2019) directly recognized PM's role in forming and utilizing lessons learned as an information source.

Studies have recognized PMs' role in execution preparations as well. This area, however, seems to be underrepresented in the literature. One recognized value-adding task for PM in this area is resourcing the project (Hermanides et al. 2010; Edkins et al. 2013; Wearne 2014). Turkulainen et al. (2013) also mention that the PM is in a key role when arranging kick-off for the project. The most recognized task in this area is, however, is the PM's involvement with formulating the contract terms since the terms affect how the execution is carried out. (Turkulainen et al. 2013) Campbell (2014) also mentioned in their book that the PM's understanding of the requirements can help to formulate the contract and scope more accurately.

2.4.5 The management of the front end

The project manager can be a valuable asset in the management of the FE. A study into Norwegian public projects found that PM should utilize their key skills and tools in the FE to improve the potential for tactical and strategic efficiency of the project in the execution phase (Olsson & Samset 2006). In addition, Morris (2005) stated that PMs have a special skill set for managing projects that is very useful in the FE despite its different nature. As part of the management, PM's role in governance set up in the FE was identified in one survey in which. Especially, the cooperation with the steering group was named important. (Hermanides et al. 2010) Elearn (2007) and Morris (2013) recognized PM's role in other areas of governance. Morris (2013) mention cooperation with upper management important in building appropriate management structures for the project. These structures enable better the success of the project. The attendance in governance and the project management skills can also improve the quality assurance of the FE further improving performance.

Teambuilding is also a management task that the PM should attend. Hermanides et al. (2010) emphasize the importance of this. Teambuilding is found to be especially important in complex projects as it can help to battle the complexity and issues in the project when started early thus improving the performance (Hermanides et al. 2010). The role of the team leading, organizing, and resourcing, is emphasized in the questionnaire to PMs by Yun et al. (2016) which indicates that they are indeed very important activities for PM in the FE. The importance is further confirmed by Wearne (2014) study identifying the biggest issues in project management to be related to organization, time, and resourcing.

The project manager also has a role in enabling the integration between execution and sales organizations with their connections and expertise. PM can help to shape the project and transfer needed information into the FE from execution. In addition, the PM gets to know the project and the client better which supports the execution phase (Edkins et al. 2013; Turkulainen et al. 2013). As discussed earlier integrating execution knowledge to the FE can help to increase the projects' success.

Basically, the PM can have a role in every task that was identified in earlier chapters and there is research backing this. However, one has to keep in mind the limitations of the PM's time. Usually, PM is simultaneously working on execution projects which is their main focus. Thus, the focus areas in the FE have to be specifically selected for each organization and considered on a case by case level which tasks are most crucial for which project and what kind of capabilities the PM has. The findings imply that at minimum PM should be assets and experts in the FE (Edkins et al. 2013; Morris 2013; Williams et al. 2019). In addition, tasks such as risk- and requirements management, some of the execution planning, and project concept require the PM's attention. Some researchers such as Morris (2005; 2013) suggest that the PM should be used in a broader strategic sense to set objectives, create a strategy, manage stakeholder's et cetera. This, however, requires much more time from the PM but has the potential to create value.

3. RESEARCH METHODOLOGY

3.1 Research characteristics

This thesis is a constructive qualitative case study. This approach was selected because the purpose of this study is to create a framework for the case organization's FE. According to Oyegoke (2011), the constructive approach is considered to be a good fit for the project management environment due to its fit to managerial structures, complex organizational problems, and the ability to focus on business benefits. The constructive approach is also suitable for creating a new construct and testing it. The constructivist approach requires problem identification, in-depth understanding, justification of the construct, highlighting both theoretical and practical contribution, and examining the applicability. (Oyegoke 2011) As this study combines the literature review with the empirical results these steps are fulfilled. Combining different types of data also improves the validity of the construct. The solution needs to be validated which is done in this study as a weak market test by representing the construct to the key personnel of the case company (Oyegoke 2011).

The research philosophy in this study is critical realism. A critically realistic approach means that the focus is on trying to understand the underlying structures and constructs that steer peoples' actions. There are two layers before the understanding. First, there is how the world is interpreted, and secondly the actual actions and beyond that the real. In critical realism, it is considered that observations do not give a full picture of the structures and it is up to the researcher to interpret causal structures that might produce these phenomena. (Saunders et al. 2016) Critical realism is great for comparing theoretical and practical findings in a specific context and finding general and particular explanations and critically evaluating them. (Oyegoke 2011). The focus is especially on the experiences and recollections of the interviewees. The collected data is cross-sectional meaning it is collected in a certain shorter period of time. The data collection is described further in the upcoming chapter. Researchers have to interpret the meanings of the phenomenon. Thus, the researcher's interpretations have an impact on the results despite the effort to be as objective as possible. To combat this the research has to be well documented and reflective. The sample size is quite small and qualitative which is suitable for a critically realistic approach. (Saunders et al. 2016) These factors mean that the critical realism approach is justified and suitable for this study.

The empirical part is conducted as a case study in a project-based firm. The case study goes in-depth and has the potential to generate insight, descriptions, and new theory (Saunders et al. 2016). However, there can be some limitations to the generalizability of the case study due to the small sample size and context (Voss et al. 2002). The deep insight that case studies can offer often balances that out (Saunders et al. 2016). Case studies are also good in producing relevant results for management and increasing understanding of the issue in question. (Meredith 1998) The development of relevant information for management is one of the main purposes for this thesis which supports the selection of this method. Case studies have been widely used with a critically realistic approach which also supports this research strategy selection. The approach to theory development is abductive. This means that the study moves from theory to data and from data to theory combining deductive and inductive approaches. (Saunders et al. 2016) In the first section, the literature was reviewed and observations were collected, and a theory was developed. In the empirical part, interviews were conducted and a framework was developed. This framework was then compared to the theory and the collected data to examine its validity.

3.2 Research process

The research process (Figure 4) started from data collection, analysis, and theory building in the literature review according to Figure 4. The research continued to the empirical study. The literature review provided deep insight into the subject understanding of the phenomena around it. The frameworks created in the literature review were used in the empirical study. The same research questions are used for both literature review and empirical study. The theoretical knowledge also supported in the planning, execution, and analysis of the empirical study, for example, who will be interviewed, what is the interview framework, and how the results are analyzed. After the initial planning, the data collection was conducted and analysis started simultaneously. When the data collection finished the analysis continued and the writing of the analysis started for the empirical portion. The findings and preliminary construct were verified in a workshop arranged for key personnel and interviewees. This was considered to be a weak market test for the construct. Both the empirical and theoretical parts were conducted discussion between the two points of view was conducted and at the end conclusions and combined framework was formed.

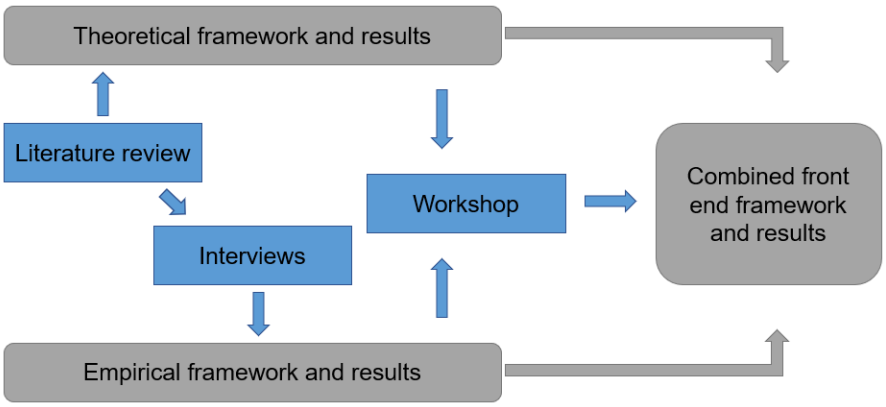

Figure 4: Research process.

As a result, the empirical and theoretical frameworks and results were combined and compared. This enabled the conduction of a thorough analysis of the case company's situation and gave development ideas that were validated in the workshop. It also enabled the study to contribute to the theoretical body of knowledge as there were conflicting and matching concepts to earlier findings.

3.3 Research environment

The case in this study means the case company's energy business units' FE. The case company is a market leader or close to it in its business areas. The projects in the organization vary from small to very large and complex. The cost also ranges from tens of thousands to hundreds of millions. The most typical delivery types are engineering, procurement and construction (EPC) and engineering, procurement and supervision (EPS). Typically, the case company subcontracts a major part of the work during the projects. Case company focuses on project management, engineering, leading the site works, and providing the technology for the projects. These projects are delivered around the world mostly to EMEA and Asia and pacific areas. The organization has tens of these projects going on simultaneously. In addition, it has tens of sales projects going on along with the execution ones.

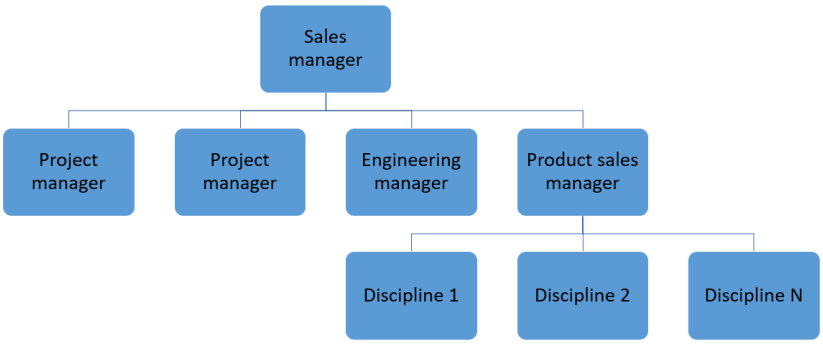

Figure 5: Organizational structure in the front end.

The case organization is a multi-dimensional matrix organization. First of all, it consists of four technology units which are divided into various functions. The units and functions are somewhat separate and each unit typically has profit responsibility. Also, the organization has resources divided into various disciplines, around 20, from installation planning and pricing to project management. Each discipline has a specific role during the project. The project organization in the FE is depicted in Figure 5. The organization for the execution phase is much bigger and selected at the beginning of execution. The project organization is steered and managed by the permanent organization. The organization is also geographically divided around the world. The sales organization is an area organization on an upper level in the matrix and includes only sales managers (SM). This means that the same people and organizational parts execute and sell the projects. The people are assigned to specific projects and collected for each project separately from the organization. It is up to the managers to specify the resources for the projects. One person can thus work on multiple projects that are in execution and FE phases.

The case organization is quite development-oriented and has development projects going on to improve organizational performance. The goal is to improve sales performance and lower costs. The ongoing development projects were quite closely tied to this study which meant that support for this study was readily available. Each part is also responsible for developing its processes. Also, there are larger development projects.

3.4 Data collection and analysis

The interviews conducted were semi-structured. Interviews enable the persons' to reflect on their answers and provide explanations more than for example in surveys. Participants can build their answers. Semi-structured interviews allow to find causal relationships between variables and probe the reasons behind the actions, decisions, and opinions that participants have taken. In critical realism, this is important to try to understand the underlying reasons for actions. A semi-structured interview also enables to lead the discussion to areas that have not been considered yet but are relevant. (Saunders et al. 2016) This method suits the explorative nature of the study and enables to collect data for framework building and answering the research questions. The time reserved for the interviews was selected to be 60 minutes. This was selected due to the scope of the topic in the interview. This time limit was estimated to allow more in-depth conversation and creates a more pressure-free environment for the interviewees' when there is no hurry. (Saunders et al. 2016)

The structure and interview questions (Appendix E) were based on the findings from the literature review. The literature review was completed prior to the interviews to get a good understanding of the subject and to be able to better select appropriate questions and themes. Three themes were selected for the interview based on the findings and research questions: general FE process, the PM's tasks, and the role and the effect of the FE on project performance. The end of the interview consisted of overall level questions to collect development ideas. In addition, the case company's operation manual which describes the way to operate was studied prior to the interviews. This helped to get a good understanding of the designed process and responsibilities thus shaping the interviews. The structure of the interview is found in Appendix E.

The invitations were sent by e-mail and teams to the interviewees with a short description of the purpose and background. Interviewees from the sales organization answered the invitation within a couple of hours on average and all were excited to take part. The PM's answer to the invitation took on average a week and required reminders. The interviews were conducted in face-to-face meetings or Teams meetings, face-to-face being the preferred one. Before each interview, a short description of the purpose of the study and the themes in the interview were sent to each participant. In addition, the participants were asked to select one completed project and gather the information for that project to smoothen the interview event. Each participant was asked if the interview could be recorded. It was made clear that the recording or the interviews as such would not be published anywhere and would be used only for transcribing and research purposes. It was also mentioned that in the final report the data would be anonymized so that the interviewees would speak as freely as possible. These mentions help to reduce interviewee or response bias (Saunders et al. 2016). During the interview brief notes were taken of the key points. Taking notes during the interview can help to maintain concentration on the subject. The notes can also act as a backup if the recording does not work. (Saunders et al. 2016)

16 interviewees were selected from the case company from which 13 interviews were realized. The requirements were that they had comprehensive experience and had conducted different types of projects and attended FEs. It was decided that PMs, SMs, and their managers would be interviewed. PMs were selected as the study directly affects their work and they have experience and knowledge of the effects to the execution side. SMs on the other hand are the ones in charge of the FE phase, so it is natural to get their viewpoint on how the FE should proceed and what are the responsibilities for each party. This was considered to produce enough different viewpoints to give reliable results. The details for the interviews can be found in Table 3.

Table 3: Interview information.

Interview No/ interviewee No	Title	Location	Duration min:sec
1 / I1	Project manager	Meeting room	60:39
2 / I2	Project manager	Meeting room	55:21
3 / I3	Manager, projects	Teams	50:39
4 / I4	Senior sales manager	Meeting room	73:21
5 / I4	Senior sales manager	Teams	60:20
6 / I6	Senior sales manager	Teams	54.23
7 / I7	Senior sales manager	Teams	70:58
8 / I8 and I9	Director, Sales and Senior sales manager	Teams	58:14
9 / I10	Director, Sales	Meeting room	49:04
10 / I11	Project manager	Meeting room	43:59
11 / I12	Director, projects	Teams	34:08
12 / I13	Project manager	Meeting room	59:20
13 / I14	Project director	Teams	65:01

It was assumed that selected interviewees had the best understanding and insight into the subject. This selection is also in line to the literature reviews project management and sales and marketing literature division. In total 13 interviews were conducted, in one of which two people attended at once. The managers for these parties were taken, to get an overall and more strategic take on the issue. In total 7 persons from project execution and 7 persons from the sales organization were interviewed. The average duration for the interview was 56 minutes and 54 seconds. The interviews were linked to 9 projects listed in Table 4.

After each interview, the transcribing was done as soon as possible. Transcribing and making a full record of the interview as soon as possible helps to maintain detail and quality to the data. The longer transcribing takes, often the more detail is lost (Saunders et al. 2016). Contextual data was also included in the interview notes.

During the interviews, the interviewees were asked to discuss about a project. Ten interviewees represented nine projects (Table 4). All of the interviewees did not represent projects since they had not been that involved with specific projects for a long time, or they had not attended both sales and execution phases of a project, or they worked at managerial level and had more overall views on subjects. The interviewees were

recommended to select the most recent project in which the execution phase had already started and preferably also finished. This was done to get data on how the project had performed in the execution. Selecting recent projects also ensured that the project is fresh in the interviewees' minds. The projects were supposed to be from normal-sized to large and represent typical projects to the company.

Table 4: The example projects.

Project / interview	Project	Front end length (firm phase + other phases) / description)	PM involvement in front end (time / description)	Financial result / execution performance	Execution
A / 1	EPC, normal sized project in Europe, technically new product for case company.	4 m / The initial discussion took long. Close cooperation with client. Excellent performance.	4 m / Pricing, technical concept and process, schedule etc.	Excellent / excellent	Went very well with the customer, customer satisfied, easy project.
B / 2	EPS, normal sized project in Asia, multiple similar projects done to same country.	6 m / Everything done very detailed, SM and EM lead well. Excellent performance.	4 m / Technical details, schedule.	Ongoing good / good	Wen't well up to now. Additional work was not agreed in the front end by the client and tries to bill case company.
C / 3	EPC, normal sized project in Europe, new project manager.	6 m / Lots of effort and commitment. Good performance.	6 m / Negotiations, schedule, lots of input	Ongoing Challenges but good / mediocre	Cost overruns due to pricing errors but cost savings done in procurement.
D / 4	EPC, bigger than average in Africa, technically challenging rebuild project.	6 m / Easy front end. However, couple issues in pricing. Good performance.	1 – 2 m / negotiations, schedule, installation and procurement	Ongoing mediocre / good, challenges but in schedule	Surprises in delivery limits and responsibilites.
E / 5 + 13	EPC, Bigger than average in Europe, challenging installation location.	2 – 3 m / For a long time nothing happened, the last couple of months were a tight sprint. Concept was not optimized and cost savings missed. Poor.	2 – 3 m / Layout, schedule etc.	Ongoing challenges but mediocre / challenges but mediocre	Started well, now faced surprises and challenges in scope and technology. Savings in procurements.
F / 6	EPS, rebuild in Asia, techincally demanding and tight schedule	3 m / Quick sales case after a longish idling time. Good performance.	2 m / Negotiations and schedule.	Excellent / good	Project manager lead well, profit margin was increased, customer satisfied
G / 7	EPC, normal sized project in Europe, very long engineering time.	6 m / Did not have resources or focus which led to a long idling time. No time to optimize. Supplier negotiations held (costs down). Poor performance.	4 – 5 m / Concept, schedule, technical details, contract.	Ongoing. Challenges but mediocre / mediocre	Cost overruns due to missed specification. Concept changed during execution. Savings done in procurement.
H / 9	EPC, Normal sized project in Europe, public.	5 m / No negotiations, client in rush, carefully considered offer. Good performance.	2 m / Schedule, risk review.	Ongoing good / challenges but good	Resourcing issues did not start as expected, but now progressing as expected.
I / 11	EPC, Very big project in Europe, untypical organization in case company and in the project as a whole, challenging contract type.	6 – 3 m / Deviations were not made until a very last point, project team was not appointed in time, PM changed. Mediocre performance.	2 m / Going through specification, schedule, resourcing, negotiations	Challenges very poor / Lots of challenges, very poor	Underestimated the required work, issues in inspections with client, schedule late, lots of claims

The projects varied in size from normal to large covered both EPS and EPC type deliveries and were from simple to more complex. The financial and execution

performance also varied from poor to excellent. Some of the projects were ongoing during the interviews. All in all, it was considered that these cases represent the typical projects in the case company. In addition to data from interviews, the case company's project management software was gone through to see the performance and financial results of the projects to get the most accurate data.

