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Delays in Global Engineering Procurement and Construction Projects

Main Factors in Project Management

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The purpose of this thesis is to develop recommendations for managers helping to avoid delays within global Engineering Procurement and Construction (EPC) projects. Delays hinder successful completion of global EPC projects within energy sector. Yet, timely completion is of crucial importance and considered as main customer value within EPC. This study asks the following research question: What are the main reasons for delays in global EPC projects? The case company of this thesis is a global EPC corporation with its headquarters in Seoul, South Korea.

In this study, after identifying the delays factors in global EPC projects, as well as analyzing the existing knowledge on the topic of delays, the possible recommendations how to avoid delays were introduced. These recommendations were delivered in the form of proposal that was eventually presented to experts in the field of EPC for validation. The experts validated the coverage of the topic and contributed by sharing their experience.

The study utilized applied developmental research with qualitative multi-method interviews and questionnaires of professionals as its main qualitative research methods. The study was grounded in the current state analysis of the standard global EPC project process in the case company as a project contractor and partly of a Kazakh state refinery as a project customer. The study also touches the current issues of EPC in the time of Corona.

Based on the results, the study reveals that delays are caused by different issues, such as legal, administrative, technical and social. This study discovered both practical matters, such as failure to order long haul equipment, as well as nowadays issues of globalized world and its effect on delays. Additionally, Corona epidemic brings new challenges and consequences, while there is so far limited information on how the epidemic affects EPC process.

Keywords	Global EPC projects, Project management, Project delays

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Key Terms

EPC	Engineering Procurement and Construction
FEED	Front-End Engineering Design or Basic Design
Feasibility Study	One of the most important stages before FEED to determine if project is meant to be successful. It studies if a contractor can tackle the project, taking into consideration its technical competence, financial power, legal requirements, possible risks and time limit
DLD	Delay liquidated damages- compensating the company for loss and damage incurred because of failure to meet the date of completion agreed in the EPC Contract
HSE	Health, Safety, Environment
ITB	Invitation to Bid
RFQ	Request for Quotation
PO	Purchase Order
LLI/LHI	Long Lead Items/ Long Haul Items- Items that include long delivery time
PR	Purchase Requisition
FAT	Factory Acceptance Tests

1 Introduction

Delays prevent a successful and efficient completion of global Engineering Procurement and Construction (EPC) projects in the energy field, such as Oil and Gas refineries and chemical plants. One of the main objectives of any EPC project is timely completion. The authors of "Critical Factors behind Construction delay in Petrochemical projects in Saudi Arabia" specify that timely completion is regarded as a leading customer value within EPC and one of the main objectives (Alhajri & Alshibani, 2018). Various research studies have shown that it is very important to complete EPC projects in time, as delays result in significant penalties specified in the Project Contract (DLA Piper Global Law firm, EPC Contracts in the Power Sector, 2012). Therefore, determining and evaluating the factors causing delays is of essence in helping the Project Management department to successfully complete the project.

Besides the importance of timing, another reason is a commonality of delays in view of the complexity of projects. The study of 2018 performed by the graduates of Institute of Ferrous Technology and Graduate School of Engineering Mastership of Pohang University of Science and Technology in Korea reveals that most global overseas EPC contractors in oil and gas field are facing schedule delays (Jo et al., 2019). Another study also stated delays as being unavoidable within global EPC projects. However, it also believes that there is a good chance of mitigating and avoiding delays in case factors causing them are identified and comprehended. (Akhtar, 2019).

1.1 Case Corporation

The case EPC corporation of this thesis is a global corporation established in the late 20ieth century. In 2018, it had about 6000 employees and its net income was over two hundred million dollars. It delivers expertise in EPC of process, power and energy plants. In 2018 it was among the top 30 companies of the top 225 international design firms in the world. The company works to bring its sound principles of business at each stage of project management so that to provide most possible value to its stakeholders within all operations.

As any global engineering corporation, the case corporation experiences the burden of time overruns. Based on the engagement of managers in discussing delays and its impacts, it is willing to bring changes and admits the need for improvement. Striving to

win customers over by providing more advantageous services, the case company understands that one of the ways is providing timely advantageous process without delays.

1.2 Business Challenge, Objective and Outcome

The world is constantly changing and getting more globalized. When a Kazakh State Refinery Client that has just awarded its project to a small and not well-known Singapore-based Engineering company GeTech, was asked why the company did not choose the case company as its Contractor, even though it was a strong competitor, the answer was simple and clear: the small company seemed to be ready to provide the same quality for a cheaper price. If before there was almost no competition for large corporations with their monopolistic EPC project management, currently more and more projects are being handled by smaller specific companies that however work in collaboration with other consulting groups making such alliances stronger, competent and even commercially more beneficial for Clients. Thus, big EPC companies struggle to get customers and win projects.

The case corporation provides mostly turn-key, one package EPC services. Therefore, it can present their value in its integrity and aligned EPC process that can deliver timely completion of projects with its complex assignments and relations.

Taking into consideration the case company and its project management procedure, this study is focused on **creating a list of recommendations related to reducing delays within global EPC projects in order to improve its business and provide successful timely completion of projects.**

The outcome of this thesis is a list of recommendations, which contains possible solutions to the problems identified during the analysis of data collected during the study. The proposed list should help in mitigating delays and avoid time overruns within a global project.

1.3 Thesis Outline

With the importance of service design in our modern world, this study is analyzing EPC services. With one of the main features of service design being the provision of value to its customers, this study is analyzing EPC services and customer values. After identifying several values within EPC projects, such as time, cost and quality, this study is focused

on time and timely delivery of EPC projects as a customer value. Taking into consideration that delivering value to a customer is a concern of Project Management, this study is limited by factors affecting Project Management. The study does not go deep into technical and engineering issues that also might affect EPC projects.

The thesis contains seven sections. Section 1 is the introduction. Section 2 describes methods and materials used in the study. Section 3 presents the results of the currents state analysis. Section 4 focuses on exploring the existing knowledge on the topic of reducing delays. Section 5 contains the proposal, and Section 6 presents the results of the proposal validation. Section 7 contains the summary and conclusions.

The study is conducted with the help of the interviews of managers being the main source of data for the case company EPC projects as a Contractor and Kazakh Client as a Customer. Existing knowledge was also selected taking into consideration the interviews. Finally, a list of recommendation is delivered based on the analysis of current state of the companies, existing literature and the input from validating experts.

2 Method and Material

This section describes the research approach and design, i.e. research process, collection of data and its analysis methods.

2.1 Research Approach

While fundamental research aims at expanding knowledge of processes of business and management, the aim of this study is to identify and understand the issues causing delays within certain EPC company and its global projects, as well as respectively to come up with solutions. For that reason, an applied developmental research seemed more appropriate to use. Applied developmental research is selected as a research strategy.

As this study is looking for insights specific to EPC industry, the qualitative methods of research using interviews appears to be suitable as it looks deeper into the matter of study and also incorporates the human experience. In this study, an inductive approach is taken, where the data is collected first followed by the exploration of existing knowledge and building a Conceptual Framework. As Saunders et al. (2016) write in their "Research Methods for Business Students" book, an inductive approach needs to begin with a clearly defined questions and an objective.

In this study, as a result of conducting interviews a certain amount of qualitative data was obtained. There are different approaches to analyze the data. Savin-Baden (2013) mentions "breaking data into meaningful parts" or Hatch describes it as "systematic search for meaning". Data analysis method used in this study consisted of a number of stages as follows:

Stage 1. Reading the data in a very close detail several times. Familiarizing with the nuances of data, reading while taking into account different perspectives, focusing on different elements of data.

Stage 2. Applying a Thematic Analysis. Picking up obvious issues and themes. Covering general issues that stand out. Focusing on what interviewee finds important and wants to emphasize.

Stage 3. Finding subtle topics. As the challenge of qualitative data is its depth of data. It is also more random and a lot is going on, lots of context and sub-text. The lack of structure and its complexity resulted in time-consuming analysis.

Stage 4. Comparing the data. What is same and what is different and why. This stage also helps to provide validity to the research as it proves consistency in data.

2.2 Research Design

Research design is intended for an overview of the whole research process with the help of research design visual. Figure 1 shows the research design of this study.

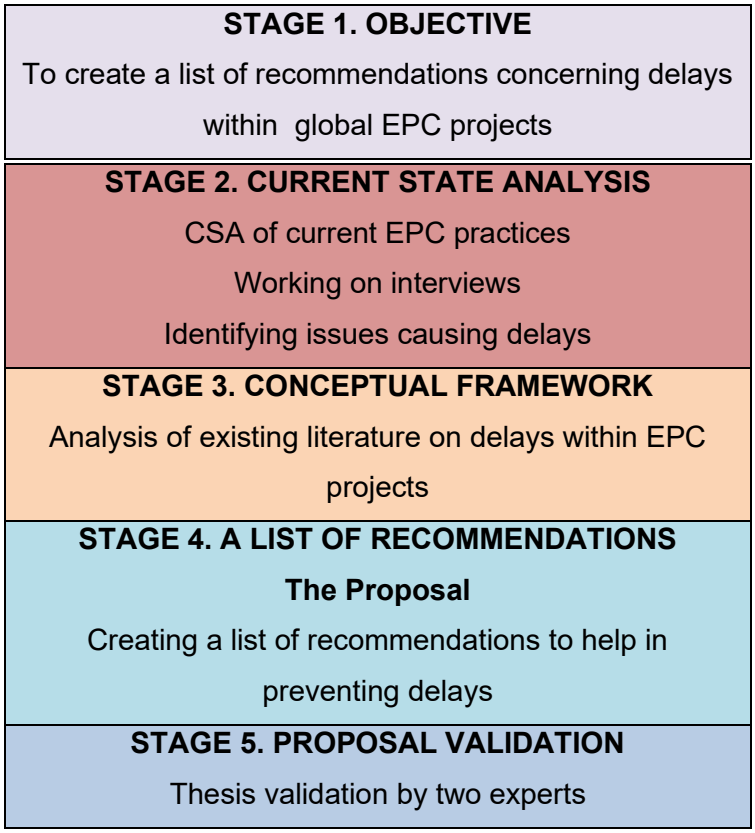

Figure 1. Research Design of this study.

