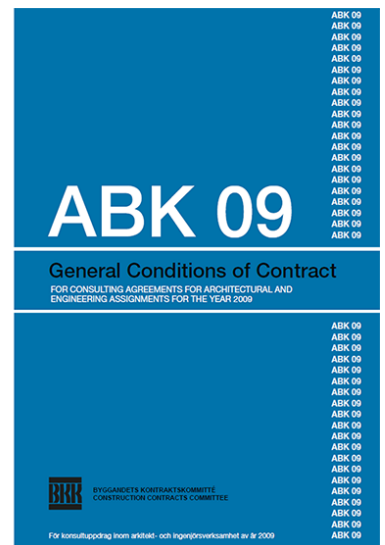
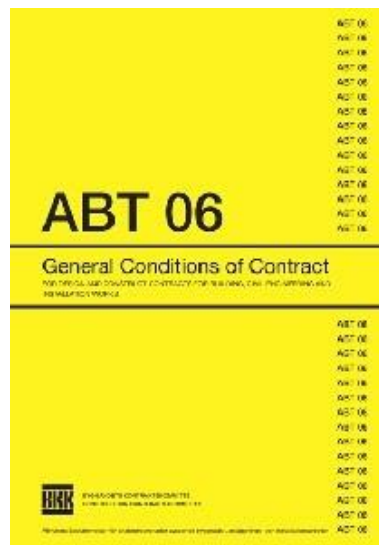
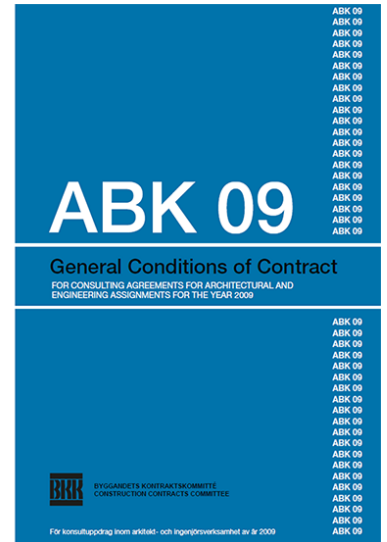
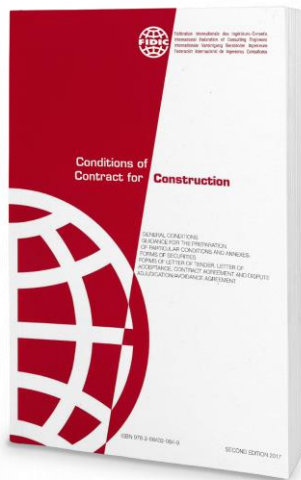




CHALMERS

UNIVERSITY OF TECHNOLOGY



Jafar Al-Saadi & Mustafa Yas Khudhair

Department of Architecture and Civil Engineering
Division of Design and Construction Project Management
CHALMERS UNIVERSITY OF TECHNOLOGY

Göteborg, Sweden 2021

Comparison between the use of FIDIC contract internationally and in Sweden

Master's Thesis in the Master's Programme Master's Programme Name

Jafar Al-Saadi
Mustafa Yas Khudhair



Department of Architecture and Civil Engineering
Division of Design and Construction Project Management
CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden 2021

Comparison between the use of FIDIC contract internationally and in Sweden

Master's Thesis in the Master's Programme Master's Design and Construction Project Management

Jafar Al-saadi

Mustafa Yas Khudhair

© Jafar Al-saadi & Mustafa Yas Khudhair, 2021

Examensarbete ACEx30

Institutionen för arkitektur och samhällsbyggnadsteknik

Chalmers tekniska högskola, 2021

Department of Architecture and Civil Engineering

Division of Design and Construction Project Management, MSc program

Chalmers University of Technology

SE-412 96 Göteborg

Sweden

Telephone: + 46 (0)31-772 1000

Cover:

Cover page is designed by Jafar Al-saadi & Mustafa Yas Khudhair, 2021

Department of Architecture and Civil Engineering
Göteborg, Sweden, 2021

Comparison between the use of FIDIC contract internationally and in Sweden

Master's thesis in the Master's Programme Design and Construction Project Management

Jafar Al-saadi

Mustafa Yas Khudhair

Department of Architecture and Civil Engineering

Division of Design and Construction Project Management, MSc program

Chalmers University of Technology

ABSTRACT

The Swedish Transport Administration (Trafikverket) is a client organisation assigned by the Swedish government to execute the task of developing the transport system for all traffic in Sweden. As the Swedish Transport Administration (Trafikverket) is establishing new mega projects under the framework of infrastructure development in Sweden, such as the country's largest road and railway construction projects, like Gothenburg's "västlänken." As a result, many international contractors are attracted to engage in these projects in order to earn a profit. Standard agreements, which implement the AB04 and ABT06 principles in Sweden, regulate and set up the contracting process. The conventional way of working in the Swedish transport administration creates barriers for international contractors to enter the Swedish market. The increasing interest in the Swedish market and specifically Trafikverket to work with international contractors in infrastructure and construction projects, and the lack of experience in contracting international contractors the following research questions is developed: *RQ1: What are the potential results that can be achieved from the comparison between standard agreements and collaborative contracts in the perspective of FIDIC and AB and ABT?, RQ2: How does FIDIC contracts govern sustainability, quality and productivity and are there any similarities or differences with the existing Swedish contract forms AB04 and ABT06?, RQ3: What are potential improvements/changes in AB and ABT to match international context like FIDIC and the challenges for implementing this change in Sweden?, RQ4: What are the challenges in implementing FIDIC contracts by the client organisations in the Swedish market, specifically Trafikverket?* The aim of this study is to propose a solution for the Swedish transport administration to make improvements to the use of current versions of AB and ABT by identifying pitfalls in AB and ABT using the FIDIC contract as a model, then adding the new appendix created by comparing the different contract forms to the contract documents to build basis for contracting international contractors.

Key words: FIDIC, AB04 & ABT06, construction industry, integrated design, Swedish Transport Administration, collaborative contracts, early contractor involvement (ECI), consultant, infrastructure, sustainability.

Contents

1	INTRODUCTION	1
1.1	Project Introduction	1
1.2	Purpose	2
1.3	Scope	3
1.4	Aim	3
1.5	Outline of the thesis	3
2	RESEARCH METHOD	5
2.1	Research Process	7
2.2	Research approach	7
2.3	Literature review	8
2.4	Interview study	8
2.5	Comparative research	9
2.6	Thematic analysis	9
3	THEORETICAL FRAMEWORK	10
3.1	Contracting	10
3.1.1	Contracting in Sweden	10
3.2	FIDIC Background	12
3.2.1	FIDIC values Sustainability, Quality and integrity	13
3.2.2	FIDIC Redbook	14
3.2.3	FIDIC Yellow book contracting conditions	15
3.3	AB contracts	15
3.3.1	AB 04 (Performance Contract)	16
3.3.2	ABT 06 (Totalentreprenad)	16
3.3.3	ABK 09 (Consultants form)	17
3.4	Degree of freedom	18
3.5	Design risk	18
3.6	Quality measures in construction contracts	19
3.7	Productivity measures in construction contracts	19
3.8	Sustainability measurements in construction contracts	19
3.9	Distinguished variances between FIDIC and AB clauses	20
3.9.1	Variations and Adjustments	20
3.9.2	Liquidated Damages	21
3.9.3	Force majeure	21
3.10	Collaboration of Swedish Transport Administration with international contractors	22

3.10.1	Entry barriers	22
3.10.2	Cultural differences	23
3.10.3	Communication and Language	23
3.10.4	Recommendations	23
3.11	Opinion of Swedish Law firms	24
4	EMPIRICAL DATA	26
4.1	Client	26
4.2	Contractor	27
5	COMPARISON STUDY	32
5.1	Quality	33
5.1.1	Quality in AB04	33
5.1.2	Quality in FIDIC Red Book	34
5.2	Productivity	37
5.2.1	Productivity in AB04	37
5.2.2	Productivity in FIDIC Red Book	37
5.3	Sustainability	38
5.3.1	Sustainability in AB04	38
5.3.2	Sustainability in FIDIC	39
5.4	Design risk	41
5.5	Instructive vs constructive contracts	42
6	ANALYSIS AND RESULTS	44
6.1	Analysis	44
6.2	The client's perspective	44
6.3	The contractor's perspective	45
6.4	Results from comparison	51
6.5	Results from thematic analysis	56
6.6	Outputs of the research questions	57
7	DISCUSSION & SUGGESTIONS	60
7.1	Limitations	64
8	CONCLUSION	65
9	REFERENCES	67
10	APPENDIX	70
10.1	Guidline for interview questions:	70

List of Figures

Figure 1. Plan for research process.....	7
Figure 2. The major stages of the procurement process.	11
Figure 3. Divided contract, different contractors, parallel contractors to each other in Design-Bid-Build (Kadefors, 2019).....	16
Figure 4. One contractor becomes the general contractor in Design-Build (Kadefors, 2019).	17
Figure 5. Relationship of ABK 09 with DBB and DB (Vogel J. A., 2020).	18
Figure 6. VINGE detection to the major differences between FIDIC and AB contracts from the Engineer perspective (Anna Kadefors, 2019).	25
Figure 7. The Engineer role in FIDIC, is equivalent somehow to the role of the Consultant and the Inspector in the AB contract.....	33
Figure 8. 1st Governance Dimension, FIDIC, The Project Sustainable Log-book (PSL).....	40
Figure 9. 2nd Social Dimension, FIDIC, The Project Sustainable Logbook (PSL)..	40
Figure 10. 3rd Environmental Dimension, FIDIC, The Project Sustainable Logbook (PSL).	41
Figure 11. 4th Economic Dimension, FIDIC, The Project Sustainable Logbook (PSL).....	41

List of Tables

Table 1. Information about interviewees.	8
Table 2. Instructive or constructive contracts, FIDIC and AB contracts.....	43
Table 3. The responsibilities and tasks of the different parties involved in a construction process from tender to finished product in AB and ABT contracts from the contractor's point of view.	47
Table 4. The responsibilities and tasks of the different parties involved in a construction process from tender to end in international contracts (FIDIC, New Engineering Contract) from the contractors point of view.	48
Table 5. Sustainability, quality, and productivity in FIDIC contracts vs AB contracts.....	54
Table 6. The entry barriers identified and the solutions are presented by Trafikverket.	62

Preface

Authors possess knowledge regarding the process of procurement and using AB contracts in Swedish construction industry. This experience was gained from the course of Construction Contract Relationships that was part of the Master program called Design and Construction Project Management at Chalmers University of Technology. Authors also have experience regarding construction contracts from international backgrounds like Australia and the Middle East.

The Examiner, Rasmus Rempling from Chalmers University of Technology, suggests a study for evaluating the use of collaborative contracts such as FIDIC contracts in Sweden. He perceives the use of old contract forms such as AB contracts as a main barrier for attracting international contractors to the Swedish market, specially at Trafikverket (Swedish Transport Administration). Several actors support this master thesis on different levels. Rasmus Rempling provides a full version of FIDIC contract books to the authors. Mats Karlsson from Trafikverket, works in collaboration with authors in order to explain major challenges that Trafikverket faces during the use of AB contracts, and he also supports authors with a copy of AB04 and ABT06 in english language. We would like to convey our gratitude to actors and their effort excreted for encouragement and honesty supporting our study.

Finally, we would like to acknowledge interviewees, Daniel Sundin & Hans Huhmarkangas who work as Specialist kontraktshantering och beskrivning metodik at Trafikverket, and Lennart Stenman who works as Director for Business Development at Skanska-Sweden. In addition, we would like to thank Chalmers library for their continuous support during our search for books and other sources.

Göteborg June 2021

Jafar Al-Saadi and Mustafa Yas Khudhair

Notations

AB 04	General Conditions of Contract for Building and Civil Engineering Works and Building Services
ABT 06	General Conditions of Contract for Design and Construction Contracts for Building, Civil Engineering and Installation Works
ABK 09	General Conditions of Contract for Consulting Agreements for Architectural and Engineering Assignments
BBR	Swedish National Board of Housing, Building and Planning Building Regulations (Boverkets Building Regulations)
BKK	The construction Contracts Committee (Föreningen Byggandets Kontraktskommitté, BKK)
DBB	Design-Bid-Build contract
DB	Design-Build contract
FIDIC	International Federation of Consulting Engineers
Trafikverket	Swedish Transport Administration (Trafikverket)

1 Introduction

In this chapter, project introduction starts with a background describing the main challenges that are facing international firms and contractors in order to work collaboratively with Swedish clients, due to two generic documents AB04 & ABT06 for establishing the contracting framework. Subsequently, the purpose and scope of thesis are defined. Then, research questions are framed to conduct the aim of the thesis. Next, subsequent chapters are mentioned under outline at the end of this chapter.

1.1 Project Introduction

The accelerated increase in the Swedish population creates the need for better and more connected infrastructure. The Swedish Transport Administration's task is to be responsible for long-term planning and expansion of the transport system for road, rail, maritime and aviation with a traffic-wide perspective. However, the practical work is not carried out within the authority as the Swedish Transport Administration, from 2010 onwards and on behalf of the government, is a purely client organisation. This means that the state has handed over to the market what the market is considered to be best at managing, while the Swedish Transport Administration, in its role as the client, must provide requirements formulation and follow-up (Österberg, 2016).

The Swedish Transport Administration (Trafikverket) is heading to establish new mega projects that run under the cover of infrastructure development in Sweden such as largest road and railway construction projects e.g. “västlänken” in Gothenburg. In turn these projects provide a strong incentive for many international contractors to participate, with the aim of economic returns. Swedish Transport Administration is looking to secure capacity and increase competition within the construction industry, because of the existence of rising planned and ongoing construction projects (Trafikverket, 2019). However, construction projects always brought up significant transactional hazards in the relationship between client and contractor. Here many issues arise such as replacement due to weakness in communication that require long-term relationship and misinterpretation with cultural differences and entry barriers (Bresnen and Marshall, 2010). In Sweden, the role of standard agreements governs and sets up the contracting framework by following AB04 and ABT06 standards. Both agreements are open for negotiation among contracting parties to frame and design final agreed contract form (Boverket, 2020).

- Quality: Swedish construction industry needs a clarification for rising costs without recognizing any improvement on the quality or increasing the number of deliveries (Karlsson, M., 2021). Therefore, the spot is pointed on the use of contract forms and its effect on the quality improvement.

- Innovation and productivity: Trafikverket project's take Design Bid Build (DBB) contract framework which is related to AB04 standard agreement as the main contract form to deal with contractors. where STA is responsible for detailed design and contractor works to execute the construction phase (Lind, Nilsson and Nyström, 2014). Drivers of changes and adjustments are seen as essential parameters for better productivity and innovation in the construction industry (Chancellor, Abbott and Carson, 2015).
- Sustainability: At European level, standards for working with sustainability for infrastructure and facilities are developed from the three perspectives of ecological, social, and economic sustainability. In Sweden, since 2015, the Swedish Transport Administration has been demanding the contractor to use the climate calculation tool "Klimatkalkyl" to trace and reduce the climate impact of the infrastructure projects (Trafikverket, 2019).

Based on the increasing interest in the Swedish market and specifically Trafikverket to work with international contractors in infrastructure and construction projects, and the lack of experience in contracting international contractors the following research questions is developed:

RQ1: What are the potential results that can be achieved from the comparison between standard agreements and collaborative contracts in the perspective of FIDIC and AB and ABT?

RQ2: How does FIDIC contracts govern sustainability, quality and productivity and are there any similarities or differences with the existing Swedish contract forms AB04 and ABT06?

RQ3: What are potential improvements/changes in AB and ABT to match international context like FIDIC and the challenges for implementing this change in Sweden?

RQ4: What are the challenges in implementing FIDIC contracts by the client organisations in the Swedish market, specifically trafikverket?

1.2 Purpose

The purpose of this thesis is to create a comparison between FIDIC contracts and 'AB 04 & ABT 06' in terms of the existence of soft and instructive aspects. Over and above that is to analyze specific clauses in both standards in order to evaluate and determine main advantages and differences with regard to the increase in quality and productivity and decrease both cost and climate impact.

1.3 Scope

The scope of this thesis will focus on the benefits of the FIDIC contracts in Swedish context and more specifically for infrastructure projects with the Swedish transport agency as a client. Promoting quality aspects, sustainability aspects and productivity aspects.

1.4 Aim

The aim of this research is to suggest a solution for Swedish transport agency to make changes on the use of current versions of AB and ABT by detecting pitfalls in AB and ABT using the FIDIC contract as a reference, after that modifying current copy to be somehow equivalent to FIDIC contract as international collaborative contracts.

1.5 Outline of the thesis

This thesis is divided into seven chapters that are briefly described below:

Chapter Two: Theoretical Framework

The key concepts used in the thesis are outlined and established in this chapter and the basis is laid for the theory used in the study and discussions.

Chapter Three: Methodology

The technique of conducting the research is discussed in this chapter. The approach to study is clarified and a model of analysis is presented. There is a short overview of how It followed the chosen research strategy, how and for what reason the data was collected.

Chapter Four: Empirical data

This chapter contains information obtained from the interview study conducted with the Swedish Transport Administration and IABSE (International Association for Bridge and Structural Engineering). Consultants as well if possible.

Chapter Five: Comparison Study

In this chapter a comparison study between the theoretical findings and the empirical data will be conducted.

Chapter Six: Analysis and Results

This chapter contains an analysis of the comparison study conducted in the previous chapter in order to fulfill the purpose of this study.

Chapter Seven: Discussion and Recommendations

In this chapter the analysis and results will be discussed to promote the setup of the recommendations for the Swedish Transport Agency.

Chapter Eight: Conclusion

This chapter summarizes the outcomes and highlights the significant findings. The research questions will be answered, and suggestions are made on potential future areas of study.

2 Research Method

According to Flick, U. (2014), researchers confront a rapid increase in the pluralization of life worlds and the resulting changes from diversification of perspectives and contexts. The method of traditional research starts directly from researchers' hypotheses and research questions that get developed from theoretical models, then testing them to find the compatibility or incompatibility with empirical evidence. For this reason, their traditional adopted method is not eager to solve raised issues from the differentiation of objects that appear suddenly after their research outputs. However, method of research is forced gradually to make use of sensitizing concepts which is the starting point for them to establish new ways of adopting inductive strategies in their research. Therefore, researchers can have access to more developed studies gained from empirical studies, also considered as local knowledge derived from practice (Flick, U., 2014).