A thorough analysis was done on the data in Excel after all interviews were conducted. The interview themes and questions were placed on rows and interviewees on columns. Some additional rows were also added to get a more granular look into, for example, different tasks in the FE. Themes and categories for the analysis were selected based on the results of the literature review, theoretical framework, and the planned structure of the analysis. The data was picked from the transcribes to the table if it was considered to be related to the theme. The idea was to find reoccurring themes, differing opinions, and trends in the answers. The objective was to find answers to the research questions. After the categorization in Excel, the analysis could be done quite easily since the data was well structured and unnecessary data was left out. The analysis structure was formed based on the research questions and also to be in line with the literature review structure.

The division between project management and sales organization was considered to be valuable since they had very different roles and views in the FE. Thus, in the analysis, it was shown from which viewpoint each comment came from. Also, the theory was divided this way. To visualize the answers the framework for the FE tasks was used. If the interviewee mentioned the tasks being part of the FE it was marked in Table 5. A similar approach was used in studying the PM's role in the FE in Table 6. To analyze the impact of the FE on the project the data from projects was collected. First in the interviews and then this was backed by data from the management systems. Again, putting this data into Table 4 shortly describing the project, FE, execution, and the performance of the project. This way the project data could quite easily be used to analyze the effect of the FE on the overall level. Conclusions and observations were made from the tables based on the number of the mentions and also the type of the mention. If the interviewee considered the aspect as a strength or important these were highlighted. In addition, the weaknesses that interviewees brought up were introduced. Observations, development ideas, weaknesses, et cetera, were picked based on how often they reoccurred in the interviews, which parties stated these, and how valid they were considered to be based on the interviewee's explanation and other evidence. If something occurred rarely it was also considered to be valuable to examine why it was stated rarely. Also, opposite

opinions for claims were tried to be found to cover all the aspects and be as objective as possible.

The findings were verified in a workshop. In addition, a separate meeting with a manager was arranged to further validate the findings. All the interviewees were invited to attend the meeting in which they could comment on the findings. Any material or preparation instructions were not given prior to the workshop. The workshop further validates that correct conclusions and interpretations have been drawn. The workshop was arranged as a Teams meeting and lasted 1 hour and 50 minutes. The workshop began with an introduction to the subject with the goals and objectives of the study. After that, the results were presented starting with the findings on the impact of the FE continuing to the FE tasks and ending with the PM's role. Lastly, improvement ideas were represented. The development ideas were prioritized in the workshop based on the opinions and comments. In addition, the ideas were evaluated based on the required effort and estimated impact. During the session, the discussion was encouraged and opinions were asked from the attendees about the represented findings.

In the discussion chapter, empirical findings are compared to the theoretical findings. For this, the framework from the literature review is used. The goal was to find what matches and what is different between these two approaches and try to find overall answers to the research questions. Each was critically analyzed in the context of research questions. Concrete development suggestions for the FE of the case organization were given. Two requirements had to be fulfilled for suggestions. First of all the suggestion has to be supported by the empirical study and verified to be of value in the workshop. Secondly, the theory must have some support for the development idea. Especially If many people considered a thing as a weakness someone gave a development idea for it and it was supported the idea was considered valuable. In the last chapter conclusions with limitations, applicability, and theoretical contribution were given.

4. RESULTS

4.1 Front end process in the organization

To get a good overall understanding of the way to operate the case company's operational manual was studied. On the first look the FEs' roles, tasks, and process are quite comprehensively described. However, there were quite conflicting opinions on the description. A sales organization member mentioned that it is very detailed and complicated, so much so that it is too much for people to read. On the other hand, a PM stated that the guidelines were too vague. A sales organization member agreed with this and stated that it is impossible to make detailed descriptions due to variation and the guiding becoming too heavy to follow. A SM took it one step further claiming that it was awfully made and has not read it and knows many people that also have not. As a contrast, other SM mentioned the accuracy of the roles as a strength of the FE process. Two project- and one SM mentioned that in many cases they do not follow the guidelines, for example, due to tight schedule. However, on the general level, the process is typically followed.

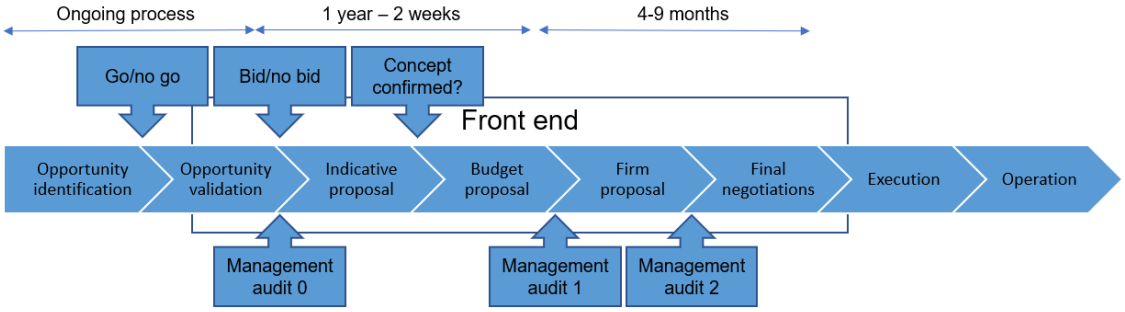

Figure 6: Project lifecycle in the case company.

The overall process in Figure 6 starts with opportunity identification and after that validation. After a bid decision has been made and in larger cases, a management audit has been held, an indicative proposal for the client can be formed. Management audits are held to support the process and get approval for the next phases of the process and according to two PMs and one sales personnel, these are the strength of the FE. This is followed by a budgetary proposal and management audit 1. In the firm proposal phase, the full specification of the sales case is created and the actual costs and price are estimated. The firm proposal is the most active phase of the FE and there is confirmed need from the client. The FE was considered by most of the interviewees to fully start at the firm proposal phase. This meant that not much was mentioned from the earlier phases especially by PMs since they do not typically attend these phases. This phase

ends in management audit 2 for getting approval for final negotiations. During the final negotiations, the contract terms and the final price is agreed with the client. After the negotiations, a kick-off meeting is held, and the project is handed over to delivery. The overall process was described in the operating manual and by two managers. Especially SMs, two of whom mentioned stated: “The process is created too much from the internal perspective”. Besides, according to two project management personnel, there is quite often a variation from case to case, for example, in some FEs there can be pre-engineering or procurement. A person from the project management organization also confirmed this by stating that projects arriving in management audits are in very varying states. Also, a SM stated that sometimes the lines between phases are blurry.

The length of the FE varies quite a lot from project to project, which can be seen from the example project list. The most active phase, firm offer, typically takes around 4-9 months according to a SM which can be confirmed from the list. The other phases can be quite short or take years depending quite much on the client. A SM stated that it is impossible to do the firm offer in under 3 months. However, there is a contradicting case as project E's firm phase took a bit under two months. Also, another person from sales stated that in some of his cases the firm phase has lasted 2 months. The common view among the interviewees on the duration of the sales case was that it too long because of the is too bureaucracy and stiffness. A PM stated that the case company typically activates only in the last couple of months of the FE. PM had received feedback from the client of project E stating that for a long time it seemed that the case company did not do much to progress the project. The SM for the project and a separate PM confirmed this. They said that there is quite a lot of idling in the FE. The length of the firm phase also varies depending on the client, for example, the needs of the client and inquiries vary from simple to quite complicated. However, a portion of the variation can be attributed to the internal management of the process and how it is designed which are discussed in the next paragraphs.

The organization is large consisting of various disciplines and people as displayed in Figure 5. The case does not have a separate sales organization for sales projects, but the organization is nominated separately for each project by the SM and discipline leaders. The sheer size of the organization requires a certain amount of time according to two sales and two project personnel. The different disciplines in the organization are responsible for producing a certain part of the offer. Discipline managers are responsible for collecting resources for each project from their discipline. Many of the disciplines have the same selected persons working on sales cases according to an interviewee. The sales’ and product sales managers' responsibility in the case organization is quite

commonly agreed among the interviewees to be sharing information and internally organize the FE producing competitive solution. Specifically, the SM's most important task is to handle the client interface. Also, the indicative- and budgetary offers are heavily the SM's responsibility. The product sales manager's role is more to coordinate between the disciplines and form the actual offer and handle the technical side. Other people outside the specific disciplines and routinely offer making personnel are from the execution side who are involved with the FE once every year or two which can create a certain set of issues. Despite not having a separate sales organization the sales organization stated that they sometimes get blamed by the execution phase of the issues in the projects. Another concern is that the process is aimed to produce a huge amount of documentation for the offer which requires time. Multiple interviewees considered at least parts of the documentation useless. For example, a SM stated: “We create an enormous amount of documentation, most of it useless”.

The current way of organizing and doing the sales case was mentioned in some way to be a hindrance by almost all of the interviewees. First of all, the way of resourcing and picking persons from disciplines can lead to situations in which the persons do not have time to actually do work for the FE or are just names in the organization chart according to five interviewees. In addition, especially common resources in business units and disciplines can have a difficult time prioritizing different cases when, for example, two different SMs simultaneously want something done as soon as possible. Currently, the organization does not have a common resourcing tool to see the load of each person. This kind of tool was mentioned by a PM to be quite useful. The practices in resourcing are currently a bit unclear and uncontrolled and each person has a lot of projects going on simultaneously.

Secondly, the prioritization of projects with limited resources is considered to be somewhat of an issue on an organizational level as it was mentioned by four people from both sales and project organizations. There are examples of this issue. In project G the FE went badly and did not have enough time since the organization did not prioritize the case enough. The SM also mentioned that this was not the only case. Two PMs stated that the other issue with prioritization is that it is done on a weekly basis which is too short term. The prioritization is a difficult issue in the organization but the consensus at least between project organization seems to be that dividing the resources for fewer cases could lead to better results through increased effort per case driving the price down and lowering the overall risks. A different organizational part has recently done quite well in sales. The interviewee from there stated that their prioritization seems to be going quite well and if this prioritization is not effective it usually causes issues in the projects.

They have also dedicated a lot of focus to the FE and the PM's involvement. There could be a connection between these factors but with only one case this causal relationship cannot be generalized.

Thirdly the organization is considered to be too divided into separate businesses. It was stated: “The organization is extremely complex” and “The organization is extremely large with all sorts of support functions”. According to two SMs, this leads to a conflicting situation because each has its own targets there can be situations where goals do not line up and the parts are not working together for common good. For example, in pricing, each part secures its own profit margin leading to a higher overall price and lost projects. The separation into business units and disciplines also makes the information exchange more difficult and "broken phones" are easily created. These were mentioned by 8 of the interviewees. The project becomes very heavy and hard to manage because there can be easily more than 20 people involved on the same organizational level according to two people from the sales organization and one from the project organization. The separate disciplines also quite easily lead to sub-optimization as mentioned by 4 interviewees. An interviewee said: "The company is currently working like 1+1 = 2 but we should actually work like 1+1 = 1,7". A SM confirmed that it is very difficult to achieve synergy benefits when each discipline is focused on its part. This also creates challenges since disciplines are dependent on information from each other so scheduling becomes crucial to get information in time and have time to optimize the entity after each part is complete. Two people from the project organization mentioned that quite often some parts are late which leads to a lot of loose ends in the whole picture, higher price, and more uncertainty. Overall the scattered way to conduct the FE in the organization has its difficulties. However, this also means that each organizational part is very specialized and thus has a very thorough technical understanding.

4.2 Front end activities

4.2.1 Business case and strategy

To analyze the significance of certain tasks in the FE the framework and division developed in the theory are used. The answers of interviewees are mapped in Table 5 if the interviewee mentioned the task in some way as a part of the FE. The different tasks are gone through in the order of the framework. The business case and strategy aspects were directly mentioned by only 5 of the interviewees all of whom were SMs or higher-level managers. As part of the internal operational guidelines, this process is mostly done by sales personnel during the early parts of the FE which PM does not typically attend. After a basic formulation of the business case, it is assessed by management if the

project is worth bidding on or not. A SM stated that they have a tool that has a lot of information that needs to be filled in to analyze the case. However, he/she considered this somewhat waste of time as the information was only guessed. A person from the project organization mentioned that it would be beneficial to better understand which projects are worthy and which are not as currently it seems that there is not enough focus. The lack of focus on each sales case was mentioned also by two PMs. A SM also mentioned that it is up to the SM to represent the profitability and business case calculations to management and sometimes there can be issues in objectivity when interpreting these calculations. The use or updating of the business case after the initial bid decision was not mentioned. This implies that the organization working on the project does not have that much information on the business aspects of it. This could be one reason why many of the interviewees considered the organization to not be that sales oriented. However, according to the official process, this information is considered in the official management audits.

Table 5: Front end tasks by how many interviewees mentioned the task. Colors visualize the number of answers.

	Total mentions	Most important	Project execution mentions	Sales mentions
Business case and strategy				
Business case	5	0	2	3
Project strategy	2	2	0	2
Setting project goals and objectives		0		
Stakeholder management	7	0	3	4
Requirements management	13	7	6	7
Goal setting and alignment	5	0	2	3
Formulation of offer and concept				
Project concept	9	4	5	4
Offer formulation **and pricing**	14	2	6	8
Negotiation **and customer relations**	11	0	4	7
Technical solution selection	10	5	5	5
Basic design (engineering)	2	0	1	1
Project execution planning	13	1	7	6
Subcontractor management	3	0	0	3
Offer and concept formulation support tasks		0		
Constructability/feasibility review (MA)	4	0	1	3
Value and benefits management	11	1	4	7
Risk & uncertainty management	10	0	5	5
Information gathering and processing	14	0	7	7
Lessons learned	3	0	2	1
Change management	2	0	2	0
Execution preparations		0		
Contract formulation and finishing	10	1	6	4
Front end management		0		
Project management methods used	11	2	6	5
Project quality control	11	1	2	9
Governance set up	6	0	4	2
Team building	9	1	5	4
Internal integration	4	0	2	2

Only two SMs directly mentioned the project strategy, both of which considered it to be among the most important tasks in the FE. One interviewee stated that it is important to understand what the client needs and act accordingly in the organization to secure the sales with a good profit. The other stated that it is important to understand the drivers behind the customer and use those as a base for decision making inside the organization. However, project strategy is something that is not mentioned at all in the operational manual. Based on the interviewees' answers they seem to have some sort of understanding of what the strategy might be but it is not knowingly steered in the organization. This can be seen from the contradicting answers of the interviewees. For example, a person from the sales organization mentioned that the case company is not the cheapest one which was also implied by a project organization member. The member stated that the more difficult cases are the sweet spot. However, the same person from the sales organization also mentioned that the case company has challenges with the price and rarely is the cheapest one. It seems that the internal goal is not that clear.

4.2.2 Setting project goals and objectives

The project's stakeholder management methods were not mentioned often in the interviews. Also, the internal operation manual does not have comprehensive guidelines in this area. Interviewees mentioned relationship management with the customer but did not bring up any methods used. Also, the internal organization was mentioned. One PM and three persons from the sales organization mentioned that it is important to understand and manage the internal stakeholders and their drivers. A SM specifically mentioned that there are opposing interests in the organization and this might be useful to understand. At a minimum, the interviewees considered that it is important to understand the internal dependencies and power relationships. It was also considered important to have a communication plan internally on how to distribute the information across the organization as there are so many different stakeholders. 3rd category of stakeholders for the organization are the subcontractors which play an important role in the organization's competitiveness and effectiveness. Three interviewees from the sales organization stated that the organization should work more closely with the subcontractors in the sales phase to drive competitiveness. For example, in project G, this was done and it was considered to be one of the winning elements in that case.

Requirements management was considered among the interviewees to be the most important task in the FE stated by 6 interviewees from sales and one from project organization and almost everyone mentioned it. It should start from the very beginning of the FE. Various requirements from execution to customer ones are mentioned also in the internal operation manual. First of all, interviewees considered it important in order

to understand what needs to be delivered and what is required from the organization. Interviewees three PMs and two from the sales organization stated that understanding the requirements greatly reduces the risk for the case organization to have surprises in the execution phase since these requirements are locked into the contract. The organization has also reviews in place for this. Two PMs and a SM also mentioned that quite often the requirements from customers have accumulated over the years many of which might not be valid or might otherwise be unnecessary or too tight. Two PMs mentioned that it is important to differentiate the necessary requirements from the nice to have ones and get the reasoning for those from the client. Good requirements management was mentioned to lead to a better project for both the client and the case company since it often drives the costs down and both parties are better committed to the requirements. Also, a person from the sales organization stated that customers value challenging their requirements as it demonstrates to the client case company's expertise and commitment to the project. The interviewees also brought up issues related to the requirements management. A project- and two SMs stated that the organization focuses too much on internal requirements which are often tighter than the customer's requirements leading to over quality and higher costs. A SM said: “Often it has been found out that the own internal requirements are much tighter than the customers’”. Three project organization members said that often the organization has difficulties going through the requirements leading to missed ones, for example, in project G. However, in some cases going through the requirements was not considered to be beneficial. If the case was a simple, standard product for a familiar easy customer it was not considered to add that much value.

Setting various goals for the project is part of the FE, for example, when formulating schedule, budget, and quality. Nonetheless, only a few interviewees specifically mentioned setting goals for the project or the FE. Three SMs stated that the organization should set and align its goals more with the customer's requirements. The goal should be to meet those as cost-effectively as possible. Currently, the goal is in their opinion to focus more on internal processes and fulfilling internal requirements. This goal setting should happen early enough in the FE to steer the project in the right direction. A PM mentioned that it is very important to set clear goals for the project since it guides how the project is executed and how it will be formed. Another PM said that this goal-setting could be quite similar from project to project. A person from the sales organization also talked about the monitoring and guiding nature of goals. During a FE, the goal is typically to minimize time and cost. When the execution starts the goal is to not exceed these estimates and if it happens it is regarded in the organization somewhat negatively.

