PRE-PLANNING IN CONSTRUCTION

DIFFERENCES IN 'DESIGN-BID-BUILD' AND 'DESIGN-BUILD' APPROACHES

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Synopsis

The following report is about pre-planning in construction. The purpose of the report is to identify the differences in pre-planning using 'Design-Bid-Build' and 'Design-Build' approaches. Information for the report was gathered using scientific articles, books, personal experience and qualitative interviews.

The report has a theoretical part based on the literature analysis about pre-planning. It describes who is involved in pre-planning and how is it done. The main research question derived from the literature studies about pre-planning.

Stakeholder analysis was made in order to identify the parties that have most influence and power during pre-planning.

Main analysis is based on the results gathered from the qualitative interviews. The respondents for include the owners, contractors, advisors and designer. The main analysis part includes the summaries of the data collected from these interviews and the analysis of the answers.

The results of the research are presented in conclusion chapter.

Preface

The following report is a master thesis for the 4th semester of Management in the Building Industry study program at Aalborg University. The report is conducted by the student Simonas Minikevicius within the period between 1st of September 2016 to 9th of January 2017.

Pre-planning in construction is a process that involves number of tasks between the initiation of the project and developments of its detailed design. Decisions during pre-planning have influence on the project progress and outcome in terms of time, costs and quality.

The report is based on research made about pre-planning in construction industry. Since there are no major differences how pre-planning is done in many of the European countries, the study was made in collaboration with Danish and Lithuanian construction companies. These companies contributed to the research by answering the questions during the interviews. The report consists of two main levels – theoretical and empirical. The first part includes analyzing the literature about pre-planning. Second part is the main analysis, where the interviews with the companies were analyzed. The purpose of this study was to find how pre-planning is different in 'Design-Bid-Build' and 'Design-Build' contract settings.

The aim of this report was to test the theory using findings in new empirical data. The research questions derived from the theoretical level of the project. Collected data is based on qualitative interviews and the respondents were selected based on their roles in the construction, companies' profiles and experiences. The research topic was selected on the author's interest to learn more about pre-planning process.

Acknowledgements

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1 Introduction

Report introduction chapter is divided into four sub-chapters. Report description chapter presents the reader what is the research focus, how it was conducted and what in included in the report. The abbreviations can be found in Readers guide sub-chapter and the Collaboration chapter introduces the parties that contributed to the research of this report. Literature review chapter introduces what is pre-planning and why is it important.

1.1 Report description

The following report is focused on pre-planning in construction. It consists of two main parts, including literature analysis about pre-planning and the empirical data analysis part. To begin with, the initial literature review was conducted to find out more about what is pre-planning and how it is done. By analyzing the scientific articles and literature it seemed as the topic could be examined even more, because the literature review did not seem to actually explain how pre-planning is done. Then initial problem questions were asked to help focus on the topic. Since the pre-planning involves different parties, the stakeholder analysis was made to see which parties have the most power and interest during pre-planning and are the best to focus on. In order to better understand the relations between those parties, the construction contracts were examined. Then additional studies were made to find out more about the pre-planning process which led to the main research question about pre-planning process in different contract types. Since there are a number of available contract forms, due to the time and resource limitation the research is focused on 'Design-Bid-Build' and 'Design-Build' contracts. In order to answer the main research question, the qualitative interviews were made with seven different Danish and Lithuanian companies and organizations involved in pre-planning. These include owners, contractors, advisors and designer. The purpose of the study was to find out how pre-planning is done using different contract types. The answers from the interviews are presented in this report and then analyzed. The results of the main analysis are then presented in conclusion.

1.2 Readers guide

This report consists of 7 main chapters. Each chapter is following each other in a logical order and has its' own sub-chapters. The first chapter is 'Report introduction' and it introduces the report ant the research topic. The following chapter is 'Construction contracting' and it introduces the different approaches for construction contracts and identifies the stakeholders involved in pre-planning. 'Pre-Planning' chapter describes the pre-planning process using the findings from the literature sources. After the chapters based on theoretical studies the 'Purpose of study' introduces the research question and sub-questions. It also describes how was the data collected and analyzed for this report. Next chapter is 'Main analysis' and it presents the findings from the interviews and their analysis. This chapter then is followed by 'Conclusion' and 'Further research' chapters.

In order to make it easier for the reader to follow the report, a list of abbreviations is presented below:

DBB – Design-Bid-Build

DB – Design-Build

SOW – Scope of work

VGTU – Vilnius Gediminas Technical University

DDEO - Danish Defense Estates and Infrastructure Organization

PDRI - Project Definition Rating Index

PPP – Public Private Partnership

LCCA - Life Cycle Cost Analysis

BIM – Building information modelling

1.3 Collaboration

This report was conducted with the employees of seven different Danish and Lithuanian companies and organizations that are working with the construction projects. The companies are taking roles as owners, contractors, designers and advisors in construction industry. The interviews for this report were conducted with the representatives from Danish Defense Estates and Infrastructure Organization, Vilnius Gediminas Technical University, 'Neoprojektai' UAB, 'Gabusta' UAB, 'Rambøll' A/S, 'Innobim' UAB and 'A. Zilinskio ir Ko' UAB. The collaboration with the companies was made through emails, phone calls and visiting the companies' offices. The interviews were made with a prepared templates of open questions designed in a way that the respondents could discuss more about the topic. In order to make discussions more accurate, the respondents were informed about the purpose of study before starting the interviews. The report was made under the supervision and guidance of Kristian Ditlev Bohnsted, who was giving constructive feedback and suggestions during the supervisor meetings and email communication.

1.4 Literature review

Successful projects require thoughtful conception, up-to-date design, skillful planning and well executed construction (American Society of Civil Engineers, 2012). During all the project phases the managers and the owners have to focus on project time and costs. (Jesper Kranker Larsen, 2015) Projects are more successful if the plans are carefully prepared and developed in advance (Robert B.Angus, 2003). The decisions made in the beginning stage of the project lifecycle has much greater influence in terms of cost than the decisions made in the later stages. The decisions about the building construction and design will influence later the operating costs and revenues over the facility lifetime (Hendrickson, 2008). During the initiation phase of the project the designers and engineering consultants should be consulted for the professional advice about different alternatives and their influences on project sustainability (Li-yin Shen, 2009). The construction project chance of success are greater if the owner carefully thoughts and studies the process before initiating the construction (Richard H. Clough, 2015). Before the building process begins the owner needs to assess his capabilities, evaluate the available resources, compliance with laws and regulations, the completion of any necessary site preparation, review possible construction alternatives and contractual arrangements (American Society of Civil Engineers, 2012).

Pre-planning is referred also as Pre-project planning (Jesper Kranker Larsen, 2015) (Hyojoo Son, 2012), conceptual planning (Peerasit Patanakul, 2010) (G. Edward Gibson Jr., 2006), feasibility analysis, schematic design and early project design (G. Edward Gibson Jr., 2006). Pre-planning of the

project is the project phase that includes all the tasks between initiation of the project to its' detailed design (G. Edward Gibson, 2001). It is the process of developing sufficient strategic information that can be used to address risk and decide how to allocate resources to maximize the chance of project success (Gibson, 1994). However pre-planning requires dealing with some challenges. (J.K. Larsen, 2013) States, that one of the challenges is the different views of strategic and construction planning between the project partners. Pre-planning phase requires a lot of information that can help to identify the possible risks as early in the process as possible. Risks identified in this early stage of the project can be potentially resolved by planned manner without affecting the overall result of the project. Therefore, the increased project predictability leads to schedule and costs savings. (Chung-Suk Cho, 2001) The earlier in the construction process the planning is performed the greater influence it has on the project outcome (see Fig 1.1). (G. E. Gibson Jr., 1995) (Awad S. Hanna, 2010).

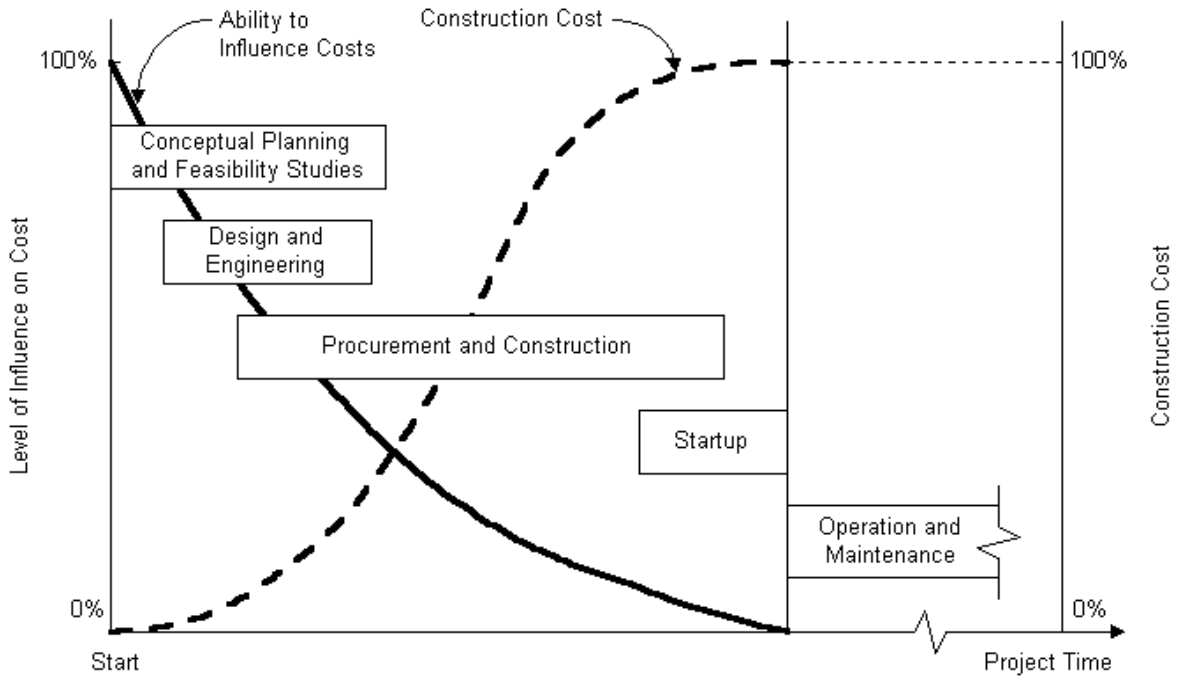

Figure 1.1 Influence over the project costs over the time (G. E. Gibson Jr., 1995)

The level of project success is set by the construction project parties' level of planning and control before and during the construction process (Jesper Kranker Larsen, 2015). Most of contractors are performing some amount of pre-planning before initiating the construction process. According to (Awad S. Hanna, 2010) the construction projects that were carefully planned were performed more successfully reaching an average profit margin of 23%, while the projects that were poorly planned experienced the profit margin of 3%. Deadline for the design and the construction stages are decided in the early phases of the project, however due to the project complexity and owner's changes late in the project the deadline can be adjusted. Meanwhile, the budget for the public projects cannot be increased. (Jesper Kranker Larsen, 2015). According to (J.K. Larsen, 2013) pre-planning has a linear positive impact towards the construction project meeting a budget, improved quality and reduced risk.

1.4.1 Strategic milestones

Milestones are clearly defined project objectives most commonly on the critical path (Keith Potts, 2014). Project milestones are used in project management in order to mark specific points along the project timeline. According to (Jesper Kranker Larsen, 2015) most of the owners and contractors understand the benefits of pre- planning, but then again together with this method they are also using strategic milestone planning. (Jesper Kranker Larsen, 2015) Deliberates it is important to combine those two planning perspectives. (Eriksson, 2010) Considers it is important to involve the contractors in determining the milestones and control of them. Milestone is an important event that occurs in the project and can add significant value to the project scheduling. A project may have various numbers of the milestones (Carmichael, 2006). Construction schedules often have appointed milestone dates with defined completion stages of the project. For example the main contractor desires to enclose the building before 1st of November in order to perform the interior work easier during the winter (Barry B Bramble, 2011). The milestones do not change anything on the project, but for a lot of people it is easier to understand it (Verzuh, 2008). Establishing milestones enhances the focus on the schedule and construction plans and makes project participants feel more involved in the project (O. Salem, 2006). According to (Jan Terje Karlsen, 2008), reaching project milestones is one of the critical factors in building the trust between the stakeholders involved in the project. Making the contractors to focus on specific milestone increases the contractor commitment to the schedule and put additional effort if necessary in order to increase their speed and finish the work on time (Eriksson, 2010). As stated by (Eriksson, 2010) many of the contractors prefer more frequent milestones to avoid increased work load at the end. However, (Jesper Kranker Larsen, 2015) says that further research is needed in order to understand how combining the pre-planning together with time-plans adjustments affects the outcome of the project.

1.4.2 Project scope

The first step for establishing the project timeline, allocating resources and setting project goals is to define what is needed. The project scope can also be referred as ‘statement of work’ or sometimes ‘charter’ (Verzuh, 2008). Project scope definition helps to select, define and prepare for the construction project. It is a part of the project planning that involves determining and documenting a list of the specific project goals, features, functions, deadlines and costs. According to (Yu-Ren Wanga, 2010) pre-project planning process contains a detailed framework for project planning and includes project scope definition. However, (Carmichael, 2006) states, that projects are done exactly as planned and the project scope rarely stays constant from the start until the end of the project. In the earlier sources (G.E. Gibson, 1996) noted that one of the most problems negatively affecting a construction project is an inadequate or poor project scope definition. As stated by (Evan Bingham, 2016) projects with improved early understanding of scope definition elements shows better project outcomes. Poor definition of the project scope leads to the higher costs of the project, due to the changes which affects project planning, cause rework and increases project time. In case of changes on scope of the project it has a negative effect on the process and the successful outcome becomes very dependent on manager’s ability to manage those changes (J.K. Larsen, 2013). Changes in the project scope can be caused by too optimistic forecasting in the initiation and the planning stages of the project (Jesper Kranker Larsen, 2015). Scope definition during the pre-planning allows more accurately predict project cost and schedule for detailed design and construction, also involving stakeholders and obtaining their commitment in scope definition process typically results in fewer user initiated changes during design and construction (G. Edward Gibson Jr., 2006). Project scope can be described by listing all the activities that leads to the end of the project. Scope establishment is a

part of initial broad planning problem (Carmichael, 2006). According to (Serrador, 2015) scope of the project is closely related to issues of specifications, technical performance and functional objectives. Project scope is not only an aspect of project efficiency, but it also has an impact on customers and their satisfaction. The project needs to be stopped as soon as the owner is sure that the project scope cannot be achieved (Ruud Binnekamp, 2006).

Planning is based on the forecasts and assumptions and the conditions during the project execution stage might be different. The inevitable changes relating to technical specifications, implementation method and owner demands or scope of work changes occur during the project life-cycle (Carmichael, 2006). Scope of work (SOW) is the part of agreement between two parties where the work to be performed is described. The SOW should contain the milestones, reports and end products that are expected to be done by the performing party. According to (El-Sayegh, 2008), the owner can often improperly intervene the construction phase by requiring design changes or will try to rush the project for time and money reasons. This will result in poor scope of work definition. As identified by (M.S.Ramabodu, 2010), scope of work changes on site is the most influential factor for time and costs overrun. According to research by (El-Sayegh, 2008) lack of scope of work definition by the owner is ranked number 6th in most significant risk factors according to the international construction companies.

1.4.3 Focus area

From the information gathered during the literature review it can be concluded that the decisions that are made in the pre-planning phase of the construction have a great influence on the project outcome. The decisions in the early conceptual stage have influence on time, costs and other factors for the construction project. Because later changes on the project are more expensive, careful pre-planning has a positive impact towards the project progress.

The pre-planning deals with certain challenges. To achieve success of the construction project it is important for all the parties that are involved to be part of the pre-planning perform it carefully. Most of contractors do some pre-planning together with the time-plans adjustments where they establish certain milestones of the project. Establishing the milestones helps to strengthen the project management and control. The design phase of the project has a significant influence on the decisions that are made in order to plan the project, execution and sustainability of the building. Using prefabricated elements needs to be foreseen in project's design. These elements can be beneficial for the project in terms of time, quality and budget. However, they require special attention during the design phase, because it can be complicated to modify them after. Another challenge for the pre-planning is the project scope definition. Clear scope definition allows more accurately predicting project cost and schedule. Yet significant changes of the project scope can have negative effects on the project outcome.

From the literature review it seems that decisions made early in the conceptual phase has a high influence on the project outcome. Yet, most of the literature sources stresses out the necessity and benefits of pre-planning or provides checklists to see if how well pre-planning is made. Yet, it seems that the authors rarely discuss how pre-planning should actually be done. Therefore, the research is aimed to answer the question: **What is pre-planning and how does it help to reach a project success?**

In order to help answer this question the following secondary research questions will be used:

- What parties are involved in pre-planning?
- How is pre-planning initiated?
- How the pre-planning can be combined with time-plans adjustments?
- What actions can be taken during the pre-planning phase in order to reduce the possible significant changes of the project scope during the later stages?
- What methods and tools can be used to make pre-planning more accurate?

2 Construction contracting

Construction contract is determined in the early stages of the construction project and it affects how the parties are planning for the project. Depending on the type of construction project, its scope and relations between the parties involved, the planning and the management of construction can be very different. The structure of the project team depends on the type of the owner's organization (i.e. public bodies, private companies). It also depends on the contract type that owner chooses to hold with other parties involved in the project. All of these aspects involve different considerations in the construction planning and management.

There are number of different parties involved in a construction projects. Each one of those parties has their own role regarding the building project. These roles together with the rights and responsibilities of the parties are defined in the contracts which are formed between the involved participants. There are a number of contract forms and types available for the owners of the construction projects. The owner has to make a decision which type of contract form is most suitable for to the situation. The selection of contract affects the relation between involved parties. If the owner is a public body it has to choose the contract form that is placed on them by applicable law. As stated by (Herbert Robinson, 2015) the procurement strategy provides the direction and the duration of the project. It also defines the risk that client takes to deliver a construction project.