The process of studying arised issues requires a real example for explanation with further definitions. This process is in need of empirical research to clear things up. Whereas, formulating research questions have to be established out of practical need in prior. In this case, research questions can take place in the research process as an initial step. After this, the interpretation and elaboration of research questions take advantage to develop specific quotations. Subsequently, the formulation of sensitizing concepts will assist narrowing down research questions to more touchable ones. Hence, evaluation and reformulation of research questions are the step forward of sending these data to the analyzing process (Flick, U., 2014).

The use of theoretical literature appoints what others know about this study, and finds where if they fabricate similar issues. In this era, diversification of studied approaches produces different types of data developed from models and even exploratory rather than sticking to theories. It is an interesting area to find data for qualitative research. However, it is more known that qualitative research applies only to find new issues and work on them, or at least avoid the literature review at the earliest stage (Flick, U., 2014). On the other hand, in this type of research in this report, the need to discover previous information/studies regarding new topics here in Sweden is valuable to find measures or tools for handling the comparison study. Therefore, using the existing literature besides comparison study is seen as essential where it adds value to the research outcomes.

Main aspects in research questions can be covered by choosing a specific type of interview. Firstly, let's choose the type of interview, Flick, U., (2014) mentioned the importance of semi-structured interviews nowadays and where it is appropriate to conduct such an interview type. In this research, identifying the use of FIDIC by a client's personnel (employees in Trafikverket) is not common for them but they consider it somehow as a problem to attract international contractors. This makes sense especially when the only type of contract used by them is AB and ABT, the

Swedish Contract System. Since, interviewees from Trafikverket hereby can have a high level of complex stock of knowledge about this issue. Then, this will end up with understanding of subjective theory in order to ask hypotheses-directed questions if possible. Thus, who is the right person/group for the interview, and does this type of interview is appropriate for them. Due to the pandemic of Covid-19 it is being hard to get face to face interviews, therefore online interviews by using e-mail are conducted instead.

In this research, comparative study has a focus on particular excerpts which are linked to research questions and it's not covering the case as a whole. Flick, U., (2014) urges researchers to concentrate their focus on one dimension for the comparison to create a purposeful research method. Comparative study is required in this research to indicate the major differences between FIDIC contracts and AB and ABT, Swedish contract system. In order to carry on this study, firstly analysis of specific clauses is needed. The result will mainly focus on the constructiveness and instructiveness differences between FIDIC and AB & ABT. In this case, measures collected from literature review are used with regard to generating a scale to the evaluation process.

Flick, U., (2014) describing the thematic method of analysis developed by Braun and Clarke, they present a group of steps to help to provide illustrative examples for the analysis of empirical data. The concept thematic analysis is “searching across a data set to find repeated patterns of meaning” (Flick, U., 2014). In this study, this type of analysis is essential to interpret different aspects exhibited in the interview study. Thereafter, this will generate a good room for discussion to set up right answers for research questions.

2.1 Research Process

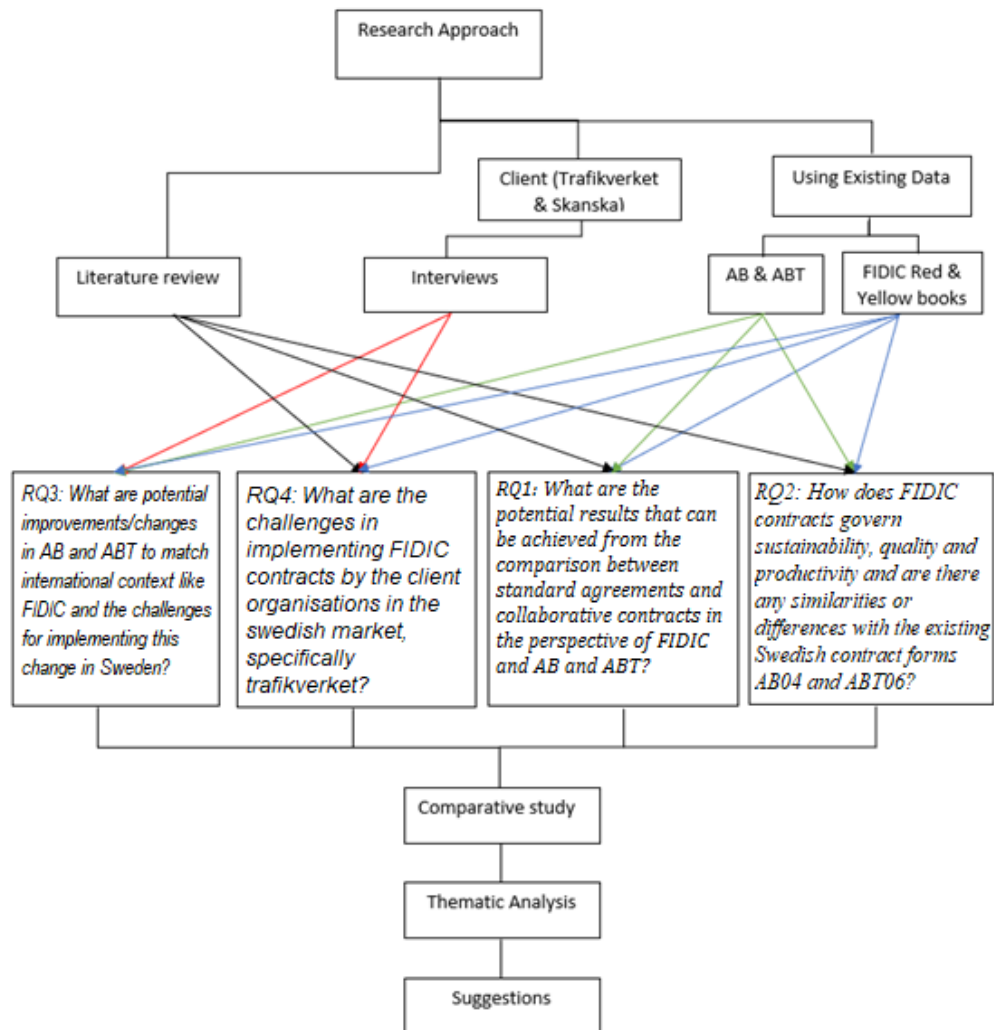


Figure 1. Plan for research process.

Research questions are developed depending on the availability of source of data and figuring out arised issues regarding the use of FIDIC by Swedish construction clients (e.g. Trafikverket). The research process in the figure above shows the relations between different sources and research questions, which are built from the core of the problem statement.

2.2 Research approach

This research is based on a qualitative research approach. This research also requires two methods of collecting data which are Talk as Data and Using Existing Data, this is the basement for establishing theories. The result of this theory will be presented as a solution in Chapter 7, Discussion and suggestions. Therefore, this movement from data to theories demands the adoption of an inductive approach for the research method.

2.3 Literature review

In order to understand theories of collaborative contracts in the Swedish construction market and find measures used to distinguish between specific clauses in FIDIC and AB and ABT, therefore a literature study is needed to be performed. A range of academic papers and articles were reviewed in preparation for literature review that will be drawn on theoretical data. The search methods used to find articles were done by using the search engine of Chalmers library database and Google scholar.

2.4 Interview study

In order to understand common barriers for adopting FIDIC contracts in mega-projects, an interview with a public client is discussed with experts from the construction industry in Sweden and international association. Therefore, an interview is to be conducted in a semi-structured manner with Daniel Sundin & Hans Huhmarkangas, working in the Department of contract management/administration as (Specialist kontraktshantering och beskrivning metodik), from Swedish Transport Administration. This requires an analysis and discussion regarding arised issues form the interview to be held with members in IABSE (International Association for Bridge and Structural Engineering). The second interview has a major focus on FIDIC and its benefits in the Swedish market, therefore an interview is conducted with Lennart Stenman Director for Business Development, Large projects, Skanska Sweden. The process of selecting right interviewees are challenging and require special interviewees experience contracting for a long time. Interview questions are developed with a focus on concepts represented in research questions. The guide for interview questions is available in the appendix.

Table 1. Information about interviewees.

Name of interviewee	Name of organization	Role in organization	Academic background	Involved in construction projects
Daniel Sundin & Hans Huhmarkangas	Trafikverket (Swedish Transport Administration)	Specialist kontraktshantering och beskrivning metodik	Civilingenjör/Chef/Uppdragsledare /projektledare inom anläggningsbranschen i 20 år	1000 Projects
Lennart Stenman	Skanska Sweden	Director for Business Development , Large projects	MSc Civil Engineering (University of Lund, Sweden)	A range of Large projects internationally and in Sweden

2.5 Comparative research

The comparison study between FIDIC contracts and ‘AB 04 & ABT 06’ can be conducted by reading both standards. However, Rasmus Rempling, Researcher at Chalmers University of Technology provides a full version of a package of FIDIC red and yellow books. In addition, Mats Karlsson from Swedish Transport Administration ‘Trafikverket’ provides a copy of ‘AB 04 & ABT 06’ in english language. The importance of caring comparison study is to reach trustworthy results and create a room to analyse and discuss them with results from empirical study. Subsequently, employ new results in the modifying process of AB and ABT, in order to suggest a solution for STA (Trafikverket) to make changes on current versions.

2.6 Thematic analysis

Empirical data contains two different views to this study, where the client (First interviewee, Trafikverket) experience less knowledge regarding FIDIC and great knowledge about AB and ABT, while the contractor (second interviewee, Skanska) have more knowledge regarding collaborative contracts, especially FIDIC. This range of data existing in empirical study shows the need for arrangement under one theme. Thematic analysis has the ability to convert the focus and be more about clearing the meaning of collected data. Therefore, thematic analysis is adopted in this study.

3 Theoretical Framework

This chapter, the theoretical framework starts off with general background information about contracting and contracting in the Swedish context followed by background information regarding the FIDIC association and the two main contract terms for civil engineering work, the FIDIC Red and Yellow Book Followed by information about the Swedish contract forms, AB04, ABT06 and ABK09. The chapter continues with key concepts supporting the aim of the thesis e.g. Degree of freedom. Thereafter, a distinguished variance between FIDIC and AB clauses is made. Followed by the entry barriers for collaboration of Swedish Transport Administration with international contractors.

3.1 Contracting

Contracts define the roles and obligations of the parties involved. It's preferable to have something written down than to be uncertain about who's responsible for what. This will help to prevent any misunderstandings or disputes. Contracts bind parties to fulfill their responsibilities. If one person wants to pull out of a contract, it can be highly destructive. A contract would bind the parties to the previously agreed-upon statement of duties, removing this issue. Contracts may specify a time period for completing tasks. If you need work to be done within a reasonable time period, a contract binds the parties to that deadline. For example, as a consultant, you might want to demand that the other party have adequate and timely access to key staff. Contracts will help you get paid. No one enjoys being short-changed for work done, and a contractual contract establishes a written legal obligation to be billed for services rendered. When a partnership falls apart, contracts have a safety net. If the negotiating parties' relationship deteriorates, the contract specifies the previously agreed-upon measures for terminating the relationship without retaliation (Coutu, w.d.).

3.1.1 Contracting in Sweden

The procurement process is a judicial term that consists of a person or a company signing a contract for buying a product or a service (nationalencyklopedin, w.d.). Normally the procurement process starts with inviting several companies to bid (Konkurrensverket, 2019). If the client is a governmental agency such as, municipality and other public authorities and agencies then according to the Swedish law they have to be regulated by the law of public procurement (LOU). If the client is a private client or the product or services procured is of a small size then the procurement could be direct procurement (konkurrensverket, 2019).

In recent years more organisations tend to procure specialists and consultants instead of employing in house (Upphandlingsmyndigheten, 2017). This requires the client to be able to specify their needs and requirements. There are tools for assisting the client

in the construction industry, a reference template called AMA short for general material and job description to help the client make the right estimation of the tender and get structured tender documents (Svensk Byggtjänst, 2019). The client is the party responsible for setting the requirements therefore they define the scope of work and what should be included in the contract.

The process of procurement and the contract form have a great impact on the execution of a construction project. A construction project is built by a collaboration of teams of specialists in diverse professionals, therefore it is easier for the client to procure a larger contractor that does the most of the work and if needed the contractor hires a subcontractor to do any additional work the contractor does not have in house. This makes it easier for the client so they don't have to procure every single subcontractor that would be problematic for the coordination. The most important aspects when choosing the contract form and the process of procurement is economy, time and risk (Söderberg, 2011).

The law of public procurement implies that if a governmental funded organisation is procuring a product or a service they shall do it in appliance with the law to regulate and promote the competition on the same conditions in EU and to secure that public tax money is used efficiently (Konkurrensverket, 2019). This includes all public agencies and companies and specific areas of business such as water, energy, transport and mail office. There are no specific laws on the product or the service procured but only on the choice of the supplier (Upphandlingsmyndigheten, 2018).

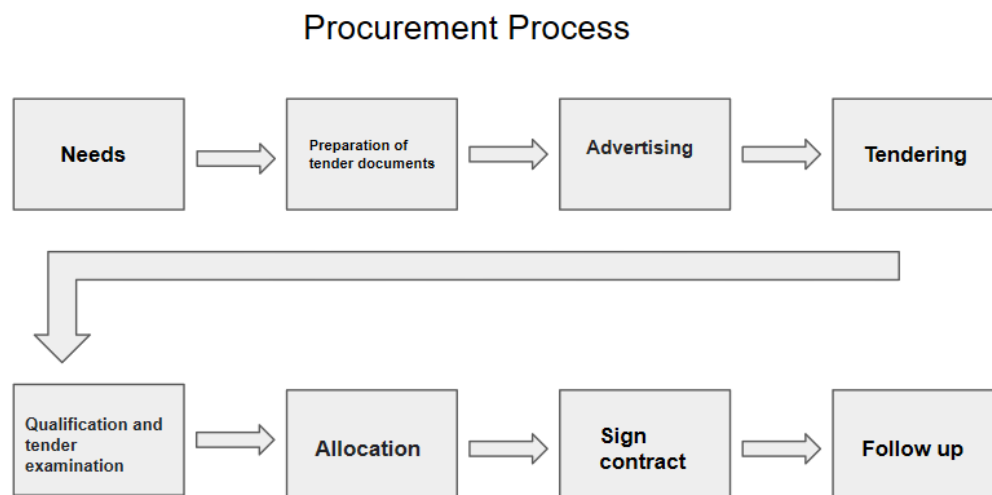


Figure 2. The major stages of the procurement process.

The procurement process starts with a need, a client is in need of a product or a service. Thereafter the clients need to specify the needs and requirements they have on the product or service and put it down in tender documents this could be done by

the client organisation alone or with the help of consultants and specialists. The tender documents are then published, and the tender process starts, where the client is in control of the parameters and requirements that the contractor needs to fulfill to win the bid. The tenders are then evaluated by the client organisation and the most qualified contractor in accordance with the client's requirements, wins the bid. The client and the contractor decide on risk allocation who should be responsible for what and then the contract is signed. The client can still influence the work by setting inspectors for follow up of the work to control that the contractor is working according to the agreement (Al-saadi, et.al., 2019).

3.2 FIDIC Background

FIDIC is the engineer's international professional body and to be more accurate it is an international association of the professional engineering bodies of member countries. The FIDIC association had its roots back before the time of the first world war, when 59 participants met at the world exhibition in Ghent in Belgium agreeing a formal constitution on 22 July 1913. The original founders of FIDIC were Belgium, France and Switzerland and they were later joined by other European countries who participated in the initial meeting. The FIDIC organisation became truly international in the mid 1950s when countries such as the USA, Canada and Australia joined as member countries. Now the organisation spans over 80 countries with member associations in Africa, Asia, Europe, Middle East and the Americas (Fidic homepage, w.d.).

The FIDIC association's main objective written in their homepage is to improve the business environment and promote the interests of consulting engineering firms on a global and local scale, consistent with the responsibility to provide quality services for the benefit of the environment and society. The general objectives of the FIDIC association is the following: Represent the consulting engineering industry globally, enhance the image of consulting engineers, be the authority on issues relating to business practice, promote the development of a global and viable consulting engineering industry, promote quality, actively promote conformance to a code of ethics and to business integrity and promote commitment to sustainable development (Fidic homepage, w.d.).

Engineers will need to become more involved in the political and social debate and its impact on the solutions offered for global challenges, to better match available resources to the needs of society. The past one hundred years of engineering excellence contribution have shown what can be achieved. The foundations for a sustainable future have been provided, with the consulting engineer now established as an essential partner for an improved society. Effective engineering is clearly fundamental for humankind, but the strategic planning skills of engineers need to be

universally recognised and used for the benefit of everyone. FIDIC strives to be recognised as a trusted adviser to decision makers involved in the planning and construction of a sustainable infrastructure for future generations! FIDIC will collaborate with other like-minded organisations to achieve this objective (Fidic homepage, w.d.).

The FIDIC association comprises different types of members. The members category with the most importance is the Member association, each country is limited to one member association that intends to be the principal engineering organisation in the country. For example, in the UK, the association for consultancy and engineering represents 800 consulting firms. In the US it is the American Council of Engineering companies. In the case of countries where they don't have a member association, any individual, association, organisation, firm or group of firms with engineering consulting as a main objective of their activities can apply for associate membership. The headquarter of the FIDIC organisation is located at the world trade center II at Geneva airport, where its secretariat is also located. The secretariat is responsible for operation of the organisation and comprises a Managing Director, a general manager, publications manager, an event manager, an accountant and an administrative assistant. The executive committee is responsible for decision making and comprises representatives from nine member associations (Fidic values, w.d.).

3.2.1 FIDIC values Sustainability, Quality and integrity

- **Quality:**

FIDIC policy promotes quality improvement with high commitment to produce a developed quality management system. FIDIC gives quality a significant weight compared with other key attributes of professional services. This achievement required team effort from all parties stakeholder of the project, government, client, consultant, contractor, supplier and operators. The FIDIC quality-based selection guide highlights the provision of services by consultants in terms of creating value related to improving quality, and ability to provide solutions. FIDIC perceives quality improvement as a network of excellence work done by multi members, which requires a focus on continuous development of every employee by providing training programs (Fidic values, w.d.).

- **Integrity:**

According to the FIDIC association, they have been energetically promoting integrity within the industry for years. There is an idea supported by evidence that a formal and systematic approach to integrity management works better than unpredictable efforts by individual organisations, but this idea has been slow in achieving success in the consulting industry. Clients, contractors, government procurement organizations, and financing agencies must all work together to discourage, not just punish, corruption. The term "integrity management" is used by FIDIC on purpose. FIDIC advocates for

ethical honesty in the fight against corruption, as well as an integrated management system to monitor and check its performance. FIDIC also has a dedicated Integrity Management Committee (IMC) and is charged with developing policies, guidelines, and procedures aimed at better understanding and managing the risks of corruption (Fidic homepage, w.d.).