However, a SM stated that it is a strength that the organization does not directly punish from this. This implies that the goals and their monitoring differ a bit in the FE and during the project.

4.2.3 Offer formulation

In the case organization, the official formulation of the project concept starts in the opportunity validation phase. The concept defines the technical solution, how the project is executed, cost estimation, and all the information regarding the project. Different alternatives are considered based on the input information from the client. According to the process, the main concept should get confirmed in the budgetary phase and further refined in the firm phase. As a result, the organization creates a very comprehensive document package containing on average four to five hundred pages. This is at the same time the proposal documentation package for the client. The organization does not have a separate official internal documentation package. According to the interviewees, the whole FE process revolves around this official project concept creation. Three interviewees from the sales organization and one PM considered this to be among the most important tasks in the FE. Two reasons were mentioned. First of all, it was considered to define what the costs for the project will be and how interesting the project is to the client and thus define competitiveness. Secondly, two interviewees from the project organization stated that locking in the basic concept early on lowers the risks considerably and is thus very important. Changing the basic concept during the firm phase creates issues due to the interconnectedness leading to a big risk for change management related issues. Creating the concept to answer client requirements and needs was considered to be very important but also an issue by three sales organization members. A SM stated that there are concept reviews but they revolve more around checklists to confirm that everything is done, not to fit the concept to client requirements and optimize it so the concept ends up being a typical solution. A project organization member stated that everything in the FE is important and thus focusing on concept creation enables the best result. Five sales organization members wanted more innovativity in the concept creation. They for example stated: “People are too used to their routines”. They also stated that often with untypical concepts the organization is somewhat in trouble. On contrary, a project organization member stated that the organization works best with more difficult cases.

A big part of the overall concept and the price especially during the beginning of the FE is technological solution selection. It is for some interviewees a synonym for the concept and the focus in the FE revolves a lot around the technology. Three sales organization and two project organization interviewees stated that the technical solution selection is

one of the most important tasks. The technical solution should be suitable for customer needs and requirements and also suit the capabilities of the organization. The formulation of the technical solution in the firm phase requires some basic engineering which was mentioned only by a few of the interviewees. This is most likely because the different disciplines are responsible for it. A PM and a SM mentioned that the more engineering is done the closer to the reality the costs and plans often are which reduces surprises in the execution phase. Seven of the interviewees considered technology to be the strong point of the organization's FE. The organization has technical capabilities that many others do not and their product quality is excellent, meaning very rarely the guarantees are an issue in the project as a SM stated. This was considered to be the case especially with the main equipment and some of the interviewees considered that the focus is often too much on it. It was considered among the interviewees mostly from the sales organization that the organization is quite proud of their technology which can lead to overdesign and quality. The organization can be reluctant to meet those lower demands and understand the customers driving forces which is often the price. This leads to higher costs according to interviewees. Also, three SMs stated that it is a common understanding among the sales organization that competitors of the case company are better at generating more innovative out of the box solutions and that the case company's focus is more focused on project management and risk control than delivering solutions to the client. A common agreement in the sales organization was stated to being: “The competitors often create more surprising and innovative solutions”. Other SMs mentioned that if the technical solution requires something untypical the organization is often in trouble. Listening to the customer and innovativity are thus important factors in the FE. These would require more time and work.

Execution planning was also considered as FE tasks. In the case organization detailed execution planning such as detailed schedule, execution risks, subcontractor selection, and resourcing are mainly done during the firm offer phase. Prior to this the FE mostly revolves around the technical solution selection and basic execution planning such as the project model selection and country investigation to assess the cost base and feasibility. A general project execution plan document was mentioned only by one project organization member others mentioned only the specific tasks, for example, planning a preliminary project organization, doing supply plan, and checking area-specific factors. A project organization member stated that creating a realistic but tight execution schedule is the most important aspect in the FE. The schedule was mentioned also by a couple of other project and SMs who brought up the schedule's impact on competitiveness. Interestingly supply planning was only mentioned by couple of

interviewees from the sales organization even though a major part of the project execution is done by suppliers. They especially mentioned how important supply planning can be for competence from which project G is a good example. Disciplines have also an important part in the execution planning since each discipline plans its own part of the execution. Various execution-related areas are their own disciplines such as installation planning and commissioning. In this area, the organization was considered to have also some weaknesses. For example, a sales and a project organization member stated that it is easy to produce too loose schedules driving the costs up. A PM and a SM said that there needs to be more focus on the resourcing of the cases. Currently, it was considered that the resourcing is left for too late without enough consideration. These resourcing issues are realized for example in project H. A SM and a project organization member also brought up the difficulty of getting the execution synergy benefits from different organizational functions even on the level of plans in the organization. An issue with the execution and offer documentation was also brought up. A PM stated that many of the documents that are produced in the FE are not utilized as such in the execution phase but a new similar document ia mSW which is obviously overlapping work. This is something the organization should look into.

Offer formulation was mentioned by every interviewee as part of the FE as it is the organization's goal in the FE. In the case organization, the offer formulation begins at the indicative offer which produces a very general level offer. The budgetary phase focuses mainly on cost estimation. An official offer is started when an official request for quotation has been received. The offer includes the previously mentioned document package and also pricing for the project with a preliminary contract. The offer formulation process was considered by two PMs and three sales organization members to be the strength of the process as it works like a well-oiled machine. Two sales organization members stated that this is the most important phase in the sales case. However, the strength can also be a weakness as it was considered to work even too effectively lacking innovation and probing to the specifics of the project. The issues mentioned by the interviewees mainly focus on the cost side of things. Many of the interviewees especially from the sales organization considered the cost control to be inefficient due to overdesign and just settling on cost too easily. It was also mentioned that often the offer takes a minimum of two rounds of iteration before the target costs are reached. Two SMs stated that once in a while the organization straightens itself getting down after lost projects. Then the organization starts to drift again getting more expensive project by project. A sales organization member mentioned that one reason for this could be that the costs are calculated from the beginning of every project and not that much reference pricing and

vast databases are used for estimation. This approach takes time and as resources are constrained the optimization is often skipped as a project organization member stated. Also, a sales and a PM mentioned that the cost reviews are too shallow not digging dig deep enough into where the costs actually come from and how they could be optimized. However, the SM mentioned that the costs for the main part of the project are often handled well but the auxiliary items which still are a big proportion cause a major part of the deviations and cost overruns. The PM brought up a possible reason for this. He mentioned that the pricing tool does not correspond with the cost follow-up and budgeting structure for the projects and it is very time-consuming to try to understand where each cost comes from.

Negotiation and taking care of the client was mentioned by most of the interviewees as an important FE task. However, in some public projects, the process might not include negotiation at all which changes the nature of the FE a bit. It was considered important to listen to the client. First of all, these actions help better to understand the clients underlying needs and requirements. Both the sales and the project organization members mentioned the importance of negotiating about the client's needs and try to understand the underlying reasons. Secondly, the chance to get the project was considered to be improved when the project can be formed favorably for the case company. The interviewees stated that the case company can and should negotiate about the requirements with the client. Thirdly, building a close relationship with the client was considered to enable the case company to get important information and guidance from the client which happened, for example, in project A. To support the negotiation of the commercial contract in the later phases of the FE it is important to build trust with the client. Two sales organization members stated that this can be done by showing that the case company has the expertise and actually cares about the result. This can help to alleviate some of the negative assumptions that the client might have. However, especially the sales organization considered that too little time is spent with the client actually negotiating. They also stated that often the organization does a lot of decisions and considerations without asking the client. Interviewees from the sales and project side stated that it would sometimes be wise to actually negotiate for difficult requirements, contract, or similar before trying to fulfill them.

Subcontractors play a huge role in the execution of the projects which was mentioned by two SMs. This means that for competitiveness they are the key players for the case organization. Despite this fact, quite little effort is put into managing the subcontractors in the FE of the case organization. Not a single PM mentioned this and only three SMs considered it to be crucial and currently done too little and too lightly. This is interesting

since the supply plan is mentioned in the operational manual. The SMs wanted more negotiation with major subcontractors about the prices. They also said that rarely someone looks beyond the known subcontractors which could be a more cost-effective and better solution. Project G is a good example in which the price was agreed on in the FE with the supplier and gained the case company a competitive advantage. This is an exception from the typical way to operate in which estimates are typically used. This means that the actual negotiation is left into the execution phase leaving more room for variance. Cooperation at least with the biggest suppliers could be beneficial in defining competitive costs for the projects and also preparing the suppliers for the project.

4.2.4 Offer formulation support tasks

The case organization conducts a handful of reviews and audits during the FE. The reviews include, for example, concept review in the budgetary phase and technology, guarantee, and design reviews in the firm proposal phase. The management audits are also reviews for the project to ensure that the project has potential and what it needs to be successful. All these can be considered to be similar to feasibility and constructability reviews. The interviewees overall considered these reviews important but the way they are currently done was not considered as effective as it could be. These reviews are done throughout the FE at certain intervals every time going a bit deeper and having different aspects. The execution of the reviews is followed up on an organizational level. When asked for strengths a sales organization member mentioned that at least the organization has a lot of reviews, but was not sure if it made the FE better. Other sales organization member stated that the reviews are great for managing risks, and checking certain items, but poor in creating competitive solutions. The reviews were considered to be too much of a checklist and about fulfilling internal requirements than creating cost-effective solutions for the customer. Other SMs wanted more empirical data to be used in reviews, currently, they are based too much on opinions and single cases. This view was supported also by two PMs.

Value- and benefits management important task in the FE as 11 of the interviewees mentioned either value- or benefits creation for the customer or the company or both. A SM stated that it is the most important task in the FE to ensure value for the customer and a good deal for the case company. Project A is a good example of benefits and value management in the FE. The case company worked closely with the customer to form a solution to their specific problem which ended up being a very good and profitable project for both parties. However, this kind of FE was an exception among the cases and overall this was considered as an issue by almost everyone from the sales organization. Four of them stated that the focus is too much around internal processes and requirements

and the client and what they value is often forgotten or sidelined. The work was considered to be driven too much by internal forces and not enough by client requirements and value. The organization is satisfied with basic solutions that work but it often is more than the customer asks or needs. Designing a solution to be closer to customer requirements would thus, according to the interviewees, either drive the margins up or increase the probability for sales or both. A project organization member had a bit differing opinion stating that the case company follows the client's wishes too much stating that the focus should be on finding the real reasons behind each request better. The interviewees talked about optimizing the execution to improve margins and project for the case company. This is only one example and in many cases, the client's perspective and how the solution fits the client was forgotten. The case company does not have a systematic way to track benefits or value creation during the project and mostly focuses on the effort put in, risks and budget.

Risk and uncertainty management is definitely part of the FE in the case organization and was mentioned by most of the interviewees. The risk and uncertainty management start in the budgetary phase but a more thorough risk analysis is done in the firm proposal phase. The risk reviews are the way to map risks in the organization. During these, the risks and uncertainties are mapped and actions are planned. Overall risks and uncertainties are also taken into account in the price with contingencies. Two PMs and a SM mentioned that risk reviews seem to be based too much on experience and gut feelings rather than broader data banks. They would like to see more objective data to be used to back up the assumptions. Risk management in the FE creates two opposing forces in the organization. One wanting to be competitive and drive the price down and the second wanting to take every risk into account which drives the price up. Four sales organization members stated that the organization focuses too much on the risks, is too risk-averse, and does not see the possible opportunities. This means that when estimating risks often the conservative option is selected driving the estimated cost up. As a SM stated: “the PM easily sees problems, challenges, and issues”. This claim can be partially confirmed by the example projects as in many of them, big savings were made which were not seen beforehand. A project organization member stated that the risk numbers change often quite a lot when the project execution starts which indicates that either the organization has been too conservative or too optimistic. A sales organization member mentioned that it is project nature that the earlier the phase the bigger the uncertainties and they then tend to lower during the project leaving contingencies for profit.

All of the interviewees mentioned collecting information about the project as a FE task. Sources that interviewees mentioned included, for example, databases, suppliers, and the client. Curiously only two SMs and a PM mentioned lessons learned to be part of the FE. One reason behind this is probably that these come naturally as people tend to refer to their previous experiences which was mentioned by a SM. However, the organization had an official task for lessons learned in the operation manual. A PM stated that it would be important to bring also the lessons learned concerning the FE since the focus is mainly on the execution lesson learneds. Two sales organization members stated that there is no official way to bring the lessons learned from execution projects to the sales organization and stated something like this would be useful. Currently, it is up to the SM to ask for the lessons learned some of who regularly kept in contact with the projects and some did not. A PM and two sales organization members stated that a lot of the information and its gathering happens on a personal level which means that the data is scattered around and not uniform. Different people have different information which they use in different ways which add up to quite a lot of variance. They would like more common databanks where certain subjects would be commonly easily available which would lead to at least better visibility.

Only two interviewees both from the project organization mentioned change management as an important task. It is curious since many of the interviewees referred to the fact of how regular changes are in the FE. Both of them brought up a possible issue with the organization. If changes are done it affects many different disciplines and it becomes quite difficult to control that all have up-to-date information. Also, ensuring that all parties update their designs accordingly becomes more difficult. Also, the internal operation manual does not mention anything about this as part of the FE. According to interviewees changes cause delays in the process which leads to lower competitiveness and possible issues in the execution phase as there are issues in the design.

4.2.5 Final negotiations and setting up the project

The end of the FE typically includes quite a lot of negotiation mentioned by many of the interviewees. Two project organization members and a SM mentioned that typically at this point there is only one company negotiating with the client so the competition element is not that major anymore compared to earlier negotiation. This negotiation is aimed to finish the contract with the client. Also, the commercial side including final price and other terms such as payment terms, et cetera, are agreed during this period. Basically, a significant part of the project definition is locked in. The main points of the contract are often agreed upon prior to the final negotiation and at this point, the negotiation is often focused on fine-tuning. Two project organization members stated

that ensuring a good and fair contract for the case company is the most important task in the FE. A PM stated: “One can sell, but if you do not understand what you sign it can lead to problems. By signing one bad project you can lose the profits of five.” During this phase also the preliminary project organization should be named.

A project and a sales organization member mentioned that it is very important to ensure that there are enough resources available for the project and that their competence meets the requirements of the project. They even proposed a system to rank the projects in terms of demand for resources. After the final negotiations and signing of the contract, an official handover procedure from sales to execution is performed. The handover was considered to be comprehensive and good according to three project organization members. The interviewees also stated that typically the project execution gets a good start early on. The handover procedure includes an official template to be filled. A SM stated that the template includes too many items and should be simplified. A PM backed this up stating that there is not much work needed if the project organization is involved in the FE as it typically is. The phase also includes official kick-off for the actual project execution team in which the FE ends. This was considered to be important for the executing organization to distribute the basic information regarding the project and get to know the project team.

4.2.6 Management of the front end

Management of the FE was considered to be very important in the organization. The management approach in the organization in the FE is quite organic. The focus is clearly on leading people and getting things done. Based on the interviews it seems that the sales does not treat the FE phase fully as a project. The organization does not plan FE that accurately. However, the overall process is somewhat defined beforehand as introduces earlier. Two sales organization members mentioned that there is an ongoing development project in finding new ways to manage the sales projects better but they did now expect that much from it. Three interviewees from the project organization stated that the FE should be managed like an execution project which it currently is not. A sales and a PM stated that project like practices create commitment and a feeling that the project is relevant. They consider that the current way leads to inefficiency and issues. Two of the project organization members considered the project like management to be the most important parts of the FE. One of the practices that was considered good was using short weekly meetings with the FE team to keep up to date, communicate, and share the knowledge. Common meetings where each has to shortly state what they have been doing was considered to also be a good way to apply some pressure on people to do their tasks in time. It was also considered important that all the experts get into one

place to go through things since the organization is otherwise quite distributed. A project organization member stated that it is very important to keep people up to speed. However, common meetings were also mentioned as a challenge by three sales organization members since people are quite busy and do not have time to attend. A PM stated that often these meetings have a habit of bee long and ineffective driving people to not attend. Thus it would be important to create memos of the meetings.

Scheduling was also considered to be a particularly important part of the FE mentioned by five interviewees as the organization in the FE is large and different parts are dependant on each other's input. Currently, the organization is not doing this on a very accurate level. Only main deadlines are commonly agreed upon, but the issue with this is that even these dates and the progress are not that well followed. The difficulty in the FE scheduling is that situations change quite quickly and thus the schedule needs to be quite flexible. A PM mentioned that creating a well-defined schedule would reduce the idling and make the FE more effective driving down the average length to even a couple of months. The current length of the FE was considered an issue by most of the interviewees. A project organization member commented that with a bit tighter schedule the result is often better. Also, the dependencies between the disciplines would become more visible. Three sales and two project organization interviewees also mentioned that responsibilities need to be defined clearly and persons actually named. It is much easier to follow-up on the work and control the work based on the scheduling and responsibilities i. This was considered to be important by the interviewees since without control things seem to be left undone. It was commonly agreed that responsibilities vary quite a lot depending on the project and people attending it. Thus, it was considered important to clearly define them.

The case company has a quite well-defined project governance framework (Figure 6) that is used with all the projects. This subject was quite rarely mentioned in the interviews. One reason for this might be that the practices are quite established. It is built quite well into the organization and people are used to using it. The governance adapts a bit according to the project's scope and type. The framework is also ready for the execution phases of the project. This means that it does not require that much setting up during the FE, only the people need to be selected and a common understanding has to be established about the project's governance framework and how it is specifically utilized.