As shown in Figure 1, the research design begins with setting the thesis objective followed by the current state analysis of the current EPC process at the case corporation. As a result of the current state analysis, a number of certain issues/weaknesses causing delays within global projects were identified. Following the current state analysis, a

conceptual framework stage was conducted, when an existing knowledge related to delays within EPC was analyzed and noted. Based on the earlier stages, the Initial Proposal is built as a table of recommendations concerning delays created on the basis of the current state analysis of the case corporation and existing literature on the topic. Later on, this table is presented to validating experts who comment on the study. After that, the Final Proposal is drawn in table 6, presented as visuals, taking into consideration Data1,2 and 3, discussed in section 2.3. of this study.

The proposed list of recommendations is developed for managers of EPC companies to raise awareness and face issues related to delays, to improve EPC project progress and help in successful completion of projects.

2.3 Data Collection and Analysis

This study utilized three rounds of data collection: for the current state analysis, proposal building and validation stages (1-3) of this study. Details of data collection are shown in Table 1 below.

Table 1. Details of Data 1-3 collection.

	Participants / role	**Data type**	**Topic, description**	**Date, length**	**Documented as**
	Data 1 for the Current state analysis (Section 3) & Data 2 for Proposal Building				
1	Respondent 1: Case company Project Manager	Skype Interview	The case company project management approach, weaknesses and strengths, procedures for Data 1 Suggestions on minimizing delays for Data 2 Update on CSA	March 17th, 2019, 2,5 hours	Field notes
2	Respondent 2: Case company Assistant Manager (JD, PMP)	Skype Interview	Causes of delays with focus on Customers for Data 1 Suggestions on minimizing delays for Data 2	July 2nd, 2019. 1 hour	Field notes
3	Respondent 3: Case company Chief Geotechnical Engineer (Ceng., Ph.D.,)	Email comments	Causes of delays Update on CSA on Corona situation	Dec 11, 2019. Oct. 25	Comments Comments

4	Respondent 4: Kazakh Owner Deputy Processing Engineering Manager (Owner)	Skype Interview	Project Management procedures from Owner/Client's perspective (Case study), Causes of delays for Data 1 Suggestions on minimizing delays for Data 2	Feb 6, 2020, 1 hour	Field notes
5	Respondent 5: Case company Senior Process Engineer	Email comments	Causes of delays Update on CSA on Corona situation	October, 2020	Comments
	Data 3, from Validation (Section 6)				
6	Respondent 6: Case company Project Country Manager	Presentation of draft proposal	Validation, evaluation of the Proposal	31.10.2020 Initial Proposal presented; 10.11.2020 comments received	Proposal review Comments on the review
7	Respondent 7: Case company Manager, CIS Area	Presentation of draft proposal	Validation, evaluation of the Proposal	31.10.2020 Initial Proposal presented; 13.11.2020 comments received	Proposal review Comments on the review

As specified in Table 1, Data 1 and Data 2 are put together in one section as due to tight schedules each of the respondents were interviewed once and Data 1 and Data 2 were collected at the same time during one interview.

In the 1st round and 2nd rounds, Data 1 & Data 2 collection were carried out for the current state analysis and building of proposal. An interview method has been applied to collect data and deliver a precise and clear picture of current state of the company affairs for Data round 1 and sharing ideas on improving and minimizing delays for Data round 2. Interviews are deemed as most suitable approach for the purpose of collecting data as they provide more accurate and deep information from actual stakeholders. Since interviews are the only source of information on Current State Analysis, matters of delays and ways to deal with it, it was decided to analyze each interview and share its findings.

While preparing for interviews the following matters were considered.

A. The goal.

Data 1. For the current state analysis it was necessary to obtain data on company EPC Project Management procedure with the focus on delays.

Data 2. For building the proposal it seemed important to get the respondents to share their ideas on delays, what are the ways to improve management process and mitigate delays.

Data 3. For the Final Proposal it was required to get validation from experts in the field of global EPC projects.

B. Interviewers. Who are the key stakeholders? As the delays issues tend to be to some extent sensitive, because it reveals weaknesses of a certain corporation, there were some difficulties to get professionals willing to participate and share the information. Ten stakeholders from an existing professional network that seem to be competent in the matter were approached via emails or LinkedIn messenger chats with a request to be interviewed on Delays within EPC. Initially, first two approached professionals refused to be interviewed. In this regard, it was decided to use a more relaxed approach to the stakeholders in order to get any relevant information in a form that is comfortable for the interviewed persons. They were free to participate in an interview via Skype or comment via email/messenger. As a result of an outreach, four professionals refused to participate in any way, one employee provided a very limited information, three managers shared their expertise in face-to-face interviews, two stakeholders contributed by sharing information via email/messenger on the issue of delays.

Thus, semi-structured interviews uncovering facts, behavior and opinion were used for the purpose of collecting data. An interview protocol was prepared for face-to-face interviews and email approach. Three face-2-face interviews via Skype were recorded as fieldnotes and transcribed as soon as the interviews were over.

In the following round, Data 2 was collected to identify suggestions in order to produce the proposal. This data was taken during the interviews, where the respondent managers share their ideas on how to improve Project Management process and mitigate delays.

All the collected data was analyzed using the Thematic/content analysis described earlier in Section 2.1.

2.3.1. Specifics on Respondent 1 Interview for Data 1&2

An interview was taken in March 17th, 2019, in English language, was two hours and thirty minutes long and was taken via Skype. Transcriptions are provided in Appendix 1. As a failure to record an audio, an interviewee's lack of time and rather quick speed of speech, it seemed difficult to transcribe the produced speech word by word, therefore only the main and most important information was written down as field notes during an interview. The text was carefully reviewed and completed as soon as the interview was finished.

2.3.2. Specifics on Respondent 2 interview

An interview with a PMP Assistant Manager of the case company took place in July 2nd, 2019 via Skype. An interview was held in Russian language. Field notes were transcribed and translated into English, attached in Appendix 2.

2.3.3. Specifics on Respondent 3 Data Gathering

Correspondence with a Chief Geotechnical Engineer of the case company took place in December 11, 2019, it was received in English language via LinkedIn messenger. The respondent shared a current situation with Corona pandemic on October 25, via LinkedIn Messenger. The comment is attached in Appendix 3.

2.3.4. Specifics on Respondent 4 Interview

An interview took place in February 6th, 2020 and was taken via Skype. It was in Russian, transcribed word by word and translated into English as soon as the interview was finished and lasted for approximately 1 hour. Transcription is given in Appendix 4, consisting of 2 pages. An interview question was on delays affecting EPC projects.

2.3.5. Specifics on Respondent 5 Data Gathering

A request for an interview happened in October 2020 via LinkedIn Messenger. The respondent decided to assist with providing comments on the issue of delays. The comments were provided same month, attached in Appendix 5.

2.3.6. Data 3 Specifics

In the third round, Data 3 was collected when conducting validation of the Initial Proposal. Data 3 included feedback for the proposal from two validating Project Managers. The initial Proposal was sent to the validators on 31st of October, 2020 via email. The first validator sent back the comments on the initial Proposal on 10th of November, 2020. The second validation was obtained on 13th of November, 2020.

2.4 Thesis Plan for Ensuring Research Quality Criteria

Since this research is done using an analysis of the case corporation and one case study provided by the customer, the thesis evaluation criteria is based on its validity. Validity defines if the research actually is solid in terms of its trustworthiness and truthfulness.

In order to provide validity, first of all, even though it is accepted for a researcher to be a source, within this work the researcher will try to to remain neutral and start with analyzing data obtained during interviews. Interviews to be done with moderate participation, so that an interviewee is not lead to any biased views of the interviewer. The interviews will also be analyzed in detail to figure out the facts from interviewer's own biases and ideas. Then follows a review of existing knowledge on the relevant issues covered during interviews. This approach is taken to avoid confirmation bias and stick to the objective facts.

Also, data collection and evidence are crucial for the thesis credibility. The procedures will be elaborated in the Data Collection and Analysis descriptions, and also separately in the data approach and data capture in the current state analysis, proposal building and validation stages (1-3) of this study.