2.1 Stakeholder analysis

Every construction projects have a number of people involved. They combine their effort in order to create a project design and make a project construction. Involvement of the team members at right timing of the project is critical for achieving the owner's objectives and requirements. Generally, the earlier team members are involved and the greater their contribution is the greater benefit to the owner (American Society of Civil Engineers, 2012). During the early stages of the project, the owner is the main figure to shape the relations among the other team members. According to (American Society of Civil Engineers, 2012), one strategy for the owner to achieve more cohesive contribution is to involve the designer early in the project conceptual development phase.

Construction contracting has different parties involved. Every party has its own purpose and responsibilities towards other parties. Stakeholder analysis provides an overview about relationships between the parties involved in the pre-planning phase. Stakeholder matrix below (fig 2.1) provides better understanding which parties have particular interest in pre-planning phase and how influential they are.

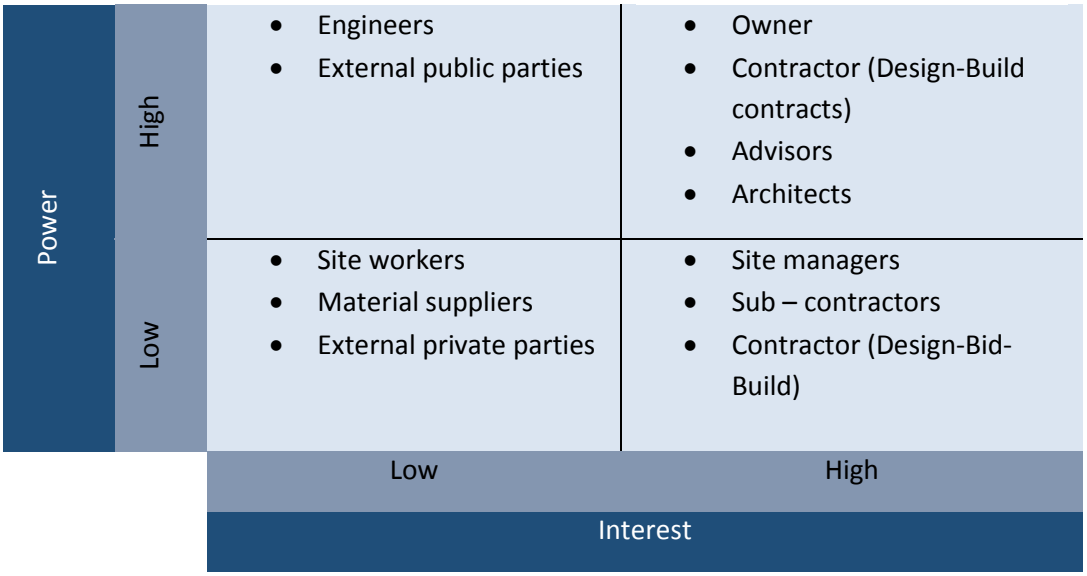

Figure 2.1 Stakeholders analysis in pre-planning

According to (John M. Nicholas, 2012) it is important to ensure good working relationships with stakeholders who have high power and high interest, since they are highly important for the project success. Stakeholders with low power and high interest bring certain benefits for the project but their influence is low. However, they should be taken into consideration if they have certain interests that need to be taken into attention. Then stakeholders with high power and low interest can have a significant influence towards pre-planning. Yet their main interest can be focused towards something else. Therefore, they will need careful monitoring and management. Stakeholders with low power and low interest might also require limited monitoring but they are low priority.

2.1.1 Owner

'A successful project begins with the owner (American Society of Civil Engineers, 2012, p. 16). The owner is the main figure of the construction project since he or she needs to take the initiative to start construction process. Also the owner is responsible for financing the project. Typically, he will think in terms of finances how much money can be spent to satisfy his or her needs. Owners can be categorized as being private and public owners. Private owners can be private individuals, companies, corporations. These owners use their private funds to finance the construction project. Public owners have the public or government funds involved to finance their projects. Public projects are designed to meet the public needs (Richard H. Clough, 2015, pp. 3-4). If the owner is private person then he will decide which company to enter a contract with. Meanwhile if the owner is a public body the bids for the project are called. In this case there are two options: either the lowest price bid wins or the most economically advantageous offer.

The owner has a right towards the contractor to direct to accelerate the work as well as deduct the payment if the contractor made defective or uncompleted work. At the same time the owner carries the responsibilities towards the contractor. The owner has the obligation to pay contractor for his work, also to provide contractor with the property surveys that locates and describes the project. He also needs to make sure that the construction site has an access to it. If there are two or more prime contractors hired for the project, then the owner may be responsible to coordinate these contractors and their operations on the construction site. However, the owner cannot give direct instructions to the contractor regarding to what procedures or methods he should use. Plus, the owner should not

interfere with the contractor's work without any sensible reason or in some other way to overly direct and control the work. (Richard H. Clough, 2015, p. 172)

Depending on the form of the contract the owner might be responsible for providing the contractor with the project design. Since the contractor must follow the contract documents, it is the owner's duty to make sure that the documents are accurate and sufficient. If the provided drawings and specifications are insufficient or defective, the contractor has a right to recover the costs for it as well as get a time extension. Also in this case the contractor cannot be liable for the end results and is not liable for the design defects. However, the contractor needs to inform the owner if he finds any significant errors in the design. (Richard H. Clough, 2015, p. 172)

Owner's involvement in the early stages of the project is very important, even if he may have very little experience in the construction process. According to (G. Edward Gibson Jr., 2006) many owners facing the uncertainty in pre-planning appoints entire process to the contractor, which later leads to negative results.

2.1.2 Designer

The architects-engineers are the party that develops the project concepts, plan and designs the solutions to fulfill project objectives. Both architects and engineers are licensed professionals. This party is responsible for designing the project. If the architect designs a building, then other engineers provide the assistance with other aspects of the building design. For example, structural engineer can be called to do the design and analysis on the structural system of the building or on individual components of it. A variety of other consultants may be involved by the primary designer to provide their assistance with specific parts of the building project. Typical professional design sub-consultants could be geotechnical, mechanical, electrical, plumbing, fire-protection engineers, structural engineers, field surveying, environmental planning and other technical specialists (American Society of Civil Engineers, 2012).

The designer has list of requirements and expectations from the other stakeholders of the project. The owner expects timely decisions and adequate communication regarding his performance. Furthermore, the designer is required to have a reasonable schedule and budget then prepare an appropriate project scope definition. These expectations are distinct from responsibilities. The designer is responsible for following the provisions of the construction-phase design services. Also he is liable for fulfillment of the contractual obligations to other team members and developing well-defined contract documents. He has to perform his work in compliance with applicable laws and regulations, fulfilling professional standards. The designer must follow project schedule, budget and program. (American Society of Civil Engineers, 2012)

2.1.3 Main contractor

Main contractor enters contract with the owner and provides him with the services defined in the contract. Contractor services are different depending on the type of contract, but the most typical are to coordinate sub-contractors, building parts of the projects, design documents review, providing the owner with professional advice, project planning and designs, cost monitoring, scheduling and other management services. In most of construction projects there is one Main contractor. He has a responsibility to the owner to finish construction on time and under the agreed price. The project also must be completed in accordance with the requirements stated in the contract documents.

Generally, the main contractor decides how much of the work on the project he will perform with his own labor and how much will be done by the subcontractors under his supervision. The contractor is expected to supervise the process of work construction on the project. The contractor must follow the rules and the laws, regarding the work safety, employment, licensing, explosives and other particulary hazardous work, trafic and pedestrian control and other aspects of work. Contractors also must follow the regulations designed to reduce the air and noise polution caused by the construction (Richard H. Clough, 2015, p. 175).

In case when the owner has a relation with the designer, the contractor has to follow the drawings and specifications provided in the contract. If everything is done in accordance with these documents, the contractor cannot hold a responsibility that the project has no defects or that the project is going to accomplish the intended purpose. On the other hand, if the contractor makes deviations from the design documents without permission from the owner the contractor assumes the risk of the variation. The contractor has no duty to review or verify the design unless that is specified in the contract. However, the contractor is still responsible for the faulty or defective work (Richard H. Clough, 2015, pp. 175-176).

2.1.4 Subcontractor

A subcontractor is a company that has a contract with a main contractor. The subcontractor usually has a specific task in part of the building construction process. By using the subcontractor services, the main contractor can have the workers with required skills without maintaining the full-time employees on a payroll. In addition to this, these skilled employees and their companies have their own specific tools and equipment that is necessary to perform certain tasks in the construction process. Subcontracting companies can provide full time employment for their workers by sending them to different construction projects to perform their specialized tasks. These types of tasks can be electrical work, plumbing works, painting and others. In many cases qualified subcontractors can perform their work more quickly and at a lower cost than the main contractor could. Also since they are performing these specialized tasks day after day it can be claimed that these subcontractors are able to consistently complete their work at a higher level of quality. The subcontractor agreement with the main contractor does not establish a relationship between the subcontractor and the owner. When the main contract hires a subcontractor to execute a part of work, the main contractor remains responsible to the owner for the negligent performance of the subcontractors (Richard H. Clough, 2015, p. 11).

Quotes from the sub-contractors are the important part of the project estimations. Most of the contractors are willing to work with the same sub-contractors that they have worked before. Before the bid day, the estimator will inform sub-contractors about the work and invite them to prepare and submit proposals for their part of the work. The sub-contractor will examine the contract documents, preliminary drawings and specifications for his part of the work. The sub-contractor's activities or part of work is referred as his scope of work (Richard H. Clough, 2015, p. 139). The sub-contractor will estimate his costs on materials, labor, machinery, indirect costs and will add his contribution margin before sending his proposal to the contractor. The contract with contractor and sub-contractor will contain the scope of work and the price for the sub-contractor's services (Richard H. Clough, 2015, p. 141).

2.1.5 Advisor

As mentioned before the construction projects have designer involved. A variety of engineering consultants can be called upon the owner or designer in order to help with certain parts of the project. For example, structural engineer can help with design analysis of the building's structural system. Other consultants like geotechnical engineers can provide with the information that is required to make a building design. (Richard H. Clough, 2015)

2.2 Types of construction contacts

Before initiating the construction process the owner has to choose the suitable contractual form for the project. Selection of the right contract can reduce the construction costs. Also the contract describes who bears the most of the risk (Richard H. Clough, 2015, p. 17). There are number of various construction contracts and they contain different provisions. There provisions are linked to specified liabilities, damages, responsibilities, requirements and other disclaimers. The purpose of these provisions is to protect owner and the designer by transferring the risk of uncertainty to contractor. The contractor has to study and evaluate all the contract documents and provisions before signing the contract, while the project is still being considered. After the contract is signed, the contractor is bounded by all the provisions and clauses in it. If the contractor is uncertain about some legal aspects in the contract he should get assistance from the attorney before any binding commitments of stated in the contract comes into effect. According to (Herbert Robinson, 2015) there are two fundamental problems with construction contracting. The first is lack of precision to define the project, cover the entire scope of work including all possible risks. It is often referred as 'incomplete contracts'. It creates the second problem that is potential for abuse and mistrust in the relationships between the parties.

2.2.1 Design-Bid-Build

Design-Bid-Build (DBB) also can be referred as 'Main contract' is the type of agreement where there is one main contractor who has a contract with the owner (see fig 2.2 below). The Main Contractor is responsible for the execution of the project and fulfilling all the owner's demands stated in the contract documents. In this case the Main Contractor has a responsibility to the owner for the delivery of the finished project for the time and cost specified in the contract documents. In this type of contract, it is owner's responsibility to coordinate with architects and engineers involved in the construction project.

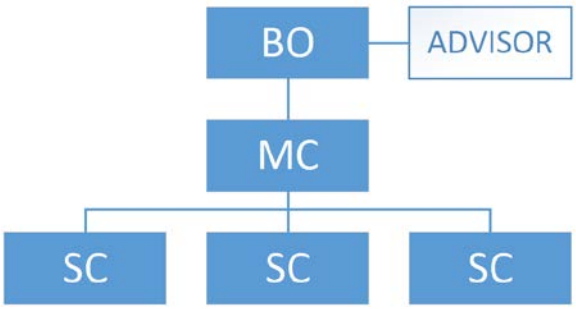

Figure 2.2 Main contractor

Typically, in this type of contract the Main Contractor is executing certain part of the project and the remaining job is done by various specialty contractors. In this type of contract, it is the Main

Contractors responsibility to coordinate and direct activities of the sub-contractors and other third parties involved in the construction. In case the work is not done in accordance to the contract, regardless of whether the defects of work were caused by the Main Contractor itself or by the sub-contractor, the Main Contractor is liable for the damages to the owner. (Richard H. Clough, 2015, p. 25)

This type of contract worked for many years and one of advantages for this type of contract is that the owner knows the price before construction begins. Some other strengths of DBB contract according to (Keith Potts, 2014) are:

- Increased control and clear accountability during every stage of the project.
- More competitive prices between the Main Contractors.
- Opportunity to get most of combining best design and contracting skills.
- Client's ability to nominate the particular specialist.
- Flexibility in design development until the contract preparation stage.
- This type of contracting for many years was used in the construction and is well tested how it works in practice and law.
- Client's ability to recover costs from main contractor in case he fails to meet contractual obligations.
- It clears the ambiguities in the documentation prior to tender.

However (Thomsen, 2006) identifies eight problems with this type of contract:

- Specialization – not only advisors are split into specialized divisions but also builders have to split into various specialized trades (for example: plumbing, electricity, carpenters, etc.)
- Inaccessible technical knowledge – the architects and engineers have no contact with the contractor during the design phase.
- Wasted effort – since the manufacturer cannot be the part of the design process, the advisor does not necessarily show the same assemblies as the contractor choose. This leads to the construction drawing replacements with the drawings that manufacturer prepares.
- Long schedules – since the contractor is unknown before the design is complete, the builder cannot start the work. Yet there is no reason to delay the work until the design details are settled.
- Unpredictable costs – the project may start one year or even more before its bid and factors like inflation and financial crisis are affecting the costs. However, price fluctuations for glass, steel, concrete and other building materials can influence the costs of the project even more.
- Chaotic procurement – before bidding on the project the main contractor will try to get the prices from as many sub-contractors as possible. However, the sub-contractors may give higher bids first time and then lower the price last minute before the bid day. Therefore, the main contractor is not always able to double check the totals and also the lowest price is not always communicated to all the bidders.
- Industrialization – the manufacturers have the most knowledge about their products. However, Design-Bid-Build type of contract does not involve manufacturers into the project design phase.

According to (Thomsen, 2006) for this type of contract to work the drawings and specifications of the building project must be prepared almost perfect. It also works if the owner has built number of similar buildings or sometimes it works when the owner has a talented staff of engages a third party to review the drawings.

2.2.2 Design-Build

Design–build (DB) contract can be also referred as the 'Turnkey' contract. In this type of contract form the owner has an agreement with one single contractor (see fig 2.3 below). In this type of arrangement, the contractor is responsible for providing the owner with a building design and construction services.

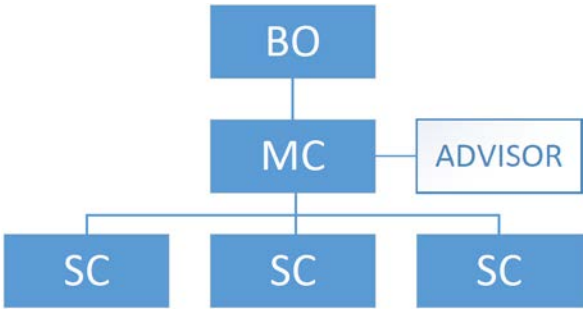

Figure 2.3 Turnkey contract

In Design-Build contract the owner transfers the responsibility for both design and construction to the contractor. The main advantage of this type of agreement is that it allows direct communication between the parties who will design the building and those who will perform the construction of it. Compared to Design-Bid-Build, where the designers usually provides the design for the project and authoring the bid documents without the assistance of the contractor, Design-Build contract allows the owner to avoid the situation to be caught in the middle of the disputes between the designer and the contractor (Richard H. Clough, 2015, p. 25). Therefore, the main advantage of this method is that construction manager is involved during the design process as well as pre-planning phase of the project. According to (Thomsen, 2006) there are additional advantages. In traditional Design-Bid-Build contract if the contractor and the designers have conflict it can be difficult to determine who is responsible for the errors. In that case the owner is stuck in the middle between two arguing parties. The Design-Build type of contract allows owner to eliminate this. Another advantage for Design-Build type of contract is improved cost control. The contractor may approach the Design-Build process with a fixed limit of construction cost. Then during the procurement process the contractor is provided with a feedback about the construction documents. By involving designers to participate in their practical application allows having more transparent communication, documentation and costs. According to (Keith Potts, 2014), in the Design-Build approach the contractor and designer are able to consider the project at the earliest conceptual stage. This can help the contractor and designer to plan and make the project design in accordance to site conditions, accessibility, available resources, labor skills, etc. (Keith Potts, 2014) Identifies several strengths and weaknesses of Design-Build approach.

Strengths:

- Reduced project execution time.
- Single responsibility for the design and construction.
- The client can make demands about desired quality and performance.
- Price certainty about the project is obtained before construction starts.
- Design-Build allows various inputs from the client towards the project design.
- Contractor's participation in the design phase can lead to more economical solutions for the design.
- It is less adversative than Design-Bid-Build approach.

- During the tender there is a competition on alternative design solutions.
- Early collaboration between the designer and contractor reduces the variations in the design.

Weaknesses:

- In case the owner was not specific enough expressing his needs, the project proposals may not meet the client's requirements.
- There is a risk of getting cheapest building in terms of whole-life costs.
- The client does not have a control over design quality.
- The owner has to prepare clearly defined brief at the very beginning of the project.
- Changes after initiation are expensive.
- The tender analysis may be subjective.

According to (Keith Potts, 2014) in practice the owner sometimes may hire the designer in order to help develop the terms for the project. Then the other designer is employed by the contractor to develop a detailed design. The owner's designer should not be contractually linked to the contractor.