Teambuilding and teamwork were also considered to be very important in the FE. A SM even mentioned it to be the most important task to focus on since building the team is not always that easy. The FE teams are cross-functional but also very large in size which

was mentioned as a hindrance for effective management. This also makes team building and ensuring that everyone has enough time available quite difficult. As the organization does not specifically have a separate sales organization the integration between sales and execution is quite natural and built into the process. This was considered to be positive by the interviewees. However, two sales organization members suggested the idea of having a separate organization for sales to have more free resources. The organization typically arranges kick-off for the FE to get the team up to speed on the case and divide responsibilities and tasks which was considered useful. Many of the interviewees mentioned a core team as a way to organize the FE. This core team was considered to include SMs, PMs and engineering managers. Many of the interviewees also mentioned product sales manager to be part of this core team. A SM and a PM also mentioned some key disciplines that could be a part of the core team. This team would be in charge of organizing, leading, and delegating the work compared to the current very broad organization with quite distributed responsibilities. Four project organization members mentioned that with a well-integrated core team the sales process would be much more efficient. In this team SM would handle the client interface. Engineering- and product sales manager the technical aspects and leading the internal organization and PM the execution. This way the big picture would be easier to optimize. An important part of the team building which a project and a sales organization member mentioned is the supervisory work which helps and supports in uniting the team and getting the FE work started.

Project quality control is heavily built in the FE process of the case company. As mentioned earlier all the reviews and audits are means to control the quality of the process. A project organization member stated that the audits are well developed and strong practice and thus it is the most important that these requirements are fulfilled. In the interviewees' opinion, they provide a good foundation for a successful project. Two SMs agreed with this view but stated that often the basic foundation is not competitive and it requires more work than just fulfilling the review and audit requirements. When asked for strengths a sales organization member stated: “We have a lot of reviews but I don’t necessarily know it is making us any better”. A PM suggested that there should be a bit more control than currently to review the materials fully before sending them to the client. Almost all of the interviewees mentioned benchmarking to previous cases in some form either as part of the execution planning, risk reviews, cost reviews, or scheduling. This was considered a good practice to increase the quality and accuracy of estimates. However, as brought up earlier the selection of benchmark cases is not systematic and

some interviewees considered it to be somewhat biased. This causes issues in estimates usually overestimating costs or schedule.

4.3 The support of the project front end to the project performance

In the literature review, five ways for the FE to impact the project were found with a sixth overall success category. Five categories were identified in the interviews and these are gone through in the following paragraphs. The difference being that interviewees did not recognize team performance but brought up competitiveness impact. The literature review identified an impact from FE performance to project performance. From the example projects (Figure 7) it can be noticed that both the financial and execution performance of each project somewhat matches with the FE performance. However, it is important to note that the data is rather limited.

	A	B	C	D	E	F	G	H	I
Front end	5	5	4	4	2	4	2	4	3
Execution	5	4	4	3	3	4	3	4	1
Financial	5	4	3	4	3	5	3	4	1

Figure 7: Example projects' performance evaluated (1, very poor – 5, excellent).

Based on the interviews the FE supports the project execution and financial performance. Three project and two sales organization members mentioned that the FE lays the foundations for the project. This means that after the FE there are lots of things that cannot be changed due to contractual limitations and that the project has taken a certain course. A sales organization member said: "The work that is done in the last phases of the FE cannot be done after the project execution has started". If the FE is not well done the problems will most likely lie ahead as projects D, E, G, and I show. As a PM said: "A lot of effort can be spent on discussion in projects". The interviewees mentioned that with a one really bad project you can lose margins for multiple projects, thus it is important to focus on defining the project. The mentioned example projects all had somewhat rushed FE or resource limitations which lead to surprises in the execution. Also, work done in the early phases of the project is usually much cheaper than in the later phases as mentioned by a project organization member. It indicates that effort put in early on saves costs. The case projects that had no issues and went well in execution all had good FEs. From the cases that had issues in the execution all but one (C) had some kinds of difficulties or rush in the FE. However, from the cases that had issues in the execution, some were turned positive by hard work during the execution.

The budget and schedule are defined and agreed upon with the customer in the FE. Thus it is quite natural that the FE has a big role in schedule and budget performance. Typically the more effort is put in the FE the beyyet optimized the schedule and budget get. This happens through better-defined execution and technical solution which was mentioned by three sales and two project organization members. The more effort is put in the FE the more realistic and predictable the schedule and budget seem to be and according to two sales and two project organization members. If less effort is put in the schedule and budget are typically quite loose which leads to variation. A project organization member stated that if the drive to get the sales are high but the effort put in the FE is low it tends to drive the price down at the cost of profit margins and greater risks. This happened in projects D, E and G. A PM stated that in many cases the execution has to do a lot of work to make savings to keep the budget. Projects C, E, and G all faced budgetary surprises which were compensated with the work done in execution. Overall five of the case projects had cost overruns in execution four of which were due to somehow missed scope thus leading to too low budget and price. Project C stands out from this crowd since it had a lot of effort put into the FE but still had cost overruns. Projects D, E, H, and I had schedule challenges two of which were related to scope-related issues and one to resources. The project I had a serious schedule and cost overruns which could be due to multiple reasons. For one the project being very complex demanding a lot more resources and effort than anticipated. The requirements and complexity of the project were not fully understood. The projects A, B, and F that went well all had experienced project and SM working on them. The projects had sufficient time and resources in the FE and were thus done with a lot of detail. The FEs were all well managed and had good cooperation with the client.

The variance from estimates can also be called risk. The FE was mentioned to have an impact on the risk levels by 9 of the interviewees. The more effort is put in the lower the risks. A project and a sales organization member mentioned that risks are better managed when the FE is executed properly. Part of this was considered to be due to the risk reviews by two project and two sales organization members. A sales organization member and two project organization members stated that there will definitely be negative surprises if the FE is executed poorly which was pointed out in the previous paragraph and is visible in the case projects. A PM, however, brought up that if risks are very thoroughly considered it tends to drive up the contingencies and thus price for the client. Locking the concept early enough in the FE was mentioned to be one big factor behind lowered risks by two project organization members. If the concept is not locked

in it can often lead to mistakes and issues in change management which cause costs and delays in execution.

The lowered risks are typically achieved through a better definition of the project and risks. This means that when the FE is done well there is less additional- and rework needed in the project phase which lowers the cost. A project organization member mentioned that with better FEs there are typically fewer change orders during the project. A sales organization member also confirmed this stating that a lot of extra effort needs to be put in during the execution if the FE is done poorly. This indicates that better performance in the FE means that unnecessary rework can be avoided in the execution. Two sales organization members specifically mentioned that the relationship between the client and the executing organization is established in the FE. This in combination with the groundwork enables a better start to the project if the FE is executed well.

Especially sales organization members mentioned the FE's effect on competitiveness and probability of getting the project. Two SMs mentioned that typically the biggest factor for decision is the price. Other major factors are typically technology and delivery schedule mentioned by two project organization members. A project and a sales organization member also stated that sometimes agility and responsiveness in the FE is a competitive advantage. Projects C and E were partly won due to the case company's responsiveness. Building trust and assuring the client of the capabilities are also an important task. As mentioned above the more effort is put into the FE the better optimized the solution, budget, and schedule are increasing competitiveness. Two project and two sales organization members believed that by putting more effort into the project by better prioritization the probability to get the project increases and simultaneously margins improve. The interviewees also believed that through a well designed FE customer requirements can be met better. Case project A is a good example of a great project with cooperating with the client and listening to the requirements driving costs down and improving the schedule. In this specific area, the case company seems to have challenges. According to SMs, the organization is focused on fulfilling the internal requirements for the sales case. The customer is often forgotten focusing on fulfilling specification producing over quality driving cost up and competitiveness down. This creates a good basic solution but not necessarily what the customer wants and what is cost-effective. Thus poorly executed FE can lead to a lack of competitiveness and losing the project.

4.4 The role and tasks of the project manager in the front end

4.4.1 Role description and point of involvement

The specific role of the PM is somewhat designed and there are a general role description and a very general task list for PM in the FE of the case organization. However, according to a PM, these descriptions are not specific enough. A sales organization member confirms this, stating that the descriptions have to be general to allow for flexibility in the FE. Supporting this view, among the interviewees, it was mutually agreed that the role of the PM in the FE varies quite a lot depending on the project and especially the SM's way to operate. A couple of the interviewees wanted to find ways to reduce this variance and personification. The personification of the roles is regarded as an issue by three project organization members and a SM. A PM took this further stating that there are no roles only persons. However, it was mutually agreed with the project organization members that the PM is very committed to the FE given that they do not have overlapping execution projects. In the next paragraphs, the PM's role is examined more accurately and the interview findings are mapped in Table 6.

Table 6: Front end project manager tasks by how many interviewees mentioned the task.

Pm tasks	Total me	Project execution mentions	Sales mentions
Business case and strategy			
Business case	14	7	7
Setting project goals and objectives			
Requirements management	7	5	2
Stakeholder management	5	2	3
Formulation of offer and concept			
xecution planning (especially document and execution schedule)	14	7	7
execution expert	11	6	5
Checking the pricing	9	4	5
Salesperson	8	4	4
Procurement plan	4	0	4
Scope definition	3	2	1
Technical definition	3	1	2
Offer and concept formulation support tasks			
Information gathering and processing	10	5	5
Risk management	9	5	4
Value management	7	4	3
Entity management ("big picture")	4	2	2
Lessons learned	1	0	1
Execution preparations			
Understanding and commenting main contract	9	4	5
Organization selection and kick off	6	1	5
Front end management			
Support sales manager	7	3	4
Project quality control	7	3	4
Front end management	7	2	5
Attend management audits	5	3	2

The project manager's point of involvement was quite unanimous among the interviewees. This is since as a SM stated: “Experience is the most important asset the

organization has”. Ten of the interviewees said that the PM should get involved at the latest around the beginning of the firm proposal phase. Earlier involvement was deemed not that useful since also other people can handle the required actions. Involvement in the firm phase enables the PM to affect the project enough and give input according to two project organization members. It also supports the commitment of the PM to the project according to another project organization member. However, a sales organization member brought up that some tasks before the firm phase can benefit from PM support. A PM wanted PM to get involved when the first inquiry arrives and thus steer the project in the right direction from day one. On the other end, a SM had a differing opinion from the rest, stating that a couple of months before the client's assumed decision making is enough. Two project organization members brought up that the complexity of the project affects the point of involvement. The more complex projects require earlier involvement. A SM raised a different type of issue stating that sometimes it is hard to differentiate between the phases thus making it difficult to pinpoint the point of involvement. The organization has some issues in getting the PM in the FE. First of all, resources are tight and this might lead to PM changing prior to the start of the execution. In addition, PM might not even be named for the project. In practice, in many of the projects PM gets involved later than desired or PM changes in the FE which can be seen in projects B, D, E G, and I. Quite often projects have to proceed quite far without a PM. Secondly, PM might not be committed in the early phase as the FE can last a long time and is often quite uncertain according to a SM.

4.4.2 Setting project goals and objectives

The interviewees did not mention any role for the PM in defining project strategy or business case. The strategy is overall mentioned only twice in the interviews which implies that as a concept it is rather unknown in the organization. However, was indirectly mentioned having an indirect role in the business case. This task is mainly on the SM’s responsibility. A PM helps to assess the risks, schedule, and costs for the execution which are used in the business case, and attend management audits representing these.

The project manager was considered to have an important role in requirements management. This was mentioned by six project and two sales organization interviewees. Especially going through the client's specification was mentioned. The PM's task is to ensure that it is gone through thoroughly and nothing is missed. Otherwise it likely results in issues and cost overruns in execution. The overruns are typically caused by missed or sometimes misunderstood requirements because the cost of changing something increases as the project progresses. This happened, for example, in project G. A sales organization member said that going through this specification

requires a thorough understanding of the area. This means that the work needs to be delegated to other experts. The PM's task is to especially focus on special or novel requirements for execution and understand the possible cost and schedule effects as stated by two project organization members. The PM must consider if the requirement is actually needed and if it can be done. Two sales organization members mentioned that sometimes the clients are not experts in this area. Thus, the PM needs to understand the underlying needs and give options for the client.

The project manager's role in setting and aligning goals was also indirectly mentioned as a PM has a key role in establishing the schedule for the project. They also support budget formulation. Stakeholder management practices were considered to be mainly the SM's responsibility during the FE. As an exception, three sales organization members mentioned that the PM should help to identify the key suppliers during the FE to support in cost estimation and project execution planning. Two PMs also mentioned that identifying key environmental stakeholders for the projects such as regulators is a task in the FE, especially if entering a new environment.

4.4.3 Concept creation and offer formulation

The project manager has an important role in defining the project during the FE especially from an execution perspective. A task mentioned by every interviewee was creating execution and a document delivery schedule. It can be quite definitively stated that this is a PM's task in the FE. The schedule was considered to be important for the competitiveness of the sales case as well. The second most mentioned task was that PM supports the concept creation and project definition overall as execution experts ensuring the delivery capabilities. This was mentioned by 6 project organization and 5 sales organization members. The PM ensures that execution aspects have been taken into account and can help solve challenges related to it. Three PMs and a SM, for example, mentioned commenting on country-specific issues, project services, technical aspects, and installation place. This role was considered especially important in more demanding and complex cases by three sales organization members. A project organization member stated that it can not be assumed that anyone else would have a similar viewpoint or experience on the project during the FE.

Closely related to concept creation depending on their background and knowledge, the PM can have a supporting role in technical definition. This was the case in projects A and G. In project A the PM was the driving force with the technical director in designing the technical specification cost-effectively and to the client's specification. This role was mentioned by three interviewees which implies that it is not that important. However,

often this is not required as stated by many of the interviewees as the PM might not have the competence and typically the products are quite standard. Also, the organization has lots of other personnel focused especially on technology.

Four sales organization members stated that PM has an important role in planning and checking at least the biggest procurements during the FE. This is part of subcontractor management and is also somewhat tied to execution planning. Interestingly, not a single PM mentioned this. The interviewees stated that this has an important role in driving the competitiveness as costs can be more accurately estimated because procurements are easily the biggest cost in the projects according. In addition, the execution could be better optimized as the manufacturing, logistics, prefabrication degree, and installation could be optimized. A SM also mentioned that the projects have to be hedged and this requires knowledge of what and how much is bought from where. According to interviewees this is quite often done quite hastily or sometimes not at all which is seen as having an impact on the competitiveness. The example projects somewhat support this view since, in many of them, procurement is the part in which quite often savings or overruns are made. Locking more of these during the FE could have the potential to improve competitiveness and estimation accuracy.

The project manager is considered to be a role in the pricing of the project. First of all, if the project goes to execution, and the PM has been involved with the pricing they have a better understanding of the available budget. In addition, the PM has had a possibility to modify it thus leading to better commitment for it. Stated by three project organization members. Secondly, the PM should check the pricing from the execution perspective with their experience and bring up comparable projects to compare the costs, according to two SMs. Based on the experience the PM should challenge the disciplines and especially manage the big picture optimizing the cost of the whole project as there are not many other parties to do this according to a project organization member. A couple of SMs, in contrast, brought up the issue that sometimes the PM can be too conservative in pricing which leads to higher costs than needed. However, according to the interviewees if the PM checks the pricing it often helps to drive down the variation at the beginning of the project. They are also an extra pair of eyes to ensure that nothing is missed. On the other hand, a PM stated that with little experience it can be quite difficult when you do not have references and knowledge of the prices.

Eight interviewees brought up the PM's role as a salesperson in the FE. This was indirectly mentioned by 4 but directly mentioned only by three sales organization members exception being one PM. A project and a SM mentioned that in their projects the PM was involved in the negotiations with the customer. In project E, the PM assured

the customer of the case company's capabilities to execute the project on schedule. It was considered by three sales organization members and a PM important that the PM attends client meetings and negotiations as they act as execution's face for the client having the responsibility for it. This can help to assure the client of the delivery capabilities. From the client's perspective, the PM is more than a salesperson and has thus better credibility and should leverage that building trust. Based on the interviews it seems that PMs do not necessarily completely recognize their value in the FE from the sales perspective since many are focused on the execution perspective. The sales and pricing skills were mentioned by interviewees five sales organization members to be something that is not in the PM's normal toolbag that has to be developed through experience. Through this PM's can understand the differences between client needs better and be less conservative.

4.4.4 Support tasks and final negotiations

Risk management also got a lot of mentions between the interviewees and was seen as a key role for the PM. Attending risk reviews and presenting risks in MA are actual tasks designated to the PM in the FE. The risk awareness and execution experience of the PM was seen by a project organization member: “It tackles many problems if the project is goes to the execution”. 8 interviewees stated that involving a PM in the FE will lead to lower risk levels overall. However, this risk awareness was also the most mentioned weakness in the PM's role. Especially one SM stated that “many PMs act as an anchors” in the FE dragging the sales case and undermining competitiveness. This means that it is quite easy for PMs to focus on the negatives and only find places where costs can overrun being overly conservative which were mentioned by 4 sales organization members and a PM. This in turn drives up contingencies and consequently price making the sales more difficult. According to two SMs, this can be partially traced back to the basic nature of human wanting comfort and security making things easier for oneself. However, a project and a sales organization member mentioned that there is often negative variation in the estimates when the project moves to execution as new risks are seen. It is thus important for the PM to be involved, but be sales-oriented and see also the positives, opportunities, and places for cost savings thus compensating for the risks.

An important role for a PM also, mentioned by two project organization members and a sales organization member, is that someone should handle the big picture and take care that it is optimized. It is agreed that the SM has a role in this and a SM considered it to be their most important task. The PM’s expertise was considered by 6 of the interviewees to be of value in this as well. However, project execution considers this to be a problem currently. They mentioned that taking advantage of the synergies and cost-effectiveness

of the entity is somewhat neglected. A project organization member stated that currently, no one else is taking care of it if the PM does not involve oneself. A SM stated that often PM focuses too much on the main product not enough on the entity. It seems that this role has to be better assigned between sales and PM in the organization to unite the different disciplines and drive competitiveness. The PM thus brings an overall view from the project execution to the FE which would otherwise be missed. Despite this no one mentioned the PM having a role in the change management.