- **Sustainability:**

FIDIC and its partners have proposed a new approach for sustainable urban development based on integrated systems, new synergies, and increased collaboration. The Sustainable Development Committee (SDC) of FIDIC is in charge of the organization's sustainability efforts. The SDC's mission is to create a knowledge base of project successes and technological advancements in the field of sustainable development, from which best practices and lessons learned can be shared. Incorporate project sustainability management principles and practices into industry policies, processes, procurement documents, and quality assurance programs, as well. FIDIC also publishes several sustainability best practice guides and information papers (Fidic homepage, w.d.).

3.2.2 FIDIC Redbook

The FIDIC red book includes the contract terms for civil engineering construction projects. The FIDIC red book maintains FIDIC's basic principles of balanced risk sharing while attempting to build on the extensive experience gained from its use over the previous years. It includes, for example, more detail and clarity on the standards for notices and other communications, provisions for treating Employers' and Contractors' claims equally and separating them from disputes, mechanisms for avoiding conflicts, detailed provisions for quality management, and verification of Contractor's contractual compliance. These Construction Contract Conditions contain provisions that are likely to apply to the vast majority of construction contracts. In the Particular Conditions Part, A – Contract Data, essential items of information specific to each individual contract must be included. Furthermore, it is recognized that many Employers, particularly governmental agencies, may require special contract terms or procedures not included in the General Conditions. Part B – Special Provisions shall contain these (Fidic Red book 2nd ed., 2017).

This publication begins with a series of detailed flow charts that usually depict the sequences of activities that distinguish the FIDIC Construction form of contract in visual form. The charts, on the other hand, are for illustration purposes only and should not be used to describe the Conditions of Contract. This publication also contains several sample forms to assist both Parties in developing a common understanding of what third parties, such as security and guarantee providers, require (Fidic Red book 2nd ed., 2017).

3.2.3 FIDIC Yellow book contracting conditions

For nearly two decades, the FIDIC Yellow Book has been widely used. It has been praised for, among other things, its concepts of equal risk sharing between the Employer and the Contractor in projects where the Contractor designs and builds the works, as well as providing plant, in compliance with the Employer's requirements, which may include any combination of civil, mechanical, and electrical work. The FIDIC Yellow Book draws on the extensive expertise gained from its use over the past 20 years while upholding FIDIC's core principles of balanced risk sharing. The Yellow Book, like the FIDIC Red Book, contains more information and clarification on the conditions for notifications and other correspondence, regulations to resolve Employers' and Contractors' claims handled fairly and isolated from conflicts, procedures for conflict avoidance and detailed provisions for quality control, and verifications of Contractor's contractual enforcement (Fidic Yellow book 2nd ed., 2017).

This publication contains Notes on the Preparation of Tender Documents and Notes on the Preparation of Special Provisions, which provide valuable advice to drafters of contract documents, particularly the Employer's Requirements and Special Provisions, to assist Employers in preparing tender documents and drafting Particular Conditions of Contract for specific contracts. Employers are advised to obtain legal and engineering advice when drafting Special Provisions if clauses in the General Conditions are to be substituted or supplemented, and before adding any example wording, in order to prevent ambiguity and ensure completeness and continuity with the other provisions of the contract (Fidic Yellow book 2nd ed., 2017).

3.3 AB contracts

Negotiated standard agreements have dominated Swedish construction industry over a century, until collaboration gets into account and makes the conversion to uniform standard agreement system called AB system (Samuelssn, P., & Iwar, L., 2005). The construction Contracts Committee (Föreningen Byggandets Kontraktskommitté, BKK) made contracting agreements covering the whole contracting documents required for construction projects in Sweden. The building and construction industry in Sweden have different contract preparation standards that govern procurement and contract processes among consultant, client/employer, contractor, and suppliers. Standard agreements are divided into contract standards that depend on the type of procurement and contracting process. The main types of contracts are construction/performance contract and Design-build/totalentreprenad contract which are called AB 04 and ABT 06 (Allmänna bestämmelser, AB), respectively. Swedish contract agreements are not project-specific and jointly negotiated by agreed parties within the construction industry (Boverket, 2020).

3.3.1 AB 04 (Performance Contract)

AB04 presents contract conditions of Design-Bid-Build (DBB) type of contracts in Sweden. Swedish standard agreement 'AB 04' corresponds to an international contract 'FIDIC Red Book'. In this contract, the client is responsible to provide project design, while the contractors carry on to run building, civil engineering and installation work. Client/Employer can access to a construction management contractor (CM contractor) early in the process acting as an advisor, and also being responsible to procure and coordinate multiple parallel contractors as it shows in Figure x.



Figure 3. Divided contract, different contractors, parallel contractors to each other in Design-Bid-Build (Kadefors, 2019).

The second option for a client/employer is to choose a general contractor who will be responsible for construction works, and procurement and coordination of subcontractors (Kadefors, 2019). Issa and Olbina (2015) observed that the traditional form AB 04 is missing key contractual aspects such as the process of procuring subcontractors and their responsibilities, collaboration methods, strategic incentives. In addition, the position of splitting client and consultant on a side apart from contractor will create barriers and work against the idea of collaboration and sharing common goals (Issa and Olbina, 2015).

3.3.2 ABT 06 (Totalentreprenad)

The Swedish standard agreement 'ABT 06' presents contract conditions of Design-Build contracts (DB) in Sweden. Swedish contract 'ABT 06' corresponds to an international contract 'FIDIC Yellow Book'. In this type of contracts, general contractor will be responsible for design and building processes by receiving the performance specifications from client/employer as it shows in Figure x. General contractor has the choice of hiring a consultant, and being responsible to procure and coordinate design team and subcontractors where in this case it's called turnkey contract (Kadefors, 2019). Main contractor has the responsibility of increasing the degree of consistency of purpose. In this form, the ability to add manuals for guiding strategic and administrative decisions on a project-base is allowed. The increased

number of using ABT 06 in the Swedish market shows about half of projects regulated under this agreement form. This is due to significant characteristics provided by ABT 06 such as more integrated process, early collaborating and the existence of steady information flow (Issa and Olbina, 2015).

ABT 06 Significant characteristics:

- Increasing the opportunity for high collaboration and partnering agreements.
- contractor's internal organizational goals are related to the achievement of project goals.
- The execution phase can start in parallel to the design phase, where it works on saving time. At the same time, any delays in regard to the construction work will carry serious consequences.
- Less competition for winning this bid, due to limited number of organizations that have access to large competences and experiences to manage design and construction work.

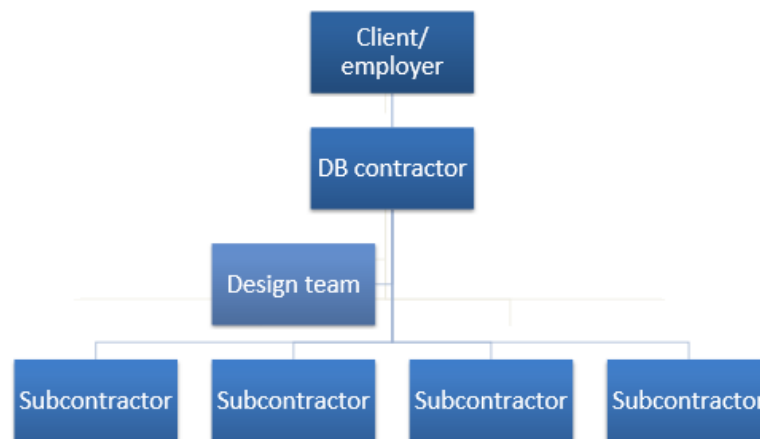


Figure 4. One contractor becomes the general contractor in Design-Build (Kadefors, 2019).

3.3.3 ABK 09 (Consultants form)

Swedish standard form ABK09 contains conditions of contract covering consulting assignments under engineering and architectural subjects. ABK09 is valid for all technical areas that start from initial design within early stages of conceptual design to detailed project design in the implementation stage. Consultants work often needs arrangements for the exchange and delivery of design information on an ad hoc basis, where it can be added as an appendix attached to this form of agreements. ABK09 tailored for ensuring the copyright of design information that hand out as hardcopy such as paper drawings, and it's not flexible to regulate modern digital information. This form lacks important aspects for consultants such as the support of integration and collaboration, and responsibility of accuracy and correctness of detailed design documents (Issa and Olbina, 2015). The relationship of consultant represented by

ABK 09 conditions with AB 04 and ABT 06 are presented by following Figure X.

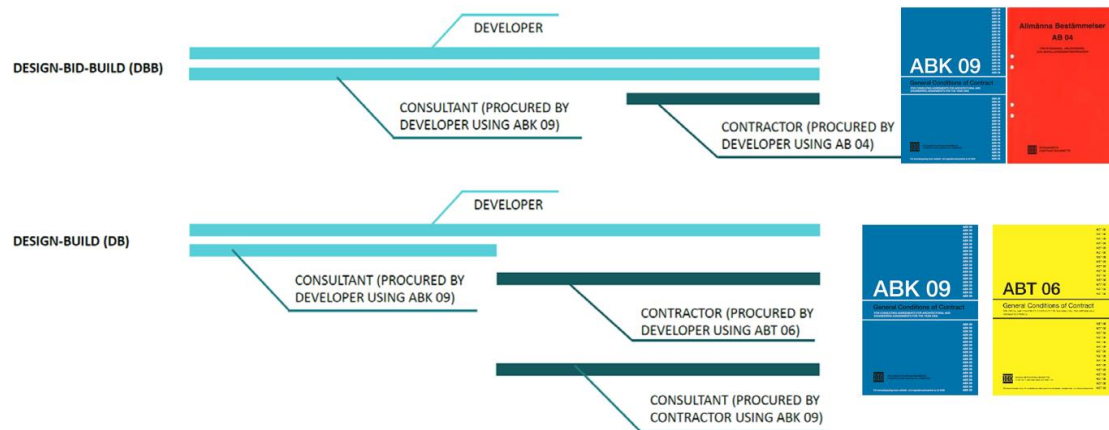


Figure 5. Relationship of ABK 09 with DBB and DB (Vogel J. A., 2020).

3.4 Degree of freedom

The degree of freedom in a construction project is correlated to the degree of freedom in the design phase of the project. Meaning that the client involving the contractor in the early stages of the project would promote more innovation and productivity in the execution phase of the project. Moving from Design-bid-build (DBB) to Design-Build contracts is one strategy that is thought to increase the pace of innovation and productivity. The latter, according to popular belief, gives the contractor more flexibility to innovate. According to theory, DB contracting has a higher potential for promoting creativity than DBB contracting. The contractor's degrees of freedom to design the project enables the contractor to consider new approaches to construction (Lind, et.al., 2014).

3.5 Design risk

By definition, project delivery approaches distribute risk for design and construction. The benefit of using DB is that it moves two primary risks from the conventional design-bid-build (DBB) delivery system to the design-builder: design liability for defects and omissions in proposals and conflicts between designers/owners and contractors. Design liability and disputes are only two of the many hazards that (Trafikverket) must consider when determining whether or not to use DB. Transferring other risks will result in higher initial prices or less design-builder competition, whether deliberately or unintentionally (Dai, & Molenaar, 2014).

3.6 Quality measures in construction contracts

Trinkūnienė, E., et.al., (2017) examined the possibilities of arising disputes among client/employer and contractor caused by the different ways of understanding quality and its requirements that both parties have in the construction works. Trinkūnienė designed quality assurance criteria that aim to limit disputes and increase quality at the early contracting stages by detecting and analysing contract characteristics related to quality assurance. The developed quality assurance criteria by (Trinkūnienė, E., et.al., 2017) will be used in Chapter 4, in order to set up the quality pitfalls in FIDIC books and AB04 & ABT09. These measures govern the contract clauses that cover following terms *time limits, delivery of materials, Supplementary and unforeseen works, deviations from the contract terms, cooperation obligation, and obligation to act diligently*.

3.7 Productivity measures in construction contracts

In accordance to Bröchner, J. and Olofsson, T. (2012), Swedish construction clients perceive the increase in contractor and client productivity is a combination between the ability of clients to introduce changes, and react to contractor suggestions for change during the contractual period. They also prefer getting full access to make changes on the contract's scope of work, when it is essential for project success. Therefore, *the degree of freedom and availability to create a room for adjustments and making changes during the project life cycle* will be considered as a measure for conserving high productivity.

3.8 Sustainability measurements in construction contracts

Sustainability is divided into three different categories, economical sustainability, environmental sustainability and social sustainability. The complexity of a construction project creates challenges in measuring sustainability, therefore, *the most common method to measure sustainability in the construction industry is to create a life cycle analysis of the project from the start of the project to end of the buildings lifecycle*. The building's life cycle is divided into 5 different stages, inception, design, construction, operation, and demolition. In each stage there are factors affecting social, environmental and economical sustainability. For example, in the inception stage, the planning of the use of land, considering that the land selection for a project site should protect cropland and natural resources. Another example in the design phase, consideration of life cycle cost, Consider the total cost involved in the project life cycle, including site formation, construction, operation, maintenance cost and demolition cost (Shen et.al 2010).

3.9 Distinguished variances between FIDIC and AB clauses

The main differences between FIDIC contracts and AB contracts are studied without a focus on ability of adopting FIDIC contracts in Sweden. However, the studies were limited to state differences without making a detailed comparative study that distinguishes the major difficulties of adopting collaborative contracts in Sweden.

3.9.1 Variations and Adjustments

Variations and adjustments hereby mean new changes for employer's conditions and requirements of the work set up early in the contract. The clear difference between FIDIC and AB in regard to variations and adjustments is that FIDIC contains an agreed procedure in case any requests for amendments have been raised during the construction process. These amendments are to be arranged under the agreed undertakings within a specific contract clause. The possibility to monitor and follow up conducted work, done by the contractor, is considered as a key point for the customer in order to measure and evaluate the need for such changes and modifications. FIDIC hereby gives the right for the contractor suggesting performance modifications and sends them to the client as a proposal. The client is committed to preview the proposal and replay with a comment to the contractor. This is not limited to the client but even its representatives. In addition, FIDIC perceives the renegotiation situation is a right solution in case of unsanctioned proposals. In contrast, AB lacks this type of commitments by the client to consider performance changes suggested by the contractor, while it only gives the right for the contractor to make proposals for performance changes. AB imposes different ways for the client to prescribe changes and supplementary works. The validation period of these changes can start only when the client presents a written order to the contractor during construction meeting minutes, or send it with contract documents prior to the commencement of the work. Therefore, AB statements have not great accuracy for forthcoming performance, where the situation in FIDIC can be described as stringent formalities and nor owns disparity among changes and supplementary work (AB System, FIDIC Red and Yellow Book, and Samuelsson, P., & Iwar, L., (2005)).

In FIDIC contracts, the contractor may accept or have special considerations to revoke what client's adjustments and variations came out for the contractor to accommodate with. The contractor has the right to not accept the request from the client because of the following:

- Contractor may have hesitation or reluctance during the achievement of the required order for the modification.
- Safety measurements of work are at low levels.
- Schedule of guarantees can be affected readily by variations.

Costly deviations appear when fundamental conditions differ from basic contract documents due to the effect of variations and supplementary work. FIDIC and AB consider cost adjustment by contractor valid only if these changes bring prejudicial effect on contractor's performance (AB System, FIDIC Book, and Samuelsson, P., & Iwar, L., (2005)).

3.9.2 Liquidated Damages

In AB 04, (Chapter 5: Liability and Rectification of Defects) AB, define and determine liquidated damages, where it is applied when the contractor exceeds agreed time of completion. Liquidated damages are calculated on a weekly basis or can be distracted as a portion agreed between client and contractor. This amount is to be stated in the contract documents as a percentage of the contract price. In some cases, it can be agreed for a specific period of execution work that needs to be done by the contractor. The validation of liquidated damages starts only if the employer/client submitted a written document to the contractor no later than three months after the approved contract documents. Therefore, liquidated damages are not capped within the context of the AB contract system, but it should comply through an agreement between client and contractor.

In FIDIC Red and Yellow books, Liquidated damages are capped by clearer wordings under 'Commencement and Delays' clause 47.1 in General conditions, while it is stated by clause 8.2 'Delay Damages' in FIDIC Red and Yellow Books. The deduction amount is represented on a daily basis and should be mentioned by Appendix documents. When the contractor fails to fulfil stated requirements by clause 48.1 'Taking-Over Certificate', sub-clause 8.8 'Time for Completion', and sub-clause 20.2 'Claims for Payment and/or EOT' regarding passing completion tests and finishing within the contract period, then the contractor is obligated to pay liquidated damages. Obligations of the contractor to complete work from tasks and deliveries should not get relieved during time of detection. The payment method applies through a direct deduction from monthly invoice, which aims to limit client losses. The total amount is determined under contract data that has to be attached to contract documents under Appendix documents.

3.9.3 Force majeure

Swedish law addresses force majeure as the occurrence of circumstances due to an exceptional event, which is consistent with FIDIC definitions. AB and FIDIC views circumstances as a damage for employer's work may be introduced by concrete events such as war, riots, natural disaster, etc. However, AB does not regulate force majeure under a specific clause but it is mentioned under other clauses that are an extension of time, termination, and liability for construction period. For example, AB deals with circumstances not caused by a contractor, preventing a contractor from

performing construction work, through giving the contractor the possibility to be entitled for time extension. AB also gives the right for both employer and contractor to terminate the contract because of the difficulty for anticipating arised circumstances. While, when it comes to payment obligations under identical circumstances, FIDIC clauses stated that payment obligations are not applicable anymore. In this case, the contractor is responsible to inform the engineer regarding expected delay, damages and losses. Thereafter the engineer will decide to what extent the contractor can access for a time extension. Despite the minor differences, AB and FIDIC end up with almost similar outcomes in terms of applied obligations among parties under this clause (FIDIC Red and Yellow Book, AB System).

3.10 Collaboration of Swedish Transport Administration with international contractors

Eriksson, P. E., et al., (2018) identify main challenges facing Trafikverket for attracting international contractors to participate in Swedish mega infrastructure projects. Challenges are varying depending on contractors' background and experience, which include entry barriers, cultural differences, and language and communication.