2.2.3 Trade-By-Trade

In the separate contract system, the owner has a contract with more than one main contractor (see fig 2.4). When the owner applies the separate contract system for the construction project, the owner needs to subdivide the project into the segments, elements or phases of construction and define a work package for each of the various parts. This way the owner defines the scope of work for each contractor which is then needs to be well-defined in their contract documents. The defined scope of work for these contractors includes a specific well-defined part of the overall construction project. Each contractor is responsible for completing his scope of work in accordance with the arrangements in their contract documents. The contractors can choose to perform the work by himself or hire a sub-contractor (Richard H. Clough, 2015).

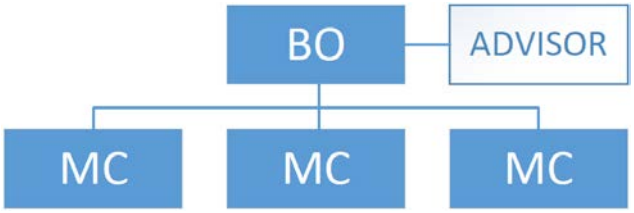

Figure 2.4 Separate contract system

Using the separate contract system can be beneficial to the owner. According to (Richard H. Clough, 2015) this type of contract can lead to shorter contract duration, finding highly skilled contractors for work and lower prices due to increased competition also if owner selects this contract system he can save on the margin on the work that would be sub-contracted. However, the use of separate contract system is very complicated. It requires not only well-prepared contract documents but also the work has to be carefully planned, scheduled, coordinated and controlled. In order to benefit from this contract system, the owner needs to have very good management skills.

2.2.4 Public Private Partnership

A public private partnership (PPP) is a long term agreement between the public and private sector. In this type of arrangement, the ownership and responsibility is assigned for a private party. Then that party is responsible for the design, construction and operation of the building (see fig 2.5 below). The building is returned for the public party at the agreed operating period (American Society of Civil Engineers, 2012). According to (Keith Potts, 2014) this approach is most suitable for a big scale projects which are designed to provide services.

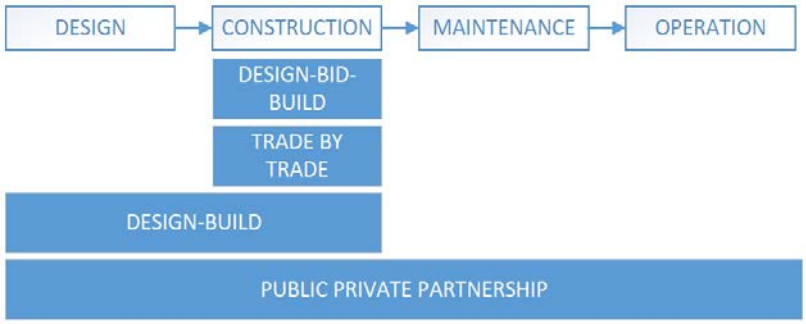

Figure 2.5 Public Private Partnership

The PPP agreement has several advantages. As stated by (LiYaning Tang, 2010) PPP approach can help to save resources and share risks at different stages of the project. Involving private sector to manage the project allows government to focus on its own competencies. However, (LiYaning Tang, 2010) states that since PPP method always requires special legislation, it can sometimes be often misunderstood and stakeholders can find it hard to handle it.

2.2.5 Partnering contract

Partnering contract is an informal contract that defines the goals and guidelines for stakeholders' communication and conflict resolution. It can be linked to documents that define legal responsibilities. Partnering contracts does not constitute business partnership or a binding agreement. Establishing partnering contract can be useful in enhancing the project quality. The main purpose of this contract is to complement the binding terms and conditions of the main contract (American Society of Civil Engineers, 2012). There are many drafts prepared for the partnering contract forms. For example, FIDIC contract gives options to suite different type of procurements and better protects the contractors that are working internationally (Fewings, 2005). Meanwhile PPC2000 Partnering Agreement was specially drafted for partnering projects and it integrates full partnering team, the procurement process and procedures for running the project (Keith Potts, 2014).

2.2.6 Joint Venture

The joint venture is a temporary form of business when two or construction companies forms a single business entity for a single construction project. This way the contractors' temporary unites their assets, resources and skills for a project and separates again after the completion of the project. Typically, this type of arrangement is formed between the companies who would not be able to perform the work alone, for example due to the financial capacity. Two or more companies can form a joint venture and submit a proposal in the name of joint venture. Joint venture usually is a very complicated formation and therefore it requires legal and counseling in order to be established. (Richard H. Clough, 2015)

3 Pre-planning

The purpose of pre-planning is to identify the possible risks in the early stages of the project. When the risks are clearly identified, the resources can be allocated to minimize those risks and avoid time and cost overrun (G Edward Gibson, 2012). Construction planning and managing is focused on creating the right sequence and performance of activities during the project execution. According to (Frank Harris, 2013), planning of the construction projects can be divided into two levels – strategic and operational. Strategic planning includes the selection of project objectives that consist of project scope, procurement ways, schedules and financing options. This planning results in creating a framework of what the project has to achieve and how it will be carried out. In contrast, operational planning covers each activity associated with a project. This planning is more detailed and it provides better understanding about resource requirements that are not visible at the strategic level.

In the construction project the parties responsible for planning can be grouped by their role in the construction process (Frank Harris, 2013). The owner together with designer can start planning the construction and include major milestones even before the contractor is involved. After the contractor joins the project team, he needs to revise the construction plans to the details necessary to start the building process (American Society of Civil Engineers, 2012). (G Edward Gibson, 2012) divides pre-planning into seven different stages relative to the project lifecycle (see fig 3.1 below) and states that in order pre-planning to be effective, first three stages (feasibility, concept and detailed scope) needs to be performed adequately and in sequence. The sequence of these phases is important because every phase provides the next stage with required information and reduces the risk.

Figure 3.1 Pre-planning gate phases (G Edward Gibson, 2012)

A feasibility phase consists of assessing the resources available for the project also developing clear understanding of the project objectives. The next phase includes aligning project team and basic design documents analysis. Decisions about project location, technology and contract strategy are also addressed during the concept phase and it should present a plan to define a project scope. In order to execute the project within required cost and schedule, the detailed scope phase involves a detailed plan that includes high level scope definition of critical issues (G Edward Gibson, 2012).

(G. Edward Gibson Jr., 2006) developed a process map for pre-planning where the pre-planning is summarized in four major steps (see fig 3.2 below).

Figure 3.2 Pre-project planning processes (G. Edward Gibson Jr., 2006)

The first step of this map is organizing for pre-project planning. This step involves selecting a project team, drafting a project charter and preparing pre-planning strategy. The following step contains technology analysis, site evaluation, preparing conceptual scopes and estimates and evaluating then selecting project alternatives. Third step is to develop a project definition package. This step includes

analyzing project risk, documenting project scope and design, defining project execution approach, establishing project control guidelines and compiling then developing project definition package. The last step is to decide whether to proceed with a project.

The planning starts with the owner, who is responsible to initiate the project in the first place. He is the main figure regarding the project planning until the construction contract is determined. The owner has certain responsibilities regarding the project planning, that includes creating project objectives, assessing the capabilities and resources, selecting a contract form and others. The choice of contract form defines which party is responsible for communication with an architect for a project design. After the design is concluded to be finished, the contractor has to prepare plan for the construction phase. Here the contractor has to evaluate the risk, make a work breakdown structure, prepare schedule, assign resources and perform other tasks. Therefore, the following chapter is divided into three different phases of pre-planning: pre-contract planning, design planning and pre-construction planning.

3.1 Pre-contract Planning

The key activities of pre-planning include assessing the capabilities, evaluating resources, compliance with regulatory laws and guidelines, evaluating and preparing construction site, and reviewing construction alternatives and contractual agreements.

Prior to entering a contract, the owner needs to prepare general plans for construction. These plans are focused on the issues that need to be addressed before the construction work can begin instead of aiming to specific construction methods or procedures. These plans include specific project goals and objectives. The owner is responsible for the planning before construction contract is awarded. By analyzing and investigating the issues that affects the construction, the owner reduces the risks that can cause cost and schedule overruns. Pre-contract planning is often obscure process, because a lot of information is not complete, objectives are still being developed and new members are joining the team. The main figure in pre-contract planning is the owner and he is responsible for all initial planning activities, including the evaluation of his own capabilities (American Society of Civil Engineers, 2012).

3.1.1 Initiating the project

To start the project, it is critical that the owner develops a clear statement and understanding why the project is needed. Here the owner needs to define the project following with the goals and objectives of it. Also in this phase the expectations of the other stakeholders need to be defined together with possible limitations to the project and the approval process. (American Society of Civil Engineers, 2012, p. 69-70)

The owner's understanding of existing conditions is very important for developing the conceptual alternatives of the project. This information about these conditions is crucial for presenting the potential benefits and consequences of project alternatives to other parties involved in the project.

3.1.2 Creating project objectives

Project objectives are statements that describe what has to be accomplished with the project. The owner is a central the main figure in creating the objectives. Effective objectives refer to specific

aspects of a project. That can be function, sustainability, maintainability, operation, schedule, technical specifications and other requirements. The chance of achieving these objectives is higher when the owner communicates these objectives clearly and in details to other parties. The failure to clearly define and communicate these objectives can result in gap of understanding the objectives by other parties. In order to avoid this, the owner should examine them together with other project members and if necessary – qualified consultants. The analysis of the project objectives helps to eliminate or revise unattainable and impractical items from project scope and can provide more realistic evaluation of costly or time-consuming items. Clearly defined project objectives leads to development of budgets, schedules, specifications, contract terms and project scope definitions. This can be used to identify and allocate resources and responsibilities for the parties involved in the project. (American Society of Civil Engineers, 2012, pp. 10-11)

3.1.3 Creating the owner's team

Due to the complex decisions that owners needs to make, even the smaller scale project may require that the owner forms a group of advisors. These advisors may be the internal staff, independent advisors or a combination of both. The goals and objectives, that the owner has established helps to prevent possible confusion among the team members. Main function of the owner's team is to initiate and guide the project during the planning, designing and execution phases so that the project would meet desired goals and objectives (American Society of Civil Engineers, 2012). The owner's team is involved in the overall project planning from finding a location for the project to operation of the building. The major decisions that the owner's team makes will have an influence on the overall project duration and finances. These points are analyzed using the overall project plan. In later stages, the owner's team can use the project plan to monitor the project progress (Frank Harris, 2013).

3.1.4 Assessing the capabilities and resources

One of the first steps that owner has to do is to assess his capabilities. Depending on the project complexity and owner's expertise about the construction, he can benefit by involving design professionals and contractors into the process. Hiring external experts can help to enhance project quality. Another thing that owner has to evaluate are the resources available for construction. Resource availability has a solid influence regarding project objectives, design, contracting strategies and construction operations (American Society of Civil Engineers, 2012).

The owner is typically responsible for financing the project. Therefore, the owner needs to develop a cash flow plan or budget in order to finance the project when it is required. Some initial activities (i.e. geotechnical surveys, preliminary planning, etc.) might require funding before the construction begins. It is important that these activities are well-supported, since the information gathered is later used to ensure that project goals and objectives are well defined also it helps to minimize the risk of unforeseen situations which can later affect project schedule and cost (American Society of Civil Engineers, 2012).

During the early planning, the owner also has to evaluate available human resources for the project, their skills and availability. In addition, the owner needs to address if there is a need of special permanent equipment, components or preferable materials. Project stakeholders must comply with the applicable laws and regulations. This can have an impact on early planning and project team

members need to take it into consideration from the conceptual phase through the design and construction phases (American Society of Civil Engineers, 2012).

3.1.5 Construction site evaluation

Activities that affects scheduling, construction site load, activity sequencing and cost, need be addressed as part of early planning. Certain activities on construction may take place in the early planning stages – before completing construction contract documents. These activities include obtaining servitudes and property rights, preconstruction permits, demolishing existing structures or objects also it may include constructing access roads, arranging temporary and/or permanent utilities, constructing temporary buildings, setting up temporary work sheds, planning for traffic control, etc. Although some of these activities can be included in the construction contract, the owner should take into consideration that it affects timing of contract awards (American Society of Civil Engineers, 2012).

3.1.6 Evaluating alternatives

Evaluating the alternatives is one of the key aspects of early construction planning. At this stage the project team needs to evaluate possible construction alternatives and their effect on estimated cost, schedule, quality, constructability, etc. During the project progress, the team later performs more detailed reviews and modifies design where it is needed (American Society of Civil Engineers, 2012). Eventually, the reviewed alternatives are evaluated in terms of project goals. The alternatives that are most consistent to the established project goals are chosen (Hayes, 2013).

3.1.7 Selecting contract type

After the client is decided about the project feasibility, concept and budget constraints, the next step is to devise an appropriate construction procurement system. Various contract types available for the owner to choose are discussed in more detail at (2.2 Types of construction contacts). However, according to (Ezekiel Chinyio, 2009) there is no objective criteria for selecting a construction contract. This choice should be made by assessing and interpreting stakeholders' requirements. The selection of contract type has to be based on project nature and scope. In general, in construction contract has included following project parameters and constraints:

- *Cost* which includes budget allocation and contingencies.
- *Time* includes general schedules, time adjustments and sequences.
- *Quality* incorporates specifications and adjustments for desired level of quality.
- *Utility* covers running costs, maintenance, buildability and flexibility for modifications. These parameters may require owner's decision between higher initial costs and long-term savings.

The selected contract type must have an appropriate framework to deal with these variables. Inappropriate choice of the contract form can be one of the major causes of poor project performance which can result in quality issues, delays, cost overruns, increase of claims and lawsuit (Ezekiel Chinyio, 2009).

3.2 Design planning

The design phase follows after the owner establishes his goals and objectives in the conceptual stage. Here the team members have to prepare contract documents. In order to achieve sufficient quality in the design this process requires organization, control, direction and coordination. The complexity of effort that is required during the design phase is different in every project. Therefore, it is important a clear understanding of the owner's needs in order for a specialist to design the activity plan. This plan can be presented as an arrow diagram or a flowchart and identify the activities and the relationships between them in order to complete the design phase. The design plan activities need to have the duration and the labor included. With this plan the milestones can be set and the design related costs can be defined. (American Society of Civil Engineers, 2012, p. 83)

Dependent on which contract form the owner chooses it determines which party is responsible for direct communication with a designer. In the traditional 'design-bid-build' method the contractor does not have any input into the design process while contractor's input for the design is a normal part of 'design-build' or 'design-manage' type of contracts. (see fig 3.3 below) In the type of agreement where the contractor is involved in the early stages of design and planning his main role is to contribute by providing an advice to designer, concerning site planning, work practices, labor activity and costs, delivery times, material availability as well as alternative working methods and procedures. The contractor's knowledge and experience can provide a lot of valuable information for the designers to make decisions (Richard H. Clough, 2015, p. 89).

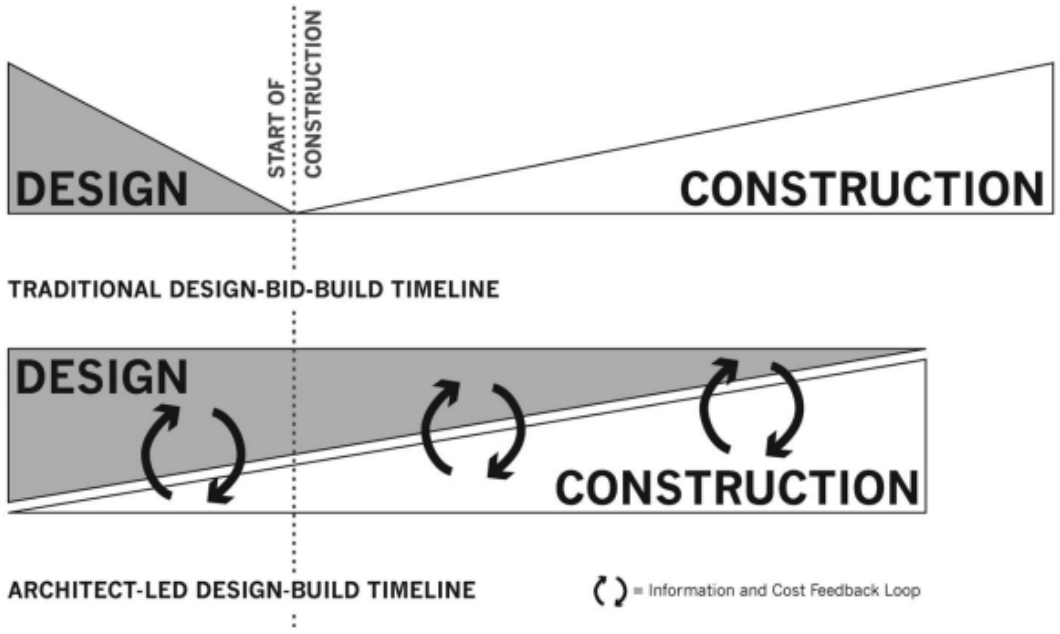

Figure 3.3 Design relations to construction in Design-Bid-Build & Design-Build (Hayes, 2013, s. 556)

The owner's choice of contract determines the design sequence (see fig 3.4 below). In the Design-Bid-Build approach, the designer is selected early in the process and only after completing project design the construction contract with a contractor is determined. The designer is responsible for preparing the project plans using the strategic decisions that the owner made in earlier stages of the planning (Frank Harris, 2013). In design-build delivery method a construction contract is determined before establishing the project design. The main advantage of this type of agreement is that the contractor is usually included into the project after the preliminary design stage and shares his own

experience with the designer. This helps to ensure greater buildability and more effective project management. (Frank Harris, 2013)

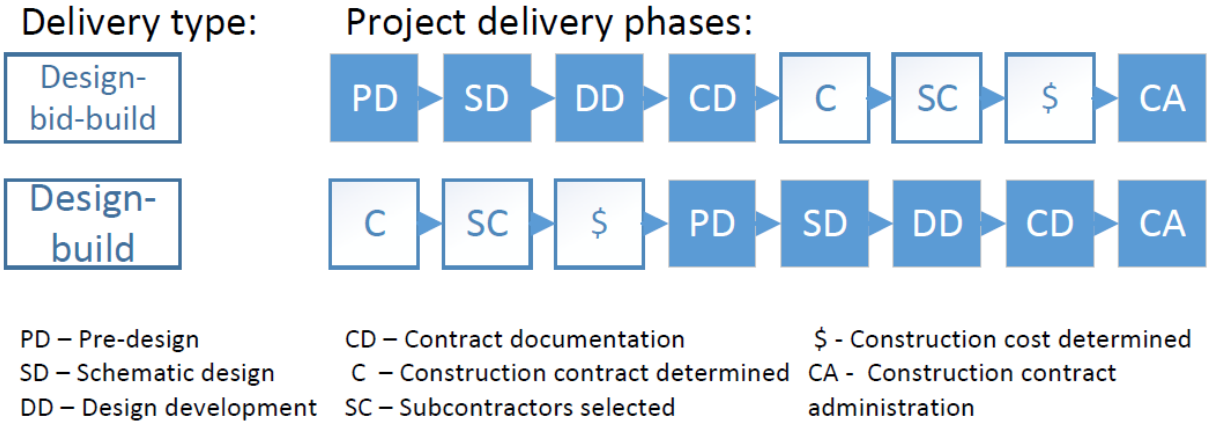

Figure 3.4 Sequences and decisions by project delivery method (Hayes, 2013, p. 516)

The designer is responsible for managing his own team. This team includes number of designers allocated to various sections of work. Design can be categorized into 3 steps: preliminary design, schematic design and detailed design. All these steps follow in order and add involves greater amount of the detail than a previous one.