Seven interviewees mentioned PMs' role in value management. Especially optimizing the project and delivery from the suppliers perspective was considered an important task. A PM and a sales organization member also mentioned that solving problems for the customer and ensuring that the client values everything to be delivered are also important. However, the internal perspective was brought up much more and overall value- or benefits management were not mentioned that often. The PM's role in constructability and feasibility studies did not come up in the interviews either. Still, some of the interviewees implied this since many of them stated that it is important for the PM to ensure that everything promised to the customer can be done.

As execution experts in the FE PM supports in the information gathering and analysis on their part. This was mentioned by ten of the interviews and it is obviously a crucial task. Especially PMs brought up the information gathering and processing relating to how the project will be executed. SMs brought up more information gathering related to benchmark and comparable projects to estimate risks, costs et cetera better. However, the issue here was considered to be that the information can be a bit biased depending on the PM's experiences. Interestingly only one SM directly mentioned the PM's role in bringing up and handling the lessons learned during the FE.

One task mentioned by 9 interviewees for the PM is to read the main contract and give comments on it from an execution perspective. Two project organization members stated that the PM must ensure that the contract is fair for both parties. A PM said: “It is one of the most important things in which PM should be involved in and understand what the contract states”. Other PM added that the contract should enable solving issues if problems arise during the execution phase. These were considered important due to the commitments made and practices agreed to affect the execution that cannot be changed in the later phases as mentioned by a sales organization member. Also, when the project moves to execution PM has a good understanding of the contract terms. Contract technics was mentioned by two PMs to be a skill that has to be specifically acquired. If PM does not read and understand the contract in the FE it can lead to contract troubles in execution according to a project and a sales organization member. Curiously only one

sales and two project organization members mentioned PMs' role in selecting the project organization during the FE despite this being in the operational manual as a task. In two example projects G and I, the organization even had troubles in resourcing whit the project so it might require more focus from the organization. Two sales and two project organization members mentioned the PM’s involvement in the kick-off and handover in the FE. Overall these were considered to go well. The exception being a SM who would like to see the PM’s role in handover preparations a bit bigger.

4.4.5 Management tasks of the front end

The project manager was also considered to be valuable and trustworthy support "a left hand", according to a SM, for SMs. They can reduce the SM's load by executing some required actions and helping the SM to run the FE enabling them to focus more on the customer. Another SM stated that sometimes it would be nice to get sparring from someone, for example, from the PM. They were also considered to have capabilities in coordinating scheduling et cetera that were considered that could be utilized in the Management of the FE. In, for example, project E, this was done and the PM was responsible for managing the whole internal organization of the FE. A project and four sales organization members would put the more internal organization on the PM's responsibility than currently. They stated that this would enable SMs to focus more on the customer. On contrary, a project organization member strongly disagreed stating that internal organizing belongs to the sales or product sales manager, not the PM. Two PMs backed this up stating that their role in Management of the FE is to support SM and for example attend the weekly meetings. A suggested way to divide these tasks dynamically was to create a core team, of which the PM would be a part of, that would manage and handle the FE. This teamwork was considered to have the potential to increase the effectiveness of the FE. Interviewees also mentioned that the PM should attend the team building in the FE such as FE kick-off. According to the interviewees PM also attends to the internal integration of the organization since they bring the relationships to the executing organization to the FE.

The PM's role in the internal operation manual also includes attending management audits. These were mentioned by 5 interviewees all of whom considered this valuable. This is also part of the governance framework for the projects and the management audits help to set the project and the leadership up. Other than governance was not mentioned as a PM's task in the FE. The management audits and reviews also serve as internal quality management. However, other attendances than MA were not mentioned. As mentioned earlier PM has a role in finding benchmark cases and comparing them to previously executed projects. This was mentioned by 7 interviewees.

5. DISCUSSION

5.1 Front end process in complex projects

5.1.1 Framework

The empirical study clarified the ending and starting points of the FE. The end of a FE is typically rather easy to identify as the transition to the execution phase is rather evident (Olsson & Samset 2006; Williams & Samset 2012; Edkins et al. 2013). However, the definition of the beginning of the FE is more difficult to define. In the empirical study, the start was tied to the permit to utilize resources in the validation of the project. In a broader sense, the FE starts when the organization officially commits resources to the specific project. However, this point can be rather vague depending on, for example, the client and how the organization receives information about the project. Public projects were considered clearer than others since they typically have clear processes on how the bidding and project FE proceeds. The framework together with the definition provides clarification to previous definitions (Williams et al. 2019).

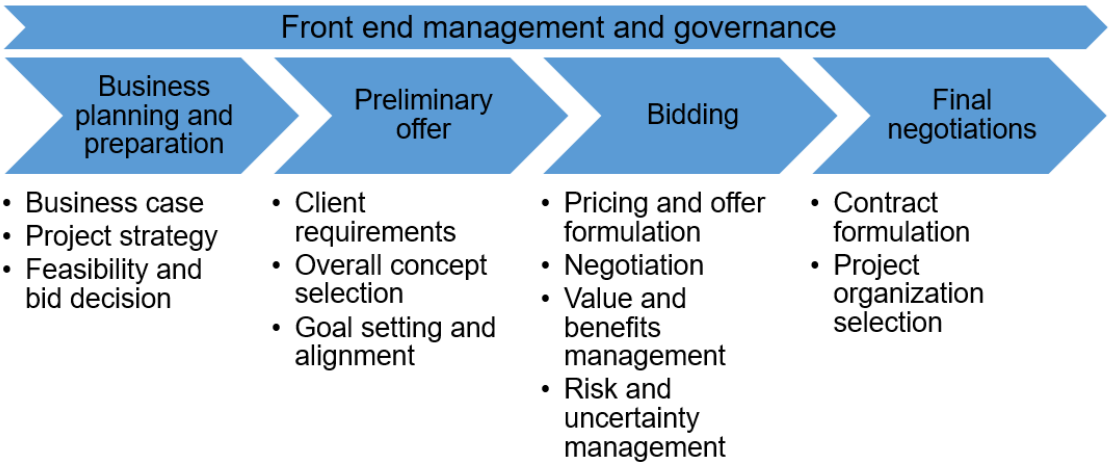

Figure 8: Combined front end framework and important tasks in each phase.

To answer the research question 1 the FE frameworks from the literature review (Figure 3) and empirical study (Figure 6) were compared (Appendix F). The frameworks were overall rather similar. The findings in both literature and empirical study confirm that the beginning of the process is focused on estimating business impact, feasibility, and the profit potential that the project has. Thus, in the combined framework this phase is named business planning and preparation (Figure 8). After establishing that the project is valid and has enough potential, the next phases revolve around creating and analyzing a preliminary concept for the project following customer requirements and locking in the

overall level concept and strategy. This helps to ensure that client needs are met cost-effectively. The third phase is bidding which begins after an official request or acceptance to bid. This phase goes into more detail optimizing the concept and the offer including, for example, technical solution selection, execution planning, and pricing considering risks and value. The bidding varies from straightforward to iterative and the length can also vary from a couple of months to even years. The FE culminates in final negotiations and signing of the contract which should be understood and commented on. Throughout the FE flexible proactive management with project management practices is crucial. However, as the empirical study and Christensen (2011) revealed the FE is rather turbulent and uncertain with a lot of variance from project to project. This sets limitations on generalizing and utilizing this framework. The tasks are further discussed in the next chapters to answer the research question 1 in more detail.

5.1.2 Business planning and preparation

The front end starts with business planning and preparation. The early tasks are aimed at validating the project (Williams et al. 2009). The first part of validation is business case creation. It is important to have established practices for this phase to justify quantitatively and qualitatively if the organization commits to the project or not (Williams et al. 2009; Williams et al. 2019). In project business, it is increasingly important to have a well-established framework for business case validation as it helps to prioritize the projects. The business case also supports communicating the key points and customer needs of the project throughout the organization. The empirical study and Kähkönen (1999) found that business case is important beyond the initial phase as well and it should be done throughout the FE. The business case and its limitations should be communicated through the organization in the FE to drive the focus to the important areas of the business for business benefits.

Having a clear project strategy is important for the project. The project strategy can be either established during the FE (Artto et al. 2008) or as it was in the case organization it can be more of a preset strategy. In either case, it is important to communicate it. According to Williams & Samset (2012), it can bring real benefits as the organization has a common understanding of the way to operate. A bad communication of strategy can cause issues in the FE about what to focus on and how to approach the project. In addition, Edkins et al. (2013) mentioned that not having a specific project strategy misses the uncertain nature of the FE assuming that the situation is static.

The constructability and feasibility reviews are important throughout the FE from the early phase to later ones in validating the project. This is first of all because they have been

found to correlate with the performance of especially complex projects (Hermanides et al. 2010). The case organization conducts various reviews and feasibility studies throughout the FE which are valuable in ensuring a certain level of quality and avoiding major problems and risks. The purpose of these reviews varied from locking in solutions to committing more resources and effort. The issue with this approach was found to be that it does not produce innovative or out of the box solutions but rather encouraged conservative solutions that might not be competitive. This is because the reviews were rather mechanical and checklist-based. Elearn (2007) presented that these reviews can be more diverse than just checklists, for example, workshops. Thus, to cultivate the important value creation and dynamism in the FE it is important to have flexibility and creativity in these reviews beyond the mechanical approach..

5.1.3 Preliminary offer

After the first phase the actual, typically preliminary, offer creation starts. At this phase, it is crucial to understand and manage the requirements. This is overall one of the most important tasks of the FE creating a foundation for the concept formulation. The findings in the empirical study and literature highlighted the requirements management since it helps to understand and define what needs to be delivered and what the client actually needs. This helps to get rid of excess requirements (Artto et al. 2001; Olsson & Samset 2006) The empirical study found differentiation between internal and external requirements which the literature did not discuss. This means that the case organization had its own requirements that were different and often stricter than the client's thus leading to higher costs and reduction in competitiveness. This differentiation is important to understand and make visible since the project suppliers might have a certain minimum quality level that they are willing to deliver. Understanding this division helps in aligning the requirements. These can be unwritten or visibly communicated in the organization.

At this early phase, it is important to establish goals and their monitoring. Especially the project management domain recognized this because it sets the direction for the project and directly correlates with the project performance (Williams et al. 2009; Yun et al. 2016; Zwikael & Meredith 2019). Bosch-Rekveldt et al. (2010) also found that clear goals and their monitoring can relieve the complexity. This task was considered very important in the interviews as well, however, receiving only a little attention. Aligning the project's goals to the client's helps to steer the project in a competitive and common direction. Unclear or poorly communicated goals especially in a scattered organization might lead to poor performance. The goal-setting includes setting milestones and goals in the FE as well. Without these, the team can have a feeling that the project is irrelevant and in a busy environment, the work that is not monitored is often low in priority.

The supplier must start considering the stakeholders at the latest in the preliminary offer phase continuing it throughout the FE. This was identified as one of the most important tasks in the literature review. Cova & Salle (2005) and Biesek et al. (2014) revealed that systematic stakeholder management can have the potential to reduce uncertainty and challenges. Also, Bosch-Rekveldt et al. (2010) found that understanding key players and having a clear communication strategy has the potential to relieve complexity. However, the empirical study did not recognize this as important, most likely because in the FE, the organization worked with rather few stakeholders, focusing on mostly internal ones. However, a systematic approach in the internal and external stakeholder management can be valuable and help to alleviate the issues that the dynamic nature of the FE and the complexity of the projects cause.

5.1.4 Bidding

After typically a formal request for bidding or an official acceptance the supplier begins to formulate a more detailed general level concept of the project and an offer to the client. This is the main goal of the bidding phase (Samset & Volden 2016) and and in the case organization the whole FE revolved around these. The bidding phase can vary from straightforward to iterative and turbulent depending on the client. It can also involve a lot or very little negotiation with the client. The concept provides a common foundation for the organization to work on the project and the offer defines to the client what is to be delivered and how. The concept should be a separate document from the offer documentation to better capture the internal aspects of the project (Williams & Samset 2010; Gibson & Bosfield 2012) which are not shared with the client. The case organization did not have these separated. In the case organization, these documents included everything from the technical solution to the execution plan and were very detailed. Tight internal requirements for the documentation utilize a lot of resources and can cause a lack of innovativeness and time to focus on the specialties of the project. Thus, it is important to have flexible predefined internal practices for the creation of these documents.

An important part of the offer is the pricing. The empirical study highlighted the importance of pricing because it often is one of the key decision criteria for the client. The pricing is a result of the technical solution, execution plans, risk management, and margins. It is important to base these kinds of tasks on data to avoid bias (Flyvjberg 2013). The pricing can go through multiple iterations as the uncertainty diminishes and information increases. This affects competitiveness negatively if there is not enough time for the iterations. Thus, it is important to get the first pricing round as realistic as possible.

The selection of the technical solution was found to be one of the most important tasks of the FE and the concept creation. The literature did not highlight the technical solution selection as much but still recognized the value of it since it defines the cost and performance levels for the project. In addition, the technical solution is often an important decision criterion for the client. This was a strength of the case organization which represents well the nature of the case organization as a technology company selling solutions to the clients. Thus, the focus on creating the best solution for the client often clearly surpassing the client's requirements is rather natural. However, this is not necessarily competitive if the client does not value the technology over the cost. Thus the focus should be on finding a solution that suits the client's needs. In technology and construction industries this process typically requires basic engineering (Kähkönen 1999). The more detailed the engineering is the more accurate the estimates and other plans typically get which highlighting its importance. It also helps to mitigate risks and issues in the project the better-defined plans are. This task is typically a responsibility of a separate function in the organization.

Both the empirical study and literature review recognized the importance of execution planning as part of concept creation. It was confirmed in the empirical study that in project business the execution plans including the schedule, resources, installation, subcontractors, et cetera, should be defined at a minimum on an overall level in the FE. This is because these aspects should be agreed with the customer and thus be appendices in the contract (George et al. 2008; Edkins et al. 2013). This decreases the number of arguments in the project. Secondly, these plans, and especially resourcing, have a direct impact on execution performance and efficiency. The execution planning affects the competitiveness also directly, as it was found, that schedule is often one of the client's decision criteria. It is important to note that the execution planning is interconnected with risk management, pricing, and engineering creating complexity.

Subcontractor management is an important task due to the subcontractors' big role in the execution. They have a major impact on delivery performance, quality, and price (George et al. 2008; Williams 2016). Thus, the organization should work with them closely and commit them to the project (Williams 2016). The empirical study recognized subcontractors' role in the FE as enabling competitive offers. This was also recognized in the literature as value-adding which could reduce variance in the projects. This is because the prices would be more predictable and accurate when the subcontractors are closely involved in the offer process.

Risk management was quite unanimously identified as a crucial FE task. For one, lowering risks is identified as a goal of the FE, and risk management is even included in

some of the definitions of the FE (George et al. 2008; Edkins et al. 2013). Secondly, remedying the risks earlier in the FE is typically more cost-effective and it allows for more maneuvering than in the execution. Thirdly, understanding what the organization commits to is crucial. (Olsson & Samset 2006; Samset & Volden 2016) The importance is also highlighted by the interconnectedness of risk management with, for example, execution planning, pricing, and other tasks (Edkins et al. 2013). Lastly, risk management affects competitiveness which was found in the empirical study. This is because the estimated risk levels affect contingencies which in turn affect the price. Thus, it is very important to avoid bias. The approach to risk management should be based on data, statistics, and systematic processes – intuition and experience should be used selectively (Flyvjberg 2013). Without a systematic process, the project organization was recognized to overestimate and the sales organization to underestimate the risks. It is important to note that both the empirical study and the literature recognized that this process should also include recognizing opportunities (Olsson & Samset 2006).

Value and benefits management are crucial tasks in the FE. This is because they are important for long-term business success in the project business (Edkins et al. 2013). Similarly, the sales organization members of the case organization considered it also very important for the competitiveness of the FE. Currently, especially among the project organization members, the focus was quite much on internal value management. It was believed that shifting the focus more towards the client would create more cost-effective and attractive solutions. In addition, Edkins et al. (2013) and Zwikael & Meredith (2019) implied that these practices help out to steer the projects in the right direction and draw attention to important areas. Value and benefits management can be either built into the FE tasks or be a separate task (Williams et al. 2009). Despite the recognized value of the value and benefits management the organization seems to struggle somewhat in this area. Thus, it could be beneficial to create a value- and benefits management process to draw more focus and attention to it.

Information gathering was found to be one of the key tasks in the FE. For example, Gibson & Bosfield (2012) defined the FE's purpose to be collecting crucial information of the project. The gathered information lowers the uncertainty and allows for better and more accurate concept and offer creation for the project. It is important to constantly focus on this task since the information in the FE can change quickly. Also, the information collecting must focus on the key information as there is typically an abundance of information to avoid information overflow (Wiliams et al. 2009) and also because the resources are limited. To benefit most from the collected information the collecting, managing, and utilizing it must be systematic (Flyvjberg 2013; McClory et al.

2017). Varying practices that rely a lot on intuition and personal information sources, like the case organization, can easily lead to biases. However, intuition, experiences, and expertise have also their place in these practices. For one, they are good for identifying the key focus areas. Secondly, lessons learned have been verified to be valuable (Williams et al. 2009). The value of experiences and lessons learned however diminishes the more complex the project becomes (Hermanides et al. 2010).

Change management is an important tool in the FE. This is because changes are common in the turbulent and uncertain FE and they can have unexpected implications in complex projects (Hermanides et al. 2010; Turkulainen et al. 2013; CII 2015). Changes were typical in the case organization and sometimes had a major impact causing problems in the project. To avoid these problems a systematic approach to change management, good communication, and monitoring are required (Hermanides et al. 2010). The case organization did not handle changes systematically and their approach was focused on avoiding major changes altogether. This, however, creates stiffness in the FE and can negatively impact the creation of a good solution for the client. Thus, the FE should allow changes and focus on change management.

5.1.5 Final negotiations

The front end and negotiations executed throughout the FE culminate in the final negotiations. The final negotiations typically mainly revolve around the commercial aspects of the contract as most of the project's concept has been agreed on earlier. At the latest at the beginning of this phase, the empirical study highlighted the importance of reading through and understanding the contract to negotiate any problems before signing it. These changes should be done together by SM and PM and other organization members to avoid complications (Turkulainen et al. 2013). The case organization did involve PM in the final negotiations but the involvement varied a lot between the projects. PMs found it important to focus on creating a fair contract with the client to establish a good foundation for the project. This was also found important by Williams et al. (2019).