3.10.1 Entry barriers

Entry barriers for new international contractors are not limited only for entering a new market, where it could cover changes taken within the organization structure such as employers or even adopted strategies. For example, newly firms prioritize increasing production without taking into account how much personal difficulties and complexity may arise. This increases the probability of ending up with diseconomies of scale. In addition, risk of brand identity may arise due to customers' preference to facilitate with already existing suppliers. Another entry barrier is learning how to do it more efficiently from the perspective of the customer, here it relies upon the organization's competence and ability for adopting new technology. This applies as long as customers' requirements are interchangeable and demand products assembled by the use of specific standardization and customization. Furthermore, Eriksson, P. E., et al., (2018) put the spot on differences in governmental policies and the client practicing a high degree of control. In Swedish market, contractors perceive the involvement of Trafikverket as a client is higher compared with other European countries. Client's interference and authority create a room for misunderstanding and weaken contractor's ability to adhere to new norms and standards. Relatively, there are mainly a few large contractors that run large projects in Sweden. These few contractors with strong reputation have restricted the relationships with common partners, which makes it hard for partners to get in touch with new competitive contractors for their customers. Then, it's difficult for new contractors to access such relationships. Under those circumstances, Trafikverket encourages international

contractors to have a long-term strategy aimed to handle market entry issues (Eriksson, P. E., et al., 2018).

3.10.2 Cultural differences

The Swedish method of collaboration has no restrictions between the cooperation process between client and contractors, which is not similar to the way of cooperation used by international contractors. In Sweden, when problems and mistakes appear for contractors then it is common to have an open discussion with the client to get solutions. While, international contractors are not used to the Swedish way of cooperation that is based on openness with the client. They also have fears from showing the client their mistakes which could increase risks as they call it playing with open cards. International contractors are facing an important stage to understand the transformation from individualism/arm-length relationships to collectivism approach, where it is essential for them to build a new cooperation strategy simulating Trafikverket's collaborative and supportive approach (Eriksson, P. E. , et al., 2018).

Therefore, international contractors perceive submitting tenders for mega projects that require high collaboration ambitions as the main challenge for entering Swedish market. In addition, this comes with the confusion of understanding the difference between formal and informal collaboration. The focus on informal communication despite the importance of formal documents that are required in upcoming stages for ensuring low uncertainty. International contractors' concessions of following high power distance will increase the opportunity to have joint decision making, and resulting with high collaboration (Eriksson, P. E., et al., 2018).

3.10.3 Communication and Language

Swedish people are knowledgeable in handling English language, especially clients in the construction industry. Therefore, communication challenges are limited to increasing the risk of misunderstanding and confusion due to dealing with people from different cultural backgrounds. This type of challenge is related to knowledge base and learning skills, for example taking courses regarding communication (Eriksson, P. E., et al., 2018).

3.10.4 Recommendations

Recommendations for International Contractors are based on acquiring a knowledge base and hiring new staff. Communication, collaboration and entering Swedish market are major aspects that can be learned through taking courses. For instance, Multi-cultural differences can be solved by getting enough knowledge from a course talking about Swedish business culture. Second important barrier is misunderstanding arising from speaking English language, therefore taking courses to improve technical English is essential. Furthermore, staff are in need of taking courses regarding partnering and collaboration. This can be applied through workshops and may be in

collaboration with research institutes. Getting knowledge about Swedish market by entering the market through investments prior to the commencement of the project is a solution to practice the business in Swedish market. Finally, the more powerful tool for full access to the market is to hire Swedish staff experienced in this field, and/or get a contract with Swedish partner that possesses high competence from similar previous projects (Eriksson, P. E. , et al., 2018).

3.11 Opinion of Swedish Law firms

VINGE and LINDAHL are Swedish large law firms that harmonize with construction contractual issues to accolade them and find the solution. Both firms contribute in collaboration agreements due to its positive impact on the ground. Therefore, they touched on collaboration presented by the FIDIC contracts and studied major differences with the AB contracts.

VINGE defines the AB contract as an agreed document where both parties are responsible to set their conditions and discuss them prior to signing an agreement. The best feature for AB contracts is the existence of compromise solutions intensively within the agreement. On other hand, FIDIC contracts are not agreed documents and it is introduced through clearer wordings to be applied literally. In addition, the importance of containing adjustments during contract running time is not allowed by AB contracts, while for FIDIC contracts, adjustments are considered to be taken over particular conditions. VINGE also mentioned apparent differences such as Liquidated damages getting capped by FIDIC and its not fully capped by its counterpart. After the completion of the project, FIDIC contracts hereby ensuring one year for defects notification period followed by legal defects liability period. AB contracts count five years guarantee from defects that start directly after project completion time. The figure below presents a brief comparison done by VINGE between FIDIC and AB contracts from the consultation perspective (Anna Kadefors, 2019).

The AB-contracts vs. the Fidic-contracts	
The engineer	
AB	FIDIC
• Agreed document – full of compromise solutions • Adjustments should be avoided? • No equivalent to the Engineer • Liquidated damages – no cap • Inspection • Guarantee period 5 years • Forms for dispute resolution	• Not an agreed document – clearer wordings • Adjustments are presumed to be made in the particular conditions • The Engineer – “not a wholly impartial intermediate” • Liquidated damages - capped • Test on Completion/Taking Over • Defects Notification Period (appr. 1 year) and Legal Defects Liability Period • Forms for dispute resolution

Figure 6. VINGE detection to the major differences between FIDIC and AB contracts from the Engineer perspective (Anna Kadefors, 2019).

LINDAHL gets step further in its identification of the differences between FIDIC and Ab and ABT, where the major focus of their study was about how each contract deals with disputes and risk share problems. This comes clearly when LINDAHL takes involvement of an Engineer in FIDIC as an important party to participate and being responsible for taking decisions in critical clauses such as extension of time, dispute adjudication, etc. In addition, an Engineer here is acting as an agent for the employer and has the role of contract administrator. Hence, Engineer in a FIDIC contract is considered as a third-party contract administrator appointed by the employer. Furthermore, LINDAHL mentioned main differences between FIDIC and AB/ABT, for example in FIDIC there is no need for inspection procedure, but it is done by a test at the end (Advokat, P., M., och delägare Advokatfirman Lindahl, 2014).

4 Empirical Data

This chapter contains the outcomes from two interviews conducted with Client, Trafikverket, and the contractor, Skanska.

4.1 Client

In order to get a deeper understanding of the research question of this paper an interview was conducted with two specialists from the client organisation Trafikverket. The two interviewees from Trafikverket are currently working in the department of contracting and description methodology. Both interviewees have a large knowledge base in the field of contracting where they both have been involved in more than thousand projects and 20 years experience working in Trafikverket. They have mostly worked with creating tender documents for contractors and subcontractors, as well as creating contracts for contractors and are familiar with the Swedish contract forms AB04 and ABT06. Most of Trafikverket's projects are large infrastructure projects that need large contractors to handle these types of projects, and in Sweden there aren't many competitors on these projects. The interviewees claim that most of their work is for the organisation "Svensk byggtjänst" where most of the projects are infrastructure projects.

According to the interviewees, the most common disputes arising when working with the contract forms AB04 and ABT06 are what to be included in the contract, mostly which party should be responsible for what. These disputes arise both in AB04 and ABT06. The interviewees added that both contract forms bring equal amounts of tenders and that there is no difference in the number of tenders in the different contract forms. The competition is also fair enough, there are a fair number of tenders in each project they had but there is still room for more variations and tenders. Duo to the brief description in the contract forms AB04 and ABT06, Trafikverket have created their own complementary documents for AB04 and ABT06 that includes EK standing for contractors contract, AF standing for Administrative regulations, TBE standing for technical description for contractor and changes for AMA standing for general material and job description for construction work.

When the interviewees were asked about the matter of international contracting, the information they had was vague and nearly not existing. They had in their 20 years working at Trafikverket never been involved in procurement of international construction and infrastructure contractors. On the other hand, they had knowledge regarding Trafikverket involvement with international contractors and according to them there are few projects of that kind. The reason for the weak presence of international construction and infrastructure contractors is the barriers existing today in the form of understanding Swedish contract documents and governmental processes and also the work culture.

The interviewees were not familiar with the international contract form FIDIC when the question was asked the answer was “We have only heard the name, nothing more”. In their opinion they have an already working system for procurement of construction and infrastructure contractors and that is the system they use today, AB04, ABT06 and their added complementary documents.

4.2 Contractor

The interviewee is a project director at a large Swedish international contracting company his work involves mostly practical management of infrastructure construction projects and the negotiation of the contract documents for the projects. He started working in the construction industry in the early 90s and worked mostly on the contractors side with the Swedish contract forms AB and ABT. The interviewee started their first international role in 1993 in Africa where he worked on a project with FIDIC contract form a project he pointed out to be a true turnkey project in comparison with the Swedish contract form for build and design contracts, ABT. The interviewee continued to work internationally with his organisation and after 7 years in Africa he moved back to Sweden to the “hallandsås” tunnel project then to the states where he worked with the American general conditions for contracting civil engineering work. Afterwards moved on to the UK to work on the New engineering contract form and back to Sweden to work on AB and ABT in mega infrastructure projects “city central station tunnel” in Malmö and “ESS” in Lund.

From the contractors point of view the Swedish contract forms AB and ABT are lagging behind in comparison to international contract forms such as new engineering contract and FIDIC. The AB and ABT contract forms per se are not the problem according to the interviewee the main issue is the clients use of the contract forms. For example Trafikverket, most of their projects are procured through lowest price competition, the problem in this kind of bidding system is that the lowest price wins and that means that the contractor that does not understand the risk wins the job because if the contractor put in risk allocation then the price will increase and the bid will be lost which results in the person with the lowest risk allocation winning the bid leading to disastrous outcome most of the time. There are several examples of this scenario repeating itself with the common nominator the client organisation Trafikverket. One example that the interviewee mentioned is the “förbifart” project in Stockholm where the contractor organisation was a foreign contractor from Italy. The contractor got terminated from the project because of health and safety reasons but according to the interviewee the real reason was the unforeseen ground condition and when the client in that case Trafikverket was notified on the issue they acted tone deaf and didn't listen to the contractor and finally terminating them to hire another contractor with the previous contractor's forecast on the rock conditions which the interviewee noted to be very strange. Another example is “hallandsåsen” tunnel project where the cost ended up 10 times more expensive than it was agreed upon in the bid due to the same reason, unforeseen ground conditions.

Unforeseen ground condition is a reality and it is difficult to investigate everything in the ground, in that case something has to be investigated and if any changes or unforeseen conditions is revealed after the contract is signed then there have to be a method for changing the price that is deriving from the agreed sum or work with target cost instead. Working with fixed price competition and the conditions in the bid differs from reality then fixed price becomes a problem because there might be additional work that is not included in the contract and the price. E.g. a tunnel project can't be purchased on lowest price and expect everything to be included because there will most certainly be differences in the ground conditions from the ones in the bidding documents because everything in the ground can't be foreseen before the real digging starts. Unfortunately, due to inexperience in the client organisation this problems leads to disputes often ending up in court or settling and the contractor suffers economical damage like in the case of the Italian company in the “förfärd” project they went out of business after that project and that is not healthy for business and society.

The UK in the 80s and 90s nearly all contracts went to arbitration and everybody was fighting in court, contractors will go bust and the clients also went bust. Then they made a couple reports of the matter and wrote that the situation could not continue in this way and it had to stop because at the end of the day it was only the lawyers making money. They started in the late 90s with collaboration contracts and in the interviewees opinion it is working very well. Since 2000 they haven't had any arbitration on big civil engineering contracts and the reason is that they use the collaboration in a very efficient way. *“It doesn't mean that they are friends or anything there could be lots of arguments but still there is a way to solve it without going to court”* compared to AB and ABT where in the case if the contractor does not agree with the client it is easy to take legal action and go to court.

The best contract to manage difficulties is the new engineering contract because what that contract is doing is that it has methods that the contractor have to follow, early warnings they call it, so as soon as the contractor stumble upon something that could be a problem or create a problem in the future they need to flag an early warning. The client has to accept that an early warning has triggered, the management of the project has two weeks to sit down together and come up with a solution and the quicker the issue is solved the scope of work can be changed continuously and the sooner the progress can proceed. If the contractor is demanding compensation for additional work then the contractor has to state it and send it in to the client and the client has two weeks to decide if they should compensate or not. In case they don't agree there should be an independent internal adjudicator belonging to the project and following the project from start to end that is involved in this type of decision making.

Also, in these types of contracts they work mostly with target cost instead of fixed price. When working on target cost the contractor is paid for the job done and if the

price is below the target cost there is a system for sharing of incentives for the sum below the target cost. The good thing with a target cost contract is that they run open books so everybody can see how much money the contractor is making and also it is easy to make a decision. If a problem that wasn't foreseen arises then a budget is made for the additional work and if the contractor is blowing up the budget the client could see that and reject the solution. The client can always regulate things openly together with the contractor, for complex infrastructure projects where there are a lot of unknowns such as geological conditions, collaboration contracts are the better option due to the disputes arising in these types of projects. The client should pay for the reality they shouldn't just pay because someone wins the bidding competition the bidding competition is based on assumptions and the contractors pushes down the price to be able to win, if the contractor win they will be very stretch and at the end of the day it doesn't matter who wins because whoever wins the bid ends up having a hard time.

The ESS project in Lund is a project that is outstanding in terms of the collaboration and the execution of the project. The project does not differ from any other contract in Sweden in terms of the contract form, the contract form and the general conditions in that specific project comes from the Swedish contract form AB. The difference in this project compared to the previous mentioned projects with Trafikverket is that the client in this project was very experienced, the same client working for the client organisation in "öresundsbron" according to the interviewee that project is a landmark in terms of execution and management. The "ESS" project was handled in a different way, simply more collaboration, the client organisation in the project consisted of three people managing 8 billion Swedish kronor and the trick they used was assigning the same company in both the design and execution phase which made the project completely integrated. Collaboration documents that resemble the new engineering contract were added in the "entreprenad kontrakt" with AB as basis and that project has been ongoing for 6 years and have been going very smoothly according to the interviewee that is currently working on the project as a project director. AB and ABT are general conditions and for every project there are always added contract documents from the client; these extra detailed conditions and clauses for the specific project are agreed on by both the contractor and the client. These documents can contain anything all parties on the project agree on and there should be an independent internal adjudicator involved in the project in case of disputes. There is room for implementing collaboration work and early warnings and other concepts from international contracts.

The client is a deciding factor in how well the execution of a project will be e.g. the guy working for the client organisation in "öresundsbron" as a project director, people that can manage that type of projects are very experienced and the same guy worked with the interviewee in the centralstation project in Malmö "citytunneln" and that project was delivered 9 months in advance and 1 billion below budget. The client is the one deciding what type of contract they want to use on their project and that

authority can have a large impact on the outcome of the project. Inexperience in the client organisation leads to devastating outcomes on the project like in the case of Trafikverket, they are purchasing on lowest price and don't understand or want to understand that the bid is only assumptions and if these assumptions are wrong then it must be re-evaluated.

Working in international contracting project compared to Swedish is different e.g. in Africa the interviewee was involved in a FIDIC contract project he called a true turnkey project adding that Trafikverket often present projects as design and build but there are truly no design the contractor need to comply with their demands on the design. But in the FIDIC project in Africa they had total freedom in the design the client wanted a certain amount of underground storage and he didn't have any previous experience so the client involvement was very low but in the end the client was handed over a "key" and he could just turn it on and start using the facility and that is called a true turnkey project not like the ones Trafikverket present.

Working with FIDIC compared to AB and ABT is pretty much similar but in FIDIC there the engineer is the person with the main authority and decision making assigned by the client to survey the design and execution of the construction work. In the FIDIC contract the contractor gets paid by rates and if the rates change the contractor get reimbursed for rate changes e.g. if the client and the contractor agree to excavate thousands qubicmeter and it turns out to be two thousands qubicmeter when the work starts then the engineer will agree to the increase in volume and the contractor get paid for it so from that point it is fairer. When working with FIDIC there could also be fixed prices but then the client has to have a different role. In the alps there is a lot of tunnel projects going on in Switzerland and Austria this contracts focus very much on details to cover everything so whatever happens on the contract the contractor get paid for it because they have quantities for everything so they do a budget to start with but if it is more of something then they get paid for that and if it is less of something they don't get paid for it so it balances.

Trafikverket are mostly using lowest price competition on their projects in both AB and ABT contract forms. The contractor receives the documents to assess it and then price it, it is done in a competitive nature therefore the contractor needs to be very efficient in the execution and *"if you win the job you have very tight margins"*. In the high-speed railroad project stretching across the UK the tender process was completely different from the traditional one here in Sweden the client was also a public client. The bid was based only on soft parameters, the bidders needed to write a detailed execution plan with the focus on quality and the best plan wins the contract. That type of bid competition is more complicated, but the interviewee thinks it is better to win on that than to win on a low price and then the contractor has to fight with the client that doesn't want to pay. When the bid is won the first 14 months are spent on developing the design and pricing a solution together with the client so the contractor doesn't do it in competition they do it openly with the client. In this case it

is a target cost price then they agree on that price afterwards the construction contract is designed and the contractor can start the work, it is a better way to bid it is a lot more work but at least the contractor won't take as much risk as they do with fixed price. In the ESS project they used a similar method for tendering with a lot of soft parameters taken into consideration therefore the outcome of the project is different in comparison with another project the interviewee is currently working on "hamnbanan" with Trafikverket as client and it is currently having over 200 unresolved issues that are still under negotiations with the client and that might end up in court.

The margins in the business are already very small according to the interviewee if they do a 3-4% profit on a job it is considered an economically successful project. If there is a 1% loss on a job then the contractor should have stayed home. The client has to understand the circumstances of the industry *"it is not like selling BMWs where they make huge profits on everything"*. There is a lot of money turned over in a construction project but there is also a lot of work that needs to be done and everything needs to be done right otherwise the contractor might as well go out of business it is a huge responsibility. The client needs to manage and use the tools they have in the contract in a way that they understand what they are doing because otherwise it can lead to devastating results.

5 Comparison Study

In this chapter, the measures presented in Chapter 5 are used to determine important features such as quality, productivity and sustainability in FIDIC Red and Yellow books and AB and ABT. Design risk and degree of freedom also works beside these measures distinguishing major differences between specific clauses stated under general conditions in AB contracts and FIDIC contracts.