3.2.1 Preliminary design

Preliminary design establishes the overall criteria to which the detailed design must conform. During the preliminary design phase the owner and the architect define their relationship, establish project framework and negotiates the agreement for professional services (American Society of Civil Engineers, 2012). Constant and frequent communication is essential. During this stage any technical issues and conflicts between the drawings have to be resolved by the designers. (Ezekiel Chinyio, 2009)

3.2.2 Schematic design

During the schematic design phase, the owner together with an architect develops a written project plan. This plan includes design parameters, constraints, administrative and communication guidelines (American Society of Civil Engineers, 2012). In this phase the fundamental components of the project and interrelation between them are defined while exploring alternatives. It contains of investigating preliminary building system concepts, analyzing and discussing initial visual concepts and defining general project scope and scale. As an outcome of this phase an architect usually delivers site plan, floor plan, elevations, key sections, a list of major material components, systems and assemblies, preliminary construction cost estimations (Hayes, 2013).

3.2.3 Detailed design

After schematic design is approved by the owner, the architect prepares design development project drawings and outlines the project specifications. During the detailed design phase the owner and the architect receives feedback from the regulatory agencies about the drawings. After the design is approved it is being ‘frozen’. It means that any significant changes are not allowed and contract documents are being focused on a single design (American Society of Civil Engineers, 2012). After this

the scale, size and the scope of the project are considered to be clear. The deliverables of this phase are similar to schematic design, only in greater detail (Hayes, 2013).

3.3 Pre-construction planning

Contractor is a third party that needs to put most effort in planning. The results of contractor's planning, monitoring and contract control will have a direct impact on the profit of the contract (Frank Harris, 2013). Planning is done from broad process making it more detailed. A project plan contains a Work Breakdown Structure, responsibility chart, schedule and additional documentation that describes budget (Robert B.Angus, 2003). To develop a detailed project plan from the pre-planning phase (Verzuh, 2008) uses six-step model (see fig 3.5 below).

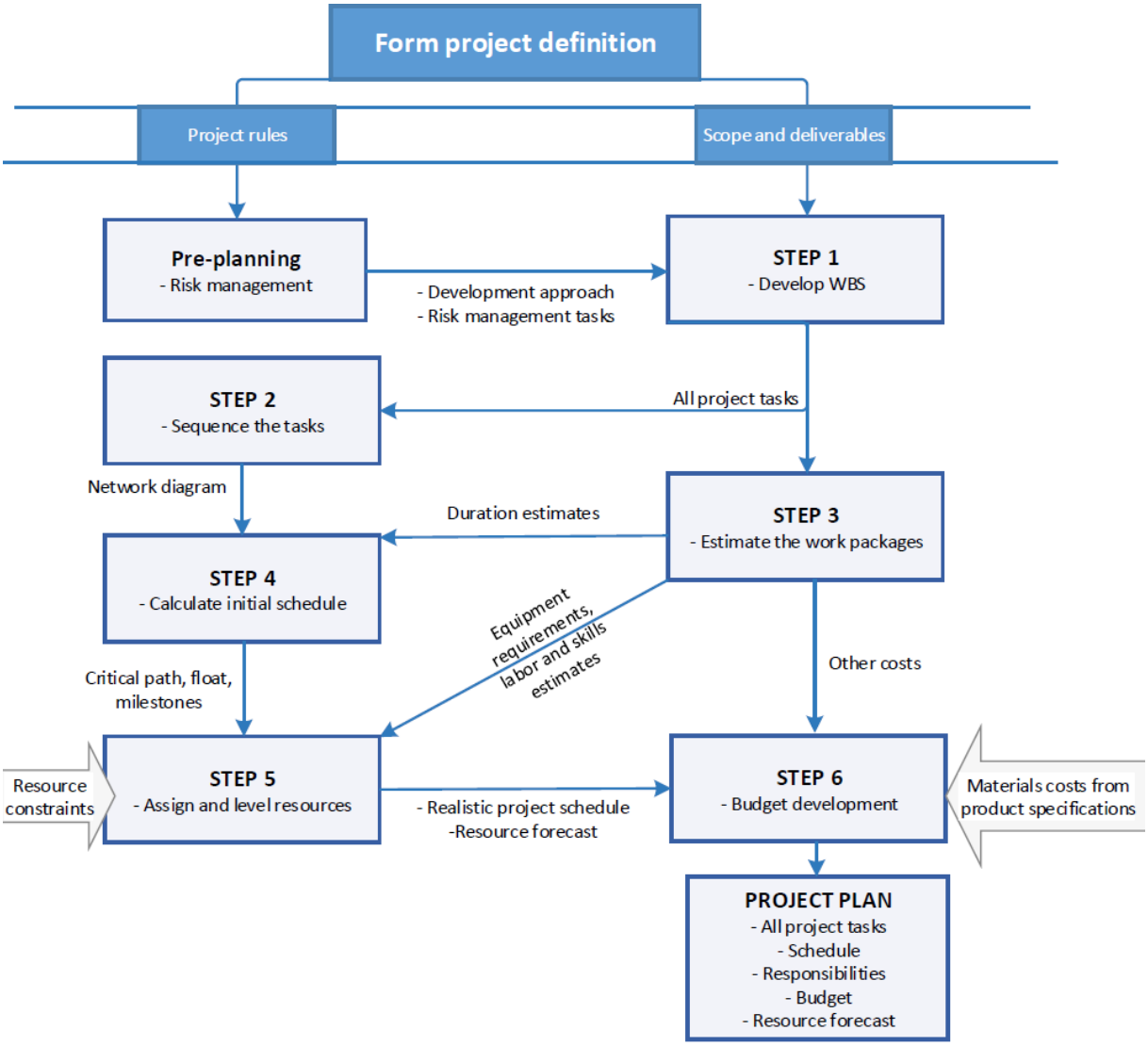

Figure 3.5 Detailed planning model (Verzuh, 2008, s. 441)

This model can be followed after the owner forms a project definition, defines the project goals and objectives as well as selects the project delivery method. Following this model, the project manager starts with risk management, where he tries to identify and minimize the threats to the project. Then he has to build a work breakdown structure where the project has to be divided into smaller work

packages. After all the project tasks are defined they have to be sequenced and each work package needs to be estimated in terms of duration, costs, labor skills and equipment requirements. After these estimations the project manager is able to calculate an initial schedule, where he can identify the critical path and establish milestones. He then also can assign and level the resources which after that leads to realistic project schedule and resource forecast. In the last step the project manager develops a budget and this finally leads to a project plan, with all project tasks, established schedule, responsibilities, resource forecast and budget.

3.3.1 Considerations before starting the estimations

The bidding period is the time between the announcement of the project and the availability of the contract and bidding documents to the contractor, and the time when the proposals have to be submitted to the owner. During this period the contractors have to carefully analyze all the tender material, prepare his costs estimations for the construction and prepare his proposal for the owner. The results of these estimations should provide the contractor with an overall idea of how much work the construction project requires. It is quite common that during the bidding period the contractors finds errors uncertainties or miss some information in the tender material. It is contractor's responsibility to identify these flaws to the owner so that the suitable modifications could be made. (Richard H. Clough, 2015)

After the owner informs the contractors about the project, the contractors have to examine the information in the advertisement or the invitation to bid. If the contractor decides is interested in the project, he will receive set of bidding documents from the owner of the designer. It is up to the contractor to make sure that all the contract documents are clear and sufficient. In tender material the owner may include pre-qualification criteria in order to eliminate inexperienced, incompetent or underfinanced contractors. The contractors' decision to bid involves many factors that includes his opinion about the owner's designer, size and nature of the project which is related to company's experience, machinery requirements, project location, seasons, duration of the project, the bidding period, terms and conditions in the tender material, possible competition, resource requirements and other aspects. The decision to bid and preparation of the bidding proposal requires considerable amount of time, effort and money, therefore the contractor will always try to bid on the projects that he thinks he will be awarded. (Richard H. Clough, 2015)

3.3.2 Contractor's team

The contractor is responsible for planning, managing and executing the building in accordance to project drawings, specifications and other contract documents. In order to help with these tasks, the owner can have number of people involved. The *planners* are responsible for producing the construction plans. These plans include task sequence and approximate resource requirements. The *estimators* are the people responsible for managing and making more precise estimates of the projects. These team members should have a good cooperation in order to prepare good pre-tender estimates. *Buyers* are responsible for material purchase and hiring sub-contractors. *Temporary works-designers* are responsible for major temporary works (i.e. scaffolding, bridge supports, false-work). *Site managers* are responsible for controlling the day-to-day operations on construction site. (Frank Harris, 2013)

3.3.3 Risk management

According to (Verzuh, 2008) the planning consists of two major components: *risk management* and *schedule and budget development* (see fig 3.6). Risk management and detailed planning are closely related to each other and can be repeated several times before the construction begins. With every review the project plan become more and more accurate.

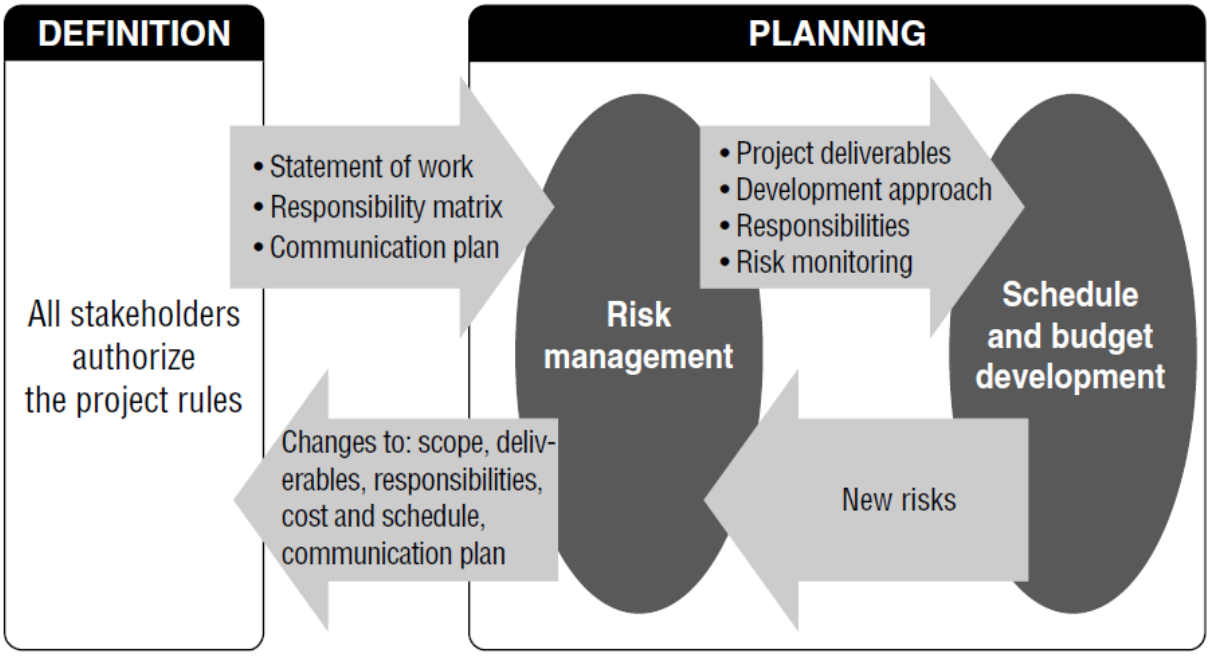

Figure 3.6 Risk management influence on the project plan (Verzuh, 2008, p. 97)

A risk management is the process of forecasting and evaluating financial risks and identification of the procedures to avoid them or minimize their impact. All construction projects carry certain risks and these risks can be managed, minimized, shared, transferred or accepted. These risks face all participants involved in the construction project. Generally, risks determine the practical, financial and contractual relationships between the stakeholders. According to (American Society of Civil Engineers, 2012) the main types of construction risks are:

- *Health and safety:* risks occur because the construction works has a high potential of injuries.
- *Difficulty:* construction is a complex process that involves construction of new design ideas using a labor with different amount of experience, skills and training.
- *Unforeseen conditions:* due to the changed or unforeseen conditions the building project may require changes in design and construction activities.
- *Environmental:* discovering the contaminated or possibly hazardous materials during the construction will require identification, handling and removal of these materials.
- *Interests' diversity:* can arise due to the project stakeholders having different interests on allocating project resources and financial risk.
- *Force majeure:* this includes weather, earthquake, fire, market conditions for materials and other factors that the project stakeholders are not able to control.
- *Labor:* amount of workforce or the skills required may not match the needs of the project.
- *Materials:* availability and the cost of materials may vary or even change significantly.
- *Professional:* risk harming the stakeholder's reputation or position in the industry.
- *Legal:* project stakeholder's and third parties carries the risk to be involved in claims and lawsuits.

- *Financial:* risk of having insufficient funding to meet the obligations.
- *Third party's expectations:* the failure to meet community or neighbors' expectations.

According to (Ezekiel Chinyio, 2009) in order to deal with risks stakeholders can take these actions:

- *Avoid the risk:* this is related to removing the specific risk from the work that needs to be done. Avoiding the risk most likely will affect the project scope and require re-design in project plans. This method is applicable when the project involves the unfamiliar risk, which if failed will cause an essential damage to the project.
- *Reduce the risk:* this method involves reducing probability or impact of the risk. Project stakeholders can direct the certain risks towards reducing the likelihood of the risk event or reducing company's exposure to the risk.
- *Risk transferring:* this involves the stakeholder transferring risk to other parties in case of the risk event. For example, a client can try to transfer management mistakes through the design-build contract.
- *Sharing risk:* by applying this method a project stakeholder's shares the impact of risk with another party. Risk sharing is useful for handling the complex projects, when one stakeholder has too many risks. The stakeholders can join the project as a joint venture.
- *Contingency plans:* it is a backup plan which involves the strategy how to cope with the losses if the risk event takes place. Normally, this method is applied to the most critical risks. The company may have some funds allocated in the project budget in case to deal with consequences of these events.
- *Accepting risk:* it is too costly to deal with minor events that can occur during the project implementation. However, due to the constant changes during the project execution it is still necessary to monitor these risks and take appropriate actions in case they become critical to the project.

There are certain risks are involved in all the phases of construction project lifecycle. In order to deal with the risks, it is necessary to asses them. This involves risk identification, impact analysis, probability estimations and prioritization. In order to manage the risks well it is important to balance the costs and benefits of dealing with them. (Ezekiel Chinyio, 2009)

3.3.4 Estimating

For the contractor estimating is part of planning process. In order to make estimates, a project plan of works is required. In order to prepare estimates, the contractor has to use information acquired from the tender documents. During the estimating process, the resources required for each activity are considered. Also the contractor identifies and allocates and calculates the costs for the work performed by sub-contractors. Estimations data is structured in accordance to the planning model. This is important because structured data later can be used for other purposes. Normally, in pre-tender estimations the units of work are expressed in weeks or days (Frank Harris, 2013).

As stated by (Carmichael, 2006) according to the degree of accuracy the price estimations can be divided into three different stages:

- Approximate (20-25% accuracy) estimations are used to evaluate size and duration of the project.
- Preliminary (10-20% accuracy) estimations are calculated by estimating every part of work in the project. This price estimate is commonly used to decide whether to start with the project.

- Detailed (5-10% accuracy) estimations are used for tendering or re-planning purposes. This type of estimation requires either accurate unit rates or bottom up approach.

3.3.5 Defining and planning project scope

A project scope is the list of works that need to be done in order to meet the project objectives. The project scope statement is a tool for managing expectations and dealing with changes. In case of disagreements on the project they often can be resolved by reviewing the original agreement on statement of work (Verzuh, 2008). However, the original agreement can be changed during the project. In this case it is important that all the involved stakeholders understand and agree on those changes. After the changes are made they need to be included in project scope statement.

Part of the project planning is defining a project scope. It involves defining and documenting a list of works that need to be done for completing the project. Project scope planning together with scope definition divides the project into different functions or sections. The project can be broken down to smaller parts which can be once again divided into even smaller parts where every lower level has a greater amount of details. This is called *Work breakdown structure* (WBS) and it is systematic decomposition of the work to be executed (Carmichael, 2006, s. 117).

The WBS identifies all the tasks in the project and sometimes can be referred as a task list. Creating a WBS assists project manager in numerous ways. Through making a WBS a project manager gets detailed information about the project scope and the tasks on WBS can be used later as a basis to monitor the project progress. It also helps to calculate more accurate the costs for labor, equipment and materials for each task and help with more precise schedule estimates. WBS can be used to build the project teams, giving them clear work assignments (Verzuh, 2008).