The project execution organization for the project must be at least preliminary planned and competent resources ensured at the final negotiations phase. This ensures that the project has a better probability to succeed as it has sufficient resources. This can be interpreted as team building that Williams et al. (2019) found valuable in the FE. The empirical study found that sometimes it was difficult to understand the resource and competence requirements for the project which can lead to issues in the execution phase. Especially if resources are planned after the FE. In addition, before the execution starts the empirical study and Turkulainen et al. (2013) recognized it important to have

an official kick-off for the execution organization. The kick-off is aimed to transfer information about the project to the execution organization thus kickstarting the project. Overall the discussion of the tasks in the final phases of the FE was rather limited in the literature and in the interviews.

5.1.6 Management the of front end

The organizational structure is very important in the FE. It should support management, creativity, flexibility, and ensure sufficient resources and competencies (Edkins et al. 2013; Morris 2013). The empirical study found that a scattered organizational structure creates difficulties in management, realizing synergies, and aligning common goals. In addition, resourcing and creativity can be limited if the processes are mechanical and a lot of effort has to be put into the internal management. This is against the dynamic nature of the FE (Gibson & Bosfield 2012). Thus a smaller team in the FE supports the dynamism and flexibility minimizing the effects of complexity (Bosch-Rekveldt et al. 2010). The empirical study found that a smaller core team that would organize, lead, and manage the main tasks of the FE together could be the most effective one. The team could probably help in minimizing the typical issues of the FE. In the organization, this team could include a SM, product sales manager, engineering manager, PM, and possibly someone from the other functions of the organization. However, the SM would still be mainly responsible for coordinating and managing the FE.

There are two main models for organizing the FE. The typical one is to have a separate sales organization (Turkulainen et al. 2013). The other is to utilize the execution organization in the FE. The case company had a combination of these as it has some dedicated resources for the FE but also many employees from the execution. Utilizing the same organization in both phases enables good integration and information flow. The cooperation can help to alleviate biases according to Pillai (2008). The empirical study confirmed that the two organizations are in fact countering forces to each other. However, the way of organizing has its difficulties as well. Firstly, as the project FE has to compete from the same resources as projects it can lead to a lack of resources. Secondly, as the resources are limited a strict prioritization and control of the resources are needed. Cooper & Budd (2007) suggested a detailed process for tracking resources and projects. A resourcing tool could be a good starting point in this kind of situation.

In some cases utilizing a separate organization can be more effective. It can better ensure the availability of resources and the resources can be more specialized. This can make the work in the FE more effective. However, this has its difficulties. For one the flow of projects from FE to execution needs to be controlled carefully (Cooper & Budd

2007). In addition, in this instance, the organization requires a specific process in handling the integration between sales and execution enabling the flow of expertise and information (Turkulainen et al. 2013). It would also make the transition from sales to execution and the information flow from execution to FE more difficult. This could lower the commitment to the project. For the hybrid model better integration, commitment, and transition were recognized as benefits. However, more dedicated personnel to the FE, for example, PM, might create value and enable more focus on the tasks of the FE.

There are two distinct management approaches in the FE. First is an organic approach that Edkins et al. (2013) found to be suitable in organizations with strong leadership. Secondly, a more mechanical approach is suitable for more stable environments. However, the findings in the literature review implied that the management cannot be as preplanned since the FE is much more dynamic with changing situations and demands. The management of the FE in the case organization was rather organic, reactive, and varied from project to project. This approach can lead to poor foreseeability, idling, and long FE which could be reduced by a more controlled approach. In a project business environment, it is important that the organization has predefined processes and practices as the time and resources are limited and the products can be rather standard. However, a certain amount of flexibility is required. This can be achieved, according to the literature review, by managing dynamically following good project management practices. The interviewees stated that the FE should be managed similarly to execution projects. This would mean monitoring costs, quality, and progress by creating more detailed plans and schedule (Olsson & Samset 2006). It is especially important to focus on the clear definition of goals and team building to create flexibility.

The FE framework is defined as a linear process with rather clear review points between the phases. This is typical especially in more stable environments (Zwikael & Meredith 2019) and present in the case organization as well. It is important to be flexible but still have a strong internal process in the FE to combat the nature of it. A good process makes decision criteria and committing resources more clear and sets certain quality requirements for the projects. This process can include, for example, benchmarking, reviews, and management audits which help to ensure quality. These are typically based on predefined checklists, for example, similar to CII (2015) approach that yielded better project performance. This can reduce risk and focus the effort on important areas such as missing information or uncertainties (Olsson & Samset 2006). However, as a flipside to the improved quality and reduced risks, the practice does not necessarily produce innovative solutions as standard ones fulfill the requirements. The case company had a

rather strong FE process and governance model and it was considered valuable but did not fully utilize it. This was considered to lead to problems in the FE.

5.1.7 Synthesis

When looking at the results of the literature review and empirical study we can find differences in them in the early FE, stakeholder management, and management of FE. From Appendix C it is noticeable that the literature highlights the importance of project strategy and business case much more than what was found in the empirical study. The case company especially missed communicating these throughout the organization. Results in stakeholder management also differ noticeably, as especially project management literature highlighted its importance. The case organization rather seemed to disregard the subject and did not draw much focus on it. This might be because the practices revolved mostly around internal practices. However, managing and understanding at least the major stakeholders were found valuable. Another area standing out from the results is the management aspect. The literature fails to address this issue comprehensively and the case company's also had varying practices in this area.

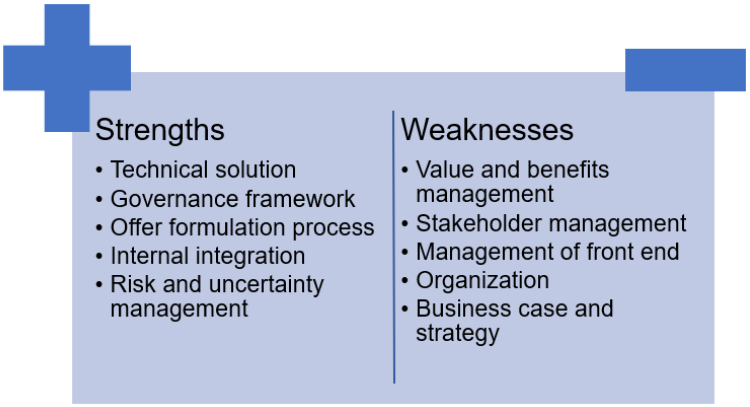

Figure 9: Strengths and weaknesses of the front end of the projects of the case company.

All in all, after analyzing and comparing the results to theoretical findings the case organization's strengths and weaknesses were listed (Figure 9). When looking at the strengths the technical solution was found to be a clear number one. Also, the case organization had a strong and well-established governance framework which is valuable in all projects defining a certain quality level. The offer formulation process with its defined roles and documentation was also found very well established and ingrained in the organization. It was rather automatic and somewhat straightforward. The process included people from sales and execution and the information flow is good between

these parts. The organization was also found to have a very strong risk and uncertainty management culture and the risks were typically priced into the projects.

The case organization's biggest weaknesses were in value and benefits management and business case and strategy. This leads to poorly prioritized projects, exceeding client needs by a lot, and overall forgetting the client and what the goal is. The case organization also focused a lot on internal processes and requirements somewhat neglecting external stakeholders. The organization's organizational structure also seemed to cause issues in information flow and lead to conflicting goals and loss of synergy benefits. Adding to organizational difficulties was the variability in the management. The approach was considered to be rather reactive, lacking planning and control which often lead to surprises and the need for iteration in the FE. These factors were considered to drive up the price and lower the competitiveness and affect variance negatively.

5.2 The supporting effect of the project front end on project performance

To answer the second part of the research question 1, the empirical study confirmed most of the findings of the supporting effect of the FE on the project performance from the literature review. The example projects that had good FEs had also good project performance both financially and execution wise or conversely poor FE resulted in weaker performance. This is a result of better-managed risks and customer requirements and better-defined project all of which are further discussed in the next paragraphs. In addition, an increase in the probability of sales was identified. One reason limiting this phenomenon is the performance in the execution phase. In many cases, the project execution overperformed compared to the estimates making significant savings or making things faster than estimated thus mitigating the issues. This can be either attributed to bad estimates in the FE or excellent execution performance or both. Nonetheless, many of the issues, such as missed or poorly understood requirements, in the execution phase can be traced back to the FE as previous research has also identified (Williams et al. 2009; Wearne 2014).

The empirical study verified Collins et al. (2017) finding that a good FE typically means less rework and change orders there are in the execution phase. Much of the increased performance can be attributed to a better-defined project and requirements. The improved understanding of the project and its requirements reduces the number of things that have not been priced in or otherwise accounted for. Typically, at least for the case organization, these issues are the factors of limited time and resources in the FE. When

these issues were not present the example projects typically had good FEs. As the cost of the changes increases throughout the project (Olsson & Samset 2006) the lowered amount of rework considerably increases project margins.

Better front end performance leads to better execution and financial performance. This means that resources spent in the FE have a return on investment. Collins et al. (2017) and George et al. (2008) recognized 5–20 % cost and schedule effect. A similar effect was identified also in the empirical study as the more the case company iterates the offer in the FE the more optimized (lower) the costs and schedule are. In addition, the schedule, budget, and plans are much more realistic, and the less variance there is in execution. This was mostly attributed to the facts that the solution becomes more optimized and that the organization tends to overestimate costs the higher the uncertainty is. Compared to Williams & Samset (2010) statement that the costs are typically underestimated in the FE there is a significant difference. However, this kind of behavior was possible especially in the domain of risks when the drive to get the project was high. This improved performance either improves margins or lowers the offered price either way lowering variance and improving competitiveness.

As the project is better defined and performance in the FE is good the risks are better understood and the risk levels are typically lower. However, the empirical study revealed a paradox. The more effort is put in the FE the higher the risks grow as more effort is put into analyzing and understanding risks thus revealing them to the organization. Conversely, the less effort is put into the FE the more hidden risks there are. In the case organization higher recognized risk levels lead to higher contingencies and price. Thus, there is an incentive to hide the risks if the drive to get the sales is high. This effect is not recognized by previous research. This implies that when the effort is put to recognize the risks the FE also has to have time to mitigate the risks to drive the risks levels and consequently price down (Gibson & Bosfield 2012; Williams & Samset 2012). The risk management is easier and more effective in the FE as there is more room for maneuvering. In conclusion, the risk management in the FE enables a tighter budget lowering the variance. If not, the project has increased transparency but has to have higher contingencies and margins to keep the risk levels manageable.

Improved project cost-effectiveness, project performance, and better-answered requirements and needs mean that the client is typically more satisfied. Biesek et al. (2014) found that, for one, increased profitability of investment due to a more successful project is in many cases behind increased long-term customer satisfaction. The second major reason behind this effect is that the more effort is put to defining and

communicating the customer requirements the more the client can value the solution (Elearn 2007).

The empirical study can not corroborate the FE's effect on improving team performance during the execution which Dinsmore & Cabanis-Brewin (2014) and Williams (2016) found in their studies. At maximum, the impact is rather limited in the typical project business organization because often the execution team involves different people than the FE team and also the FE team is rather small compares to it which was recognized in the literature. The execution team is also typically built after the FE phase.

The empirical study found that more effort put into the FE increases the probability to get sales. The literature review did not identify this effect on competitiveness in this manner. The effect comes from the effort put in the FE which optimizes the solution driving down price, schedule and typically helps to answers the client's needs better. All of these are typical selection criteria for the clients. Also, the work the organization puts in the FE can be considered by the client as a commitment and interest towards the project. The FE is thus very impactful on the organizational level in the project business environment. This leads to a conclusion that with limited resources it is important to prioritize the efforts between projects to enable the best possible FE.

5.3 The role of the project manager

There is not a clear definition of PM's role in the FE. For one this is because by the traditional definition of project management they are not appointed prior to the execution phase (PMBOK 2012; Williams et al. 2019). On the other hand, newer research and empirical study have recognized PM's and their experience's importance in the FE (Dinsmore & Cabanis-Brewin 2014). Adding to these, Dinsmore & Cabanis-Brewin (2014) stated that the role in the FE requires more creativity being more informal than in the execution, and can require some sales and contract skills that are not necessary for the execution phase. However, it was in the empirical study it was found that this was not a problem among the PMs. Still, due to thede factors PMs' do not necessarily fully understand their value in the FE (Morris 2013). Thus to utilize PMs' in the FE it is important to have a predefined role just like the case organization had. However, this definition was considered to be quite general. This combined with the fuzzy and uncertain nature of the FE (Edkins et al. 2013) lead to a quite notable variance in the role.

The empirical study clarified the point of involvement of the PM in the FE on which the previous research has not found a common agreement. However, the specific point is still difficult to pinpoint due to the variance and fuzziness. The previous definitions vary

from the earliest phases to later ones (Morris 2013; Dinsmore & Cabanis-Brewin 2014). The empirical study found that at the latest the PM should be appointed at the beginning of the bidding phase. This makes the official request for quotation an important milestone. At this point the organization is rather committed to the project, the certainty for the project was high enough and there were enough tasks for the PM. However, the actual point of involvement was still typically later since PMs did not often have time for the project FEs. This involvement point can be earlier if the PM has time to attend. In smaller organizations, there might not be a separate SM which means that PM handles the SM's tasks and is involved throughout the FE.

The project manager can be valuable in the **earliest strategizing phase of the FE.** The involvement can create value for both the supplier and the client and also support in establishing good relationships and practices with the upper management (Williams et al. 2009; Morris 2013). However, it is not very typical in project organizations to involve PM in these tasks and it was not done in the case organization either. However, the PM can be of value in business case creation although their involvement is more indirect. In addition, it is in the later iterations of the business case as they typically get involved in the FE in the bidding phase. This involvement can help avoid issues, risks, and make the project more profitable (Edkins et al. 2013; Campbell 2014).

The project manager has an important role in requirements management at the latest in the bidding phase. This is because they get a better understanding of the requirements they need to fulfill (Elearn 2007; Dinsmore & Cabanis-Brewin 2014). This is when they read through the contract and possibly discuss with the client about their needs. The PM's involvement can also make the requirements more achievable and solve practical issues (Biesek et al. 2014; Campbell 2014). With their experience PM knows if the requirements have issues in executability and also might have experience in solving them. Thus, PM has an important role in supporting requirements management.

The project manager has an important role during the **bidding phase** in the concept creation. As this is the foundation for the offer and in some cases is the offer PM has a role in the offer formulation as well (Turkulainen et al. 2013). Firstly the PM's role in the execution planning of the concept was highlighted. This was found in the empirical study to create a more optimized project schedule and budget-wise improving competitiveness in bidding. Secondly, PM was considered to be a very valuable assets as an execution expert supporting others giving opinions from the project execution perspective, and ensuring that execution perspective has been taken into account. Their value was found to be increasing as difficulty and complexity increased. These tasks are natural for the PM as they are responsible for them in the execution and have the experience and the

skills (Wearne 2014). The execution responsibility also means that their commitment to the project FE is very high compared to the people who are not involved with the project after the FE. Thus, the PM is typically very motivated in the FE which the literature review did not consider. Thus, getting PM motivated can be rather simple.

As part of the offer formulation, the PM has a role in the pricing. In this are the literature recognized mostly PM's value in helping to minimize risks and issues (Morris 2005; Wearne 2014). The empirical study found a broader role for PM in budgeting and pricing. This role put quite a lot of responsibility on them to ensure correct cost estimates. The PM's were considered to bring realism into the estimates using reference projects and also identifying mistakes or issues. However, as discussed earlier, the pricing and similar tasks should be based on objective data to avoid biases. Thus, PM can be used to spot potential issues in pricing but the more detailed costing should be based mostly on data.

The project manager can have a role in technical solution selection which is a key part of the concept. In this area PM's role is to help to ensure client value (Artto et al. 2001; Morris 2005). Also, PM can help to validate technical selection and designs from an execution perspective and support the selection of executable designs (Hermanides et al. 2010). The involvement is, however, dependant on the project and PM's skills. The organization also has an impact on this. For example, as the case organization had a lot of specialized personnel focusing on the technical solution, PM's attendance was not required. The same reasoning applies to basic engineering which supports the technical solution but is not a project management task.

The roject manager has an important role in value and benefits management. Artto et al. (2001) found that the PM should monitor value creation closely thus improving value for both client and supplier. This involvement can also reduce overdesign (Yun et al. 2016) and that benefits can be met (Olsson & Samset 2006). The empirical study verified this role highlighting especially PM's role in monitoring the internal value. However, this view is rather limited compared to previous findings. Closely related to value management empirical study found that PM has a role in entity management in the case organization – a task that the literature does not discuss. Entity management means extracting the synergies out of the overall solution and ensuring that different parts function together. In other words, PM helps to align the solutions from the disciplines together especially optimizing the execution. This finding depicts the fact that the case organization has only a few persons on an overall project level and typically this area is neglected.

The project manager can be very valuable in the information gathering process in the FE. This includes, for example, identifying benchmark projects to estimate price, risks,

and costs. Edkins et al. (2013) suggest that PM acts as an internal consultant recognizing the key areas in the execution plans to dig deeper, ask questions, and collect more information. The role can vary from rather hands-on information collecting to a more advisory role. The PM is a valuable information source with typically a lot of experience. Thus, both literature and empirical study recognized that PM should attend the lessons learned process. This task, however, received little attention in empirical and theoretical studies. Still, it is important to note that subjective information can be biased thus highlighting the importance of a systematic information process (Flyjberg 2013).

Another important **supporting task in the bidding phase** for PM is attending risk and uncertainty management process prioritizing and recognizing especially the key execution risks and major issues. PM can be valuable and tackle many problems with their expertise, experience, and good intuition. This key role was also identified by the previous research (Williams 2012; Campbell 2014). The task is natural for PM as they are responsible for the risks in the execution phase (Elearn 2007). PM's involvement in risk management can, however, affect the competitiveness depending on the risk management process. The interviewees considered it quite typical for PMs to be conservative on the risk estimations and not seeing many opportunities to make the execution easier for themselves. Thus the risk management must not solely rely on PM.