According to Saunders et al. (2016), business and management research is eclectic in its nature, including knowledge from various disciplines such as social sciences, psychology, as well as economics, which are enhanced with different inside assumptions. Taking the above said into account with undertaking of applied developmental research that values practical implementations, only highly professional experts in their own field , with long lasting experience, high credit within the company, as well as certified experts were chosen as respondents to contribute to this research. One of the respondents is PMP certified (Project Management Professional is an internationally recognized professional designation offered by the Project Management Institute). Another professional is a Chartered Engineer (registered with the Engineering

Council, the British regulatory body for engineers). One of the Project Managers has ten years old experience with the case company having a good credit within the corporation with plenty successfully completed projects all over the world.

In order to provide trustworthiness of the study, several steps are to be taken into consideration:

- Making sure that data received during interviews is consistent and precise.
- Deep analysis of data and acknowledging biased information using critical reflection.
- Making a research transparent for the contributors, inviting all the participants if not to validate but to comment on the research.

3 Current State Analysis of Case EPC Projects in the Case Company

This section examines and describes the current method of carrying out work within global EPC projects. The current state analysis is an analysis of the current state of a project process.

3.1 Global EPC Project

For the current state analysis it is important to define the project first. This is how a project is defined by the project management Body of Knowledge (PMBOK):

> *'A project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists.'*
>
> *PMBOK (Project Management Body of Knowledge) Guide, 5th edition*

In the case corporation, a standard International EPC (Engineering, Procurement and Construction) project is aimed to create a design, procure required equipment, carry out construction works, test, provide and set up a proper integrated system. It includes technical specifications, a budget and a schedule.

Engineering is a complex and multi-scale industry and in order to deal with related issues, the major EPC projects in developing countries are oftentimes implemented in partnership with engineering contractor companies from developed countries.

International collaboration brings advantage to developing countries by providing updated competence and advanced know-how (Interview 4 notes).

Client provides its technical assignment with distinct requirements for the final product and an engineering contractor is obliged to deliver a system able to produce the product with required characteristics in due time.

Contractor, in turn, needs to buy licensed process units and collaborate with licensors, who own a process technology and necessary chemical formula patents. If the objective

is clear, the milestones of project execution are defined, the participants of the projects are also determined, in this case the project team is heading towards success. Yet, international projects are tough and it is difficult to avoid disputes and delays (Akhtar, 2019).

3.1.1 CSA Interview 1 Analysis and Findings

The first interview was purposefully made in order to collect data on the current state analysis of case company's project process, as the interviewee was a Project Manager in the case company for over ten years and has a significant experience in all areas of project management and execution. Taking this into account, it was decided to take this interview first, as it seemed to collect most abundant information possible. The purpose of the interview was to get a general picture of company's EPC project process and its weaknesses that might cause time overruns. The interviewee was focused on delivering a complete view of the process, its complexity, challenges and proneness to changes. An objective of interview was stated clear at the beginning of the interview, so that an interviewee could also cover such issues as weaknesses and delays while sharing an information on general current state of the company project processes. An interview started with an open question about the current state of projects' processes and was focused on the interviewee's experience gained from actual practice at the case company. The interview was focused on CSA meanwhile the respondent was helpful in covering ideas and suggestions along the way. When the respondent talked about issues, they were followed by the ideas for improvement. This interview is considered most prolific and important in its essence. Based on the input from the interview, the following insights were gained.

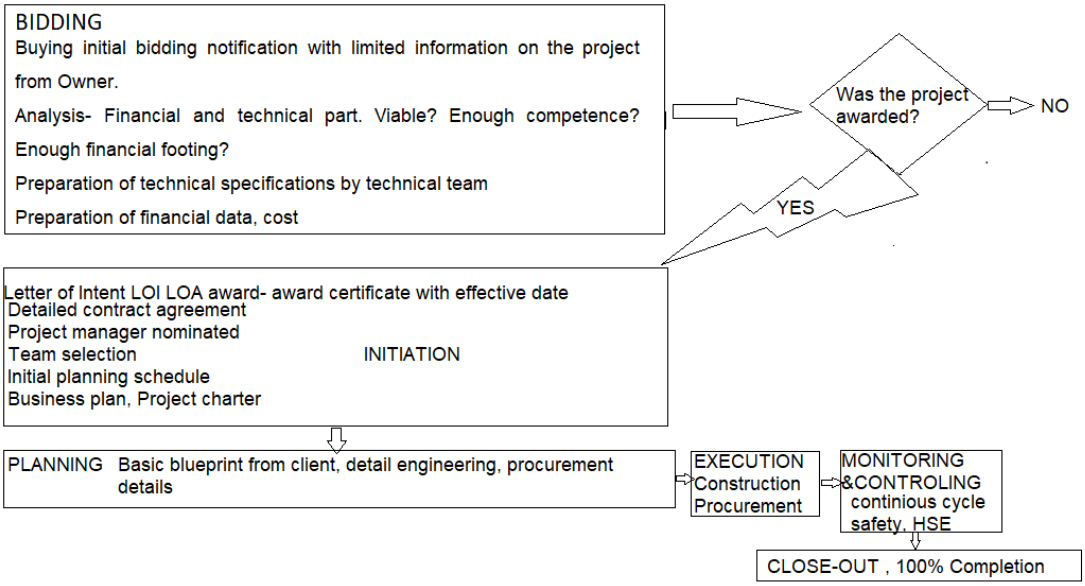

Figure 2. EPC project workflow in the case corporation.

According to the Project Manager, the activity of the company is basically Engineering, Procurement and Construction services. The project process itself can be divided into stages as Initiation, Planning, Execution, Monitoring & Controlling and Close out. Weaknesses affecting delays were pointed out in each phase.

Based on the interview results, the detailed description of the project workflow can be described as:

Project phase 1. Bidding/Initiation

Initially an interviewee shared that EPC business is tough, competitive and complex and it would be good for the companies to take any bid possible and work with it, put efforts in order to succeed. One of the most important departments of the company is the Bidding Division, as these ”guys” get the projects. Bidding division is something like marketing team hunting for possible projects. Energy or chemical industrial companies announce bidding for certain EPC services (project notification), like plant modernization, etc. Bidding division accepts it and then a huge amount of resources and time is given to check if the project is viable. Marketing division checks credibility of the company and its portfolio.

First, is a technical part of a study, when technical engineers of division check project's feasibility, what scope of work is needed, what is the most efficient way to provide required assignment and submits given feedback to company's financial part, which later checks its financial terms, if project is financed by the company or if it takes loans from banks. They also perform a financial assessment/feasibility of a project, how much money it will take in general, the amount of financial footing, etc. If both technical and financial divisions agree that project seems viable, company buys the bid, which provides a full and more detailed information on the project from the client. This stage can be called project Initiation. For the purpose of selection and awarding the EPC contractor, client already has an approximate technical assignment with the Scope of works and Contract Price. The Client examines quality and technical capabilities of bidding contractors. Later on, a commercial side of bids is taken into account.

Eventually, if both technical and commercial parts are admissible, 10 most suitable bidders are invited for a few meetings and eventually, the Letter of Intent or Award Certificate is issued to the winner. It might already include the project's deadline.

Next step is producing a detailed contract agreement with all clauses, technical assignments from the Client, obligations of the contractor etc. The project manager can be nominated and his/her team chosen already at the bidding stage or after getting LOI and drawing up the agreement.

After the Feasibility Study, the FEED (front-end engineering design or basic design) stage begins. It is time before beginning of EPC works, when different assessments happen, in order to clear out on technical issues as well as roughly calculate the project costs, price and risks.

Weaknesses: During a bidding stage, a significant job using financial and human resources (many man hours) in order to win the bid (technical part to check the viability of project and scope of works, prepare initial technical specification package, financial part then works on costs, etc). Buying the bid with full information on the project from the owner is also costly. In case of not getting the project, all time and effort consuming job is wasted with no profit at all (very risky yet unavoidable job done by bidding/marketing/commercial team in order to get a project). With potential and existing customers, they would go with most efficient contractor in terms of cost and proficiency.

Project phase 2. Planning

Next important stage is Planning, which consists of baseline schedule and detailed schedule (how to perform certain activities), developed by project engineers. At that time project charter and business plan can be issued. At a planning stage the detailed scope of works (what activities to perform) with detailed timing is being executed. As it was mentioned, it is also very important at this stage already to decide on the equipment list and what needs to be procured with attention to Long Delivery Items. At this stage engineers get vendors' portfolios, issue Requests for Quotations and proceed with Technical Bidding Evaluation resulting in vendors' selection.

Project phase 3. Execution, including Procurement

Execution stage is basically a construction stage, when construction engineers perform site land grading and carry all the work assigned in scope of works, as dealing with construction sub-contractors, organizing temporary camps for manpower, mobilizing the staff and performing the actual construction works.

Weaknesses at Construction stage: Construction is the biggest and most risky stage of EPC project, also timewise it runs at the end of the project, when its optimization, enhancement of value and alternatives for change are very few.