3.3.6 Managing the project scope

In construction industry a project scope is often referred as the design brief and is considered under the project definition (Fewings, 2005). It involves defining and documenting specific goals of the project, features, functions, tasks, deadlines and costs. The more is described during the design brief, the more it is possible to develop and improve it. Defining the scope can be time consuming process, especially if the stakeholders that contribution is needed are not available. Differences in understanding of what the client expectations are can lead to different understandings what is exactly required. That is why the project scope not only needs to be agreed in the early stages of the project but it also requires constant monitoring in order to avoid exceeding project budget, time overruns and conflicts with stakeholders' expectations. For all the stakeholders to have a better understanding it is beneficial not only to define the things that are within the scope, but also the things that are out of the project scope. According to (Newton, 2015) most of experienced project managers agree that the project scope needs to be decided and documented before any actual work starts. Once the project scope is written and defined it can be negotiated and modified by the project stakeholders and once they formally agree to its' contents it becomes an instruction for the project (Verzuh, 2008).

Along with defining the project scope in the planning stage it is also important to actively manage it. This is because the stakeholders will try to make changes of the scope during the project lifecycle. According to (Newton, 2015) these stakeholders can be classified into two parts:

- Internal stakeholders: are the project team members. These stakeholders are usually under the direct control of the project manager. Their reason for scope changes involves professional pride and functional factors.
- External stakeholders: includes project sponsors and end-users. The reason they want the changes in the project scope could be that not all their expectations were included in the initial project specification. They might be unaware that making additional changes during the execution phase can increase the risk and costs of the project. They might believe that these changes are relatively small but will add great value to the project.

Uncontrolled changes or continuous growth in a project scope is refereed as scope creep. Suggestions to increase the project scope can be very good. However, changes on the project plan, resources design and other areas can be incompatible with original objectives. Accepting the suggestion and doing the things that were not in the plan will lead to cost and time overruns. On the other hand, if the suggestion is inevitably rejected that can have a negative effect on project team's morale (Newton, 2015).

Managing the project scope is a set of processes that ensures a project scope is defined and mapped accurately. It covers time management also design implementation to the right level of quality and the resource planning for product delivery. According to (Fewings, 2005) the project scope planning and controlling can be divided into five stages:

- Establishing the project contract
- Defining the project scope
- Planning
- Controlling changes of scope
- Verification of the project scope

3.3.7 Pre-construction meeting

A pre-construction meeting should be called after the owner chooses a contractor. The purpose of this meeting is to introduce the involved parties to the procedures that need to be followed through the development of the project. According to (American Society of Civil Engineers, 2012) the first pre-construction meeting is usually held by the owner. Depending on the type of contract after the owner's pre-construction meeting, the similar meetings can be called by the main contractor, prime consultant or some other party. Regardless of who is calling the meeting, it is important that all important topics are covered. That can be achieved by proposing an agenda for the meeting, allowing participants to have their input on discussion topics (Hayes, 2013). According to (American Society of Civil Engineers, 2012) the agenda for these meetings should include the issues that needs to be resolved before construction of specific activity begins. Pre-construction meeting should include all the major stakeholders of the construction phase. Since the architect is in control of some essential administrative processes during construction (i.e. submittal approvals, determination of work conformance, etc.) it is beneficial that the architect is included in the meeting (Hayes, 2013). The main difference between the owner's and the contractor's pre-construction meeting is that the second one is more focused on the performance of the parties who supports the constructor (American Society of Civil Engineers, 2012).

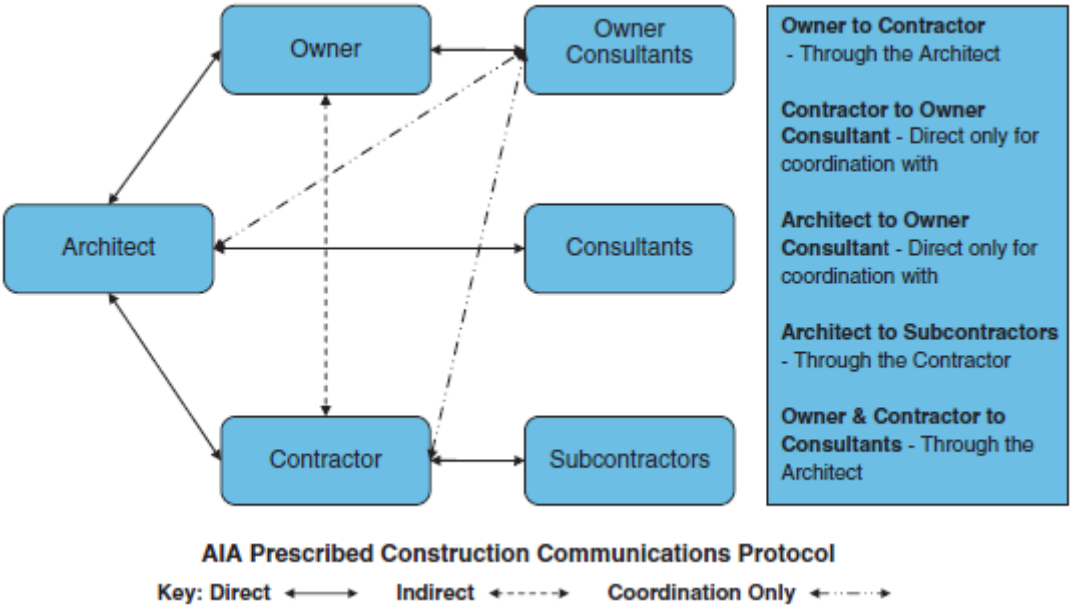

Figure 3.7 Construction communication protocol example (Hayes, 2013, p. 718)

During this meeting the parties have to establish construction phase procedures, identify the milestones, changes of the contract documents, areas of special requirements, submittal process of the drawings, the communication protocols (see fig 3.7 above), the goals and objectives of the project. Establishing the communication protocols allows avoiding miscommunication and unauthorized directives (Hayes, 2013). The outcome of successful pre-construction meeting is better communication and more successful construction phase (Hayes, 2013).

3.3.8 Project planning tools

Project Definition Rating Index (PDRI) is a method to measure the completeness of project scope definition, identifying gaps and taking right actions in order to reduce risk during the pre-planning phase. It is used during the multiple stages of the pre-planning process. The tool has included list of 64 elements that needs to be considered during the pre-planning process. The tool was developed by a research team formed by the Construction Industry Institute (CII) (Chung-Suk Cho, 2001). The tool uses scoring system where lower score represents a better scope definition. It is applicable to several floors as well as single story commercial, institutional, or other light industrial facilities. PDRI is an effective tool that can help owners, designers and contractors to assess the possibility to achieve the project objectives during pre-planning (Chung-Suk Cho, 2001).

Part of the project planning is to assign responsibilities for the various elements of the project. A responsibility matrix is a tool to list all the parties involved in the project and linking them to the tasks that needs to be completed. The responsibility matrix is a way to inform project stakeholders about their roles and duties. Creating this matrix can be time consuming, but the project manager can find it useful, since he can get a clear indication that is responsible for various tasks of the project. This helps to prevent misunderstandings about the task assignments and highlight the workload of every stakeholder involved in the project. Yet, the responsibility matrix can become quite complex for a very large projects (Robert B.Angus, 2003).

In order to assist with a planning process, the parties involved in the construction project can use Building Information Modeling (BIM) process. The outcome of the BIM is the digital building model that includes every aspect of the building: design, construction and operation. BIM does not only

offer a technology change but it also encompasses a process change. Applying BIM process changes how the client's requirements are recorded and used to develop a site plans in the early stages of the project, it also changes how the owner analyses the design alternatives for aspects like energy, cost, buildability, etc. BIM also has an influence on how the building has influence on how the building is actually constructed, that includes the fabrication of different elements. BIM enables new capabilities for the stakeholders to plan and execute the construction project. (Chuck Eastman, 2011)

Even though various planning tools can be beneficial for the project (G Edward Gibson, 2012) argues that methods and tools used for pre-planning is not as important as the stakeholder's commitment to the process. The organization's top-management commitment, planning sequence and standardized process are all critical to project success.

3.3.9 Task order

Construction planning and managing is focused on the right sequence and performance of the activities at construction site. The project planning phase consists of three stages (Richard H. Clough, 2015):

- Identifying the tasks to be done in order to complete the project
- Establishing order in which these tasks will be completed
- Making a graphical activity network schedule

Some tasks need to be performed before the others. That is *sequence constraint* and it is dependent on the relations between the different tasks. For example, the foundation has to be made before building the walls and covering the roof. The order of the tasks cannot be changed and they must follow the certain order. The activities that can be performed simultaneously are known as *concurrent tasks* (Verzuh, 2008).

According to (Verzuh, 2008, p. 147) two rules can be followed when making a graphic network diagram:

- During the project there might be lots of detailed tasks and levels of sub-tasks. Task relationships should be defined only between detailed tasks. However, the exceptions can be made on a very large scale projects.
- Task relations should be based on sequence constraints, not resource constraints. Despite of lack of resources, the tasks still need to be performed in the same order, therefore the fact that there might be not enough resources on multiple tasks is not relevant in sequencing tasks.

3.3.10 Calculating initial project schedule

Realistic schedule is part of the project success. It needs to be regularly updated during the pre-planning phase and later also during the construction. During this process the project team increasingly includes greater amount of details about the activities for the sub-contractors and other involved parties. The contractor can prepare daily, weekly or monthly schedules in order to direct the construction labor (American Society of Civil Engineers, 2012). According to (Verzuh, 2008) realistic schedule must:

- Include a detailed knowledge of work to be done
- Sequence the tasks in the right order

- Take into account the external constraints that cannot be controlled by the project team
- Can be achieved with available resources
- Consider all the objectives of the project

The scope and complexity of the project affects what scheduling processes and technologies are chosen. The project team has to establish schedule milestones that reflect the individual needs of project stakeholders also the activities that need cooperation between two or more parties involved in the construction project. Construction schedules changes with the project's life-cycle and they can indicate current status of the project, rate of progress, anticipated milestone and completion dates (American Society of Civil Engineers, 2012).

The initial project schedule is composed by using network diagram with the duration of every activity in order to determine the start and finish dates for every task and for the entire project. The initial project schedule represents the sequence of the tasks, however, it does not have a labor and equipment estimations included (Verzuh, 2008). Methods like Gantt charts and Critical path can be used in order to calculate initial project schedule.

3.3.11 Gantt charts

Gantt charts, also called as 'bar charts' (Carmichael, 2006) contains an information about the project activities and levels. It is a graphical picture displaying schedule information. On the horizontal axis the schedule is displayed, while the vertical axis lists the activities to be done. According to (Richard H. Clough, 2015) the main advantage of Gantt chart is the simplicity of its' visual design which makes it very easy to understand. It provides a convenient way to monitor the work progress, check schedule and equipment, material deliveries and follow project advancement.

3.3.12 Critical path

For composing the initial schedule, Critical Path Method can be used. In this method the critical path is one of the key features of the initial schedule. Typically, the critical path is the longest path at the activity network. Ensuring that all the activities on the critical path begins and ends at the expected time is a way to make sure that the project will be finished on time (Verzuh, 2008, p. 161). The critical path method is commonly used in construction industry for the time control. It provides the contractor with information that is necessary to make schedules and guides the contractor when forecasting necessary man power, required equipment and materials and also can help to select the best way to reduce the project duration (Richard H. Clough, 2015).

3.3.13 Establishing milestones

Expectations can provide clarity for the workers when they are involved in the project. According to (R. Duane Ireland, 2009) employees are more willing to accept more challenging expectations when they are clearly defined. Milestones are tools used by the project managers that can help to create a structure and clarity for employees. Established milestones set expectations for progress rate and objectives to achieve. Having pre-specified can determine time when stakeholders can discuss progress, compare it to pre-planned forecasts, unforeseen obstacles and other unforeseen changes that may influence the progress of the project.

Schedules of the construction projects often have pre-arranged milestones for completing certain phases or segments of work at certain time. Often milestones are acting like a guide for the

contractor to direct the workflow towards a desired end. Milestones are frequently used in work breakdown structures and network diagrams. As stated by (Verzuh, 2008) there are three main reasons to use the milestones:

- The project start and the end milestones can be used as a foundation for the activity network. These milestones do not affect project schedule but are easy to understand.
- Milestones can be used to mark the input of various involved parties.
- Milestones can indicate important events that are not represented in the work activity list. For instance, if the owner pays to the contractor based on the accomplished work, these payments could be represented as the milestones.

The milestones should not only provide guidelines to monitor the contractor's performance, but they should also be tied to reasonable owner's requirements and should not be too optimistic in order not to put too much work load on the contractor. If the contractor thinks that the milestones are too optimistic it should be stressed during the negotiations or pre-bid meeting. Too optimistic milestone dates may increase contractor's cost on the project, affect project timing and quality. The relation between the intermediate milestones and final completion date should be clearly stated in the contract (Barry B Bramble, 2011).

3.3.14 Resource planning

Resources can be people, machinery and other matters that are required to carry out the project tasks. They are separated from finances that can be used to measure their usage. Resource planning is deciding about the usage of the resources on a project. Part of the resource planning is leveling the resources. The project manager can desire resource leveling to keep the workers at consistent and reasonable rate (Verzuh, 2008). Similar to that it is also not desirable to use the machinery intermediately. Smoothing the material usage helps to avoid possible shortages in supply during the peak time periods. Resource constraint scheduling is a planning method that resource requirements would not exceed the available quantity. Some of the resources can be expensive or limited quantity (i.e. crane, skilled workers). A schedule is not realistic if it requires excess of the available resources (Carmichael, 2006). Essentially, evening out the resources peaks leads to higher utilization and more efficient usage of the resources it also helps to avoid the situations where needed resources are not available.

3.3.15 Financial planning

Financial planning is related to every stakeholder who is involved into deciding how much money should be used on the project. The project budget is a detailed estimate of costs for all the activities and tasks required to complete the project. Initial project budget is based on the estimated project scope, effort, schedule and it represents expected costs over the life of the project. As the project is being executed the actual costs can be tracked and compared with preliminary estimated values. Changes in the project scope, resources costs fluctuations and other factors can negatively affect project costs. The designer can provide probable construction costs to the owner. Often the designer's costs calculations are based on his experience with similar projects (American Society of Civil Engineers, 2012). In order to get more precise budget estimations, the owner can review the costs with a professional costs estimator and experienced contractor.

4 Purpose of study

From the analysis of different scientific articles, books and other relevant sources about the pre-planning process it can be concluded that that properly done pre-planning process can significantly contribute to the project success. In many sources about the pre-planning authors emphasize the importance of involving the stakeholders in the pre-planning phase and establishing good communication among them. Detailed planning model can help to develop a clear work breakdown structure, where the involved parties can easily distribute the tasks among each other. This helps the involved parties to sequence the tasks in the right order, estimate schedules, resource requirements and budget. Accurate estimations of these elements have a positive impact on project time and costs.

When the owner starts initiating the project he also has to decide what type of construction contract is most suitable for the project. The choice of contract is important because it does not only define the risk and responsibilities of the stakeholders, but it also defines the roles and affects how the parties communicate between each other. The contractor has to examine all the contract documents during the bidding period and decide whether to sign it. There are several aspects that the owner needs to consider before entering the contract. If the contractor notices any errors, inconsistencies or missing information in the bidding documents it is contractor's responsibility to indicate these defects.

From the conducted study regarding pre-planning it appears that different type of contract forms have different effects on how pre-planning phase is performed and what parties are involved during the different phases of it. For example, in the 'Design-Bid-Build' type of contract the main contractor is not involved in the pre-planning phase with the owner and advisors. He has to plan the construction based on decisions that were made between those parties. Meanwhile in the 'Design-Build' type of contract the main contractor has a direct relation to the designer, therefore he can be included in the discussion. In the trade contract system, when the owner enters the multiple contracts with more than one main contractor it is up to the owner to divide the project into different phases and define the scope of work for every contractor. In the 'public-private partnership' contract the main contractor needs to consider in advance not only the project execution stage, but also how to operate the building after the construction is completed.

It appears that every party needs to do some amount of pre-planning for their part of the project. The owner needs to evaluate if the project is feasible, make decisions about the project goals, form the team, document the project scope and design and finally decide whether to proceed with a project. Part of this work can be done together with an architect since in 'design-bid-build' contract the architect has close collaboration in order to help the owner to prepare the contract documentation. Contractor's pre-planning includes preliminary estimations on cost, schedule and resources and risk assessment for the project. This requires the contractor to divide the work into separate work units. Based on these preliminary calculations the contractor can decide whether to enter the contract with an owner. After the contractor enters the contract with the owner, the initial calculations of pre-planning can be used further to develop more detailed planning model.

Different type of contracts not only affects the relations between the parties, but also their involvement and responsibilities on the project, therefore every type of contract requires different procedures of planning. However, during the literature study it seems that the authors describe how pre-planning phase is done in general and do not take into account how it is affected when various contract forms are selected.

Therefore, the focus of this report is on the relation between the pre-planning and the different types of construction contracts. The main research question is: **how pre-planning is done using different contract types?** And the following sub-questions are:

- Do different contract forms affect pre-planning process?
- How do the different contract forms affect pre-planning?
- How can pre-planning be used in different settings of construction project?

4.1 Research and methodology

The aim of the report is to highlight the aspects how different parties involved in the construction project performs pre-planning. This topic is selected due to the personal interest and after conducting literature review it came into view that it can be further investigated.

The report contains of two main levels – theoretical and empirical. The first level includes development and relations of the concepts about the pre-planning. It is 'deductive research' and the goal at this level of research is to test the known theory using new empirical data. Meanwhile the empirical level is about testing how well the gathered empirical data reflects the theory. This is 'inductive research' and the goal is to conclude theoretical concepts and patterns for the observed data. The results of new data can be used to enhance the theory (see fig 4.1). (Bhattacherjee, 2012) To ensure the credibility, the report is conducted by limiting use of online sources and focusing on data from scientific articles, books and journals.