An important task for the PM **in the bidding phase** is to attend the negotiations and meetings with the client. Earlier this was only identified by Turkulainen et al. (2013). The PM can especially support if changes need to be negotiated to the contract helping to understand the effects. Secondly a sales organization member stated that “The PM is the face of the execution”. The PM helps to assure and convince the client of the delivery capabilities. They can also bring knowledge and expertise to the negotiations that others might not have thus increasing credibility and acting as a salesperson in the FE. The PM's involvement was considered to improve the probability of sales. This kind of involvement was also considered to help kickstart the project as the relationship with the client is already established.

Project manager's role in stakeholder management. This can be valuable as they have skills and knowledge which can help to identify, prioritize, and understand the stakeholders better (Morris 2013). They can also start building the relationships that are needed in the execution during the FE as mentioned earlier. The case organization did not, however, utilize the PM much in the FE stakeholder management outside identifying key suppliers in the project. The involvement in this area was lacking despite the recognized importance of subcontractor management. The involvement in subcontractor management was considered to have a lot of potential for project success and margin

improvements. Thus, the PM should start building relationships at the minimum with the biggest suppliers and also with other large stakeholders. This interaction helps to confirm the costs and project execution plans with the subcontractors in the FE.

The empirical study and literature (Turkulainen et al. 2013; Campbell 2014) found that at the latest during the **late bidding and final negotiations phase** the PM should be involved in the contract formulation. They should read the contract through and comment on it from an execution perspective ensuring fairness and helping to define the execution scope. The PM can also identify if the contract enables flexibility if problems arise in the execution. The involvement in contract formulation also prepares them for the execution creating a better understanding of the contract terms. During this phase, the PM should be involved in selecting the execution organization (Hermanides et al. 2010; Edkins et al. 2013). PM knows the competencies better and has to work with the teams through the execution thus making this a natural task for them.

Utilizing project management practices and PM's skills in the FE can create value in **the management of the FE**. This is also discussed by previous research (Morris 2005; Olsson & Samset 2006). However, in the empirical study, it was found that the PM should not typically be the one managing the FE. This is because typically the PM's main focus is on the execution projects and thus they have limited time for the FE. Thus, their efforts are typically more valuable in the execution projects and being involved in the FE tasks. However, to support the Management of the FE PMs could help the development of Management of the FE. In addition, they should be part of the FE core team. Firstly, this is quite a dynamic way to manage the FE and can be adapted based on the skills of the team. Secondly, cooperation has the potential to create value as a lateral integration mechanism (Turkulainen et al. 2013). Further, being part of the Management of the FE team PM can support and give sparring for sales and product sales managers which was identified as important and valuable. Lastly, they can also help the SM with running some tasks and in team building (Hermanides et al. 2010). This support gives more time for the SM to focus on the client.

The project manager should also attend governance building in the FE. This is especially important if the organization does not have a strong predefined governance framework. If the organization has strong governance structures, as the case organization had, the building is not as important as establishing cooperation, relationships, and agreed practicalities with upper management. This also means that the PM helps to ensure the quality of the FE attending, for example, audits, reviews, and filling checklists. The PM can also benchmark the project based on their experiences and previous projects.

All in all, taking into account the theoretical and empirical findings we can summarize an answer to the research question 2. PM's role in the concept creation phase attending execution planning is important which was highlighted by both the empirical and theoretical studies. The empirical study found the PM's role to be especially as an internal consultant helping the organization to take the execution perspective into account and integrating execution to the FE. Other important tasks for PM are, for example, risk management, getting to know the contract, and gathering important information for the execution in the FE. In these tasks, they have perspective, experience, and knowledge that many others do not have which can bring real value. An area which the empirical findings highlighted is the PM's role in sales. PM can bring real value, credibility, and support to the sales negotiations thus improving the probability of sales. They can also help free up the SM's time for the customer relationship and give valuable input into the management of the FE with their experience. In addition, the empirical study revealed PM's role especially optimizing and taking care of the big picture. To avoid bias in the FE, it is important to have systematic processes and rely on data in the activities. Without PM's efforts and timely involvement in the bidding phase tasks can be left undone and important areas are missed leading to variance especially in more complex cases.

5.4 Recommendations

The case company is aiming to increase sales through competitiveness and reducing variance in estimations. Recommendations that would utilize PM better and possibly improve the front end (FE) to increase project performance are presented below **in prioritized order.**

Short-term (<1 y.), relatively big impact and easy implementation

Focus more on value and benefits (business case). The case organization had practices that revolved quite a lot around internal practices sometimes struggling with stiff internal processes and focus on internal requirements driving up the price. I recommend that the case organization creates a value management process ensuring that every solution creates value for the customer and the organization. The SMs could immediately start encouraging personnel to discuss with the customer to better understand the customer needs and possibly avoid unnecessary work. These would enable improved alignment of the internal and external requirements.

Utilize proactive project management practices and a core team. The importance of the proactive and dynamic management practices of FE has been established. As the case company had issues with the organizational complexity and variance in the

management I recommend that the management focuses on selecting and building a core team early on in the FE including SM, PM, product sales manager, and engineering manager. This team should plan and follow-up on the work in the FE, establishing common practices and goals, and committing the personnel. A better and more committed team along with systematical practices could reduce conflicts, improve efficiency, and overall create a better drive for the FE. Improved management would also likely better enable the utilization of the FE framework.

Short-term (<1 y.), relatively small impact and easy implementation

Ensure project management's availability. The study established that the PM's involvement is valuable in the FE. The case company had also a rather good framework and understanding of the PM's role. However, the biggest issue lied with getting the time and effort from PM to the FE. Thus, I recommend that managers ensure that for each project PM is actually available at the beginning of the firm phase and have time to commit and attend.

Use systematic change management. Changes are typical in the FE. However, the case organization did not have systematic approach in managing changes. It is recommended that, for example, the SM establishes a practice and a channel for communicating changes in the project FE.

Long-term (1-5 y.), relatively big impact and difficult implementation

Utilize information management strategies. With limited time and resources, the FE relies on getting the right and critical information and doing the right decision with it. It was noticed that the organization relied a lot on information from individuals and individual decision making. This can lead to unwanted biases and variance. Thus the information should be managed systematically and the decision-making criteria should be agreed on it. As a long-term goal, the organization should create common databanks where objective data, e.g., realized costs and risks would be available.

Align FE and execution. It was found that for example, the pricing and documentation structure was different in execution and FE. This creates extra work and room for mistakes. Thus, the organization and different disciplines should start systematically going through the practices and utilizing the same documents and structure in both phases. This would increase accountability and enable a continuous learning loop from execution to the FE and on a long term better estimate accuracy.

6. CONCLUSIONS

6.1 Achievements

This study contributed to the definition of the FE of project suppliers as a phase where common understanding and agreement of the project is created with the client. This emphasizes especially serving the client compared to Edkins et al. (2013) or Williams et al. (2019). It was defined that the FE begins when resources are committed to a specific project and ends when the contract or preliminary contract is signed and kick-off is held which is in-line with the previous research. This study represents a new FE framework for project suppliers. The framework combines sales, construction, and project management perspectives. Four distinct phases were identified: business planning and preparation, preliminary offer, bidding, and final negotiations. The division depicts the FE from the supplier's perspective considering also the buyer's process. The phases have decision points between them which commit the supplier more and more to the project.

The findings also contributed to the understanding of the FE focus areas. Firstly, it was found that identifying the client's needs and requirements and focusing on creating a cost-effective value-creating offer is crucial in the FE of the supplier. This involves understanding the contract, defining and communicating the business case well, and pricing accurately. Secondly, adding to Edkins et al (2013) findings, it was found that the FE process and management need to be well defined but flexible to counter the dynamic and resource-restricted FE. Proactive project management practices and close teamwork should be utilized. Thirdly, an effective FE process is highlighted in the project business environment as, in addition to the project performance benefits, the actions directly affect the probability of sales. The effect is, however, undermined by the performance of the execution organization. In addition, a unique effect of risk management was identified. The effort put into the FE reveals more risks lowering competitiveness. Thus, time and resources must be spent to mitigate these identified risks to drive competitiveness. The effort put into the FE has a return on investment.

The definition of the PM's role in the FE was clarified compared to, for example, Morris (2013) and Williams et al. (2019) general definitions. It was verified that PM should attend the FE and the point of involvement was pinpointed creating new knowledge. Preferably they should get involved at the latest after the beginning of the bidding phase. The involvement creates commitment, enables to mitigate risks in the project and optimize the execution cost and schedule-wise especially in more complex cases thus driving

competitiveness. It is important to note that the role can vary quite a lot depending on the way the FE is organized as in, for example, in smaller organizations the PM can handle everything from sales to the operation phase. First of all, the study identified execution planning, supporting others as an execution expert, and risk management as key tasks for the PM. Secondly, understanding and commenting on the contract is a crucial task for PM. Thirdly, as a completely new contribution to the previous research, the study identified the PM's key role in salesmanship and as a support to the SM bringing credibility and expertise.

The findings have practical implications for managers. First of all, PM should be involved in the bidding phase with execution-related tasks of the FE. Without their involvement, value and potential are left on the table and important signs can be missed. Secondly, utilizing proactive project management methods in a predefined governance framework is crucial for an effective FE. In addition, it is important to focus on building an effective and compact team. The organization should also have a suitable structure. Thirdly, the organizations should recognize the FE phases and build a governance framework around them. Fourthly, due to the resource and time-limited nature of the supplier's FE, the supplier organization must focus on the key tasks creating a competitive and value-adding solution and offer. Lastly, it is important to base the decision making in risk management, pricing, et cetera, on objective data to avoid bias but also utilize intuition to identify the key aspects.

6.2 Limitations

The research was conducted as a case study into a specific company in the energy industry from a supplier's perspective. To increase the credibility and dependability of the study the whole research process is described in this thesis in detail. The interview structure is also available and it was followed during the interviews. Interpersonal factors could have affected the results of the interviews. To minimize this, the interviews were recorded and transcribed. Also, the interviewees had varying backgrounds with different viewpoints which further decreases this effect. Enough time was reserved for the interviews and they were conducted in a neutral environment. In addition, the findings were confirmed with the interviewees in a workshop where they could comment on the results and interpretations. To further increase the credibility the buyer's perspective should also be considered and included in the research material. Also, the interviewees represent only a small specific part of the organization which limits the credibility.

The transferability of the results is affected by the varying industry practices in different regions. The public or not public nature also affects the transferability. The projects also

vary a lot in size and complexity. The practices also varied a lot inside the organization and might vary a lot in other organizations. The empirical findings thus represent one way of operating in the energy industry mostly in Europe and might not be directly comparable to different industries or areas. To increase transferability the study environment, research process, and reasoning are described in this study. However, a more systematic approach could have been applied in the selection of the example projects and the interviewees. Through the discussion with theory and different perspectives used in this study, the transferability is increased.

To increase the confirmability of the results the research was evaluated by outside evaluators. In addition, the results were compared to previous research and the results were found to be quite in-line with them. To further increase the confirmability the records of the interviews and the material could be available but to ensure privacy this was not done. Also, due to the interconnected nature of complex projects finding a definitive causal connections between the cause and the effects is difficult.

6.3 Further research

An overall process was defined and important tasks in the FE were identified. However, the findings could be limited to the construction industry's project supplier's perspective and should be broadened to other industries. This study revealed that the FE can impact project execution in many ways. However, quantitative studies on what kind of effect different actions in the FE have on execution are rare (Williams et al. 2019). Therefore, further studying this impact would be valuable, for example, calculating what kind of return the invested resources in the FE have. In addition, a narrative study into projects could better reveal the causal relationships between the FE and execution further identifying the important tasks. Also, this study revealed the impact of the FE on competitiveness in sales. This should be validated and studied further in the project business environment in different industries.

The project management literature or any literature for that matter is lacking in understanding management of the FE (Zwikael & Meredith 2019). The management aspect was found to be very important in this study and it would thus be valuable to understand the best practices and approaches in different kinds of projects and organizations. A study in multiple organizations in different project-based industries could create a better understanding of good and bad practices. This and previous studies revealed that the roles in the FE are not well defined (Edkins et al. 2013). It is important to understand the various roles in the organization and thus researching the different roles in the FE would create valuable information for the managers.

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APPENDIX A: FEATURES OF FRONT END

Authors	Context	Methodology		Limited time	Limited information	Limited resourced	Uncertainty	Stage gate	Dynamic	More creative	Interaction with stakeholders
Empirical papers											
Biesek et al. 2014	Doctoral research, large construction projects (public) in UK	theoretical, in-depth case studies, lab-based experimental studies			x						
Cano & Lidon 2009	Project management course in University of Zaragoza, real and fictitious projects	81 initial + 66 final surveys					x				
Christensen 2011	Major public projects in Norway 3 in depth and 23 ongoing	Theory + interviews and public documents, pilot study			x			x	x		
Collins et al. 2017	Construction industry, industrial projects USA+abroad, developing framework	65 industry professionals used for development, 50 validation projects, statistical analysis		x	x	x					x
Cova & Holstius 1993	Finland, marketing projects in export firms + case study on French aerospace supplier.	Theoretical study + 34 surveys and case study		x				x	x		x
Edkins et al. 2013	Wide variety of industries from Construction to IT, big global companies	Multi case study + in-depth interviews, 9 organizations					x	x	x	x	x
Flyvbjerg 2013	Real life multibillion-dollar building project in UK, public-private	Building theoretical framework and testing on real case		x			x				
George et al. 2008	Construction projects from all market sectors (industrial etc.) from 100k to 100M dollars., Survey in USA	51 questionnaire surveys, validation on 51 construction projects + 51 further validation questionnaires			x						x
Gibson & Bosfield 2012	Construction Industry institutes member organizations, largest, complex and sophisticated organizations	Survey 59 responds		x	x	x		x			x
Kähkönen 1999	2-year study, 5 companies in heavy industry (paper, pulp, chemical, mining, energy)	In depth research scheme				x	x			x	x
Morris 2013	Summarization of a book	Literature reviews, summarizing and comparing 40 years of research		x						x	
Oh et al. 2016	CII member companies from wide variety of construction industries	Survey 38 responses from 27 organizations + 2nd survey 28 responses from 18 organizations + 30 Case projects with 9									x
Turkulainen et al. 2013	Global automation system supplier, customers in pulp, paper and energy, projects from 300k to 10 million €	Case study of three projects in the company									x
Yun et al. 2012	Consturction industry institutes development program data	Survey data from database of 419 projects, statistical analysis				x					
Zwikael & Meredith 2019	Established and experienced project organizations on varying industries (private + public) in UK, Australia and New Zealand	Literature review + 17 senior execs. Interviewed, analysis on 16 organizations		x		x		x			

APPENDIX B: THE SUPPORTING EFFECT OF FRONT END ON THE PROJECT EXECUTION PERFORMANCE

Authors	Context	Methodology	Answering customer needs better (strateegic)	Avoiding unnecessary work (tactical)	Better team performance (tactical)	Better risk management	Overall project success (tactical)	Better budget and schedule (Tactical)
Empirical papers								
Artto et al. 2001	Production plant projects in various logistics, paper, material handling and food	Four empirical cases	x	x				x
Biesek et al. 2014	Doctoral research, large construction projects (public) in UK	theoretical, in-depth case studies, lab-based experimental studies	x					
Cano & Lidon 2009	Project management course in University of Zaragoza, real and fictitious projects	81 initial + 66 final surveys	x				x	
Christensen 2011	Major public projects in Norway 3 in depth and 23 ongoing	Theory + interviews and public documents, pilot study						x
Collins et al. 2017	Construction industry, industrial projects USA+abroad, developing framework	65 industry professionals used for development, 50 validation projects, statistical analysis		x			x	x
Edkins et al. 2013	Wide variety of industries from Construction to IT, big global companies	Multi case study + in-depth interviews, 9 organizations	x			x	x	
Flyvjberg 2013	Real life multibillion-dollar building project in UK, public-private	Building theoretical framework and testing on real case					x	
George et al. 2008	Construction projects from all market sectors (industrial etc.) from 100k to 100Mdollars. Survey in USA.	51 questionnaire surveys, validation on 51 construction projects + 51 further validation questionnaires		x			x	x
Gibson & Bosfield 2012	Construction Industry institutes member organizations, largest, complexand sophisticated organizations	Survey 59 responds				x		
Hermanides et al. 2010	Dutch process industry, NAP network	Survey 67 accepted responses			x		x	
Kähkönen 1999	2-year study, 5 companies in heavy industry (paper, pulp, chemical, mining, energy)	In depth research scheme					x	
McClory et al. 2017	Lessons learned from project management's point of view	Theory + 66 responds to online survey, conceptual paper						x
Morris 2005	Variety of industries from project business	400 web surveys, 50 interviews and case studies					x	
Oh et al. 2016	CII member companies from wide variety of construction industries	Survey 38 responses from 27 organizations + 2nd survey 28 responses from 18 organizations + 30 Case projects with 9 interviews		x				
Olsson & Samset 2006	Norwegian public projects	Multi-case research. Three data sets. Qualitative and quantitative data.					x	
Williams et al. 2012	industries and traditional investment projects typically construction, energy etc.	Analyzing guidelines, 14 interviews and 8 cases of different organizations				x		