DBB and DB type of contract share the same general conditions in both contracts, but the main differences in parties' roles and responsibilities has a direct impact on the risk allocation and project factors that are quality, productivity and sustainability. Therefore, AB04 and FIDIC Red Book are used as the main source for general conditions for the comparison.

Firstly, it is important to identify major actors in the AB contracts and FIDIC contracts prior to applying quality, productivity and sustainability measures. In the AB contracts, there are the Client and his representatives, the Consultant and the Inspector, and the Contractor and his representatives, consultant in case of DB type of contract is adopted, and the inspector could be hired by an agreement between client and contractor. The role of consultant is limited to design and may refer to when there are defects found during the execution phase. The client should use the ABK form of contract in order to hire the Consultant. The inspector is responsible to follow inspection schedules to check where the work done by the contractor is done in accordance with the design documents. In the AB contract, there is no specific form of contract that is available to hire the Inspector, but the content of final inspection is stated within the contract documents with a schedule for different types of inspection. In the FIDIC contract, there are three main actors which are the Client/Employer, the Engineer and the Contractor. The Engineer is here hired by the client in both cases of DB or DBB contracts, and should access the site during the whole project life cycle with the right to inspect and carry out investigations for the execution work. Figure below shows how the Engineer role from the FIDIC contract is represented in the AB contract. However, the Engineer in FIDIC contract is sharing a portion of risk in parallel to the Client and the Contractor. While, in the AB contract, the client gets the whole risk alone from this separation of the Engineer duties, the Consultant and the Inspector.

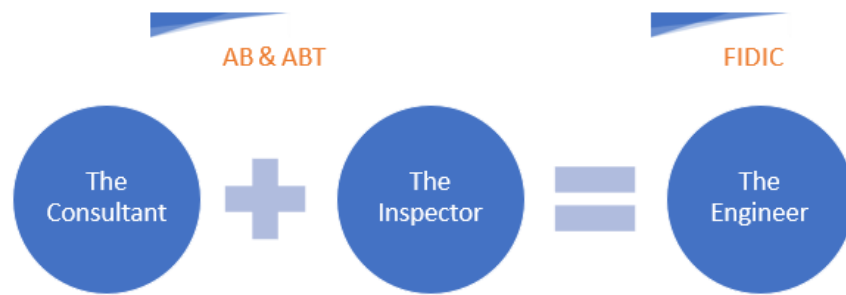


Figure 7. The Engineer role in FIDIC, is equivalent somehow to the role of the Consultant and the Inspector in the AB contract.

5.1 Quality

Quality measures: *time limits, delivery of materials, Supplementary and unforeseen works, deviations from the contract terms, cooperation obligation, and obligation to act diligently.*

5.1.1 Quality in AB04

First measure for quality in contracts is *time limits*. In Chapter 4, Times, the contractor is responsible to create a time schedule for the execution of the work. Here the scope of work is set up by the client and considered as an agreed document involved in contract documents. The main concept is to let the contractor determine the contract period and even the time for work completion. The time for the inspection process, that is needed to be done by the client, is also required to take place in this schedule. In addition, time required for adjustment is to be involved as well. However, it is highly recommended for the contractor to not adopt adjustments or avoid them. AB04 is lowering the uncertainties regarding extending the period of contract for the contractor through highlighting specific reasons for extension. Hence, it is stated that the extension can be applied due to general circumstances such as war, weather issues like water-table getting higher, problems arising from the employer side, or certain decisions released by the government.

The contractor is responsible to prepare a quality plan and state clearly their method for handling quality plans at the ground in respect to the measures stated by the client at the early tendering process (Chapter 2, Execution). However, *delivery of materials* can be inspected by a person who gets hired from the client or a third party that both the client and the contractor agree on, then the payment for the inspector will be divided to half for each. The inspector should develop a report and describe what type of inspection is done and defects were found. AB04 has several and flexible types of inspections that can be applied. For example, pre-inspection or reinspection can guarantee the work from the start. Contractors in this case can agree with the employer to make an inspection, with high risk, or agree with the client on hiring an inspector, for less risk.

Supplementary and unforeseen works are not only limited for cost, but it considers time extension as an important step to have access for too. However, Chapter 2, Execution, AB04 links excess costs generated from unforeseen works to the general circumstances stated in Chapter 4, Times. This means that if there is additional work developed due to these circumstances only, then the contractor can add these costs to the invoice.

In Chapter 1, scope of contract, contract documents build essentially from scope of work that is developed by the client, where the contractor should follow literally all conditions stated, and as soon as the contractor agrees then there will be no additional price that can be added to the total price. When it comes to *deviations from the contract terms*, the client has a good room to make strict decisions in terms of limiting the contractor work through creating tough conditions added from their strategies in contract documents. AB04 ensures high quality results for the client regarding this point because it provides a highly disciplined contractor that is obligated to evaluate client documents as important documents in the contract. It is not from the contractor side to adopt any type of deviations from contract terms, where the guarantee period could come up with negative outcomes. Guarantee period may get extended to more than five years because of these minor changes. The contractor has to *act diligently and work in collaboration with the client* to avoid such fluctuation. Therefore, the high-quality level is conservative and runs under contract conditions developed by the client.

5.1.2 Quality in FIDIC Red Book

Time limits.... In clause 40, General conditions, the engineer has the right to suspend the time for the execution work due to specific reasons such as to ensure safety of workers at the site, the need for proper work execution, and climatic issues on the site. The contractor can also request to suspend the time of execution work because of defaults developed by the client or the engineer, otherwise the contractor can admit suspension that stated in the contract. In clause 44, general conditions, the engineer is entitled to inspect any events that could happen and affect the execution work, where the time expansion is requested by the contractor. Events may arise due to special circumstances similar to the ones stated in clause 40. While, additional work is not considered in this case as a reason for time extension. The engineer has to accept this work and inform the client for such changes. Then, the client should refer to the contract to decide if there is enough budget to involve the price of additional work. After this, the engineer will give green light to the contractor to proceed for the execution. The contractor is always responsible to provide notifications with details for any changes to the engineer and the client that could occur and need time expansion. In this case, the contractor should carefully achieve results with high quality in order to not fall down in such time suspensions and/or extensions. The

engineer here takes high responsibility to ensure the work done by the contractor matches proper professional levels and proceeds under contract price.

Delivery of materials... In clause 36.1, General conditions, it mainly determines the process of achieving high levels of quality through giving the right to the engineer to make instantaneous tests during the contractor's execution work, and inspecting equipment, tools and labour that should be provided by the contractor. This process should be done before materials and staff get incorporation in the work. In clause 55 and 56, general conditions, the examination of execution work is based on drawings and records for measuring the work and quantities. These measures should be prepared by the engineer. The contractor should send a qualified representative to work as assistance for the engineer in the examination process. The engineer may request to break-down lump sum items, and the contractor here is accountable for sending the price breakdowns of items, then the engineer will preview to give the approval. In sub-clause 60.5, statement at completion, the completion of execution work should get approved by the engineer, then the contractor should submit the documents to the client in order to achieve a Taking-Over certificate. This process gives the right for the client to proceed issuing certified payment for the contractor. In clause 9.1, tests on completion, the contractor should submit to the engineer the test program including resources and intending time for the tests prior to the commencement of the tests. Here the engineer should check where tests comply with the contract. After results of tests on the completion get issued by the contractor then it should be sent to the engineer to agree and give allowances to the employer to comment on the results.

Supplementary and unforeseen works... In sub-clause 69.5, resumption of work, here the contractor has the right to suspend the work or even request time extension due to a reduction in the rate of work that both are entitled under clauses 44 and sub-clause 69.4 following the stated special conditions that are required to match the reason arisen at site. In such cases, the engineer is responsible to inspect and schedule the amount of time required for extension and specify the costs developed because of this suspension.

Deviations from the contract terms... The uniqueness in the FIDIC red book is that there are specific clauses that mention most related issues to the common disputes among the client, the engineer and the contractor. For example, In sub-clauses 71.1, 72.1, 72.2 & 72.3, cover the whole expected disputes regarding currency and rate of exchange. Where there is no way for any party to make changes in the payment process that starts from creating invoice by contractor till it gets approved for payment. The engineer has a main role in carrying out the settlement of disputes in case there are any deviations from the contract terms by the contractor or the employer/client. Under sub-clause 67.1, the engineer decision, the engineer has the power to give a notice to the employer and the contractor in order to solve the arisen issue no longer than 84 days, accounted from the day of receiving the dispute

notification. In case the engineer was not able to get this settlement done within time then they should refer to rules under Arbitration of the International Chamber of Commerce. The certificate of the engineer for making decisions will be previewed and have access to open up and check the engineer decision.

Cooperation obligation... under sub-clause 3.7, Agreement or determination, the engineer here is to act neutrally in dealing with the contractor and the employer. The collaboration is related to the role of consultation which works to reach agreement between parties by creating discussion and making proposals. The records of consultation have to be available for both parties and the engineer is responsible to get both parties agreed. There is a room for both parties to not agree with the determinations of the engineer regarding consultation results. In this case, more collaboration has to take over under sub-clause 21.4, obtaining DAAB's Decision. These sub-clauses contain time limits for each party to give a notice for other parties regarding his/her decision. In addition, Sub-clause 3.8, Meetings, present the high level of collaboration especially between the engineer and the contractor to discuss and highlight the important phases during the execution work. Major topics to discuss during these types of meetings are management meetings and mostly related to the future work and check where the contractor is ready to commence the work with respect to the planned time schedule. The employer should receive a copy of meeting records from the engineer. As a result, all parties have a clear view on how the project runs and ensure where the work is done in accordance with the contract. Sub-clause 4.3, Contractor's representative, plays an important role in keeping the engineer's representative updated with execution performance proceeding at the site.

Obligation to act diligently... it is not limited to the contractor work but it includes the employer obligation to follow laws, for example clause 1.13, compliance with laws, the whole required permits, licences and approvals should be achieved by both parties in order to avoid any consequences arising with high effect on the quality. The contractor and the employer should act diligently through keeping secrets and show high confidentiality in dealing and treating documents from the contract. As it stated in clause 1.12, the engineer and the employer should act the same in dealing with the information received from the contractor then it can be marked as confidential. In addition, clause 17, care of the works and indemnities, the contractor is responsible for the care of all stages of implementing the work from the start to the end of the project. This care means that the contractor is responsible for any damages and losses created during the execution work. The engineer here has to inspect the work and may reject the work completion referring to sub-clause 7.5, defects and rejection. Subsequently, The Taking-over certificate should be issued with clarifying full care of the work then it can pass to the client.

Moreover, FIDIC provides a Quality Based Consultant Selection Guide explaining to the clients, the reason for choosing the right consultant and the importance of this selection due to significant factors such as consultant costs 3-4 percent from the total

project budget, and the impact of consultant on the overall project quality. The client decision can affect the project value and the process of improving effectiveness and efficiency in the projects. This guide contains also a procedure for the consultant that can follow for achieving Best Project Value presented under Quality Based Selection (QBS). QBS supports the idea of adopting design innovations and optimizing the overall cost savings and keeps the main goal of obtaining better quality for the project at the top. The guide states that the use of QBS increases the degree of project satisfaction in alignment with cost optimization.

5.2 Productivity

Productivity measures: *degree of freedom and availability to create a room for adjustments and making changes during the project life cycle.*

5.2.1 Productivity in AB04

In AB04, Chapter 2, Alterations and Additions, the contractor manner of executing described works in scope of work has no relation to Alterations/Additions, in case client orders contractor to follow this manner then it can be considered as Alterations/Additions. The contractor's ability to make Alterations/Additions are limited and should get shared and agreed with the client, otherwise it will not be considered as a part of the work and has no right to be covered under contract price. *Degree of freedom* practiced by the contractor is restricted by the client. While, the achievement of higher innovation and productivity in projects is strongly connected to the contractor's ability to make changes and have access to express optimum suggestions. Furthermore, the contractor is also obligated to give notice for the client when observing difficulties to understand or defects in contract documents and all this should be done prior to signing the contract. The client can suspect the contractor for not pursuing client conditions by making a decision to make another test. Chapter 3, Organization, presents the client ability to arrange site meetings and carry inspections regularly during the execution period. However, it is mentioned that the contractor is the only one who can direct the total work on the ground.

In AB04, Chapter 4, Acceleration, this clause gives the right for the contractor to adopt an acceleration for execution of total work, this applies only if the client regret to extend the contract period. This acceleration is valid only when the contractor sends a written request to the client and it gets accepted. In this case, a degree of freedom for the contractor is considered as a hindrance with a critical impact on productivity. Most of AB04 chapters seem to advise the contractor for avoiding adjustments and changes, where it is seen as essential for creating a room of development and innovation to achieve high levels of productivity.

5.2.2 Productivity in FIDIC Red Book

In clause 51, general conditions, Alteration, additions and omissions, the engineer should decide where there is a need for variation concerning the quality and quantity in the project required for obtaining higher productivity. The contractor is obligated to

make such changes that are seen appropriate for the work and still under contract conditions. This change could be additional work necessary for the completion of the work such as changing dimensions, levels, etc, or timing assigned for a specific part of the work. The contractor can evaluate the additional work and if there are additional costs found, then the contractor can refer to clause 52 to get this issue solved. However, the contractor has no permission to make variations without receiving instructions from the engineer.

In sub-clause 52.2, General conditions, Power of Engineer to fix rates, and Clause 13, Variation and adjustment, the engineer can evaluate the contractor's work and decide where it is a reasonable price issued by the contractor before the handling of the Taking-over certificate. In this case there should be a meeting with the contractor and the employer regarding the work evaluation by the consultant and what price reduction has to be admitted further. After the agreement of both parties to the decision of the engineer, then the engineer should make provisional prices stated under a certification in accordance with clause 60. In case the contractor disagrees, the engineer has to rearrange another meeting and come up with new fixed rates, where a copy should be sent by the engineer to the employer and the contractor prior to the meeting. While the contract price should not get a total reduction percentage reaching more than 15 % of the contract price, under sub-clause 52.3, variation exceeding 15 percent, this process has to get checked by the engineer, otherwise the contractor has the right to refer to conditions stated by clause 14, contract price and payment.

The contractor variations and adjustments have to be instructed under following conditions in clause 13 which are:

- Unforeseeable work arises due to general specifications stated in clause 18, Exceptional events, that is not matching the scope of work.
- Difficulty to obtain major goods for the work
- The contractor can not proceed with the work due to high impact developed during the work affecting the health and safety obligations or/and protection of the environment stated under clause 4, the contractor.

Otherwise, the permanent work should kept without any alteration and modification except if the engineer has decided to make variations.

5.3 Sustainability

Sustainability measures: *the most common method to measure sustainability in the construction industry is to create a life cycle analysis of the project from the start of the project to end of the building's life cycle.*

5.3.1 Sustainability in AB04

In Chapter 2, Execution, the contractor is responsible to draw up an environmental plan presented in a document that contains environmental measures affecting the

environment. These measures should be presented by the client, then the contractor in this document has to underline the adopted method for ensuring work runs in accordance with environmental measures. After this, the client needs to agree in order to add this document to the contract. There is no specific text that shows an obligation to create a life cycle analysis of the project from the start of the project to the end of the building's life cycle. The client has the freedom to build such an analysis as a measure and present it to the contractor. However, sustainability consists of mainly three pillars which are social, environmental and economic. When it comes to AB04 handling sustainability, then it is clear that it is limited to cover only the environmental aspect.

5.3.2 Sustainability in FIDIC

In the FIDIC Project Sustainability Management Guideline (PSM), FIDIC develops the PSM approach to sustainability. The consultation and monitoring project performance are seen as main project goals and indicators for the project stakeholders by this guide. The first stage of PSM-I works to increase the relations between client and stakeholders to feel more involved through presenting project issues and constraints, then evaluating the stakeholders' perspective in order to process issues and make decisions. This involvement will align FIDIC's sustainable goals with the main goals set by stakeholders. FIDIC found problems arising from this approach. FIDIC says that it is rare to find an organization that possesses required knowledge and experience to optimize project sustainability, and the low ability to process sustainable optimization during the whole project life cycle from the cradle to the grave. FIDIC means here clients could not have enough room able to handle sustainability goals. Therefore, FIDIC develops the PSM-II with a focus on processing issues and links it to the sustainable perspectives such as minimise use, use renewable alternatives, etc. This process requires the involvement of stakeholder's consultation, making *life-cycle analysis*, Goal selection, and achieving integration with project development. In this case, the client can use PSM-II as a tool to achieve sustainability optimization for the project.

The second important sustainable tool developed by FIDIC is The Project Sustainable Logbook (PSL). It seems that FIDIC maintains the same concepts from the PSM approach, for example, Logbook contains the stakeholder involvement prior to presenting three sustainability pillars: social, environmental and economic. However, the *project life cycle analysis* is developed and covers all the important stages of the project; planning phase, design phase, construction phase, operation phase and End-of-life phase. Logbook creates different tables for each phase, and it's called the PSL monitoring table. These tables consist of four sustainable dimensions in the perspective of FIDIC which are governance, social, environmental and economic. The themes and objectives of these dimensions are shown in the figures below, which are also available at the tables in the Annex of the PSL book. The PSL simulates a number of international systems works to improve sustainability such as BREEM, Miljöbyggnad and LEED, for engineering works especially for buildings.

Oversight	Stakeholder involvement	Transparency
• Risk management • Cross-cutting • Innovation • Selecting site, materials, etc.	• The response to a local request • Information, consultation and coordination • staff and user awareness	• Implementing monitoring • Implementing certification • Dedicated communications

Figure 8. 1st Governance Dimension, FIDIC, The Project Sustainable Log-book (PSL).

Health/ Safety	Social cohesion and employment	Living Environment	Cultural diversity	
• Hygiene and air quality • Other health risks (electromagnetic, etc.) • Safety: access and exits, operation, etc. • Ensuring safety and security during maintenance	• Professional insertion and return to work • Job creation • Fighting exclusion, personal mobility • Facilitating access to services (employment, education, etc.) • Facilitating accesses and exits • Forced displacement of people • Poverty alleviation	• Respect for the neighbours' and users's living environment • Thermal and climate comfort • Acoustic Comfort • Visual comfort • Quality of the indoor and outdoor environments • Integration into the site and the landscape	• Enhancing the cultural identity • Landscape quality • Respect for the built heritage • Respect for the natural heritage	

Figure 9. 2nd Social Dimension, FIDIC, The Project Sustainable Logbook (PSL).