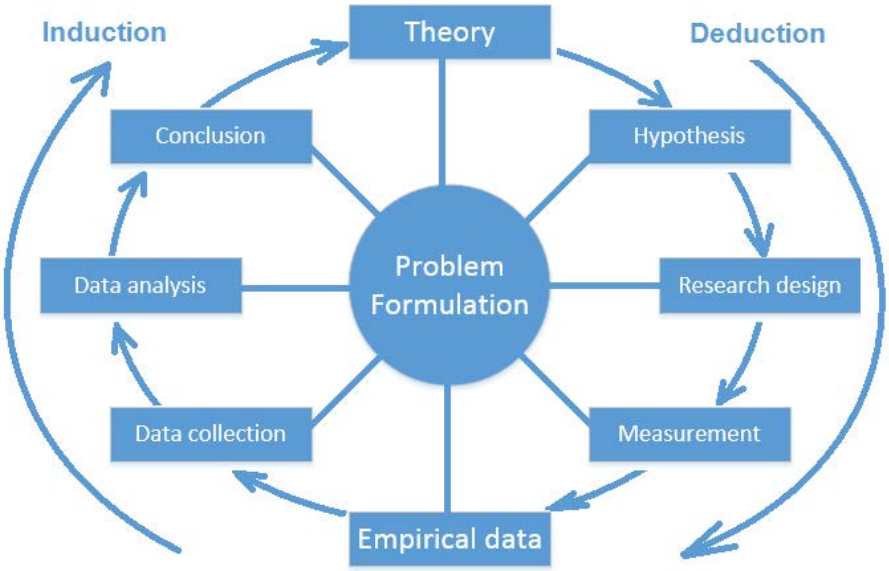

Figure 4.1 The cycle of research

The research questions derived from the theoretical level of the project. The aim of these questions was to understand how pre-planning is performed by different stakeholders in different contract settings. Since there are numerous articles with quantitative data that presents the benefits of pre-planning, a qualitative method was chosen to get a better understanding about pre-planning. The interviews were open questions to allow the respondents talk freely about the topic. Respondents include various stakeholders involved in pre-planning: owners, contractors, architect and external advisor. Because the pre-planning is performed very similar regardless of the country respondents were selected from Danish and Lithuanian companies.

4.1.1 Data collection

The data collection was focused on the qualitative research. This method was chosen in order to get a deeper understanding about the pre-planning process. For this study the interviews with were conducted with 7 different companies and organizations that are involved in construction projects. Two of the companies are located in Denmark and five in Lithuania. They are various sizes, from very small ones to big construction companies that are the leading in the industry. Since the interviewers in the smaller construction companies had a solid experience working in the construction field and the data from respondents is considered to be credible. The respondents are working with different construction projects that include the construction of new buildings or facilities, to renovation and modernization projects, designing of the engineering communications.

The selection criteria for the interviews were based on that the companies and possible respondents would be involved in construction projects and pre-planning process. More than 20 companies and organizations were contacted and seven of them agreed to spare the time for the meetings. The interviews were conducted by phone calls and personal meetings and took from 40 to 60 minutes. The questions for the interviews derived from the main research question and the sub-questions. For the interviews different templates were prepared for every stakeholder (owner, contractor, designer, and advisor) with approximately 15 to 20 questions. The interviews were semi-structured with the templates that combined open type questions, so that the respondents could explain more and rather than giving short answers. The disadvantage of this method is that the study may not be as representative as it would be in a larger sample. However, open questions allow the respondents to talk more about the topic and therefore emphasize the experiences and views of the participants, which can give a better understanding about the pre-planning.

Before starting with the questions for the interviews, the respondents were introduced to the study objectives and what is involved in pre-planning. During the interviews the goal was to get the respondents talk about how they are doing pre-planning. Sometimes the respondents were talking about the detailed planning, giving only short answers or even misunderstood the questions. Then further questions or explanations were given, so they could answer the questions in more details. After going through the interviews it was noticed that some opportunities to ask follow-up questions were missed. Also it shown some new questions about pre-planning can be asked.

4.1.2 Data integrity

In order to collect reliable and valid data the methods described by (Anne Lacey, 2009) were used. Data reliability means that the collected data is sufficient and complete and it refers to consistency and stability of the test scores. Data validity refers to the accuracy of the inferences or the interpretations made from the findings. According to (Anne Lacey, 2009) both of these characteristics are important for the credibility of the research.

According to (Anne Lacey, 2009), one of the ways to demonstrate the reliability and validity of data is a triangulation method. This means that data is gathered more than from one source to get a wider perspective of the investigating area. As mentioned before, the data for this report was gathered from seven respondents that include: two building owners, two contractors, two advisor companies and one designer. However, this data cannot be used to check the conclusions from one data source against the other, since the collected data may contradict between the respondents. The strength of triangulation method is the possibility of uncovering the complexity and finding different views. The contradictions and differences within the collected data can lead to the further analysis and research.

To prepare the semi-structured questions for the interviews, some recommendations of (Michael A Campion, 1998) were used. To enhance validity of data and prevent irrelevant information or avoid excluding relevant information the questions were based on research topic. The questions were based on their role in construction project. In order to standardize the samples every respondent had the same questions asked according to their part in the construction project. To use an appropriate length and sufficient number of questions the interviews lasted from 40 to 60 min and included 15 to 20 questions.

The respondents for this report were selected by thinking who could provide with necessary information for the research. As a result, all the respondents are related to construction industry and pre-planning. Since there are a lot of different parties involved in pre-planning process, the respondents are selected from the parties that are most involved in the process. Most of selected interviewees are working in a big companies and organizations. Yet, there are few respondents from a small size companies. Nevertheless, due to their long time experience in construction industry the answers from these interviewees are considered to be credible.

Ensuring data integrity is important for the report results. Yet in the qualitative data analysis each respondent brings a unique perspective to study, based on his views, experiences and knowledge. The construction industry is constantly changing and every project is unique. Therefore, the results of the analysis may be different even if the same questions were given to other respondents or even the same respondents few years later.

4.1.3 Data analysis

After the interviews were completed, the results were transcribed and summarized. Then the interviews were grouped according to their role in the construction project. Their answers then were compared to one another and the findings in literature studies. This was done not to see if the respondents are doing pre-planning right or to compare who is doing it better, but to understand how is it different. As mentioned before, the respondents are different and they are working with different projects and construction contracts. In order to make it more visible, the tables were made to identify how the respondents are different. Then the results of these analysis were compared to see if there are any differences or similarities between how all these parties see pre-planning.

4.1.4 Delimitations

This report is conducted as a student project. The purpose of the study is to find out and describe the main differences of pre-planning in ‘Design-Bid-Build’ and ‘Design-Build’ contracts. These differences are identified by analyzing the responses from the qualitative interviews. Yet in these responses are subjective and based on each interviewee experience and point of view. The results of the report could be different if the research was made with different respondents or in different time. Due to the time and resources limitations the report does not include quantitative analysis which could also affect the report results.

5 Main Analysis

This chapter of the report presents the findings and data analysis about the research topic. The chapter consists of two main parts: 'Findings' and 'Data Analysis'. First part involves companies and organizations' descriptions and summarizes the interviews of the respondents. In second part the data is analyzed by comparing the answers from the interviewees to each other and findings in literature.

5.1 Findings

This chapter presents the companies and organizations that were interviewed for this report. The chapter is divided into seven sub-chapters for every company and organization. Each sub-chapter includes company's description, contract preferences and pre-planning parts. Companies' descriptions and structures are prepared using the information from the interviewees' responses and their official websites. Contract preferences and pre-planning parts are summarized using the information form the interviews.

5.1.1 Danish Defense Estates and Infrastructure Organization

Forsvarets Bygnings og Etablissementstjeneste or the Danish Defense Estates and Infrastructure Organization (DDEO) is an agency under the Danish Ministry of Defense that consists of ministerial department and number of agencies (see fig 5.1 below). Using these agencies, the Danish Ministry of Defense solves national and international tasks that contribute to the peace and security. These tasks include exercising of Danish sovereignty, participating in international security and defense operations (Forsvarsministeren, 2016).

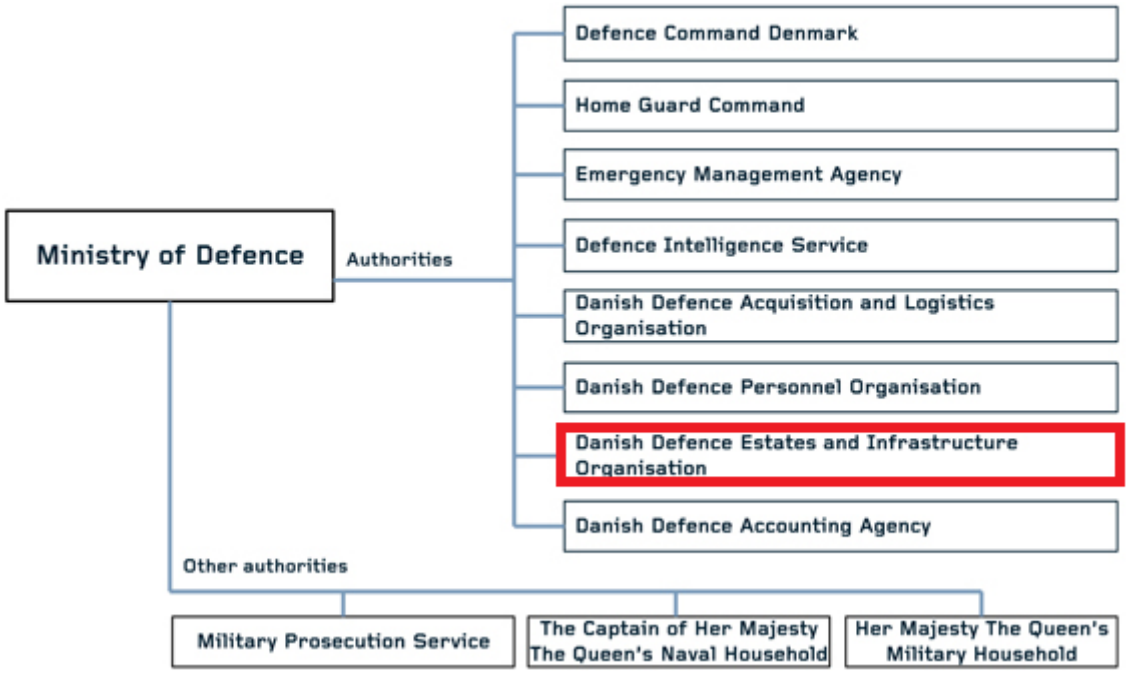

Figure 5.1 Organizational chart of the Danish Ministry of Defense (Forsvarsministeren, 2016)

The DDEO main function is to look after the properties and areas of Ministry of Defense. These functions include construction projects, maintenance, facility management, environmental and energy tasks, nature preservation. Most of these tasks are performed by external organizations. DDEO supports the operational units of Danish Armed Forces, so they could stay focused on their military tasks. DDEO has approximately 750 employees and the overall planning; controlling and larger projects are normally handled by main DDEO office which is located in Hjørring in Northern Jutland. (Forsvarsministeren, 2016)

The DDEO is a public organization which works with military projects. These can be summarized into three main categories: 1) new buildings (i.e. housing, administrational buildings), 2) maintenance projects, 3) infrastructure projects (harbors, airports). The organization has yearly budget of approximately 2.5 billion DKK for the construction projects and facilities management and about 0.75 to 1.5 billion of these finances are allocated for construction projects. The interview for this report was conducted with a department manager for construction managers - Henrik Sørensen (10.1Appendix 1 – Meeting with Danish Defense Estates and Infrastructure Organization). He is responsible for 9 of the construction managers.

Contract preferences

The organization is mostly working with a DBB contract. They prefer this type of contract, because they are working with military projects. This allows the DDEO to have more decision making power and more control over the project design. According to the interviewee, a DBB contract allows the owner to be more specific. However, the organization has some experience with Design-Build contracts. From their experience the contractor does not always get full understanding of tender material in 'Design-Build' type of contract. Also they feel that in this setting the contractor can have too much influence on the design phase. He states, that DB contract increases the amount of pre-planning and it is more difficult to be very specific in this contract and if they don't have clear and detailed definition of their expectations, then the contractor may have too much power to influence the project.

Pre-Planning

According to Henrik Sørensen, they try to form a project team according to the members' competences, but at the end of the day the teams are formed on the available resources. The project planning in organization is done in certain steps. First step is project definition, which is driven by future facilities users. In this step they consider the needs and prepare a rough project definition. The next step is called a business case and here the initial resource estimates are being prepared and the board of directors makes a decision about the project finances. To get an overall idea about the budget they rely on the key figures from historical data. For example, they know approximate prices of m^2 for administrational building or asphalt. According to Henrik Sørensen, they are making Life Cycle Cost Analysis (LCCA). This analysis normally allows them to forecast certain building aspects, like number of floors or elevators. Also possible project alternatives, such as construction of a new building, renovation or even rent are considered. After the budget approval the organization engages the advisor to help with the project description and tender preparation. Then the designer is involved to develop more detailed project design. The project is designed based on specifications and normally they are not considering contractor's interests in the early stage of the project. The tender includes pre-qualification criteria that the contractors need to meet in order to participate in the project procurement. The contractors are informed about the project during the briefing that takes place before entering tender. If some misunderstandings occur in the later stages of the project first they try to solve them by clarifying everything between the conflicting parties before taking legal

actions. During the initial stages of the project a start-up meeting takes place where all the parties included in the project are introduced to each other. The purpose of the meeting is to discuss the communication and responsibilities.

5.1.2 Vilnius Gediminas Technical University

Vilnius Gediminas Technical University (VGTU) is a public university located in Vilnius, Lithuania. It has 10 faculties, 14 research institutes, 33 research laboratories, four training and two research centers. The university focuses on research in sustainable building, environmental and energy technologies, sustainable transport and other areas. The university has around 1780 employees out of which around 940 are working as an academic staff (VGTU, 2016).

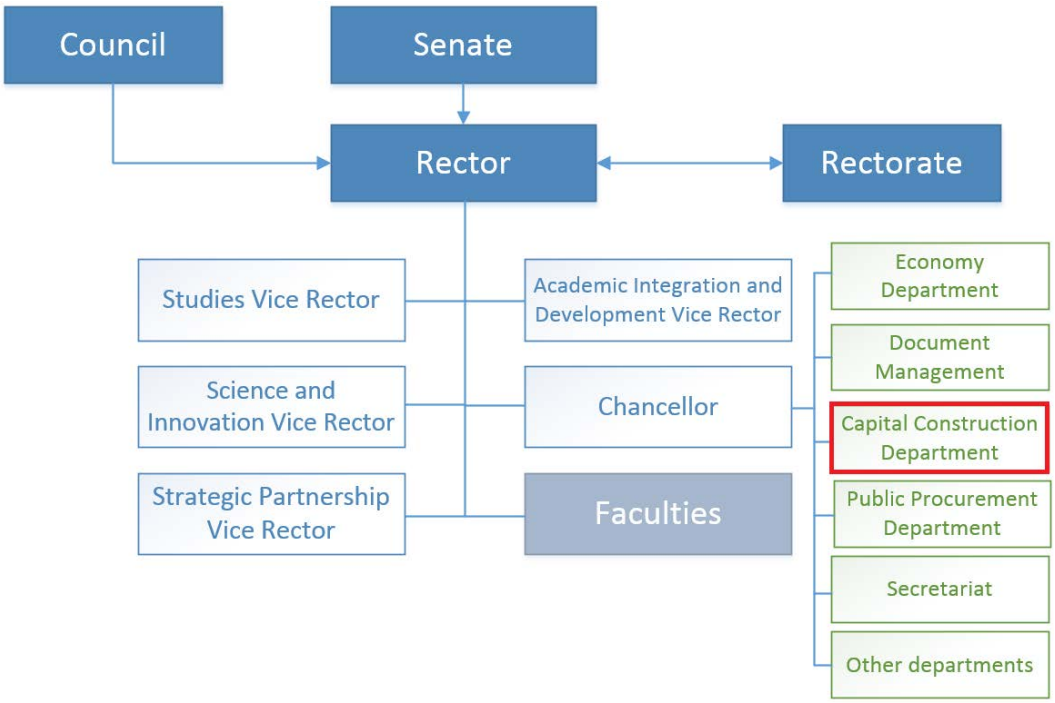

Figure 5.2 Structure of VGTU (VGTU Structure)

Department of Capital Construction is working under the control of the university's rector (see fig 5.2 above). The department is working as a public body with a yearly budget of approximately 3-4 million euros for construction educational buildings projects. The interview for this report was conducted with the Director of the Capital Construction Department – Svajunas Karvelis (See Appendix 2 – Meeting with Vilnius Gediminas Technical University).

Contract Preferences

The organization is working with DBB as well as DB projects. The contract type is decided by the procurement board. However, they are trying to separate the design from the construction approximately only 1 of the projects is executed as DB to 30 projects of DBB. Before entering the tender, the organization is considering possible requirements for contractor's qualification, terms of agreement. According to Svajunas Karvelis, using DBB contract it is easier to prepare the working packages for the contractor. The DB contract form is preferred if they want to save some time on the project. However, there is a higher risk of failure on the project design and construction. He thinks that in the DB contract you are not always aware of what are you going to procure and it is much more accurate when you have the project's design already prepared. Since the detailed designed is

prepared by the designer in DBB type contract it is possible to specify the owner's needs in more detail. Meanwhile in DB contract it may not always be clear if the project is feasible in accordance with the owner's needs and this only becomes more apparent in the later stages of the project when the contractor is already engaged in the project. This may lead to the problems occurring for the project and raise its price.

Pre-Planning

According to Svajunas Karvelis, they see the planning as a collective process. They have procurement specialists to prepare the tender documents; lawyers help to prepare the conditions for construction contract. Some of these parties can be hired as consultants. For example, if they feel that they have little experience with a particular parts of the project, they can hire an external construction consultant to help with it. Before the detailed project design, they are performing market analysis, considers the needs, assesses their own capabilities and the financial sources. As stated by Svajunas Karvelis, evaluation of the project alternatives is crucial and it has to be done for every project. This analysis must be performed from economical, technical and feasibility perspective. To make the analysis of project alternatives they are using their own experience, discuss with the consultants and make calculations. The project finances are determined by aggregated regulations and similar projects. However, later they change as more detailed information on the project is prepared the expert estimations. The designer is involved after they make their own considerations about the project. After the detailed design is complete they get some preliminary estimations which helps to evaluate the scope of work. The most precise estimations are obtained after the contract with a contractor is signed. To ensure the contractor's interests they are asking for the designer to prepare rational solutions for the building project. To prevent misunderstandings due to the unforeseen matters, sometimes they invite parties to make an inspection on the project. This can be important when working with the project where the building is not complete, or they need to perform repair works. The goal of this observation is to provide as much information about the project as possible. However, if some disagreements between the parties later occur, they are usually solved by involving an independent expert. The expert is selected by the agreement of the involved parties.