In developing countries, there is a problem with poor infrastructure, contractors have to build infrastructure from scratch causing additional costs. Additionally, it can happen that owner made a poor choice of site location. In developing countries there is a lack of skilled personnel, causing the need to mobilize skilled staff from abroad with much higher salary. Same for equipment, majority can't be acquired locally and needs to be procured from abroad. There is a need to get special permits to work from government or even just at the site, cases of staff standby. Other problems include:

- Cultural aspects of the country, e.g. workers prone to strikes etc., cultural differences.
- Climate conditions delaying project.
- Weak legal framework makes permit obtaining procedure complicated, unclear.
- Poor legal standards of area cause unclear, complicated and costly procurement and logistics procedure. Delay cause.
- The owners themselves are those who regulate laws and standards.

Another problem is a language barrier, many clients don't speak English. Need for translators/interpreters- they need to translate all documentation for clients' approval. Can cause delays, misunderstanding and complicate communication process.

Weaknesses at Procurement stage: During interview 1 it was mentioned how important the procurement of Long Delivery Items for special equipment is, due to the fact, that some equipment can take many months to be delivered at site. Therefore, efficient planning and scheduling is vital, as well as immediate finalization of equipment right after Letter of Intent (Project award) and purchase ordering.

Project Phase 4. Monitoring& Controlling

Monitoring& Controlling stage is being active from the beginning of execution stage. It works as a continuous cycle where safety and HSE conditions are checked and counter actions are taken if something unplanned, unknown has happened.

Necessary alternative methods are found and executed, for example, like increase of manpower, acquisition of additional permits, etc.

Weaknesses: M&C team needs to study and check in a continuous cycle to create contingent plans and mitigate unknown risks, yet still they are unavoidable in any project. Timeline needs to be monitored at all times during execution of project.

Project phase 5. Close- Out

Close-Out is a stage when all EPC works required as per contract need to be completed 100%. If so, the close-out certificate is issued by inspectors from Clients' side.

Weaknesses: The project shall be completed by given date at 100%. If it is completed even 90% the owner can't use it and the close out certificate will not be issued. Then contractor is obliged to pay penalty.

Summing, the key findings that Respondent 1 considers as needed to be focused on include the following points:

- The importance of preparation at the bidding stage. The importance of working together and negotiate, collaborate on schedule, budget, make revisions, useful

and timely suggestions, team spirit. Very important at Planning stage already to decide on the Equipment List and what needs to be procured with attention to Long Delivery Items.

- The importance of using experienced professionals, who know well their own strengths and advantages. There was an example brought up of the company loosing the bid just because the bidders could not explain their advantages while a client was focused and concerned with expensive service costs.
- The importance of bringing up its own advanced technology, know-how and expertise. Ability to prove and bring evidences of successful timely completion of projects.
- The importance of having full and exact bidding documentation, the value of good and well-made MTO (Material Take-off).
- The importance of clearing out responsibilities of the team especially for large projects.
- Issuing RFQ of the LLI ASAP. TBE, CBE to be finalized and PO placed.
- Thorough M&C of equipment delivery.
- PO and post ordering status to be maintained in line with the project baseline schedules.
- The importance of making sure that there is sufficient funding at hand for Long Delivery Items to procure as soon as possible.
- The importance of having alternate methods at each stage of the project. Contingency plans, unknown risks appear.

3.1.2 CSA Interview 2 Analysis and Findings

Interview 2 was held via Skype. The question was on the main reasons of project delays. The main root cause of delays was stated as Clients, i.e. changes initiated by them and who are also potent to adopt new legislation as the client is oftentimes a state company. Additionally, interviewee mentioned Clients' unpredictable change of mind that can cause delays and rework. New legal requirements introduced by Clients lead to the delay of the project schedule and cause extra costs for owners.

One issue was risen from Contractors' side as follows. Many contractors can impose their own rules. The customer is demanding and requires all the data and documents to be translated into Russian. Some projects are ongoing, a few new projects are on the way.

There were times when the acceptance of Basic Engineering documentation delivery in stages, which is an important step before actual execution phase, was refused by the Customer. In the comments the Customer brings up the reason for refusal. First most important issues are legal. There were several comments on using the wrong GOST (Russian Construction Standard) for particular construction works. For example, not appropriate approach to construction of structures and using existing foundations, what kind of materials shall be used in line with GOST and what is not allowed. As documentation had to be translated, there were also problems related to wrong translation. For example, instead of "enclosures" the translator used "borders", which could not be accepted by the Customer. Another problems causing refusal were simply administrative or human errors as lacking documents that were in the documents checklist, sending wrong attachments etc. Eventually, the Customer refused the acceptance of the documentation and required to redo it taking into consideration all the comments provided.

There are also issues in technological know-hows and what methods to apply. The Customer often is old-fashioned and persistent in its demands. The Contractor with its competence and expertise in new technologies makes efforts to persuade the Customer in better solutions about the projects by providing studies and feasibility studies. For example, on using a particular licensor with a better catalyst for oil and gas plant. The Customer demands another supplier with the approach, that requires more work at all the stages from the Contractor. The Contractor offers an option that requires less work and looks efficient. However, the Customer requires additional information and seems hesitant to a new technology.

During the meeting with a Customer, there are also disagreements about suppliers and vendors. For example, as the Contractor already collaborates for a long time with a certain company for provision of some parts of instrumentation systems, The Customer prefers another company as its provider as it has been using its services on its plant already and does not want to get used to a new system. The Contractor on the contrary has never collaborated with it and finds it more complicated to install its products and integrate within the plant.

Summing, the key findings that Respondent 2 considers as needed to be focused on include the following points:

- The respondent was focused on Clients as main root of delays. He mentioned that clients interfere too much in the process in the way that can be disturbing and causing delays. Interviewee advised on the aforesaid matter to clear out straight away at the Kick-off Meeting that a Contractor, is given a full responsibility and is free to optimize. This approach can help in mitigating interference from Client's side.
- Undoubtedly, in such projects with big budget and resources at stake it is important to win the leading position of the project at the beginning. The Contractor needs to be confident despite its powerful Client.
- During meetings it is important not to give in to Clients demands, keep strong in Customer's design and decisions on the matter. As it is in any project, that profit is the key, the sides try to gain as much advantage as possible trying to avoid responsibilities where it is possible.
- The Contractor has to stand its ground in order to complete the project in a most optimal and beneficial way.

3.1.3 CSA Correspondence 3 Analysis and Findings

As respondent's personal experience was needed for an interview, it was requested to share interviewee's own experience gained while working in the case company. The respondent started with mentioning that there are many factors influencing delays lasting from few months to years. Reasons for delays were provided coming from a Client, a Contractor and Unusual Site Conditions.

As for reasons caused by Client, main factors were stated as change of scope of work, no payment to the contractor, facing some political sanctions, a fact of late site handover to an EPC contractor, as well as poor FEED design basis. Next, in terms of the Contractor, delays can occur if there are delays in EPC designs, delivery of designs of poor quality, delays in procurement, as well as collaborating with inexperienced subcontractors.

The respondent, being a Chief Geotechnical Engineer, also contributed by providing information related to his own area of expertise. It was noted that unusual and complex site conditions can cause delays. Such circumstances might be both owner's and EPC contractor's responsibility. In the matter, there can be such factors as poor selection of site by Owner, also a poor study on feasibility and FEED stages by Owner. It is possible

also not to inform on the history of the site in relation to soil type, contaminated soil or uncontrolled fill for site preparation. Complications occur if there is an unusual behavior of soils after excavation, such as ground settlement and ground water influences. It is a problem if there has been a site handover, EPC contractor performs detailed site investigation, resulting in identifying unusual soil conditions. It will bring a big argument for scope change and variation order. As an example of delays for years, can be that during a poor investigation, problems were not found and later during construction a foundation settlement occurs- to take remedial actions might need months to years in some situations.

Corona Pandemic Update: The respondent also shared on recent Corona pandemic situation and how it affects EPC contracts.

New regulations were established in view of recent Corona pandemic. The virus outbreak caused new business trends when nations' welfare is at stake. The corporation proclaims healthy working conditions and set up the rule of 50 % employees working from HOME in alternate days. It banished meetings in closed rooms. Therefore, most of the meetings within the company, with Owners and PMC and Vendors are being conducted through MS Teams or Skype or Zoom. It results in increase of meetings times than face-to-face meetings. Online meetings have its downfalls. There are problems with poor connection, disruptions. Pregnant women employees are asked to work from home every day. If employees work at the office, they should wear masks during working hours. The employees attending offices are checked on temperature. Those with high temperature are requested to take COVID 19 test. This whole situation brings discomfort for working and project in fact are getting delayed much. Those projects that were newly awarded to the company are on hold for the last nine months, some ongoing projects are also delayed for approximately four months.

3.1.4 CSA Interview 4 Analysis and Findings

In order to analyze current state analysis from the perspective of Clients/Owners, an interview with a representative of state-owned Kazakh refinery (Deputy Processing Engineering Manager) has been taken. During the interview, a project of modernization of Kazakh refinery involving Korean EPC contractor, in partnership with Romanian EP company called RominServ contractor, was discussed. Another Russian contractor for construction works was hired.

According to the interviewee, the details of the case project are as follows:

The project took off in summer 2013 with planned deadline of 2016. The project actually was completed in December 2017. The project was completed one year later than planned.

Main Contractor for oil refinery was a Romanian EPC company. It hired another Korean company that is based in Singapore for Engineering part. For procurement another Russian company was hired.