Biodiversity	Climate Change	Resource Management	Controlling Emissions
• Preservation of natural habitats • Maintaining ecological corridors • Tackling light and sound pollution • Supporting inherited plant species	• Controlling emissions from the project or program • Controlling emissions from induced traffic • Reducing the dependence on fossil fuel derived energy • Adapting to climate change	• Controlling energy production, consumption • Renewable energy use • Controlling water resources • Controlling raw materials' consumption • Consideration of materials life cycle	• Limiting air pollution • Waste management • Protection of water tables, soils • Limiting hydrogeological impacts

Figure 10. 3rd Environmental Dimension, FIDIC, The Project Sustainable Logbook (PSL).

Economic Justification	Economic Development	Life-Cycle Costing
• of the project or programme in the short term • Envisaged future of the project or programme • Serviceability • Investment efficiency	• Direct economic impacts • Induced and indirect economic impacts • Regional development • Job creation • Economic partnerships • Synergies with other developments • Poverty alleviation	• Simple evaluation (Investment, operation and maintenance) • Whole life-cycle costing (including external costs, dismantling and costs avoided) • Risk Limitation costs

Figure 11. 4th Economic Dimension, FIDIC, The Project Sustainable Logbook (PSL).

FIDIC creates a life cycle analysis of the project from the start of the project to end of the project's life cycle and makes PSL as a functional tool supported with PSL monitoring tables that make the process more easier to handle during the work.

5.4 Design risk

Firstly, FIDIC contracts contain general conditions which are applicable in both DBB and DB type of contracts, which means that general conditions in the FIDIC red book

are somehow similar to the ones in the FIDIC yellow book. It is the same case in the AB contracts where both AB and ABT share similar general conditions for the contract. However, the responsibilities will differ for each party. For example, the FIDIC yellow book is valid for DB type of contracts, it works to accumulate risks on the engineer and the contractor, while the employer will keep an eye on the design and execution processes till the completion day. The engineer does the work of the employer side by side with the consultation work in the FIDIC yellow book. The only difference with the FIDIC red book is that the engineer will receive the design documents from the contractor, and they discuss it as a team in order to agree up on design documents with the client. In the FIDIC general conditions, clause 65.1-65.8, special risks are stated and cover special circumstances that could occur during the work execution phase such as damage to the work due to defects from the employer, injuries or loss of lives, costs increased due to special risks, or outbreak of war. The risks' considerations in this case stand with the contractor side more than other parties because it is valid in the construction phase only.

AB contracts put high risk on the client, the client is responsible to do the work of the engineer as well, it does not matter if the client will hire the consultant and the inspector but both of them are stated in the AB contracts under client work. In AB contracts, there are mainly two parties presented, the client and the contractor. The ABK contract is here a good example, the client should sign to different types of contracts AB/ABT for getting the contractor and the second ABK in order to have a consultant. Additionally, the inspector has to get involved in this work and get hired by the client as well. The major difference between ABT and AB is that both client and contractor have the right to assign their own consultant in ABT contract, the contractor can work with a specific consultant, ABK contract applies here too, and works side by side with him. While only the client has the right to hire a consultant during the whole project life cycle in the AB contract. Risks are not shared equally and may get increased due to less collaboration that may get generated from the relationship between the consultation/inspection work and the contractor work.

5.5 Instructive vs constructive contracts

The table below explains the major difference between FIDIC contracts and AB contracts in terms of constructive and instructive method for creating contract documents.

Table 2. Instructive or constructive contracts, FIDIC and AB contracts.

Dimension	FIDIC is constructive	AB contracts are instructive
Context	Guide parties to follow written conditions.	Agreed documents.
Design risks	Risks are shared and distributed on different parties (the client, the engineer and the contractor) in accordance to their workload.	The client and the contractor work as the leader and the follower. Risks are not shared equally compared to their workload.
Degree of freedom	Have room for presenting new changes and updates by organization and ability to write your strategy (the engineer power). The benefit of the project is at the top.	The client will assess changes and adjustment, and that could be done without referring to experts like consultants, then decide where it is accepted and allowed in the contract documents.
Collaboration	The engineer plays a vital role increasing the connection between the design and construction phases. The engineer representative at the site supervises the contractor work, and the responsibility of controlling and monitoring design documents to issue approved certification at the same time.	The collaboration is limited to the meeting minutes. While, it is higher within the organization.

6 Analysis and results

6.1 Analysis

In this chapter a thematic analysis of the interviews from the empirical study in the fourth chapter in this study is conducted. The thematic analysis clarifies the most valuable information received from the interview study presented in the empirical study, followed by the result for the research questions formed in the first chapter of this study. The answers to the research question are collected and formed from diverse parts of this study such as the literature study, the empirical study and the comparison study.

6.2 The client's perspective

From the perspective of the client organisation Trafikverket or the Swedish transport agency the most common disputes arise in the early phase of the contracting process, the general conditions in AB and ABT contract forms are not enough to create a contract that includes all the requirements set by the clients, therefore there is a need for additional documents including the scope of work and the execution plan for the project and it comes from the clients. Here the problem for Trafikverket arises and the discussion for what the contractor should be responsible for is the main issue here. Trafikverket in this case have complementary documents such as EK, AMA and AF documents but to what extent does these documents cover when disputes arise, later in this analysis the perspective of the contractor is presented on the matter and how the contractor experienced this. This gives us a clearer picture of the lack of knowledge and experience in the client organisation which is strengthened by contractor's perspective.

Trafikverket as a client organization has little to no knowledge working with international contract forms such as FIDIC. The interviewees had in their 20 years working with contracting for the client organization Trafikverket never worked in a project with international contract and continued with revealing that Trafikverket have very few projects of that kind. This further strengthens the previous statement of Trafikverket being a client organization with low knowledge and experience base. From their point of view the main reasons for the low presence of international contractors in the Swedish market is contractors not understanding the Swedish contract documents, the governmental process of the procurement process and the Swedish construction industry's work culture.

From the client's point of view the existing system for contracting construction and infrastructure projects AB and ABT are working for the organisation and they are comfortable in using them together with their added documents. The interviewees didn't have any knowledge regarding FIDIC therefore, the researchers of this study

suggest that Trafikverket doesn't have the knowledge required to evaluate if the use of another contract form is beneficial for their organisation. In this case Trafikverket is in a comfort zone and to develop further there is a need to extend beyond that comfort zone and try new procurement strategies and contracting forms and strategies.

6.3 The contractor's perspective

According to the contractor the main problem in the procurement and contracting of construction and infrastructure projects with public clients in Sweden are not the Swedish contract forms AB and ABT per se but the client and the clients use of the contract is often the main issue. In comparison with working outside of Sweden the interviewee that in fact has had a long history working both internationally and nationally in mega infrastructure projects claims that working for example in the UK is completely different from working on a contract in Sweden. The main reason is the collaboration created with the help of the contract form, the contract form which the interviewee described as being the best he have worked on is the international contract form New Engineering Contract mostly common in the UK. This contract form in comparison with working in a AB or ABT contract with Trafikverket is different in terms of the dialogue created between the contractor and the client organisation. This dialogue brings forward the disputes instead of hiding or ignoring them to come up with a solution together with the involved parties of the project.

From the contractor point of view the client organisation Trafikverket is lagging behind in terms of contract development, this is seen through the many projects that end up in arbitration, projects where the client organisation is Trafikverket. There are many mega infrastructure projects that end up with poor results and a lot of disputes ending up in court with Trafikverket for example the “västlänken” and “Hamnbanan” projects being recent examples mentioned by the interviewee being a recent subject of discussion duo to ground conditions differing from the tender documents. The main reason for additional unforeseen cost is for most of the time different ground conditions from the ones described in the tender documents. In mega infrastructure projects such as tunnel projects, it is a reality that the ground conditions can't be totally covered therefore, the bidding sum often have to be re-evaluated because of the changed conditions which Trafikverket does not empathise with. The bidding is based on assumptions and often in reality these assumptions at best can be roughly the same, therefore the client has to be knowledgeable and experienced to procure such projects and use the tools they have correctly like the contract documents and the tender process.

Lowest price competition often leads to poor results due to the fact that lower price being associated with low risk allocation. Trafikverket often works with complex mega projects where the conditions often are one of a kind therefore it is hard to include everything therefore a better system is needed to be implemented in these types of projects. An example brought up by the interviewee is the procurement

strategy they used in the high speed railway project in the UK, where they competed only on soft parameters resulting in the contractor that understood the work that needed to be done to win the bid instead of the cheapest one. Resulting in a successful project with little to no disputes in the execution. Using soft parameters and target cost instead of lowest price in mega infrastructure projects results in a more accurate assumption on the bidding of the execution of the project instead of hoping to get a low price where they end up with a higher cost than for target cost due to arbitrations.

The client has to be knowledgeable and experienced and if not, they should appoint someone that is, to understand the demands they are requiring. The tender process and the contract form and documents are all tools that if used efficiently by the client could result in a successful execution of the project. The “Öresundsbro” Project is a good example of a knowledgeable and experienced client and clients like Trafikverket should take a lesson from such a project. Another exemplary project is a current project the interviewee is working on, the ESS project in Lund and the same person from the client organisation working in “öresundsbro” project worked for the client organisation in this project. The project differed in terms of the procurement process compared to the typical one done with Trafikverket, the competition focus more collaboration work instead of lowest price they wanted a project with high collaboration which the interviewees contractor organisation could offer and the project was a totally integrated project and it used AB as general conditions but the additional contract documents resembled the international contract form New Engineering Contract. The project has been ongoing smoothly for 6 years proving that contract form does not matter; the client is the important factor.

Table 3. The responsibilities and tasks of the different parties involved in a construction process from tender to finished product in AB and ABT contracts from the contractor's point of view.

The main parties	Creating the tender documents	The tender phase	Winning the bid	The execution phase	The finished product
The Client	In this stage the client suggests their requirements and the expected end result of the project and creates together with the consultant the bidding documents.	The client put the project up for bidding and in the case of public clients they have to do that in accordance with the LOU.	The client sits together with the contractor to go through the execution plan and agree on the budget.	The client does not take responsibility and does not acknowledge additional unforeseen conditions arising in the execution phase such as unforeseen ground conditions.	The client ends up unsatisfied with poor results and a lot of arbitration with a higher cost than for the original additional work
The consultant/The Engineer	The consultant is responsible for creating the early design and bidding documents according to the client's requirements; thereafter the consultant is not responsible for defaults in the execution phase.	The consultant is not involved in this stage.	The consultant is not involved in this stage.	A new consultant is appointed for the inspection of the execution, done on a period basis. The previous consultant is not responsible for any default in the design.	The consultants are not responsible for any additional cost.

The contractor	The contractor is not involved in this stage.	Different contractors compete together to come up with the most efficient execution plan both in terms of execution and economically beneficial. In the case of a public client the competition is often based on lowest price therefore it is important for clients to focus on keeping low cost often ignoring or missing on risks.	The contractor sits together with the client to agree on the budget and the execution plan.	The contractor is often responsible for any additional work that comes up in the execution phase and clients such as Trafikverket often do not listen to the contractor in case of additional cost. Concerning the low margin business the contractors are running and any additional cost not pre agreed on causes economic setbacks for the contractors if it is not being paid by the client.	In the case of the client refusing to pay for additional unforeseen costs the contractor ends up in legal conflicts with the client which is not beneficial for any of the organisations ending up as scandal projects in the media. For example, the “Hallandsås” project in lund and many other examples.
-----------------------	---	---	---	--	---

Table 4. The responsibilities and tasks of the different parties involved in a construction process from tender to end in international contracts (FIDIC, New Engineering Contract) from the contractors point of view.

The main parties	Creating the tender documents	The tender phase	Winning the bid	The execution phase	The finished product
The Client	In this stage the client suggests their requirements and the expected end result of the project and creates together with the consultant the bidding documents. (And the contractor in case of an integrated project.)	The client put the project up for bidding and the bidding competition should be based on the type of project and in more complex projects there should be more soft parameters and less hard parameters .	The client sits together with the contractor to create the execution plan and agree on a target budget with a shared incentive system.	There is a discussion created between the involved parties in case of problems arising to sit down and come up with a solution together and decide on responsibility sharing .	The client ends up satisfied with good results and little to no arbitrations.

The consultant	The consultant is responsible for creating the early design and bidding documents according to the clients requirements; thereafter the consultant is involved throughout the whole project and has some responsibility for defaults in the execution phase.	The consultant should be involved in the choosing of the contractor they want to work alongside to create a hostile collaborative work environment to avoid disputes later on.	The consultant sits together with the client and the contractor to create the execution plan.	The consultant is present daily at the site with an inspector working alongside the contractor to detect early problems and inspect the execution of the work.	The consultants are responsible for additional costs in terms of lesser incentive payments in case of design defaults.
The contractor	The contractor is not involved in this case except the case of collaboration work.	The competition should be based on more soft parameters to include the experience and knowledgebase of the contractors to create a better evaluation of the contractors for the client and the consultant to choose the best possible contractor for the job.	The contractor sits together with the client and the consultant to create the execution plan and agree on a target cost and the shared incentives.	The contractor is responsible for notifying in time if any problems arise so the directors of the project could sit together and come up with a solution and avoid wasting time and resources. The contractor has the right for additional payments if the conditions differ from the agreed ones.	The contractor bears responsibility in case of execution defaults created by the contractors own inexperience such as delay due to mismanagement.

The Contracting process is essential for a successful execution and results of an infrastructure project. The clients use of AB contracts like the case of Trafikverket gives the client the ascendancy for decision making which leaves the contractor in a weak position. According to the contractor in this study many projects with Trafikverket end up in arbitration due to Trafikverket falling short to acknowledge additional unforeseen work, the reason could be low experience and knowledge and/or conservative client with hierarchical decision-making system. In comparison with international contracts the process is not very different. The main difference is how the client uses the process of procurement in terms of what parameters they use to evaluate the winning bid and the payment method.

In Trafikverket case only hard parameters are used, the economical aspect is the most important factor for evaluating the winning bid and according to the contractor this method falls short in the case of mega infrastructure projects where there are a lot of unforeseen conditions. Using lowest price competition and having a refusing attitude towards changes is how the contractor perceived Trafikverket as a client organisation. The issue of working with lowest price in mega infrastructure projects is the unforeseen conditions that arise in the execution phase that is not included in the original bid. This situation is common in mega infrastructure projects and the client and contractor have to make a decision and AB contractors make it easy for the client to take it to court to resolve the issue if they don't agree with the contractor's solution. Working with other contract forms on the other hand is different in terms of solving arising issues. The New Engineering contract allows the project to have an internal impartial adjudicator for more complex decision making in case the client and the contractor disagree with one another. FIDIC contractors allows the engineer to make decisions during the execution phase and with the help of the open book concept the engineer can monitor the contractor and knows if the contractor is blowing up the budget.

Winning on soft parameters was perceived harder than winning on lowest price (hard parameters), the soft parameter evaluation is more complex for the contractor organisation to perform, winning on soft parameters was perceived more efficient for the project by the contractor. This allows the client to choose the best qualified contractor for the job ending up with more satisfying results. Bidding on soft parameters also allowed the winning contractor to have the freedom to design the budget together with the client to form a target cost. The bidding assumptions created with the soft parameter evaluation are more accurate due to the client focusing on for example risk allocation, quality and sustainability instead of cost estimations. This creates room for innovation and innovative solutions that otherwise doesn't come forward in the case of lowest price competition where the contractor focuses on the cheapest solution instead of high quality and sustainability.

Target price allows the contractor to be paid for additional cost for unforeseen work which the contractor perceived to be fairer in comparison to the lowest price method. The client is paid for the extra work most of the time with lower arbitrations than in the lowest price method where the cost ends up much higher due to additional costs for settlements, court procedures and lawyers. Therefore, to get an accurate assumption of the cost of the project the target price is more realistic and includes more conditions than the lowest price bid, leading to satisfactory results because the assumption is closer to reality in target price contracts in comparison with lowest price.

The role of the Engineer/Consultant is different in AB and international contracts. The Engineer in FIDIC is responsible for the inspection of the contractor's work due to the Engineer in FIDIC having the same role as the client in AB contracts. Which makes

the Engineer which naturally are more experienced, knowledgeable and have been involved in the project from the beginning, the main decision maker in the project. The involvement of such an important party in the project will lead to higher collaboration in the consultant and the contractor organisations resulting in higher productivity.

6.4 Results from comparison

The comparison between FIDIC contracts and AB contracts results in defining two different methods for presenting rules and terms for parties, FIDIC contracts builds from experts that come from practicing vital work at the site and issues related to the contracts, therefore FIDIC contains different points of view including the client, the engineer and the contractor opinions. On other hand, AB contracts have the view of lawyers and adding their touches for creating the bases for the contract. In AB contracts, contract documents will steer the project to benefit the client in both DBB and DB types of the contract, while the contractor practices hierarchical orders received from the client for handling the execution work. Therefore, AB contracts give the right to the client to act as the leader and force the contractor somehow to act as a follower.

The results of measuring quality in FIDIC and AB contracts shows that there are some similarities and differences in the general conditions of the contract. For instance, the time limits for measuring quality results in different levels for the project quality. In FIDIC contracts, the engineer is able to extend the time scheduled for execution work in case if the engineer sees that the contractor needs more time to do the required work in accordance with the contract requirements, or the work is suspected to get done without high quality. In addition, FIDIC considers the special considerations at the site such as water table, war, etc as another need for extension. In contrast, the contractor in AB contracts has to streamly follow the time schedule for the execution of the work, as the contractor should design the schedule and send it to the client during the preparation of the contract document, as soon as the client agrees and determines the contract period, then the contractor is obligated to pursue agreed project timeline. The only exception for time extension is that the extraordinary conditions happen at the site such as weather conditions, war, etc. where here both FIDIC and AB contracts mention nearly the same conditions. However, the project quality has to be evaluated during the execution work and this is adopted in FIDIC contracts because of the continued engineer supervision to the contractor's execution work at the site.

The project quality has to get inspected and tested, both FIDIC and AB contracts present their own way for determining the requirement to the work completion certificate. In FIDIC contracts, the engineer's representative is following the process of work execution from the start to the end with full access to all facilities at the site that are related to the work performance and implementation. The engineer has the

right to ask the contractor for any tests that are seen as essential for ensuring work runs under contract. At the end of the work, there should be a final test carrying on by the engineer to test the whole project. The role of engineer is not just consultation, but it is inspection too. The engineer experience gives excellent results for the inspection due to the time spent during the project life-cycle, well study of the drawings and design documents, high involvement at the site, promoted collaboration among the engineer and the contractor, direct inspection for received materials from the suppliers, monitoring the work execution schedule, and ability to give decisions for the contractor regarding logistics management at the site to ensure better material quality. In contrast, in AB contracts, the inspector has a pre-specified inspection schedule to follow and could make weekly inspections, the inspector is hired by the client or by an agreement between the client and the contractor. The inspector has a limited time to spend at the site, while more of their work will be at the office to read design documents like drawings.