5.1.3 Neoprojektai UAB

'Neoprojektai' UAB is a private owned design company working with gap pipeline project management. This includes interior and exterior facilities and pipelines development, LPG, biological and natural gas pipelines and equipment design also project technical and maintenance supervision (Neoprojektai). The company is working with public bun in most cases with private clients. Although with a turnover of 30 000 euro per year it is a very small company compared to some other companies on the market, the interview was conducted with the director of it – Svajunas Karvelis (See 10.3Appendix 3 – Meeting with UAB 'Neoprojektai') who has 15 years of experience of working in construction industry and 10 years of experience working as a designer.

Contract preferences and pre-planning

According to him they are working with similar number of DBB and DB type of contracts. He says that he does not see any fundamental differences to prefer one contract form over the other. He is involved in the project after the client has terms and conditions to connect to the main pipeline and what he wants from the project. The client then provides him with the information about the existing engineering networks and describes what needs to be done. The client then expects him to prepare a design in terms of agreed time and price. However, he thinks that the owner is not always clear

about his project objectives. Sometimes the owner discusses with the contractors, who then are trying to propose the solutions which are better for contractors. The owner sometimes is tempted by the low price or some special functions proposed by contractor. However, these solutions are not always most suitable for the project. Sometimes the contractor comes back to him with their own interests, which can lead to some project changes. He says that he is also involved in the contractor's pre-planning so that the owner would be satisfied with project solutions. According to him, when preparing the design, he is always trying to think how the project will be executed and as a result create a feasible project. While making a project he is thinking from the practical perspective.

5.1.4 Gabusta UAB

'Gabusta' UAB is a private owned construction company located in Utena, Lithuania. It works with both – public and private clients. The company has 23 employees and is working with the renovation projects, building single-family houses, administration buildings and sometimes apartment buildings. Company's turnover is approximately 500 000 euros per year. The interview was conducted with the company's owner Gintautas Gaivenis (See Appendix 4 – Meeting with UAB 'Gabusta').

Contract Preferences

According to him, they are working with DBB contracts, because they don't feel that the demand for DB contracts is high enough. He thinks that the main advantage of DBB contract is that the contractor does not have a liability for the errors in the design and the owner is responsible for expressing his needs.

Pre-Planning

For the project planning he relies on his 25-year experience in the construction where he learns from his mistakes and practices. Also he attends some additional courses, reads literature and talks to engineers in order to improve the overall process. Before starting the detailed planning of construction they are calculating everything – resources, budget and schedule. These estimations are then adjusted in the later phases of the construction. Then they are evaluating if they are capable to do the project. First he is reviewing an offer and tries to evaluate if they are capable to build it and then assigns a person to calculate the costs and technical details. He considers these activities as the pre-planning. To make the estimations the owner provides them with a scope of work and then they are using special software for the cost estimations. Currently they are preparing one employee to work with BIM. But it is still only very first steps. According to Gintautas Gaivenis, they are hiring subcontractors for the works that they are not performing themselves. For example: plumbing, electricity, road works. They are contacting the sub-contractors before starting the project and use their prices for the estimations of the project costs. If needed, they engage external advisor for the project. This is normally for the works that they don't have experience with. It could be engineers, electricians, plumbers. If the designer is not available during pre-planning, then they address their questions to the owner and discuss what actions can be taken.

Sometimes they are involved in the owner's pre-planning process. Especially the long time clients seek for his advice prior to the construction. They want to hear his suggestions on the project; sometimes they discuss the health and safety. However, if the client is public, then they are not involved in his pre-planning. However, he thinks that data provided by the owner is usually accurate and sufficient and requires only small discussion to solve the minor questions. Yet, they are trying to avoid the contract prepared by the owner and suggest their own contract.

5.1.5 Rambøll A/S

Rambøll A/S is a part of the Rambøll Group. The company was founded in 1945 in Denmark and has the business units working internationally including Nordic Region, North America, United Kingdom, Central and Southern Europe and other countries and regions. Rambøll has nearly 300 offices in 35 countries. The company is working with construction, transport, urban development, water, environment and health, energy, oil and gas management and consulting. The turnover of Rambøll Group is around 2.7 billion DKK. (Rambøll, 2016)

The interview was conducted at Rambøll office in Aarhus, Denmark, with the department leader within construction management Hans Didrik Nielsen (See Appendix 5 - Meeting with– Rambøll A/S). The office in Aarhus is located in Skejby, Aarhus North and it is the second biggest office in Rambøll Group. This office has around 500 employees, who are working daily to deliver holistic and sustainable solutions (Rambøll Aarhus, 2016). Rambøll Aarhus is working mostly with public clients and other departments of the company. Yet, according to Hans Didrik Nielsen, they are planning to get some private clients as well. They are working mostly with renovation and office building projects. Also they have worked with a hospital project in Herning and another hospital in Aarhus.

Contract Preferences

The company is working with DBB contracts, because that is what their customer prefers and they are working as an external advisor for the owner. He thinks that DBB contracts are advantageous for them because they are in contact with a client and it makes it easier to involve their ideas into the project. However, he thinks that DB contracts are good for pre-planning phase, because the contractor have all the parts of the construction phase. In this case the contractor is able to able to tell the owner what are his ideas for the project and this can help to make a building design right the first time.

Pre-Planning

The client usually encompasses them in his team at the very early stages of the project. According to Hans Didrik Nielsen, they are involved in pre-design stage when the owner decides what to build and makes a first sketches. The designer is also involved in these steps and usually helps with the first sketches. Normally the other branch of the company is helping the owner with these very first steps of the project and they are involved a bit later where they have to prepare an accurate time tables, sometimes project economy, construction planning that involves agenda for contractor what needs to be delivered during construction and at times health and safety is involved. They usually aim for 10% accuracy of their estimations. He thinks that the owner is not always clear about his project goals and normally the owner has a vision for what he wants, but it does not match his finances. Then they advise the client what to do and the client has to decide whether to change a project or ask for extra finances. When the finances are fixed they have to adjust to the project and then it is decided how the finances will be divided between the designers, engineers and other parties. While making schedules they are thinking about what would make work easier and relies on experience, they also talk to other engineers to get a better idea how much time it is required to perform specific parts of work. Most of the time they are able to do everything and do not need to hire any external advisors. In their organization they have geotechnical, acoustics and other advisors.

5.1.6 Innobim UAB

'Innobim' UAB is an advisor company providing consulting services for applying BIM methods in construction projects (Innobim, 2016). The company is working with the contractors and owners of whom most of them are private parties. Most of the projects are office buildings, shopping malls and manufacturing facilities. Compared to the other companies that is a small advisor company, with only one person employed and the turnover of approximately 50 000 euro per year. The interview was conducted with a director of the company who is also working as a BIM coordinator – Vaidotas Sarka (See Appendix 6 - Meeting with– UAB 'Innobim'). He has 20 years of experience in the construction industry of which almost 10 years are in consulting services.

Contract Preferences

According to him the company is working with DBB and DB type of contracts, of which DB is more common. It depends on the owner's choice of contract form for construction project. The owner involves him at the beginning of the project until the end and he is working with all the parties included (owner, designer, contractor) and his job is to coordinate all the process of creating a BIM model. He says that he is engaged since the beginning of each party's work and he is working involved as a part of the team. For the project he normally considers who he is going to work with, instead of what contract form is selected. However, he can see some differences in the pre-planning when selecting a contract form. According to him, if the owner choses a DBB contract based on lowest price, then it is crucial that the owner has a control on the processes. He says that construction project progress and the end result highly depends on the project design and lack of the owner's control over it may lead to misunderstandings. However, if the owner pays enough attention and uses other criteria besides the lowest price, then he is able to make a rational project design and invite the contractors with more precise offers. According to Vaidotas Sarka, the DB contract is in a way similar but in DB contract the project outcome highly depends on how the owner identifies his needs. The owner has to be clear about the level of desired quality and materials. If the owner is not clear about these things, it will affect how the contractor is coordinating the design and the owner risks to get the project based only on minimum requirements. However, he says that the advantage for DBB project is that the owner gets a fixed price for both – design and construction. But then again this price certainty highly depends on how well the owner defines the project terms. Yet if the owner is clear about his expectations then he can get a clearer view and more developed project. He thinks that the owner should choose the contract type after the evaluation of construction site, because it can help to prepare the terms and conditions for the project. According to him, the owner is not always clear about his objectives and sometimes does not have enough experience or competence. In his opinion the owner must have someone who has some competence in making project design to help prepare these terms and conditions for the project and the architect can help from the very first steps when the owner is making project objectives. However, if the owner is experienced he usually knows these things very well.

Pre-Planning

During the pre-planning it is expected from him, that the BIM process will be controlled as well as that the BIM model will be prepared in time and the goals will be achieved within a budget. To start a project planning he follows the procedure introduced by (The Pennsylvania State University, 2010). However, sometimes they skip the conceptual phase and moves directly to the project planning. During pre-planning they are forming the BIM team and then they form the tasks and provide the BIM model also coordinates when, what and in what detail the estimations have to be provided. He says that as a BIM manager he is using the method that work is built into team and he is trying to

involve everyone as soon as possible, in the conceptual phase. To make the model more accurate they are asking for the input from the designers and engineers about each of their fields (architect, fire safety, construction managers, etc.). However, the contractor is not included here. If there is a need they are contacting the contractor for the planning part of the project and the sub-contractors to consult about the prices and feasibility.

5.1.7 A. Zilinskio ir Ko UAB

'A. Zilinskio ir Ko' UAB is the construction company located in Jurbarkas, Lithuania. The company is working for almost 30 years with the design and construction of infrastructure, engineering networks, building and renovation of residential also non-residential buildings and other projects. The company has about 400 workers, with 60 million euros turnover and is capable to work with projects for 20 million euro and above (Zilinskio ir Ko).

Contract Preferences

The interview was conducted with the construction manager – Andrius Onusaitis (See Appendix 7 - Meeting with – UAB 'A. Zilinskio ir Ko'). He is working with a modernization and renewal projects. His department is working with a public clients and their last year turnover was around 6 million euro. According to him they are mostly working with DB contracts and approximately 1 out of 10 is DBB type of contract. According to him the main advantage of this contract is that it is easier to make a project in accordance to his own, as a contractor, needs. It is also easier to supervise the project later and make changes. However, he thinks that it is more difficult to make estimations.

Pre-Planning

He says that the type of project that he is working with are right away being prepared to the details and do not require any pre-planning from the contractor. The required tasks are briefly defined in the project conditions and that is usually enough to make a detailed planning. He says that the head of the department finds the construction projects and sub-contractors, and then divides them between the managers. Then every manager in the company makes their own decisions about the project planning and they also do not include any external parties to help with it. Despite that he works with a team, the team is normally not involved in pre-planning. From the interview it seems that the only pre-planning they are doing before making a bid on the project are costs estimations. To perform the cost estimations for the project he is using software 'Sistela'. He says that the prices for construction works are approximately known and to make a bid calculation they are using the data, provided by the owner (i.e. m^2). After that they are calculating what percentage form that price will go to architect, engineers and how much then it is left for them. Prior to the bidding on the project they are also contacting the sub-contractors for the price estimations. According to him sometimes it happens that the sub-contractors are changing a price a bit later, but usually it stays the same. If the sub-contractor raises a price too much, then they are contacting another sub-contractor. The prices from the sub-contractors are used for the project costs estimations.

According to him he is involved in owner's part of pre-planning. After the owner submits a work assignment, the contractor needs to coordinate the design preparation with an architect and later present it to the owner so he could examine it. Normally the data provided by the owner is adequate and if there are any uncertainties, they are being revised. Usually these revisions include specific parts of the construction project and there are no are no essential changes. Also the owner provides them with the maximum cost for the project. However, he says that when the owner prepares

contract documents, he is normally using prepared templates and the main flaw of this is that they cannot make any changes in the contract.

5.2 Part 2 – Data analysis

This chapter includes the analysis part of the respondent's answers. The chapter is divided into five sub-chapters. In first four sub-chapters the respondents are grouped according to their role in construction and their answers are compared to each other and the findings in literature. The last sub-chapter is a partial conclusion, made from the analysis of other four sub-chapters.

5.2.1 Analysis of owners' responses

As mentioned before the interviews were made with two respondents who are involved in construction projects as the owners. One of the respondents was the department manager for construction managers - Henrik Sørensen, working at Defense Estates and Infrastructure Organization (DDEO) and another was Svajunas Karvelis, who is working as a director of Capital Construction in Vilnius Gediminas Technical University (VGTU). Both of the organizations are considered as public clients, where the first one is working with a military projects and another one with buildings for educational purposes. The organizations have different budgets for the projects. DDEO has a yearly budget of approximately 0.75 to 1.5 billion DKK, while VGTU has a yearly budget of 3 – 4 million euros (approximately 22 to 30 million DKK) (see table 5.3 below).

Organization	Defense Estates and Infrastructure Organization (DDEO)	Vilnius Gediminas Technical University (VGTU)
Respondent	Department manager of construction managers	Director of VGTU capital construction
Budget (DKK)	750 000 000 – 1 500 000 000	22 000 000 – 30 000 000
Type of projects	Military projects (new buildings, maintenance, infrastructure)	Buildings for educational purposes
Type of client	Public	Public
Preferred Contract	Design-Bid-Build	Design-Bid-Build

Figure 5.3 The owners

Both of the respondents say that they have some experience with DBB as well as DB type of projects and both of them says that they prefer DBB type of contract. It appears that both of the respondents' views are similar about choosing this contract form, because they want to have more decision making power and more influence during project design phase. Both of respondents think that it is easier to be more specific in DBB type of contract because the designer then is able to specify the owner's needs in more details. According to Henrik Sørensen from DDEO, DB contract increases demand in pre-planning and it is more difficult to be very specific using it. It seems that Svajunas Karvelis from VGTU thinks alike as he says that in DB contract the owner is not always aware of what he is going to procure and that can raise the project price. Responses from the owner's confirm some of the strengths identified by (Keith Potts, 2014): the owners feels that DBB contract allows them to have more control over the construction processes, it gives flexibility in design development until the contract preparation stage and it allows to be more specific which clears the ambiguities in the documentation prior to tender process. Response from Svajunas Karvelis, that sometimes they are selecting DB contract in order to save some time on the project confirms one of the problems with DBB contracts stated by (Thomsen, 2006) that it increases duration of the project.

During pre-planning both respondents says that they are considering users' needs, assessing the capabilities, project finances. In both cases these activities are done before engaging a designer into the project. Both respondents say that they are working with a team that is ideally formed based on the members' competences. According to Henrik Sørensen, they are not including contractor in the team, but someone who has contractor's practice. Both of the owners include external specialists to help with pre-planning. This includes architects, engineers, legal advisors and other specialists. The way owners speaks about their teams formation and functions confirms that the team has to include expert advisors as stated by (American Society of Civil Engineers, 2012) to help the owners to initiate, plan and guide the project. The designer is normally included after the owners are making their own considerations about the project. To consider project finances both owners makes some analysis, relies on experiences from previous projects. When shaping a tender material, they are considering the possible requirements for possible contractor's qualification and experience. Henrik Sørensen says that they have a meeting in the initial stages of the project where they are discussing communications and responsibilities and normally does not discuss details of the project. Meanwhile Svajunas Karvelis says that in some projects they have a meeting where they invite the parties for the inspection of the existing conditions. The goal of this meeting is to provide as much information as possible in order to avoid later misunderstandings. Both owners consider possible project alternatives prior to building process. This includes both alternatives for the overall project as well as parts of the project.

Comparing the responses from the owners it appears that they share similar thoughts about the DBB and DB contracts. They both agree that DBB gives the owner more control over the project and that DB contracts require more effort in pre-planning. Yet, they both are public clients, with many years of experience which allows them to manage the processes better and they know on what they should focus during different stages of the project. It appears that pre-planning is done in a similar method and it one or the other way incorporates the pre-planning process activities of the pre-planning process map by (G. Edward Gibson Jr., 2006) (see Chapter 3 Pre-planning).

5.2.2 Analysis of contractors' responses

The interviews were made with two construction companies in Lithuania. First one is a smaller construction company 'Gabusta' UAB with the turnover of approximately 500 000 euros (~3.7 million DKK) per year and another is 'Zilinskio ir Ko' UAB with a turnover of approximately 60 million euros (~446 million DKK) per year. (See fig 5.4 below)

Company	'Gabusta' UAB	'Zilinkio ir Ko' UAB
Respondent	Owner of the company	Construction manager
Turnover (DKK)	3 700 000	446 000 000 (For the company) 44 600 000 (For department)
Type of projects	Renovations, family houses, administration buildings	Modernization and renewal projects
Type of clients	Public and private	Public
Type of contract	Design-Bid-Build	Design-Build

Figure 5.4 The Contractors

'Gabusta' is working with both public and private clients, while according to construction manager Andrius Onusaitis in 'Zilinskio ir Ko', his department is working only with public clients. The companies are also working with different type of projects and contract types, where 'Gabusta' is doing renovations, housing and administration building projects and are working with DBB contracts. Meanwhile 'Zilinskio ir Ko' is working with modernization and renewal projects which are

approximately 9 out of 10 times DB contracts over the DBB. According to Gintautas Gaivenis from 'Gabusta', DBB contract's advantage is that the contractor is not responsible for the errors in the design and the owner is responsible for expressing his own needs. Yet, Andrius Onusaitis thinks that the main advantage of DB contract is that the contractor can make a project in accordance to his own needs also it is easier to make changes and supervise the project. However, despite that one of the advantages stated by (Thomsen, 2006) that DB contract allows the contractor to have improved cost control, the respondent thinks different and he says that it is easier to make estimations for DBB contract.