Kazakhstan lacks modern technology, expertise and know-how. For this reason, Kazakh refinery hired Korean EPC contractor. The contractors perform activity in line with International standards and norms, while ex-USSR countries have their own technical documentation according to GOST (State Standards and norms). Projects carried out in ex-USSR countries shall be done in conformance with its own rules. Because of this problem another subcontractor that is competent and in line with the local norms had to be hired. So shortly, EPC contractor provided its engineering documents and drawings in line with International standards and then a company subcontractor had to change and adapt it according to local norms. It all took more time. Even with this procedures, Kazakh company could not accept Contractor's documentation as it was not in conformance with local standards. There was 6 months delay at FEED stage.

Again, there was a delay at procurement stage when Vendors were late delivering their equipment. Even though there were Russian Vendors, who produced their equipment according to GOST, Contractor again procrastinated because its drawings and layouts were according to ASME, International standards, not GOST.

Summing, the key findings that Respondent 4 considers as needed to be focused on include the following points:

- Main problem causing delays when working with International EPC companies is different engineering practice. Delay in project is inevitable if EPC contractor has no experience in CIS (Commonwealth of Independent States, i.e. former USSR) countries, no matter how experienced and well established the company is by International standards. In CIS countries one has to abide by local norms.

Next, the respondent mentioned the issue of communication as another reason for delays. It is much better when it is just Contractor and the Customer. When at the project there are too many stakeholders involved, it is difficult to find responsible party when

issues emerge. Who is to blame when the project is complex and there are so many people… reason for conflicts and delays because it takes too much time to agree on matters.

One more issue that leads to time overruns is different locations. When a Contractor is in Korea and The Client is in Kazakhstan. You can not control matters that can be important for Client's interests.

Another issue was mentioned by interviewee as a language barrier. When project is International, engineers not speaking English need help of translators. Unfortunately, there are not so many professional technical translators experienced in EPC area. Then interaction between engineers during technical meetings is complicated, might bring misunderstanding, errors causing delays in execution of a project.

Another fact was that Client changed the scope of work as the project's objective has been changed. It also caused a delay. This fact confirms the statement of PM assistant (Respondent 2) that oftentimes delays are caused by a Client when certain change occurs far behind planning and initial stages (Appendix 4).

In general, an interviewee was eager to reveal and share on the topic of delays. However, it might seem that in some cases there was an effort to cover up responsibilities and liabilities from owner's side and blame more a contractor and its activities causing delays. Oftentimes it seemed that an interviewee starts revealing some of the details of what was happening within the project, but then would seem it inappropriate and it would result in interviewee closing and changing its initial intention to share the information, which will somehow show the owner in a negative way. The interviewee was more eager to share on the issues caused by contractors or third parties, but when it was about owner's responsibility the information was scarce and limited.

As it was mentioned that the topic is sensitive, lack of trust and not knowing each other that well resulted in certain professionals' refusals to share information. Those interviewees, who shared were the colleagues with whom some amount of trust was built through collaboration and working together at the projects.

3.1.5. Respondent 5 Comments Analysis and Findings

The respondent is a Senior Principal HSE Engineer with 8 years of experience in the case corporation. Currently, the respondent is working for American-German Linde Engineering PLC.

The respondent states that usually delays in EPC projects are caused by following reasons:

1. The delay can happen because of initial wrong planning for the project, when it is simply impossible in view of scope of works and too optimistic. Eventually engineering and construction teams struggle to meet project deadline.

2. When the project runs in a completely new territory in terms of location. EPC Contractor finds it difficult to understand local codes and standards, especially in CIS countries where, Codes and standards are in Russian language. The information comes in a foreign language, it brings communication issues, delays, difficulties of translation, etc.

3. There are also problems with the government. The approval authorities create hurdle to give clearance to the project. It might cause unexpected circumstances and delays.

4. During Bidding phase, the Contractor has access to ITB documents from the Customer. if ITB documents are incomplete and if Owner does not resolve the Bidder's query this will lead to delay in execution of the project.

5. Delays also occur in procurement part, during the supply of the material for the project. Contractors can hire subcontractors for procurement of certain equipment required by the project. There can be issues when Subcontractor is delivering it to the main Contractor.

6. The respondent shared current situation caused by Corona pandemic and how it affects EPC projects:

a. As the employees are forced to work from home, the design review meetings with owners which occur face to face takes longer (estimated consumed 20% more time) considering these meeting last for a month or even more.

b. Because of Corona outbreak, many international flights are unavailable which causes problems with manpower deployment to construction sites.

c. Another problem as a result of pandemic is that fabrication and shipment schedule of long-lead items are severely affected.

3.2 Analysis / Key Findings from the Current State Analysis

This chapter covers issues that seem consistent, mentioned by several respondents and were mentioned by respondents as important and need to be focused on during EPC projects.

3.2.1 Root cause of delays, comparison

After analyzing all five respondents' data from the employees of global EPC company, the key players or root cause of delays were identified together with their negative input.

A. Client/Customer/Owner

According to words of a PMI certified PMP Assistant Manager of EPC corporation (Interview 2 notes), who works specifically on CIS projects, owners were identified as main reasons of project delays. What happens is that clients oftentimes initiate changes during EPC stages far behind planning and when designs are already made, even worse when execution is already on the way. As it was mentioned by the interviewee, re-work can be caused simply by Clients changing their minds or by adoption of new legislation affecting execution of the project. Oftentimes Clients, i.e. owners of refineries or plants, are at the same time the lawmakers, as most energy companies are owned by the State.

Same fact was mentioned by the Owner's representative (Interview 4), when he admitted that significant rework had to be done because of change of scope of works when Owners decided to change its objectives as well as its budget.

An interview with Chief Geotechnical engineer of same corporation (Respondent 3 notes) revealed that it also happens, that delays can be caused when Client presents poor FEED. A good FEED will reflect all the clients project specific requirements and avoid significant changes during the execution phase. FEED Contracts usually take around a

year to complete for larger sized projects. During the FEED phase there is close communication between Project Owners and Operators and the Engineering Contractor to work up the project specific requirements. Owners, especially at engineering stage, when initial design is done, can complicate approval, ask to redo design several times, it consumes lots of efforts and man hours.

B. Contractors

According to Interview 2 data contractors can impose their own rules during the course of the EPC project. From the words of project assistant manager of the corporation (Interview 2 notes), another big problem on the matter of Clients is that especially in developing countries Clients/owners/customers can be ignorant/negligent when it comes to projects, they can often lack expertise, knowledge and local legislation on the matters concerning EPC operations, this may lead to contractors taking advantage of situation. Also, it can happen that contractor lacks knowledge on legislation of particular foreign area of client, where the site is located and can impose their own rules. Client, as ignorant as the contractor can easily accept the process and eventually it results in project re-work when actual legislation rules are revealed during M&C. Same problems can also be found in literature, (Buldybayeva, 2014).

C. Shareholders

From data taken during Interview 1, Shareholders usually don't want to go deep into complexity of project and understand reasons for delays.

Additional stress from their part on project executors in case of delays.

D. Vendors/Licensors

Licensors, as well as important vendors, are fully aware of their importance and can use it as advantage. As owners of patented technology oftentimes, they can be hard to reach when needed. High level performance- contractor is solely responsible for it, when performance depends also on licensors providing unit technology (like catalyst and chemical formulas, for example for petrol etc.,).

3.2.2 Strengths and weaknesses of global projects done by corporations

One of the issues that needs consideration in this chapter is the importance of communication within global corporations as it also significantly affects collaboration within projects and impacts timely completion. This chapter also covers matters of global corporations and issues of ethics within corporations that draw attention nowadays.

We live in the world of globalization. When a project is multinational, cultural clashes and conflicts are unavoidable and culture itself, manifested by players from different backgrounds, can significantly influence project implementation. Global collaboration requires greater understanding and awareness of cultural diversity when it comes to project management. Intercultural competence is vital for effective interaction and communication for the sake of successful execution of projects. Cultural issues contribute to conflicts among parties to international project and increase difficulties in the management of such projects (Fellows & Hancock,1994).

Globalization of the economy, huge advancement of technology and progress in information and communication technology have improved communication between people from every part of the world. Respectively, scholars in fields of psychology and sociology have begun to analyze the results of such globalization, communication technology progress and cultural interactions. Intercultural management is «a combination of knowledge, insights and skills which are necessary for adequate dealing with national and regional cultures and differences between cultures at several management levels within and between organizations». (Burggraaf, 2017).

Nowadays most of what we hear in media is somehow related to globalization. Politically and economically globalization means denationalization of markets and social systems. The global economy is increasing rapidly. Companies all over the world engage themselves in the emerging global economy and strive to take place in foreign markets. Respectively for marketing they change and adapt according to local culture of the country they have their presence in. Because of globalization companies are facing constant rapid changes and in order to survive and succeed they have to forecast, plan beforehand and expect future developments.

If globalization is of utter importance in our lives these days then only companies and corporations that have a multicultural structure can prosper and go beyond local level and succeed on a global level. As Rothlauf states in his book, mono-structures and

monocultures will be limited to regional importance. But this does not mean that companies equipped with multicultural structure will be successful by themselves. If management of such companies is inappropriate it can cause worse consequences on a larger scale. Therefore, proper management skills in multicultural companies are crucial for the successful conquering of the global market. Globalization and new adapted corporate culture result in managers becoming global. Such global managers interact and collaborate with colleagues who have various and sometimes contradictory ideas about working culture molded with influence of their cultural backgrounds. Global managers have to be aware of and accept the complex of values, standards and beliefs of the staff.