APPENDIX C: FRONT END TASKS

Relative importance	Body of literature	Project management	Construction management	Project sales and marketing
By number of mentions	Viewpoint	Focus on successfull execution and delivery of a project, management perspective	Focuses more on the technical aspects, engineering, and the product of the delivery, construction.	Focus is on the stakeholders and interaction with them, linking the organizaional capabilities to the outside world.
	Business case and strategy			
0,7	Business case	Campbell 2014, **Christensen 2011**, Dinsmore & Cabanis-Brewin 2014, Elearn 2007, **Morris 2005, Olsson & Samset 2006**, Samset & Volden 2016, Williams & Samset 2010, Williams & Samset 2012, Williams et al. 2012, **Zwikael & Meredith 2019**	CII 1996, CII 2015, **Collins et al. 2017**, **Kähkönen 1999**, **George et al. 2008**, **Back & Moreau 2000**	Cooper & Budd 2007, **Turkulainen et al. 2013**, Tikkanen et al. 2007, Skaates & Tikkanen 2003
0,4	Project strategy	**Biesek et al. 2014**, Artto et al. 2008, PMBOK, Dinsmore & Cabanis-Brewin 2014, **Morris 2005**, Morris 2013, **Olsson & Samset 2006**, Samset & Volden 2016, Williams & Samset 2012	**Edkins et al. 2013**	Tikkanen et al. 2007
	Setting project goals and objectives			
1,0	Stakeholder management	**Hermanides et al. 2010**, PMBOK, **Artto et al. 2001**, Artto et al. 2008, **Biesek et al. 2014**, Campbell 2014, **Cano & Lidon 2009**, Dinsmore & Cabanis-Brewin 2014, Elearn 2007, **Morris 2005**, Morris 2013, Neal 1995, **Olsson & Samset 2006**, Samset & Volden 2016, Williams & Samset 2010, Williams & Samset 2012, Williams 2016, **Williams et al. 2012**, **Zwikael & Meredith 2019**	CII 1996, CII 2015, **Collins et al. 2017**, **Edkins et al. 2013**, **George et al. 2008**	Cooper & Budd 2007, **Turkulainen et al. 2013**, Cova & Salle 2005, Tikkanen et al. 2007, **Cova & Holstius 1993**, Skaates & Tikkanen 2003
0,9	Requirements management	PMBOK, **Artto et al. 2001**, **Biesek et al. 2014**, Campbell 2014, **Cano & Lidon 2009**, **Christensen 2011**, Williams & Samset 2012, Dinsmore & Cabanis-Brewin 2014, Elearn 2007, **McClory et al. 2017**, **Morris 2005**, Morris 2013, Neal 1995, **Olsson & Samset 2006**, Samset & Volden 2016, Williams & Samset 2010, **Williams 2016**	CII 1996, CII 2015, Collins et al. 2017, **Edkins et al. 2013, George et al. 2008**	Cooper & Budd 2007, **Turkulainen et al. 2013**, Cova & Salle 2005, Tikkanen et al. 2007, **Cova & Holstius 1993**
0,7	Goal setting and alignment	**Hermanides et al. 2010**, Artto et al. 2008, Campbell 2014**, Cano & Lidon 2009**, Williams & Samset 2012, Elearn 2007, **Mesa et al. 2016**, Morris 2005, Morris 2013, Neal 1995, **Olsson & Samset 2006**, Samset & Volden 2016, Williams & Samset 2010, **Yun et al. 2016**, **Zwikael & Meredith 2019**	CII 1996, CII 2015, Collins et al. 2017, Edkins et al. 2013, Kähkönen 1999, Gibson & Bosfield 2012	Cova & Salle 2005, Tikkanen et al. 2007
	Formulation of offer and concept			
0,8	Project concept	PMBOK, **Artto et al. 2001**, Campbell 2014, **Christensen 2011**, **Cano & Lidon 2009**, Elearn 2007, **Morris 2005**, Morris 2013, **Olsson & Samset 2006**, Samset & Volden 2016, Williams & Samset 2010, Williams & Samset 2012, Williams et al. 2009	CII 1996, CII 2015, Collins et al. 2017, Edkins et al. 2013, Oh et al. 2016, Kähkönen 1999, George et al. 2008, Gibson & Bosfield 2012	Cooper & Budd 2007, Turkulainen et al. 2013, Tikkanen et al. 2007
0,2	Offer formulation			Cooper & Budd 2007, Turkulainen et al. 2013, Cova & Salle 2005, Tikkanen et al. 2007, **Cova & Holstius 1993**, Skaates & Tikkanen 2003
0,4	Negotiation	Neal 1995, Pillai 2008	CII 1996, CII 2015, **Collins et al. 2017, Edkins et al. 2013**, **Kähkönen 1999**	Cooper & Budd 2007, **Turkulainen et al. 2013**, Cova & Salle 2005, Tikkanen et al. 2007, **Cova & Holstius 1993,** Skaates & Tikkanen 2003
0,5	Technical solution selection	**Hermanides et al. 2010, Artto et al. 2001**, Dinsmore & Cabanis-Brewin 2014, Samset & Volden 2016, Williams et al. 2012	CII 1996, CII 2015, **Collins et al. 2017, Kähkönen 1999, Back & Moreau 2000, Gibson & Bosfield 2012**	Cooper & Budd 2007, Turkulainen et al. 2013, Cova & Holstius 1993, Skaates & Tikkanen 2003
0,4	Basic design (engineering)	**Artto et al. 2001,** Biesek et al. 2014, Williams & Samset 2012, Elearn 2007, Morris 2013, Samset & Volden 2016, Yun et al. 2016	CII 1996, CII 2015, Collins et al. 2017, Kähkönen 1999, George et al. 2008, Gibson & Bosfield 2012	
1,0	Project execution planning	**Hermanides et al. 2010**, PMBOK, Bachy & Hameri 1997, **Biesek et al. 2014**, **Cano & Lidon 2009**, Williams & Samset 2012, **Flyvjberg 2013**, **Mesa et al. 2016**, **Morris 2005**, Morris 2013, **Olsson & Samset 2006**, Pillai 2008, Samset & Volden 2016, , **Wearne 2014** , Williams & Samset 2010, **Williams et al. 2012**, **Yun et al. 2016, Zwikael & Meredith 2019**	CII 1996, CII 2015, **Collins et al. 2017, Edkins et al. 2013, Kähkönen 1999, George et al. 2008, Back & Moreau 2000**	Cooper & Budd 2007, Cova & Salle 2005, Tikkanen et al. 2007, **Cova & Holstius 1993**, Skaates & Tikkanen 2003
0,4	Subcontractor management	Dinsmore & Cabanis-Brewin 2014, Williams & Samset 2012, **Christensen 2011**, Morris 2013, Williams & Samset 2010, **Williams 2016**	CII 1996, CII 2015, **Collins et al. 2017, Kähkönen 1999, George et al. 2008**	Cova & Salle 2005, Tikkanen et al. 2007

	Offer and concept formulation support tasks			
0,4	Constructability/feasibility review	**Hermanides et al. 2010**, Campbell 2014, Elearn 2007, **Mesa et al. 2016**, Williams & Samset 2012	CII 1996, CII 2015, **Collins et al. 2017, Gibson & Bosfield 2012**, **Edkins et al. 2013, Kähkönen 1999**	Cova & Salle 2005
0,6	Value and benefits management	[illegible], Williams & Samset 2012, Elearn 2007, **Morris 2005**, Neal 1995, Williams & Samset 2010, Williams et al. 2012, **Zwikael & Meredith 2019**	CII 1996, CII 2015, **Collins et al. 2017, Edkins et al. 2013**	Cova & Salle 2005, Tikkanen et al. 2007, Skaates & Tikkanen 2003
0,9	Risk & uncertainty management	**Hermanides et al. 2010**, PMBOK, Campbell 2014, **Cano & Lidon 2009**, Dinsmore & Cabanis-Brew in 2014, Elearn 2007, **Morris 2005**, Morris 2013, **Olsson & Samset 2006**, Samset & Volden 2016, **Wearne 2014**, Williams & Samset 2010, **Williams 2016**, Williams et al. 2012, **Zwikael & Meredith 2019, Bosch-Rekveldt et al. 2010**	CII 1996, CII 2015, **Collins et al. 2017, Edkins et al. 2013, Kähkönen 1999, George et al. 2008, Gibson & Bosfield 2012**	Cooper & Budd 2007, Tikkanen et al. 2007, **Cova & Holstius 1993**, Skaates & Tikkanen 2003
0,5	Information gathering and processing	**Morris 2005**, Morris 2013, Williams et al. 2009, PMBOK, **Flyvjberg 2013, Bosch-Rekveldt et al. 2010**, **Olsson & Samset 2006**, Samset & Volden 2016	CII 1996, CII 2015, **Collins et al. 2017, George et al. 2008, Gibson & Bosfield 2012**	**Cova & Holstius 1993**, Skaates & Tikkanen 2003
0,3	Lessons learned	**Hermanides et al. 2010, McClory et al. 2017**, Samset & Volden 2016, **Williams et al. 2012**, Williams et al. 2009, **Zwikael & Meredith 2019**	CII 1996, CII 2015, **Collins et al. 2017**	Cooper & Budd 2007
0,1	Change management	Morris 2013, PMBOK	CII 1996, CII 2015, Collins et al. 2017	**Turkulainen et al. 2013**
	Execution preparations			
0,6	Contract formulation and finishing	[illegible], Dinsmore & Cabanis-Brew in 2014, Elearn 2007, **Morris 2005, Williams 2016**	CII 1996, CII 2015, **Collins et al. 2017, Kähkönen 1999, George et al. 2008, Back & Moreau 2000, Gibson & Bosfield 2012**	Cooper & Budd 2007, **Turkulainen et al. 2013**, Cova & Salle 2005, **Cova & Holstius 1993**, Skaates & Tikkanen 2003
	Front end management			
0,4	Project management methods used	**Morris 2005**, Morris 2013, Samset & Volden 2016, **Zwikael & Meredith 2019**, **Christensen 2011**, Dinsmore & Cabanis-Brew in 2014	**Gibson & Bosfield 2012**, CII 1996, CII 2015, **Collins et al. 2017, Kähkönen 1999, Edkins et al. 2013**	Cooper & Budd 2007
0,2	Governance set up	Williams et al. 2012, Edkins et al. 2013, Dinsmore & Cabanis-Brew in 2014, Wearne 2014, Williams & Samset 2010		
0,6	Team building	**Hermanides et al. 2010, Cano & Lidon 2009**, Williams & Samset 2012, Dinsmore & Cabanis-Brew in 2014, **Mesa et al. 2016**, **Morris 2005**, **Wearne 2014, Williams 2016, Williams et al. 2012**, Yun et al. 2016	CII 1996, CII 2015, **Collins et al. 2017, Edkins et al. 2013, Kähkönen 1999, Gibson & Bosfield 2012**	Cooper & Budd 2007, Cova & Salle 2005, **Turkulainen et al. 2013**
0,3	Internal integration		CII 1996, CII 2015, **Collins et al. 2017, Edkins et al. 2013, Eun ho et al. 2016**	Cooper & Budd 2007, Turkulainen et al. 2013, Cova & Salle 2005, Tikkanen et al. 2007, **Cova & Holstius 1993**
0,2	Project quality control	**Hermanides et al. 2010, Flyvjberg 2013, Olsson & Samset 2006**, Pillai 2008, **Yun et al. 2016**	CII 1996, CII 2015, **Collins et al. 2017**	

APPENDIX D: THE ROLE OF PROJECT MANAGER

		Empirical papers											Theoretical papers								
Front end activity	**Role of PM**	**Artto et al. 2001**	**Biesek et al. 2014**	**Edkins et al. 2013**	**Hermanides et al. 2010**	**Morris 2005**	**Olsson & Samset 2006**	**Turkulainen et al. 2013**	**Wearne 2014**	**Williams et al. 2012**	**Yun et al. 2016**	**Zwikael & Meredith 2019**	**Campbell 2014**	**Dinsmore & Cabanis-Brewin 2014**	**Elearn 2007**	**Morris 2013**	**Neal 1995**	**Samset & Volden 2016**	**Williams & Samset 2012**	**Williams et al. 2009**	**Williams et al. 2019**
Business case and strategy																					
Business case	Supporting the estimation and the viability of the case.			x		x		x					x							x	
Project strategy	Supporting the upper management to establish project strategy		x	x		x										x				x	
Setting project goals and objectives																					
Stakeholder management	Supporting in relationship establishment and mapping out key stakeholders		x			x							x		x	x					
Requirements management	Identifying the requirements from execution perspective and ensuring capabilities		x					x					x	x		x	x			x	
Goal setting and alignment	Helping to establish and align goals and measurements.			x	x								x		x						
Formulation of offer and concept																					
Project concept	Support making the internal project definition and establish understanding of the project.		x	x				x	x		x		x	x		x				x	
Offer formulation	Helping in formulation and pricing.					x		x								x					
Negotiation	Can help in negotiating and when changes occur.							x													
Technical solution selection	Can help support technological solution selection.	x		x		x		x			x			x		x				x	
Basic design (engineering)	Can help in validating desings				x																
Project execution planning	Should draft the schedule, budget etc. and support others doing these.			x		x			x		x					x		x		x	
Subcontractor management	Establishing relationships to subcontractors and helping in selection.			x		x										x				x	
Offer and concept formulation support tasks																					
Constructability/feasibility review	Can help to assess the viability/constructability of the design.				x										x						
Value and benefits management	Helping in understanding and establishing benefits and ensuring	x				x					x					x	x			x	
Risk & uncertainty management	Supporting in identifyin the risks.		x	x	x	x			x	x			x		x	x				x	
Information gathering and processing	Being execution expert in the front end.			x	x			x		x		x	x					x	x	x	x
Lessons learned	Collecting from earlier projects.											x									
Change management	Controlling and commenting changes.							x	x												
Execution preparations																					
Contract formulation and finishing	Helping to identify a feasible scope and better understanding what is included. Project resourcing			x	x	x		x	x				x			x					
Front end management																					
Project management methods used	Using project manafement experience and tools to help manage front end.		x			x	x				x				x	x				x	
Governance set up	Establishing relationships and governance practices				x									x		x					
Team building	Giving opinions and helping in resourcing in FE.				x						x			x	x	x				x	
Internal integration	Bringing the execution view.		x	x	x	x		x								x			x		x
Project quality control	Validating the designs and plans.				x	x					x										

APPENDIX E: INTEVIEW STRUCTURE

Background information

1. Previous experience and current role in the company
2. Main responsibilities and tasks

General process and tasks

3. Describe the sales phase/front end in general
    a. Beginning and end definitions?
    b. Step by step process and main activities in them (focus areas), is something missing?
    c. What is good and what is bad?
    d. How are the responsibilities defined?
    e. How does the process compare from project to project?
        i. How does complexity/project size affect?
    f. What would you consider to be the most important tasks/things and why?
4. What are good management practices for the front end?
5. What is project manager's role and tasks in the front end?
    a. What kind of value does project manager bring to the front end?
    b. What tasks should project manager be involved in the sales phase and why?
    c. When should project manager get involved?
6. How would you describe the impact of front end on the project execution?

TASKS AND ROLE

7. Describe on overall level the last completed project you were involved with.
    a. Short summary of the project, highlights
    b. How long the sales phase took?
    c. Complexity considering organization, technical solution and environment?

8. What were the main activities in the project front end? How did the front end progress?
    a. How was the front end managed and how were the responsibilities divided?
    b. How where the specialties of the project considered?
    c. Who was mainly responsible for what? Main activities.
9. How was the project manager involved?
    a. The point of involvement, tasks etc.

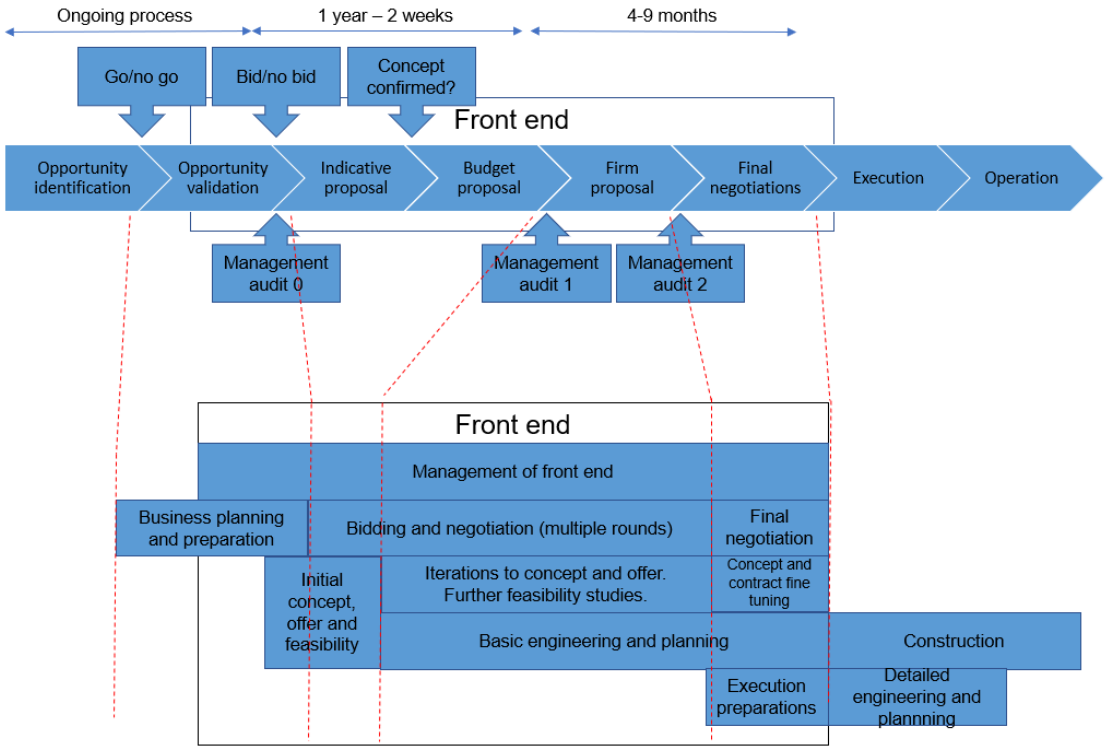
Effect on project performance

10. How did the sales phase/front end go?
11. How would you describe the project's success (financial/execution)?
12. What kind of effect do you think that sales phase had for the project?

Development ideas

13. What do you think are the strengths of the current sales phase/front end?
14. What do you are the biggest challenges in the current sales phase/front end?
15. How would you improve the sales phase/front end? Is something missing, is there too much of something?
16. Anything else worth mentioning?

APPENDIX F: COMPARISON OF THE THEORETICAL AND EMPIRICAL FRAMEWORK



The Process description above is based on the case companys front end process. The process below is the process description from the literature review.