Despite the differences both contractors are doing some amount of pre-planning. None of contractors have any specific guidelines to make a pre-planning and they are relying on their own knowledge and experience. Gintautas Gaivenis from 'Gabusta' UAB says that in pre-planning they are trying to calculate everything – resources, budget, schedule and he considers this as pre-planning. Meanwhile Andrius Onusaitis says that before entering the tender they are only calculating the budget and all the other estimations are done later in the project progress. However, since they are working with DB contracts, he says that they are involved in pre-planning together with the owner, because they are responsible for preparing the contract for the owner, which is later examined by the owner. Meanwhile Gintautas Gaivenis says that if it is a public owner, then he is not involved in pre-planning. Only the long term clients from time to time seek for his advice. Both of respondents thinks that normally the owners are doing well and the information that they are providing about the project is sufficient and accurate. Only minor uncertainties appear that requires revisions. In order to avoid flaws in the contract documents, 'Gabusta' is always trying to sign a construction contract that is prepared by them. Meanwhile the clients of 'Zilinskio ir Ko' are following the prepared templates for the contract and the respondent thinks that the main flaw about this, that they cannot make any changes to it. Both of respondents say that they are contacting sub-contractors to get the prices for their work. Then those prices are used to make calculate the project costs. Gintautas Gaivenis says that his team helps him with pre-planning, after he evaluates if they are capable to build the project, then he involves other people to make cost calculations and review technical details. If there is a need he also involves external advisors to help him with pre-planning. Meanwhile according to Andrius Onusaitis, his team does not contribute in his pre-planning and he does not seek for the help from external parties.

The answers from the respondents regarding pre-planning are very different. However, there are a lot of differences between the companies. They are different in size also both work with different type of projects and use different contract forms. Therefore, it is very difficult to compare both of respondents' pre-planning process and how is it influenced by the contract form. However, there are some common points that they agree on. Both of them are doing cost calculations and both of them contacts sub-contractors in order to get more precise prices. Despite that one of them is working with DBB and another with DB contracts; they both think that the owner usually provides them with accurate and sufficient amount of data. However, it seems that the contract type affects how they are involved in owner's pre-planning, because 'Gabusta' is working with DBB contract's and the respondent says that the owner does not involve them in his pre planning, meanwhile 'Zilinskio ir Ko' are working more with DB contracts and since in that case the contractor is responsible for coordinating the project design, they have to coordinate with the owner.

5.2.3 Analysis of designer's responses

For this report the interview was conducted with one small size designer company in Lithuania – 'Neoprojektai' UAB. This company is working with gas pipelines and equipment design. Despite that it is a small size company, director of the company - Svajunas Karvelis has many years of experience working with a construction projects and project design. He is working with both – public and private clients and with DBB as well as DB type of contracts. The designer is working with about same amount of DBB and DB type of contracts and he says that he does not see any fundamental differences to prefer one type of contract over another. From his responses it seems that does not matter if he has to work with the owner or with a contractor and the most important thing is that the owner's needs would be clear and that he would be provided with sufficient data to make a project design. According to Svajunas Karvelis, when making a project design he is always trying to think about the project feasibility and how it will be executed from the technical perspective. However, then he says, that the owner sometimes talks with a contractor and then the contractor is trying to make changes to project design, which are not always most suitable for the project. Or the contractor comes to him directly with his own interests and this may lead to some changes in the project design. Since the contractor has a direct communication in DB method, it can be assumed that these changes are happening less often using this contract type over DBB.

According to Svajunas Karvelis, he does not make any activity plan for design phase and tries to work fast and focus on quality. However, as mentioned before it is a small size design company, so it is very likely that the projects are relatively small too with only few people involved. Therefore, there is no point to make an activity plan for the design phase.

5.2.4 Analysis of advisors' responses

For this report the interviews were conducted with two companies that are working as advisors in construction industry. First one is a small size advisor company located in Lithuania – 'Innobim' UAB. The company provides the BIM coordination and consulting services for all the parties involved in the construction project. Another interview was conducted with Rambøll A/S at their office in Aarhus, Denmark. It is part of the Rambøll Group which has a turnover of approximately 2.7 billion DKK. Rambøll Aarhus helps the clients to prepare timetables, construction planning and project economy. Since the companies are very different not only in size, but also in the advisor services they provide (see fig 5.5 below), the respondent's answers in this chapter are analyzed separately instead of being compared to each other.

Company	'Innobim' UAB	Rambøll A/S
Respondent	Company's director, BIM coordinator	Department leader within construction management
Turnover (DKK)	371 000	2 700 000 000 (For Rambøll Group)
Type of projects	Office buildings, shopping malls, manufacturing facilities	Renovation, office buildings
Type of clients	Mostly private	Public, also 'internal' customers – other departments
Preferred Contract	Design-Bid-Build and Design-Build	Design-Bid-Build

Figure 5.5 The Advisors

As mentioned above, 'Innobim' is a small advisor company, providing BIM coordination and consulting services for contractors and the owners. It is working with both, DBB and DB type of contracts, where DB is a bit more frequent. As an advisor who works with both types of contracts, the respondent perceives some similarities and differences in both approaches. He says that both contracts are similar in a way that the owner has to be very clear when expressing his needs. The differences are that in DBB contract the owner must have control over and understand design process in order to have the successful project in the end. Meanwhile in DB the contractor is responsible of design coordination and therefore the owner has to be very clear when he expresses his needs for the project. In his responses he confirms some of the advantages of the DBB approach identified by (Keith Potts, 2014) – increased project control by the owner and tender documents are clear of ambiguities. He also thinks that another advantage for DBB contract is that the contractors are giving more precise offers on the project. However, while (Keith Potts, 2014) as one of the strengths names that the client is able to make demands about desired quality and performance, the respondent says that if the owner is not clear with about his needs regarding quality and the materials, then the risk occurs to get a project based on minimum quality requirements. This reflects on some of the weaknesses identified by (Keith Potts, 2014) about the DB projects: the risk of getting cheapest building in terms of whole-life costs, the client does not have control over design quality, tender analysis may be subjective and that the project proposals have may not meet the project's requirements. He thinks that if the owner does not always have an experience and competence to know on which of the project parts focus on and that the experienced contractors usually know these things very well. He says, that designer can already help with very first steps of the project, when the over is creating the project objectives. In his opinion, when the owner creates the project terms, he must have someone who is competent in the design to prepare them. This confirms with the statement of (Keith Potts, 2014), that in DB approach, the owner may hire a designer that is not contractually linked to contractor in order to develop a terms of the project.

Another interview with an advisor was conducted at Rambøll office Aarhus with its' department leader within construction management - Hans Didrik Nielsen. This company is working with DBB contract type because that is what their customer prefers. They are helping the owner to prepare schedule, construction planning and project economy. For DBB approach as an advantage he sees that it is easier to implement their own ideas, since they are in contract with a client. This again confirms that in DBB contract the owner has more control over the processes. However, he thinks that DB contracts are good for the contractor's pre-planning, since he is in control of all parts of the project. In DB approach the contractor can tell the owner about his ideas for the project which can help to make the building design right the first time. It is one of the strengths of DB contract identified by (Keith Potts, 2014), that an early collaboration between designer and contractor reduces variations of the design. Same as the previous advisor he also thinks that the owner is not always clear about his project goals and usually his vision does not match the finances.

5.2.5 Partial conclusion

The respondents' answers show that pre-planning to some extent is done in all sizes and types of companies. Most of the answers correspond with the theoretical findings from the literature sources, such as books and scientific articles. Both owners talked very similar about the DBB contracts and both of them agreed that this approach gives them more control over the project design agreed that it is easier to prepare tender material when the contractors are invited to procurement with already developed project design. As mentioned before, their responses correspond with some of the DBB approach strengths introduced by (Keith Potts, 2014). While one of the advantages for DB contract is

considered to be the contractors' ability to design project in accordance to his own needs, it seems that the contractors have different opinion about it. Hans Didrik Nielsen from Rambøll also names this as an advantage for DB project. However, another contractor thinks quite opposite and he thinks that DBB advantage over DB approach is that the owner has a responsibility over the project design and therefore the owner is responsible for expressing his own needs. As for designer's responses he says he does not see any fundamental differences if he has to work with DBB or DB approach. However, he says that in DBB contracts the owner sometimes consults with a contractor and this can later lead to some project changes. The advisors think alike. They agree that since the contractor is involved in the project design, he is able to make his own inputs and this can help to make a project design right the first time. Many respondents think that DBB contract makes pre-planning more accurate. This is because the owner thinks they can be more specific about their project goals before entering a contract with a contractor. Also having all estimations before engaging the contractor should allow the owner to make a better evaluation of the alternatives. The owners think that DBB approach allows the owner to know what he is going to procure and the owner is more aware about the project feasibility in the earlier stages. From contractor's perspective it is easier to make project price estimations when the owner selects a DBB approach. The contract documents usually are prepared by the owner with a help of legal advisors. The contractors are not always happy about it, since they are not always being able to make any changes. The smaller contractor firm is usually trying to suggest their own contract. However, this might be because they are working with a smaller construction projects, where the client does not always have experience with construction projects and is not always able to hire a legal advisor to help him prepare a tender material. In this case the contractors' desire to sign the contract that is prepared by him seems sensible, since the company has experience of working in a construction industry.

The project begins with the owner considering the needs for the facilities. Then the owners are making some rough project definition, considers their capabilities and financial sources. While pre-planning, the owners and contractors are making estimations on project resources, budget and schedule. Many of respondents are working in construction industry for many years now and while making these estimations they are relying on their own experience also on historical data from the previous projects. Knowing the approximate prices for construction works allows the owners and the contractors to make preliminary estimations to get overall idea about the project costs. If the project includes something, that the respondents do not have an experience with, then they are seeking for a help from external advisors. These may be architects, mechanical engineers, structural engineers and other advisors. The contractors are also contacting the sub-contractors to consult about their work and also to get prices for their part of work. These cost estimations are then used by a contractor to make more precise bids on construction project. Part of the owners' pre-planning is evaluating the project alternatives which includes not only considering parts of the building, like number of floors, but also if renovating or even renting new facilities would be a better alternative for the new built facilities. This analysis is performed by the owner and he is evaluating economical, technical and other aspects of the project.

Pre-planning involves number of different tasks and to make it easier the construction project participants are forming their teams. The owners are not including the contractor in their teams during pre-planning. They are relying on their own team and the architect's experience to make a project feasible. The interview with an architect also shows that while making a design, he is considering how the project will be actually built, to make a contractor's work easier. The contractor, who is working with DBB approach also confirms, that the public clients never seeks for his advice during pre-planning. However, some of the long time private clients are asking for his advice in the initial stages of the project. The other contractor is working with DB approach and he is involved in

the owners pre-planning, since they have to coordinate the design. Despite that the owner's do not involve the contractors in their pre-planning, according to contractors, the owners are normally clear about their project goals. On the other hand, the designer and the advisors think that the owner sometimes needs help to clarify his needs. According to the designer, the owners sometimes come back to him after they consult with the contractors and this may lead to some changes in the project design. The contractors say that normally the projects require only minor changes and clarifications about some parts of the building. This can be a result of pre-planning activities, since the advisors and designers are involved to help the owner prepare the project tender. The designers are usually involved after the owners are making their own considerations about the project. The designers are helping to develop a detailed project design and cost estimations. These estimations are then used to evaluate the scope of work. The contractor working with DBB approach says that they do not receive any cost estimations from the owner's designer. However, he says that the owner is providing them with a scope of work. The contractor who is working with DB approach says that the owner normally provides them with a maximum cost for the construction project and the tasks for the project are briefly defined in the project conditions.

While it seems that the owners pre-planning process is very similar, the contractors pre-planning looks more different. This can be caused not only because they are mostly working with different contract types, but also with different type of projects. None of the companies had any specific guidelines how their employees should do pre-planning and every manager is supposed to make his individual decisions. The manager who is working with DB contracts is only making cost estimations for pre-planning and says that other estimations are made later and right away to the details. However, since he specified that this is done with the type of projects that he works with, this might not always be the case with DB approach. The teams' involvement in the contractors' pre-planning is also very different, since one of them is involving members to help making estimations and the other is calculating everything by himself. However, it is hard to say if this is influenced by the contract approach, or the types of construction projects, or just because of every manager's freedom in choice how the pre-planning should be done.

It appears like most of the findings about pre-planning process from the literature studies and the answers from respondents' matches quite well. Also they are confirmed some of the strengths and weaknesses of DBB and DB contracts. Also all of the respondents could see some differences in pre-planning between DBB and DB approaches.

6 Conclusion

Pre-planning is a process that includes the activities from project initiation to its' detailed design. The owner's pre-planning is related to the activities from the initiation of the project to design development and awarding the contractor for execution of it. Contractors' pre-planning also includes risk analysis where he has to evaluate the project risks and decide if he is able to execute the project.

The purpose of this study was to find out how pre-planning is done in using 'Design-Bid-Build' and 'Design-Build' approaches. The study was based on conducting seven qualitative interviews with representatives from construction companies, public organizations, advisors and designer. The companies are located in Denmark and Lithuania. They are various sizes and are working with different construction projects. The results are presented and examined in the 'Main Analysis' part of the report. To help answer the main research question following sub-questions were used:

Do different contract forms affect pre-planning process?

There is a difference in pre-planning using different contract approaches. The owner is responsible for selecting a contract form for the construction project. This contract form determines responsibilities, communication, and the risks of the parties. Contract form affects who is responsible for the managing the project design, sub-contractors and what is to be determined in the tender material. All the respondents could see some differences in pre-planning when using different contract forms.

How do the different contract forms affect pre-planning?

This report is focused on differences in pre-planning using 'Design-Bid-Build' and 'Design-Build' approaches. In 'Design-Bid-Build' contract the owner is responsible for providing the contractor with the project design. This allows the owners to be more specific about their expectations of construction project and gives them more control over design. Since the project design is prepared before the contractor is engaged, the owner is able to make more precise estimations about the project economy, feasibility and schedule. In 'Design-Bid-Build' approach the contractor has more information about the project and can make more precise estimations. However, since in the 'Design-Build' approach the contractor is responsible for providing the building design, it enables the him to make the project design in accordance to his own needs. This can help to make the project design right from the very first time. Another difference is that in the 'Design-Bid-Build' approach the designer provides the owner with some initial estimations and the project design.

How can pre-planning be used in different settings of construction project?

The pre-planning can be used different in 'Design-Bid-Build' and 'Design-Build' approaches. In 'Design-Bid-Build' setting the owner's experience can influence how the project design is managed and what will be the outcome of it. In this approach the bid proposals, construction progress and end results are highly dependent on the quality of the design. As a result, it is important that the owner has someone in his team who can supervise the design. Even though the contractor is not known during pre-planning in 'Design-Bid-Build' approach there is no necessity to include him in the owner's team. However, it is important that the team has someone with contractor's practice, also the designer and advisors should consider the possible contractors' interests while pre-planning. The owner can benefit from 'Design-Bid-Build' approach, when evaluating project alternatives, because the project design is developed before the contractor is engaged. Having the costs estimations from the designer it should be easier for the owner to make an analysis of the project alternatives or even

to see if the project is feasible. Since the owner provides more detail about the project in 'Design-Bid-Build' approach the contractor can benefit from that during his part of pre-planning by making his estimations more precise. The owner also benefits from that because the contractors are able to give more precise bid offers.

During pre-planning in 'Design-Build' approach the owner provides the contractor with his expectations for the project. Only then the project design is prepared by the contractor. Therefore, in this setting it is very important for the owner to be very clear and detailed while creating the project objectives. Despite that the contractor is responsible for delivering the project design, the owner can still benefit by including designer in his own team while pre-planning. This designer is not responsible for developing a detailed design for the project, yet he can help the owner with expressing the project objectives and preparing tender material. Since the contractor is able to make the design in accordance to his own needs, both parties can benefit from pre-planning in 'Design-Build' approach because this way the design can be made right the first time. However, there are some risks included when the contractor is given the power over the project design and not all owners are willing to take those risks.

Besides answering these questions some other conclusions regarding pre-planning were made. Since the owner is the main figure initiating the project and making very first steps in of the project, his experience is one of the factors affecting pre-planning. They know how to control the parties and what requires more attention to be paid. This can determine what type of contract is chosen for the construction project, because the experienced owner can benefit from having control over the project design. Even the experienced owners are using the advisors' services in order to help them with pre-planning. Engaging the advisors in the construction project can be very beneficial in both 'Design-Bid-Build' and 'Design-Build' approaches since the construction projects are very complex and they can help the owner with number of services, including design, planning and legal issues. During pre-planning it could be a good idea for the owner to include someone who has a design experience even in the 'Design-Build' approach since the designer can help the owner to develop a terms of the project and clear any ambiguities in the tender material.

7 Further research

This report is focused on 'Design-Bid-Build' and 'Design-Build' approaches. For further research it would be interesting to make a more detailed analysis of how pre-planning is done in different approaches. This could include comparing how certain activities are done in different approaches. For instance, it could be interesting to study to what detail the owner is preparing models to evaluate project alternatives and what are the differences between these models in different approaches.

Since one of contractors for his part of pre-planning is only calculating the project budget, it could be interesting to study if all the projects require same amount of pre-planning and what type of projects would require being more specific during pre-planning.

Furthermore, it would be interesting to make case studies of pre-planning in different approaches. It would be interesting to see the whole process from the initiation of the project until the operation of the building. Then to compare the differences in pre-planning process using 'Design-Bid-Build' and 'Design-Build'. The case study could not only identify the differences in the whole process but also it would be possible to evaluate how the pre-planning affected the project execution phase and the outcome of it.

Finally, it is important to mention that there is number of other contract settings, including 'Trade-By-Trade' and 'Public-Private-Partnership'. Thus, it could be interesting to study how is pre-planning different in these approaches, where the owner is also performing as a main contractor during the project execution or the contractor has to consider the building operation after construction is finished.

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