Our world is culturally diverse which makes a task of global project manager challenging and sensitive. Success of any business depends on proper and effective communication. Taking into consideration the afore said theory on necessity of intercultural mindset and importance of new corporate culture, another question is how to find a way to change and introduce global intercultural structure to countries, economies and monopolist businesses, where everything is fixed and absence of competition causes solid corporate culture with its pluses and minuses.

A. Case company, Korean or global?

Korea's economic dynamism and rapid growth have attracted foreigners seeking employment. Despite the rapidly growing number of foreigners in Korea, the number of high-skilled foreign professionals is quite low. Only 47100 high-skilled foreign professionals reside in Korea (OECD 2013), the rest is a low-skilled foreign labor. This fact shows that global talent is not attracted to Korea in terms of employment. The Korean average inflow of foreign professionals has decreased from -1.3 percent to -1.4 percent.

Recently, a book was written by Eric Surdej, a foreign senior manager, an exposé of his 10 years of experience in LG, he wrote about company's crazy working hours, the suspicion of Koreans to his westernized working style, which resulted in his replacement by the founder's grandson. Korean corporations realize they are facing a problem in retaining foreign talent and address it by different solutions, as shortening meetings, giving freedom to speak your mind with superior colleagues, not encouraging overtime and staying late at work. There are such programs as Family Day, introduced by the case corporation, when employees are off at 17:30 pm (as per Employment Contract)

two Wednesdays each month. One of the interviewees said that recently, the company has a Global employee program held twice a year. During the 2 days program employees listen to speakers from HR who are experts in Korean culture and company's corporate culture and employees are taught how to behave within its framework. Once a year all employees write a questionnaire where they share about their problems and possible solutions.

However, still the problem lies deeper in this ethnocentric embedded culture. There is a common pattern in middle management of all Korean corporations, that hiring foreigners is just a façade in order to keep an image of international company. As it is clearly shown in the study that «inclusiveness increases with egalitarianism and democratization and decreases with embeddedness», foreigners are never given any responsible and important assignments and are excluded from any decision-making meetings. On this 'ingroup-outgroup' thing, it can be rigorously played and manipulated by management. When dealing with Koreans, who were born and raised overseas, it was deemed obligatory to work as much as Koreans, and management would say: «You are Korean, you are supposed to work as the rest». However, when it came to benefits and promotion: «Oh no, you are not Korean, no benefits for you".

Korean corporations

> *We live in the age of corporate organisms. Though no formal announcements have been issued, it's becoming harder to ignore that they have wrested control of the earth from homo sapiens and supplanted us as the planet's dominant species. It is the multinationals, government bureaucracies, religious hierarchies, military bodies, et al, not individual humans , that generate our era's character, its patterns of wealth and poverty, its technological progress and ecological peril, its entertainment and political agenda. They have, in short, taken over.*
>
> David Kubiak, Kyoto Journal, 1990

It is necessary to understand the Chaebol'(Korean conglomerates) culture in order to understand Korean corporate culture. Chaebol' are Korean giant family owned conglomerates, such as Samsung, Hyundai, LG and others. In spite of their similar organizational structures, their corporate cultures are distinct and quite different. Corporate culture is often forged by the founder when sharing his/her innate values with followers (Walker & Moylan,2014). Now if we can take a look at some of the characteristics of two large companies, as Hyundai and Samsung, as an example. For

Hyundai it is the Can-do spirit, traditionalism and discipline (Kim, 1996), traits brought in by its founder, who was born to a poor peasant family and raised in a restrictive environment when Korea was under Japanese rule. In comparison, the founder of Samsung Corporation was from a wealthy landowning family, who studied in Japan.

Accordingly, Samsung company is more openminded and its characteristics are risk taking, technology innovations and excellence. Korean corporations' working style is similar to Japanese zaibatsu companies, because they were founded during Japanese occupation and many Chaebol' founders got their education in Japan. Additionally, Confucian values are presented in Korean corporations in strong hierarchy, permanent employment, preference of seniority and loyalty while neglecting performance skills. At one career workshop, when talking about networking in different cultures, participants from Europe found it inappropriate to show some information about oneself on one's phone to people you have just met and expressed their opinion that just exchanging business cards is enough when networking, while for a Chinese participant it was absolutely normal. Korean and Asian companies are keen to establish a sense of brotherhood and family.

When working for a Korean corporation one has to consider it as a family and put it first. Bosses are expected to be treated as father figures with obedience and fear. The 'Nuts over nuts' scandal, when a Korean Air vice president Heather Cho, after she was served macadamia nuts in a package, assaulted the cabin crew chief, ordered him off the plane, causing a delay, when a plane had to return to the gate, is an example of a Korean punishing work culture. Another tragic example happened in April 2014, when 295 people, mostly Korean teenagers, sank with the ferry. The ferry was sinking gradually and people knew that they are drowning. However, because the captain said to stay in cabins, so they did, eventually going down with the ship. Obedience and respect to seniors and fear to upset them results in inability of subordinates to tell directly what they think.

Malcolm Gladwell in his book called 'Outliers' covers a story about a Korean Air plane crash. The tragedy could have been avoided if a flight engineer didn't loose time hinting to the captain about the threat but instead immediately and directly warned him. In this example we can see how important it is to address cultural legacies when it comes to avoiding tragedies. Gladwell reflects and hypothesizes that cultural legacies define to some degree how we communicate and behave with one another. If one's cultural

background involves respect to seniors above the rest, then it will be difficult, even when it is a matter of life and death, to stand up to superiors.

On the contrary, if culture encourages speaking your mind to anyone , no matter if its your superior and there is a horizontal organizational structure, one will freely demonstrate authority and will go on communicating one's mind despite whatever power imbalance. Korean social traditions directly impacted the events that occurred in the plane. Koreans with low-context culture (Hall, 1976) are strong in interpreting what has been communicated, tend to pick up on nuances and get the meaning, that is why the speech doesn't have to be blunt. There is a Korean concept called 'Noonchi', literally meaning 'eye measure', which is a skill of sensing the mood and the state of mind of the others (van Rijn & Bahk, 2006). Yet in times of stress and multitasking, this ability of interpreting well might fail and cause serious problems, even fatalities. Gladwell suggests to address cultural legacies: yes, they are powerful and have a major impact on our tendencies and behavior, yet when necessary they should be confronted and addressed.

B. Ethics and Project Management

Truth, says the cultural relativist, is culture-bound. But if it were, then he, within his own culture, ought not to see his own culture-bound truth as absolute. He cannot proclaim cultural relativism without rising above it, and he cannot rise above it without giving it up. (Mannheim’s paradox) Thomas W. Cooper in his book «Communication ethics and global change» addresses such matters as universal truths, if there are any, what do norms entail and their status. In his essay he moves the concept of normativity out of the focus. He compares all previous ethics based on Platonic absolutes and related to noncumulative phenomena, where morality could be the property of all.

However nowadays, the technological era is cumulative, in constant reform and expansion. In «Communication ethics and universal values» Christians and Traber review protonorms across cultures, consider different theories on values and ethics, such as Kant’s fundamental approach to justification(when truth shall be told in any case, even if it is in conflict with duties or inconvenient, regardless of the consequences) and Klaus Steigleder’s moral obligations. However, both authors are prone to another form of justification, hermeneutical one, which is based on a hermeneutic of the need for meaningfulness. Truthfulness becomes a practical recognition of a state of meaningfulness in relations between human beings. Hence, «truth becomes a good that is morally worth striving for and is therefore also a moral obligation». According to study,

carried out by Korean scholars and published in the Journal of Business Ethics (2008), there is a significant association between ethical commitment of Korean companies and their valuation on the Korean stock market. (Choi & Jung, 2007).

Recent events in global market, with Volkswagen, installing the software to defeat the emissions testing procedure, Mitsubishi, cooking the fuel efficiency numbers scandal and Toyota, concealing safety defects, show the need for decent business ethics, corporate culture and regulatory frame. Those events demonstrate how important it is to make ethics a key point in project management and tells us the effects that happen when ethical matters are neglected. An engineering education also needs to involve ethics. Oftentimes upon graduation young engineers start their careers absolutely unprepared for the 'realm of complexity and ambiguity requiring a myriad of judgment calls -some of them involving competing values and murky ethical choices' (Baura, 2006). Nowadays, most engineering decisions include society, politics and ethics. Engineering is no longer an individual discipline. However, many engineering schools do not have special ethics course requirements. Some schools demand a course in philosophy or religion. Therefore, in order for graduates to understand their professional and ethical responsibilities, it is good to include ethics in engineering curricula and properly integrate such ethics education with practice.

Though the events heightened awareness of ethical issues, unethical business practices continue to be on unacceptable level (Choi & Jung). It can be explained by the fact, that companies firstly strive to increase their profit leading to wealth of shareholders. It is especially easier to proceed with unethical practices causing dark sides when a project is being carried out in the developing countries. (e. g. Exxon Valdez, Mexico Gulf accident, Bonga Onga exploration area disaster) (Buldybayeva, 2014). For example, former Soviet Republics, rich with natural resources, lack a strong updated legal framework and sufficient financial and technical capabilities to develop fields and infrastructure. For this reason foreign investors and contractors are being attracted.