As a result, the engineer in all measures for quality in FIDIC contracts is presence and acting as an assistance person evaluating and making assessment to the contractor work for ensuring that the work is done with high quality levels and in accordance with the contract. In addition, the client and the contractor should listen and obey the engineer's decisions, the engineer power, in order to achieve better quality results, hence high collaboration has to be considered under consultation work by parties. Whereas, AB contracts put the responsibility, for ensuring high quality level of the work, on the client side despite the inspector work being limited to make inspection reports and send them after to the client. The client here has to check where there are defects and then send them to the consultant for further evaluation. It seems like a long process that requires time and could end up with misunderstanding due to the involvement of three organizations.

The availability of making innovative adjustments are related to the existence of a room for adopting changes during the work execution. FIDIC contracts support the idea of adopting such changes by considering arised variations from the site. Therefore, 15 % of the contract price allowance for reduction is considered due to changes and variations that promote high project quality. The engineer hereby is responsible for studying and confirming any type of adjustments and variations. However, in AB contracts, if the contractor sees a need for changes then the client needs to request a detailed report from the contractor, otherwise the changes occur due to special considerations such as war, weather. In addition, adjustments and changes are not covered under contract price. By measuring the productivity in FIDIC, the degree of freedom and ability for making adjustments and changes are considered in contract documents. While, it is limited to just mentioning them and advising the contractor to stick to contract documents at AB contracts.

FIDIC develops the Project Sustainable Log-book (PSL) which clearly states the process of making life-cycle analysis covering the whole phases of the project from the cradle-to-grave considering four dimensions for sustainability that are governance, social, environmental and economic. Moreover, the existence of the engineer at the site assesses the contractor

actions to keep better health and safety measures into account. On other hand, Ab contracts gives the client green light to add their strategy regarding sustainability. For example, the client may request from the contractor to build the project in respect to Miljöbyggnad certificate requirements, or the adopted method in Trafikverket is a good example which is the use of the calculation tool called “Klimatkalkyl”. Furthermore, the contractor is responsible only to make an environmental plan and send it to the client in order to get attached under the contract document later. Major differences between FIDIC contracts and AB contracts in terms of sustainability, quality and productivity are presented in Table below.

FIDIC contracts contain a specific clause that talks about expected risks that could develop during the execution work. It considers defects from the employer, injuries or loss of lives, costs increased due to special circumstances arising from weather conditions, or outbreak of war. FIDIC contracts here has a focus on the uncertainties that may face the contractor, and gives the right for the engineer to decide whether it is necessary for time extension or there is a need for additional price not involved in the contract price. The way of designing the risk in FIDIC contracts puts lower risks on the contractor, this applies only if there is a good collaboration practiced among parties. The engineer’s representative at the site keeps an eye on the contractor work with readiness for correcting the work at the site. On other hand, in AB contracts, there will be an inspection process conducted by an inspector from the client as a site visit and it is limited to the inspection rules with less involvement at the site. In case there are defects found, then risks are higher for the contractor and the client with high impact on the project productivity and quality. The client responsibilities are more because they are in charge of the work of consultation and inspection.

It is found that FIDIC contracts are constructive and AB contracts are instructive due to several factors that are seen from different dimensions which are context of the contract, design risks, degree of freedom and collaboration. The context of FIDIC contracts is built on writing conditions steering all parties, while Ab contracts depend on an agreement between the client and the contractor. Additionally, risk allocation is not shared equally compared to parties' workload in AB contracts. While FIDIC contracts perceive the importance of sharing risks among parties. When it comes to Ab contracts, the client will assess changes and adjustment in order to decide where it has a critical impact on the project or not. However, FIDIC contracts have a room for presenting new changes and updates by the engineer and the contractor. AB contracts do not support collaboration between parties because it is limited to the meeting minutes, and it is considered higher into the organizations. In contrast, FIDIC contracts possess higher collaboration between parties applying the open book concept.

Table 5. Sustainability, quality, and productivity in FIDIC contracts vs AB contracts.

Factor	Measure	FIDIC contracts	AB contracts
1. Quality	Time limits	- The engineer is able to extend the time scheduled for execution work in case if the engineer sees that the contractor needs more time to do the required work in accordance with the contract requirements. - The work is suspected to get done with less quality, then the engineer has the right to extend the time limit. - Consider the special considerations at the site such as water table, war, etc as another need for extension.	- The contractor has to streamily follow the time schedule for the execution of the work. - The only exception for time extension is that extraordinary conditions happen at the site such as weather conditions, war, etc.
	Delivery of materials	- Engineer ability to make instantaneous tests during the contractor's execution work. - The examination of execution work is based on drawings and records for measuring the work and quantities. - The engineer may request to break-down lump sum items. - The completion of execution work should get approved by the engineer. - The engineer has to check the test program including resources and intending time for the tests of completion that should be done by the contractor.	- Delivery of materials should get inspected by a person/organization (the Inspector) who gets hired from the client. - Several and flexible types of inspections, pre-inspection or reinspection.
	Supplementary and unforeseen works	- The contractor has the right to suspend the work or even request time extension. - The engineer has to check excess costs and time extension requested from the contractor side.	- Considering excess costs generated from unforeseen works. - time extension only if there are special conditions like war, weather or etc.

	Deviations from the contract terms	- Mention the common disputes among the client, the engineer and the contractor. - Limiting expected disputes regarding currency and rate of exchange. - Power of the engineer to detect any deviations resulted from contractor or client. - Rules under Arbitration of the International Chamber of Commerce govern all parties' disputes arising due to such deviations.	- The client's power for limiting the contractor through stating their strategy of acting ethically in the contract documents. - A highly disciplined contractor, afraid from the client to request for extending the guarantee period.
	Cooperation obligation	- The collaboration is related to the role of consultation. - Types of meetings are management meetings and mostly related to the future work and work examination. - The contractor obligation for updating the engineer with proceeding work performance at the site.	- The contractor has to work in collaboration with the client to avoid such fluctuation from contract terms.
	Obligation to act diligently	- The employer's obligation to follow laws like permits, licences and approvals to ensure less impact on the quality. - The contractor takes care of the works and indemnities like responsibility for any damages and losses. - The Taking-over certificate creation and acceptance.	- The contractor obligations run under contract conditions that are stated by the client.
2. Productivity	Degree of freedom	- The power of the engineer to evaluate the contractor's work. - The contractor evaluation of additional work. - The contractor has the right to request an extension for the timing assigned for a specific part of the work. - The contractor's ability to make self-decisions for ensuring high quality levels.	- High quality level is conservative and runs under contract conditions developed by the client. - The contractor is the only one who can direct the total work on the ground. - The contractor can adopt an acceleration for execution of the total work.
	Making adjustments and changes	- Variation concerning the quality and quantity are determined by the engineer.	- Scope of work has no relation to Alterations/Additions.

		- 15 % of the contract price allowance for reduction due to changes and variations that promote high project quality. - Considering exceptional events like unforeseeable work.	- Adjustments and changes are not covered under contract price.
3. Sustainability	Life-cycle analysis, "cradle-to-grave"	The Project Sustainable Logbook (PSL) clearly states the process of making life-cycle analysis covering the whole phases of the project from the cradle-to-grave considering four dimensions for sustainability that are governance, social, environmental and economic.	- The client setups environmental measures. - The contractor's responsibility to make an environmental plan. - The client is free to add special sustainability measures created within the organization under the contract documents.

6.5 Results from thematic analysis

The contract forms are not the main determining factor for the success of a project, instead this study suggests based on the interview study that the client's use of the contract forms and the contract procedures is the main determining factor for the success of a project. A knowledgeable and experienced client uses the contract in a constructive manner to jointly execute the project with the consultants and the contractor. International contract forms emphasize collaboration more in compares with the Swedish AB contract forms. For example the New engineering contract allows the contractor to be more open with the client regarding the issues arising during the execution phase of the project for the purpose of solving the issue early and efficiently, to be able to continue according to schedule this keeping cost lower compared to the case where the contractor and the client end up in conflicts escalating to court. In case the client and the contractor disagree, the new engineering contract suggests the use of an internal impartial adjudicator. In FIDIC contracts the consultant/engineer have a different role compared to AB contracts, FIDIC recognizes the inexperience the client organisations could have and therefore gives the consultant a different role with more responsibilities to help create good collaboration with higher client involvement.

The procurement process and the payment method are important tools that the client can use to their advantage to evaluate and choose the right contractor for the project. By using soft parameters instead of hard parameters, soft parameters such as contractors experience working in similar projects, quality and sustainability. Procuring based on soft parameters and setting the target price together with the winning contractor was

perceived the best method to procure a contractor for mega infrastructure projects. In comparison to lowest price contracts, target price contracts are more realistic and include more risk awareness and risk allocation, resulting in satisfactory results because the assumption in target price contracts creates room for unforeseen changes and are closer to reality. Lowest price competition with a client with a refusing attitude that falls short to acknowledge unforeseen conditions is going to end up in disputes no matter the contractor they work with in case of arising unforeseen conditions.

Trafikverket is a client organization for mega infrastructure projects in Sweden on behalf of the Swedish government and is obligated to follow the role of public procurement. The role of public procurement forces the organisation to put the economical aspect of the project as a priority. Therefore, most of Trafikverket's projects are procured with lowest price competition. Low client involvement and low collaboration is how the contractor describes Trafikverket with a lot of projects ending up with arbitration. Trafikverket does not recognise and acknowledge deviations from the original bid therefore end up in conflict with the contractor. With AB contract forms that Trafikverket uses, it is easier for the client to take the matter to court. Working with AB contract forms is deeply embedded in the client organisation Trafikverket and there are few projects procured with other contract forms therefore Trafikverket have low experience working with other contract forms and using other procurement strategies. Trafikverket does not have the knowledge to evaluate if international contracts can be of any benefit for their organisation.

6.6 Outputs of the research questions

RQ1: What are the potential results that can be achieved from the comparison between standard agreements and collaborative contracts in the perspective of FIDIC and AB and ABT?

High collaboration levels are found in the FIDIC contracts due to the high involvement of the consultation and inspection work, the engineer work, at the site working side by side with the contractor. However, collaboration in AB contractors between the client and the consultation and inspection work is higher, and it is limited to short meetings with the contractor, and inspection schedule. AB contracts are instructive and conservative, and view changes and adjustments arising at the site as a reason for low commitment by the contractor to the contract documents. It considers only hard changes developed due to exceptional circumstances such as war, weather conditions, etc. On other hand, FIDIC contracts are constructive, the engineer plays a vital role increasing the connection between the design and construction phases. The engineer representative at the site supervises the contractor work. There is a room for presenting new changes and updates that are seen essential for the project benefit.

In AB contracts, the client needs more time to prepare contract documents and a special method for the procurement process. Also, the contractor needs to prepare some documents such as quality and environmental plans by following the client's measures. While, FIDIC contracts produce guidelines and forms for parties to use during the procurement process and a whole contract document that contains all conditions stated in FIDIC books. The procurement process in FIDIC contracts consists of soft parameters concerning quality, productivity, sustainability, health and safety, promoting work efficiency and effectiveness. For instance, FIDIC provides a Quality Based Consultant Selection Guide explaining to the clients, the reason for choosing the right consultant and the importance of this selection due to significant factors such as consultant costs 3-4 percent from the total project budget, and the impact of consultant on the overall project quality. However, AB contracts comprise hard parameters for procurement process in terms of selecting contractors depending on lowest price competition.

FIDIC contracts take into account risk management plans that give trust to parties with high satisfaction. Risks should be shared between all parties to enhance efficient risk management. The difference between AB and FIDIC is the involvement of the Engineer/consultant, the FIDIC contracts gives the consultants more responsibilities compared to AB contracts, therefore the FIDIC contract allows the employer/client to reallocate the risk. The idea in FIDIC is that risks should be shared proportionally equally between all involved parties to promote more efficient risk management. In the case of Swedish clients using AB contracts, where they usually go for lump sum contracts and any additional costs will be added to the pre-agreed sum and paid by the contractor, this means that in this case the contractor is carrying the most risk. Furthermore, FIDIC contracts give a high degree of freedom for the engineer and the contractor compared to the AB contracts that give a low degree of freedom for the contractor that should stick to the contractor document.

RQ2: How does FIDIC contracts govern sustainability, quality and productivity and are there any similarities or differences with the existing Swedish contract forms AB04 and ABT06?

The answer of RQ2 is presented above in *Table 5. Sustainability, quality, and productivity in FIDIC contracts vs AB contracts.*

RQ3: What are potential improvements/changes in AB and ABT to match international context like FIDIC and the challenges for implementing this change in Sweden?

The potential improvements that can be added to the AB contracts to match international context like FIDIC and New engineering Contract is increased collaboration work. The increased collaboration work is associated with higher degree of freedom in a project which results in higher quality, productivity and there is space

to implement sustainability measurements. The increased collaboration in the project includes higher client involvement and open book concept that allows the client to monitor the contractors work throughout the whole project which lowers the risk for opportunism by the contractor e.g. blowing up the budget. Higher collaboration creates room for discussion and problem solving between the involved parties e.g in the new engineering contract the contractor and the client pre-agree on early warnings in case of unforeseen conditions that arise in the execution phase. The contractor must report any conditions that could be a problem or a setback for the project as early as possible to allow the involved parties to sit together and jointly come up with a solution. The project should hire an internal impartial adjudicator in case the contractor and the client do not agree on a solution, instead of taking the matter to court or settlement, ending up with higher costs. These changes are to be added in the additional contract clauses in the contract documents such as AMA and not AB contracts general conditions, the reason for this is the legal process needed to make changes in AB contract forms directly. Although the most important result obtained in this study is not the differences in contract forms but the different way the client uses the contractor forms and the procurement process.

RQ4: What are the challenges in implementing FIDIC contracts by the client organisations in the Swedish market, specifically Trafikverket?

The main challenges for implementing a new contract form is firstly the legal aspect. The new contract form needs to be approved by certain governmental agencies before being used in the industry therefore there is a legal process that needs to be taken in consideration for the implementation of a new contract form. The Swedish construction and infrastructure sector have worked mostly in AB contracts therefore both client and contractor organisations in Sweden have low experience working with other contract forms resulting in an obstacle for implementing a new contract form. The consultant role is different in AB contracts compared to FIDIC, in FIDIC the engineer has more responsibility and is more integrated with the client organisation. This different role that the consultants need to adapt to can create a challenge for the consultant organisations in Sweden.

7 Discussion & suggestions

In this chapter, the obtained results from both comparative and empirical studies are discussed, and solutions for the stated issue are presented with a recommended procedure for right adoption.

Trafikverket is facing obstacles in their projects and a solution for this is to expand their range to attract international contractors to work in Swedish mega-infrastructure projects to promote diversity among competitors and innovation. In the literature study, Eriksson, P. E. , et al., (2018) identify the main challenges that Trafikverket is facing today for attracting international contractors to participate in Swedish mega infrastructure projects as the following: Entry barriers the authors means that any international contractor that want to make their way into the Swedish market will face inter organisational changes to adapt to the new environment. The cultural work differences, the execution of different stages of the project can be different when working in a Swedish project compared to a project in the UK, for example the procurement process could differ. Lastly, the communication and language barriers, working with people with different backgrounds can create communication misunderstandings, translation misinterpretations.

This statement of the existing barriers is strengthened by the interview study and the interview conducted with Trafikverket. When the question about the current situation on the interest of international contractors to work with Trafikverket was asked the answer was clear. Trafikverket has procured a few projects involving international contractors and the interviewees did not have any knowledge on those contractors. The reason for the low presence of international contractors was the barriers existing today in the form of understanding Swedish contract documents and governmental processes and also the work culture.

The main reason the author of this study found for the weak presence of international contractors in the Swedish market could be seen as the contract forms being different and handled and used differently in different contexts, Swedish and internationally. International contractors are not used to the Swedish contract forms AB and the Swedish contracting procedures and strategies. Therefore, this study suggests that the main reason for the weak presence of international contractors in Sweden is the contract forms AB and the clients use of it. International contractors are more used to collaborative ways of working therefore a clash arises when international contractors work in the Swedish contract forms with Swedish clients with low experience in the field of international contracting.

By comparing the general conditions in both the contract forms AB and FIDIC, the main difference found is the role of the engineer. The role of the engineer in FIDIC carries more responsibility and has a greater impact on the project compared to the consultant in AB contract forms. In FIDIC the engineer is involved throughout the

whole project regardless of the contract form from beginning to end with high influence on decision making, this is because through practice the FIDIC association realised that the engineer is the most knowledgeable party involved in a construction and infrastructure project. Therefore, the engineer should assess the client/employer with the decision making from a professional perspective from the early stage of creating contract documents to the inspection of the contractor's execution of the work. In a typical project with AB contract form the consultation work and the inspection work is carried on by separate parties. Involving the engineer in the early stages as FIDIC does gives the engineer a vital role to be the medium to translate the design into reality with the help of the contractor resulting in higher collaboration and enables the engineer to monitor the work continuously side by side with the contractor. International contracts are promoting and creating more room for collaboration and risk sharing compared to the Swedish contract forms.

To achieve higher collaboration in a project the following measurements are important to take into consideration when procuring mega infrastructure projects: The evaluation system for the procurement of an infrastructure contractor, The payment method and the level of client involvement. The contractor in the interview study stated that Trafikverket on numerous occasions used lowest price competition to evaluate the contractor and it led to devastating results. Lowest price bidding forces the contractors to focus on keeping the cost down instead of focusing on other value adding measurements such as quality, productivity and sustainability. Lowest price bidding is associated with low risk allocation, to be able to win the bid the contractor has to be as efficient as possible with the assumption of the execution of the project leaving no room for including risk for unforeseen conditions. Instead for example the construction industry in the UK it is more common for clients to procure on soft parameters such as experience, quality and sustainability. After the evaluation of the winning bid the client meets with the contractor to create a target price and agree on shared incentives. The client decides what level of involvement and influence they want to have in the project by employing consultant engineers to assist the client to create tender documents, evaluate contractors and inspect the contractor's execution work.