Unfortunately, many foreign companies take advantage of weak sides, such as technical incapability and ignorance of locals, become inconsiderate to needs and problems of the region and pay no attention to social and environmental aspects of the area. When the project is big, 'the pressure is immense to reduce costs and to meet an aggressive schedule and rigorous quality standards' (Kliem,2012). The environment is tough and profit is becoming more important than ethics, values and rights. Project managers, when

dealing with complex and vague issues, neglect ethics for the sake of profit and success. If project managers could admit an essentially positive relation of ethics and project financial performance, the odds of improvement in project ethical commitment would be much higher.

C. Strengths of the case company

As difference in engineering practice is one of the triggers of delays, the case company as a whole EPC package provider is aware of that and keeps its services in line with practices that are accepted in certain locations. Its long history and experience also contributes to its credit and solid image in EPC world.

One of the strengths of large EPC corporations is a strong financial footing. Oftentimes, companies have to use their own budget to proceed, as invoice approvals and payments from Clients side takes time. Moreover, if delays occur it all affects turnover and finances.

3.2.3 Selected Focus Areas

The previous chapter had an intercultural twist and was intended to look at the effect of global corporations in general in terms of globalization. Even though such problems lay in the core of business and significantly affect an image and trustworthiness of corporations, impact its standing in the market, winning contracts and having successful projects with minimal delays and disagreements, this thesis is intended still for practical issues that can be dealt with in the short-term. Therefore, the focus areas of this thesis are those shown in the following Table 2.

Table 2. Key results from CSA: weaknesses identified as causing delays in global EPC projects in the case corporation.

	*Key focus area from **CSA** (from **Data 1**)*	*Description of the focus area*
1	**Poor Preparation at Initiation Stage/ Bids**	As Initial stage and preparation for projects are mentioned several times by Respondents as crucial for timely completion of project, it seemed appropriate to consider it as a focus area. Bidding stage is considered vital as it brings projects to Contractors, for Clients it's the stage for determining key factors such as the executor and main contract conditions. Negotiations are also considered as important part of initiation Poor preparation and study of local conditions also affect in failure to carry out works in line with local requirements.
2	**Customers** **Interference,** **Demanding customers, unrealistic deadlines, schedules and budgets** **Customers changing scope of works, demand for rework.** **Knowing customers well.**	Customers are considered as main root of delays by the Respondents. This thesis will examine delays initiated by Customers. Main reason for delays was mentioned by a number of Respondents as Customers changing something during the project. Demanding customers raise the need to study them well to know what their wishes are.
3	**Late site handover or incomplete FEED handover/ late documents handover**	Late handovers by Clients, whether it's a Site itself or any documents needed for design affect the project and its timely execution.
4	**Poor site feasibility study**	Poor feasibility study affects significantly the project timeline. In case its incorrect, there is a risk or re-work. As an important factor it will be examined in this study.
5	**Blaming game**	As several Respondents mentioned difficulty of complex projects that parties try to escape responsibility and start to blame multiple players, it seemed necessary to examine this issue as well.
6	**Payment from Customer**	Financial footing is considered crucial and needed consideration
7	**Accelerating procurement**	Long Haul Equipment is mentioned an important factor for avoiding delays. Proper procurement is of essence and was analyzed.

The Current State Analysis exposed weaknesses and issues that are practical in nature and lead to delays within global EPC projects. Many factors were identified at a preparation/initiation stage. As respondents consider preparation stage very important and pivotal in projects success in general, this study is focused on issues at preparation/ initial stages. A number of mentioned issues are related to Customers as root of delays. Therefore, it seemed necessary to examine Customers and their role in causing delays. Another important factor brought up by the Respondents was the need to speed up procurement stage and pay attention to equipment.

These issues can be categorized into three main focus areas:

Preparation/Initiation stage;

Customers;

Accelerating Procurement

Those focus areas were also considered while analyzing existing knowledge and best practice discussed in the following chapter 4.

4 Best Practice of EPC Projects with the Focus on Tackling Delays in EPC Projects

This section focuses on existing knowledge and best practice related to tackling delays in global EPC projects. Business and academic research works were reviewed and examined for the purpose of identifying factors affecting delays within EPC. Some articles were informative and supportive of issues covered by CSA respondents. Additionally, new findings were discovered that might be helpful in avoiding delays. (4.1.1.)

However, as it was mentioned before, in view of the extensive amount of information on EPC delays, the review of existing knowledge in this thesis was focused on the weaknesses revealed during the interviews in Section 3.

4.1 Conceptual Framework of Selected Best Practice for Tackling EPC Project Delays

The following table 3 reflects key selected actions to tackle delays brought up by Respondents from literature

Table 3. Conceptual framework for selected best practice for tackling EPC project delays.

	Key delays brought up by Respondents	Key selected actions to tackle relevant delays from literature
1	Delays in material or equipment delivery (Baron 2018)	• consider all process equipment not just LH equipment (Baron 2018) • BOM to be delivered ASAP (Baron 2018) • Get Vendors equipment design ASAP to measure unit sizes needed for engineering drawings (Baron 2018) • Importance of submitting POs ASAP (Baron 2018). • Good for POs to include information on terms that link payment to documents' submission and consequences, as Liquidated Damages if documents are issued and submitted late (Baron 2018).
2	Poor Preparation at Initiation Stage/ Loosing Bids (Carrillo 2005; Lifschitz et al. 2016; Hebert et al 2015), Shapiro (2015)	• Maximizing your position, showing your competence, your power during negotiations (Lifschitz et al. 2016) • Focus on details, accurate bidding documentation, research on previous

		similar projects, find out, call and talk to previous clients (Hebert et al 2015) • LL or lessons learned as a good practice for organizational learning and knowledge management. persistent analysis of company's experience with following transformation of it into knowledge(Carrillo 2005)
3	Customers Interference (Bouckaert 2018)	• To provision in Contract that the owner shall only comment what is expected as a result from the project only after the Contract has been completed.(Bouckaert, 2018) • to provide in EPC contract: that Clients' engineers or Advisors from Customers side shall not interfere in a too detailed way, in the project.(Bouckaert, 2018).
4	Late site handover or incomplete FEED handover Adib, (2019)	• Appeal to stakeholders to think in advance (Adib, 2019) • Initiate M&C staff already in advance starting from FEED phase(Adib, 2019)
5	Blaming game (Bouckaert 2018; Lifschitz et al 2015)	• To mention in EPC contract that the functional specification should not be prescriptive for methodology, specific supplies or detailed characteristics when not directly linked to the expected outcome (Bouckaert 2018) • Clear wording of EPC contract (Lifschitz et al. 2015)
6	Finances (Taneja 2020)	• Managing projects by balancing between cash flow and profit margin for growth and stability • Physical plan vs Actual, budget vs actual, earned value analysis- using proper tools to have control on project completion and overall performance of company

4.1.1.Previous Studies on Delays in EPC

Previous studies confirm that EPC works are the most crucial stages that must be thoroughly monitored and controlled so that it is possible to avoid delays and enhance

project execution in general (Salama, 2008). Literature also states that time overrun in EPC projects is one of the common issues in the industry. (Alinaitwe, 2013.) According to Alinaitwe (2013), the critical factors causing delay in EPC projects are such as variation in scope, deferring pay, not effective system of control of the project, too high costs of the project itself, as well as lack of stability and political security. According to Rao (2016), the main reasons for delays in schedule are caused by the Customer, the Client, the design engineers, also some third parties of the project (Rao, 2016).

Additionally, Rao (2016) lists the causes of EPC delays in the order of significance, such as the delays in payment procedures, communication issues between the parties, late issue of instructions, incompetent management contractors, procrastination in approvement process of the design documentation, lack of certain materials and eventually fluctuating prices.

Alhajri (2018), based on his review of previous studies on the matter of delays, identified 23 factors that, as he claims, cause delays within EPC business all over the world. He made a questionnaire listing these factors and had 90 selected project managers, project engineers and construction supervisors to respond to the questionnaire. According to his analysis, the top five factors listed in order of importance are:

1. Delays in material or equipment delivery
2. Poor management and supervision of site by contractors
3. Incompetent planning and scheduling of projects by the contractors
4. Long procedure of approval and decision-making by the owner
5. Delays in work permit issuance. (Alhajri 2018.)

The first factor of delays in material or equipment delivery was also mentioned by Respondents as one of the most important factors causing delays within global EPC projects. The last two factors being Long procedure of approval and decision making together with Delays in work permit issuance were mentioned by Respondents as well.

4.1.2. Importance of Ordering Equipment on Time

The delays caused by Procurement were analyzed by Baron (2018), a project manager with engineering background with many years of experience at Technip corporation. In his article about EPC delays: the universal cause, he writes on universal reasons that majority neglects, and mentions issues that are more technical and engineering specific.

One of the reasons given by Baron(2018), together with Alhajri (2018), was also mentioned as one of the main reasons causing delays during the interview with a Project manager (Interview 1). All three professionals state the main reason at the Procurement stage when the equipment that was ordered on the projects was delivered too late.