For Trafikverket to develop further and to attract international contractors there are certain strategies and changes that need to be adapted. As this study began, the direction it was headed was to evaluate and compare the use and benefits of FIDIC in replacement for AB contract forms for Trafikverket. As this study developed it was found that the contract forms are not the only main obstacle, it is believed that most contracts are similar with few differences and when it comes to the Swedish contract forms AB, the main difference is the lack of promotion for collaboration compared to international contract forms. In projects with high collaboration the client is more involved compared to projects without collaboration, the client involvement can be done through a hired consultant that monitors the execution process and makes decisions in the client's place. Higher collaboration is associated with higher client

satisfaction, there is a continuous dialogue throughout the whole project to keep all parties informed in case of delays and unforeseen conditions.

The authors of this study suggest for international contractors to follow the recommendations of Trafikverket regarding entry barriers, which are identified as knowledge and experience based obstacles. It is preferred as a first step for international contractors to enter the Swedish construction and infrastructure industry. In table xx the existing entry barriers are identified and the solution for them is presented.

Table 6. The entry barriers identified and the solutions are presented by Trafikverket.

	Communication	Collaboration	Swedish market
Knowledge Base	Multi-cultural differences can be solved by getting enough knowledge from course talking about Swedish business culture. Second important barrier is misunderstanding arising from speaking English language, therefore taking courses to improve technical English is essential.	Staff are in need of taking courses regarding partnering and collaboration. This can be applied through workshops and may be in collaboration with research institutes	Get knowledge about Swedish market by entering the market through investments prior to the commencement of the project
Hiring Staff	Hiring Swedish staff experienced in this field, and/or get a subcontractor like Swedish partner that possess high competence and experience from similar previous projects		

There are several possible solutions for the problem Trafikverket is facing in attracting international contractors and developing the contracting process. The first solution and the hardest to achieve is to change the general contract forms from the Swedish AB contract forms to FIDIC or other international contract forms. The reason for choosing the FIDIC contracts instead of AB contracts is the advantages presented in the results from the comparison and empirical studies. This solution can face legal setbacks, there is a certain legal process that takes time and resources to accomplish. Another obstacle is the Swedish construction industry, both clients and contractors might still not have use for it considering the low experience and knowledge base the Swedish industry has working with other contract forms.

The second solution is the involvement of a collaboration information document in the contract documents in AB contracts. This document consists of the results from

the advantages of using collaborative contracts compared to the AB contracts. The advantages of collaborative contracts, Fidic contracts, are the following:

- The high cooperation between the consultation and inspection work with the contractor in the execution phase.
- Increasing the connection between the design and construction phase, the engineer power.
- The procurement process in FIDIC contracts consists of soft parameters concerning quality, productivity, sustainability, health and safety, promoting work efficiency and effectiveness.
- The collaborative contract forms in FIDIC consist of ready and pre-agreed guidelines for general and detailed conditions that could be used directly by all parties.
- Risk management plans are considered and agreed on by the main parties.
- Ensuring high degree of freedom for consultation and execution work.
- Supporting the concept of openbooks.
- Create better dialogues ex. early warnings.
- Supporting the concept of early contractor involvement (ECI).
- Adding value to the project in terms of quality, productivity and sustainability.
- Higher competition results in greater diversity of received technical proposals from bidders offering a larger range of sustainability solutions.

The application process of the collaborative information document should be applied by the client. The collaborative information document is to be added to the contracting documents as an agreed document between the client and the contractor as it is described under the first chapter in AB contract forms, the scope of contract. The reason for adding the collaborative information document to the contract documents instead of directly into the AB contract forms is due to the legal difficulties of changing the contract forms.

The aim of the collaborative information document is to increase the collaborative work in construction and infrastructure mega-projects in Trafikverket. The Swedish contract forms allows the client to put requirements for the contractor to develop quality and environmental plans, the idea here is that the Trafikverket can also request a collaboration plan with the measures stated in the Collaborative Information Document, then the context of the plan should get established by the contractor and approved by the client.

The optimal solution is to create an association with the sole purpose to improve the Swedish contract forms AB to match the context of international collaborative contract forms. This association is assembled with people from the client

organisations, Swedish contractor organisations, research institutions, consultant and inspector firms, international contractor organisations, law firms, FIDIC association and IABSE association. Considering that IABSE has connections with international contractors working with mega infrastructure projects. This will be Trafikverkets gate for introducing international experienced contractors to the Swedish mega infrastructure industry. Therefore, it is suggested for Trafikverket to work in collaboration with IABSE. The collaboration association is privately owned and impartial with the aim of appealing as a more trustworthy organization for the previously mentioned organisations. It works to improve the Swedish procurement process and contracts to be more appealing for international contractors, the organisation acts as a medium for international contractors to enter the Swedish market. By closely working with client organisations like Trafikverket with the influence of research institutions and industry participants, the organization can serve and benefit both sides.

7.1 Limitations

The limitations for this study are, the last solution is far-fetched but should be mentioned as well. To create an association with the sole purpose of developing the Swedish contract forms and making them understandable by international contractors. In addition, Trafikverket could have a limited number of mega-projects, so large international contractors may not be attractive, and it could come up with negative returns. Therefore, there should be an assessment considering the future situation for adopting such solutions which is not included in this study. Due to COVID-19 pandemic, the number of interviews conducted in the study is limited and digital communication tools are used such as email, Microsoft TEAMS, and ZOOM. Limited number of projects conducted with international contractors to survey and limited number of contractors working internationally.

8 Conclusion

Trafikverket sought to clarify the main obstacles facing international contractors for entering Swedish market and apply for infrastructure projects' bids released specifically by Trafikverket. The major difficulties identified by Trafikverket are entry barriers, cultural differences, and language and communication. However, these challenges are seen related to knowledge base solutions and should be considered by international contractors as a first step to do as soon as they enter Swedish market. The result of this study shows contradicted outputs compared with previous studies. The main challenges for attracting international contractors for participating in Swedish mega infrastructure projects are seen related to contractual issues found in AB contracts. Therefore, the differences between AB contracts and collaborative contracts such as FIDIC contracts and new engineering contracts are studied in order to assess substantial pitfalls in AB contracts.

The comparison study conducted in this study measures and evaluates main factors in AB contracts and FIDIC contracts which are quality, productivity, sustainability, design risk and degree of freedom. The results from comparison study show a higher level of consideration and application of these factors in FIDIC contracts resulted in benefits for the projects with constructive returns compared with AB contracts. AB contracts are perceived instructive contracts that lack cooperation and collaboration among parties because of low involvement of consultation at the site and its limited to client commands. The role of the engineer in FIDIC contracts is viewed as the reason behind adding positive impacts on these measures. The engineer works in collaboration with the client and the contractor and acts normally in dealing with them. This increases the trust between people who work at site and office. The engineer's representative possesses higher knowledge, ex. design documents, drawings, and competence working side by side with the contractor at site. On other hand, the formal connection between the client and the contractor, that is found in AB contracts, increases the hierarchical way of dealing with each other, which means that the client plays here the role of leader and the contractor performs as follower. The collaboration is limited to office work and the client guides this process with only the consultation and the inspection work that are working under the client cover, while giving the feeling to the contractor of working alone at the site and waiting for inspectors and consultants to find pitfalls at site.

The interview study has almost similar outcomes which are generated from the practice observations from the client and the contractor perspectives. The contractor's point of view, Lennart Stenma from Skanska, experiences FIDIC contracts during his works with Skanska outside Sweden and AB contracts while working in Skanska-Sweden. Lennart stated that the client's use of the contract forms and the contract procedures is the main determining factor for the success of a project. Additionally, Lennart sees that international contract forms emphasize collaboration more compared with the Swedish AB contract forms. For example, the New Engineering

Contract is suggested as a good solution to minimize disputes that arise during the execution phase among parties. Lennart mentions the importance of including soft parameters in the procurement process and setting the target price together with the winning contractor is perceived the best method to hire a contractor for mega infrastructure projects.

On other hand, the client point of view, Daniel Sundin & Hans Huhmarkangas from Trafikverket, Trafikverket gives priority to the economical aspect of the project during the procurement process, this is due to their position that forces them to follow the public procurement requirements. Trafikverket gets complaints from the contractor regarding low client involvement and low collaboration and takes it as a reason for the existence of arbitration at the end of many projects. Trafikverket as a client organization has little to no knowledge working with international contract forms such as FIDIC. AB contracts are the main contract forms used by Trafikverket. Their way of setting requirements using AB contracts does not include cooperation measures.

The results also highlight the similarities between AB and FIDIC that are limited to fundamental contract conditions. Therefore, suggested solutions presented in Chapter Seven, are created by considering advantages of adopting the concept of collaborative contracts by Swedish client, Trafikverket. The main challenges for implementing a new contract form is firstly the legal aspect. In this case, the idea of converting from using AB contracts to FIDIC contracts is hard because it needs legal permission to accept FIDIC as a valid contract by Swedish courts. However, it is highly recommended to adopt the second solution of adding collaborative information documents to the contract documents in accordance with the AB conditions. The client will put the measures for the collaboration plan at the early stages of developing contract documents, then the contractor has to develop the plan and submit it back to the client in order to agree on. This process will ensure no need for making changes in AB contract forms. This movement is seen as essential for Trafikverket to adopt in order to attract international contractors, as they are used to collaborative types of contracts more than instructive ones.

In addition, AB and ABT have been used for decades and therefore it will be a major challenge to try and implement new contract forms. The solution should be a step by step modification of AB and ABT contracts to optimize the document. There is a need also for a special association responsible for developing and sponsoring the collaborative information document. The future focus for Trafikverket may concern the development of an ideal method for adopting new changes on their strategy specified for the use of AB contracts, such as suggested solutions.

9 References

Advokat, P., M., och delägare Advokatfirman Lindahl, (2014). 'Jämförelse mellan AB och FIDIC Föreläsning Juridiska Fakulteten, Lund', LINDAHL, [PPT - Jämförelse mellan AB och FIDIC Föreläsning Juridiska Fakulteten, Lund PowerPoint Presentation - ID:1981740 \(slideserve.com\)](#)

Al-saadi, Campos, Eriksson, Karlsson, Kultje and Yasin, (2019) "Upphandling av tredjepartslogistik i byggbranschen". Chalmers University of Technology 2019. Publisher: Diva-portal. Link: [257183.pdf \(chalmers.se\)](#)

Boverket (2020). *Building in Sweden For developers and construction companies, Standard agreements*. Boverket. Viewed 2021-02-17. <https://www.boverket.se/en/start/building-in-sweden/swedish-market/procurement/standard-agreements/>.

Bresnen M. and Marshall N. (2011) "Projects and partnerships: Institutional Processes and Emergent Practices". The Oxford Handbook of Project Management. Link: [Projects and Partnerships: Institutional Processes and Emergent Practices - Oxford Handbooks](#)

Bröchner, J. and Olofsson, T. (2012) 'Construction Productivity Measures for Innovation Projects', Journal of Construction Engineering & Management, 138(5), pp. 670–677.

Chancellor, W., Abbott, M. and Carson, C. (2015) 'Factors Promoting Innovation and Efficiency in the Construction Industry: A Comparative Study of New Zealand and Australia', Construction Economics & Building, 15(2), pp. 63–80.

Coutu (undated) "Why you need a contract". Article published in Consultant journal. Link: [Why you need a contract \(consultantjournal.com\)](#)

Dai Q and Molenaar R., (2014) "Impact of Risk on Design-Build Selection for Highway". Publisher: JOURNAL OF MANAGEMENT IN ENGINEERING © ASCE. DOI: 10.1061/(ASCE)ME.1943-5479.0000210. Link: [Impact of Risk on Design-Build Selection for Highway Design and Construction Projects \(ascelibrary.org\)](#)

Eriksson, P. E., Larsson J., Järvenpää A. T., ProcSIBE & Luleå University of Technology (2018). Multi-national infrastructure projects – Attracting and collaborating with international contractors. Swedish National Road and Transport Research Institute (VTI), Corporate Authors: Trafikverket, Sweden. Available at: https://fudinfo.trafikverket.se/fudinfoexternwebb/Publikationer/Publikationer_003301_003400/Publikation_003395/final%20report_180110%20Multi-national%20infrastructure%20projects.pdf

Fidic homepage (2021). Link: [FIDIC | International Federation of Consulting Engineers | The Global Voice of Consulting Engineers](#)

Fidic values (2021). Link: [FIDIC | Our Values | International Federation of Consulting Engineers](https://www.fidic.org/Our-Values/)

Flick, U. (2014) An introduction to qualitative research. 5. ed. SAGE. Available at: <https://search.ebscohost.com/login.aspx?direct=true&db=cat07470a&AN=clc.567c5935.d7b7.46ba.9e82.f1bc3aa7ea5d&site=eds-live&scope=site>.

Issa R. A. and Olbina S., (2015) '5.3.1.1 Standard Form of Consultants Form of Appointment (ABK 09)', in Building Information Modeling - Applications and Practices. American Society of Civil Engineers (ASCE). Available at: <https://search.ebscohost.com/login.aspx?direct=true&db=edsknv&AN=edsknv.kt00UR8CT2&site=eds-live&scope=site> (Accessed: 09 March 2021).

Kadefors, A., (Procurement routes/strategies: contracts, payment principles and tendering Consultancy procurement), *TEK140 Construction contract relationships*, Lecturing on November 5-6, 2019.

Karlsson, M. (2021) 'Regeringsuppdrag kostnadsutveckling vid upphandling och genomförande av investeringsprojekt'. Available at: <https://search.ebscohost.com/login.aspx?direct=true&db=edsbas&AN=edsbas.60A55D24&site=eds-live&scope=site>

Konkurrensverket. (2019). Upphandlingsreglerna - en introduktion. Link: <http://www.konkurrensverket.se/globalassets/publikationer/informationsmaterial/upphandlingsreglerna--en-introduktion.pdf>

Lind, Nilsson and Nyström (2014) "DEGREES OF FREEDOM IN ROAD CONSTRUCTION". Center for Transport Studies Stockholm, CTS Working Paper 2014:20. Publisher: Diva-portal. Link: [Degrees of freedom in road construction \(diva-portal.org\)](https://diva-portal.org)

Li-Yin Shen , Jian Li Hao , Vivian Wing-Yan Tam & Hong Yao (2007), "A checklist for assessing sustainability performance of construction projects". Journal of Civil Engineering and Management, 13:4, 273-281.

Samuelsson, P., & Iwar, L., (2005). 'Fidic; an Analysis of International Construction Contracts'. Kluwer Law International and International Bar Association, Vol. 20, p.p. 277-312. Available at: <https://search.ebscohost.com/login.aspx?direct=true&db=edsvlx&AN=edsvlx.62445598&site=eds-live&scope=site>

Shrestha, P. and Mani, N. (2012) Impact of Design Cost on Design Bid Build Project Performance. Construction Research Congress, pp. 1570-1579.

Svensk Byggtjänst. (2019). AMA för bygg- och anläggningsprojekt: Med AMA undviker du fel. Link: <https://byggtjanst.se/tjanster/ama/>

Söderberg (2011). *Att upphandla byggprojekt*. Lund: Student literature.

Trafikverket (2019). Largest railway and road construction projects
<https://www.trafikverket.se/en/startpage/projects/Railway-construction-projects/> Hämtad 2021-02-15.

Trinkūnienė, E., et.al., (2017). 'Evaluation of quality assurance in contractor contracts by multi-attribute decision-making methods', *Economic Research*, VOL. 30, NO . 1, 1152–1180.

Upphandlingsmyndigheten. (2018). Om regler för upphandling. Link:
<https://www.upphandlingsmyndigheten.se/upphandla/om-upphandlingsreglerna/>

Vogel J. A. (2020). 'Incentivising Innovation in the Swedish Construction Industry'. Doctoral Thesis, School of Industrial Engineering and Management, Department of Energy Technology, KTH Royal Institute of Technology, Stockholm, Sweden.

Österberg E. (2016) "*Marknadsidéer i själva verket: Trafikverket och den renodlade beställarrollen*". Södertörns Högskola, 2016 p. 109. Publisher: Diva-portal. Link:
[Marknadsidéer i själva verket : Trafikverket och den renodlade beställarrollen \(diva-portal.org\)](https://diva-portal.org/)

10 Appendix

Interview study needs to review two perspectives, the client, and the contractor. First interview with the client was planned to cover the main issues that Trafikverket has regarding the use of AB contracts and what do they know about collaborative contracts. Therefore, questions have a direct focus on the problem without getting more in open discussions. On other hand, the interview with the contractor required an open discussion and questions in order to fulfil the aim of understanding collaborative contract importance for contractors.

10.1 Guidline for interview questions:

Interview questions for client organisation (Trafikverket):

The name of the interviewee:

Name of the organisation:

General background questions:

1. Describe your role in the organisation? How long have you had that role?
2. What is your academic background and past experience (What roles have you had in the past) in the construction industry/Client organisation?
3. How many infrastructure and construction projects have you been involved in?

General questions about contracting in the swedish context (AB04 and ABT06):

4. Do you have any experience in procurement of construction and infrastructure projects/ Consultant services or do you have experience regarding contracting in general?
5. How familiar are you with the swedish construction and infrastructure contract forms, AB04 and ABT06? How many projects have you worked on with these two contract forms?
6. What are the pros and cons of each contract form? What are common disputes that arise when working with AB04 and ABT06 contract forms that trafikverket have today?
7. What contract form brings the most tenders, do you have any thoughts on why?

8. When you as a client organisation set up a project for tendering, do you think that the bids you get are fairly competitive or is it usually few bidders and limited bids with few options to choose?

9. Does trafikverket have contract documents for construction projects, concerning the briefly described conditions in AB04 and ABT06 contract forms?

General questions about contracting in international context (e.g FIDIC contracts):

10. Do you have any experience in procurement of international construction and infrastructure contractors?

11. Do you have any knowledge if trafikverket have any contact with international contractors?

12. What are the barriers that exist for international contractors to enter the swedish market?

13. Are you familiar with the international contract forms such as FIDIC contracts (they are standardised international contract forms used in many countries and have gained experience throughout the years), if so how can these standardised contracts be useful for introducing international contractors?

14. How is the situation for introducing an international contract form in the swedish context? What are the largest barriers?

15. What are potential improvements/changes in AB and ABT to match international context like FIDIC?

Sustainability questions:

16. How do AB04 and ABT06 contracts govern sustainability, quality and productivity?

17. What are the sustainability and quality requirements that trafikverket use today? Do you have any types of documents to drive sustainability besides the requirements in AB04 and ABT06?