The difference between the expected equipment delivery and the actual date of its arrival can cause substantial delays. Even more, as an Interviewee 1 accentuated Long Haul Equipment or Long Lead Items, which should be given extra attention and ordered at first place. As Baron (2018), states, that usually there is no problem with Long Haul Equipment, as they are always on the radar. He takes into consideration all process equipment, such as compressors, pumps, heat exchangers, packages and the rest needed for the Process Plant. Baron mentions that the date when Equipment is ordered has direct impact on determining the duration of project itself. (Baron, 2018).

According to Baron (2018), the player starting first is the Engineering department. It is for them to figure out how quickly it is possible for BOM or Bill of Materials and specifications to be delivered, so that Procurement department can begin its work and procure things. The same for drawings will be needed for construction execution. Baron (2018), also says that engineering activity of global EPC project is like climbing a hill. It starts slowly and gradually accelerates. Thus, it is important for Engineering department to get all its equipment integrated. The design of the facility is derived of the equipment and it is very important for engineering to calculate equipment sizes and other spaces for a facility layout. Additionally, the utilities should be sized taking into consideration equipment consumption. Respectively, equipment nozzles define the route of the pipelines. Power supply stations are sized in view of power consumption of the equipment. Shortly, the system integrates parts of the equipment and measuring size of equipment is crucial. (Baron, 2018).

The above said confirms the importance of equipment information. While the facility is designed by EPC contractors, the equipment is done by equipment vendors. They determine all about the equipment, its kind, measurements, its location, auxiliary products that are required as well as consumption of utility. Understanding how important equipment data is, it is not available before the design is completed by the vendor. In other words, EPC contractor is unaware how much space the equipment will take, as well as its auxiliary equipment, how much free space will be left, no data on power consumption, needed utilities, etc. For this reason, it is impossible to continue with the design of the plant until vendor completes its design of equipment and submits

information of results to the EPC contractor. Then acceleration begins when the information on equipment starts coming in.

Next, Construction department depends on engineering as they need drawings in order to proceed. That is how we can see how the date of purchasing the equipment determines the duration and completion date of the project. If the procurement of equipment is delayed by several months, engineering as well will be delayed by several months, respectively the project completion will be delayed by several months. (Alhajri, 2018)

When 80% of the engineering work is done, meaning that 50% of drawings of pipelines is issued and piping preliminary fabrication is on the go, a construction part begins. Taking a look at the sample picture provided, one can see that construction is simply making a certain amount of equipment integrated into a facility.

Respectively, the layout of the whole facility is dependent on the size of equipment, spare spaces, places for maintenance and operation. The stations needed for heating or cooling are also sized in accordance with necessary consumption of the Equipment. Electrical power supply as well to correspond to power consumption of the Equipment. Main point is to show that it is all about equipment information in order to proceed with construction. (Baron, 2018).

If the facility itself is designed by the EPC Contractor, the Equipment, being a part of the facility layout, is designed by the vendors of the Equipment. The latter identifies the kind of equipment, its parameters, sizes, location, data on auxiliary and its consumption. The point here is that it means that EPC Contractor is unable to get information on the total area covered by all the equipment before the design of all equipment is done. While EPC Contractor is waiting for Vendors in order to proceed with engineering layout so that construction can begin. Meanwhile, what makes it more complicated is that vendors are actually chosen not by engineering but by procurement department of the project. And Procurement department depends on quality/compliance service. The time that the whole supply chain qualifies, negotiates, complies with the market standards, the project scheduling can be fast behind (Interview 1). At all levels, this delay is passed on and amplified in relation to a contract where the financial deadlines are for the moment set. The date when the equipment is procured directly impacts and defines the project timeline and date of completion. Therefore, what crucial is ordering equipment early as was mentioned also during Interview 1 by Project Manager.

In order to issue RFQ the process design shall be frozen, and specs should be issued. For Material Requisition all disciplines shall be ready with its requirements. As it was already mentioned, at the early stages of the project all stakeholders must be concentrated on submitting Purchase Orders as early as possible. Critical engineering deliverables shall be properly listed, requested dates of submission in line with engineering schedule and listed in Material Requisition's VDRS (Vendors Document Requirement Schedule).

Hevre (2018) also suggests that it would be effective if Purchase Orders include information on terms that link payment to documents' submission as well as consequences, as Liquidated Damages if documents are issued and submitted late. Document Control System shall monitor and take a record of incoming deliverables (with special notes for Planned and Actual dates of receipt) and keep a record of outstanding documents during the whole project. The same system also checks if contractor reviewed the documents on time.

4.1.3. Importance of Negotiating EPC Contracts

As mentioned in many published materials on project delays, negotiations are crucial when deciding on the contract (Shapiro, 2015). When projects are complex with multiple stakeholders and huge risks it is important to be prepared, the player needs to have a strong game plan. There is no doubt that the negotiating parties both strive for a beneficial deal, each side always tries to switch any occurring risk to the opposite party. The Contractor when awarded for a project is looking for increasing its gain, get a full payment done on time, as well as face as less risks including delays as possible. The Customer on the other hand wants his project to be delivered in a good quality at the most cost-effective value, within the deadline and the budget. As a result of competition of interests of both sides, a contractor and a client will do their best to solidify their positions. That’s why negotiations are so important.

Lifschitz and Kapner (2015), when discussing ten best practices for negotiating EPC contracts, stress a clear definition of objectives and goals that are reasonable, as well as adequate awareness of project risks, understanding of each parties advantages and disadvantages. There is also a need to comprehend legal tools with which an EPC agreement distributes occurring risk among parties that enter into an agreement. Lifschitz and Kapner (2015), state that the party that comes to a negotiating table without

preparation will be at a huge disadvantage. Early planning and due diligence are the beginning points of a negotiation, the parties should prepare with possible strategies for talking through crucial provisions. Parties should not rely that much on past experience and past contracts. Projects are always different and there are always changes within projects. However, Hebert et al. (2015) suggest to research on previous similar projects, find out, call and talk to previous clients for meticulous preparation. Lifschitz and Kapner (2015), suggest considering the wordings. Words must be chosen with care and thoughtfulness. When the project begins and significant costs will come into play, the parties will try to take an advantage of possible weak sides or unclear conditions of contracts. The parties will start blaming each other and try to shift responsibilities to each other.

One practical example is when the contract was not clear about the consumables, in other words the properties of gas that was to be provided by the Client as per Contract, did not correspond to what was needed by the Contractor and its equipment. As a result, there was a disagreement that caused delays and constant shifting of responsibilities from one party to another. The Customer wanted a Contractor to invest and install a new unit that will bring gas to needed properties, the Contractor wanted the Customer to deal with this issue and pay additional finances as providing water was a Customer's responsibility as per contract.

The above said is also an example of importance of setting an appropriate pricing model for the project and establishing a sound reasonable budget. If the budget is not realistic, the disputes will happen and affect drastically the project completion.

Another point by Lifschitz and Kapner (2015), is that the schedule should be feasible and realistic. As the project consists of people, what can hinder a successful completion is conflicts between colleagues, personalities that bring division, as well as miscommunication. The competence of members of teams in respect of team play should not be overlooked. As it was mention several times by the respondents that change of scope can significantly slow down the project, it is of utmost importance that both parties clearly define the scope of works and have a clear template of division of responsibilities. Clearly undetermined scope and hazy responsibility divisions will surely bring in additional costs and result in delays.

Carrillo (2005) in in her study Lessons learned practices in the EPC sector describes LL or lessons learned as a good practice for organizational learning and knowledge management. It is useful for persistent analysis of company's experience with following transformation of it into knowledge. This knowledge then can be open for all within the company in order to learn from previous mistakes and improve its performance in future. According to Carrillo, BP corporation is using knowledge management called Retrospect for reflecting on previous activities. The study states that in order for a company to become a learning one it shall be trained in methodical problem solving, trying innovative approach and learn from experience of their own as well as of other EPC companies. So that this experience can be transferred into knowledge in an efficient way. For capturing its own experience it would be good to arrange a special meeting with right people, review the objectives and deliverables of the project, its planning and process itself. It is possible to ask such questions as what was positive and negative about the project? Let the participants share on what difficulties they had to face and record the meeting.

4.1.4. Late FEED and Site Handover

As respondents covered the problems caused by late site handover and late FEED, as part of Initiation stage, it seemed necessary to review existing knowledge in terms of FEED delivery and Site handover.

Adib (2019) in "Eight strategies to minimize capital expenditures for a better bottom line" mentions the importance of bringing key players to realize that it is necessary to always forecast and consider steps ahead. FEED stage being a base on which the rest design is being build on, needs to be taken into account as crucial and nothing can be overlooked. Adib (2019) suggests to initiate Monitoring and Controlling team already at the FEED stage in order to avoid possible occurrence of issues that were not considered in advance and cause rework.

4.1.5. Optimizing under EPC Contract

As mentioned in reviews and publications on project delays, Customers can also cause delays because of change of scope of works, they also interfere in the process and even change legislation there seemed not so much advise on how to deal with it, besides bringing up possible consequences of their change, such as CAPEX change, possible delays causing penalties.

Bouckaert (2018) mentions that Contractors undertake higher risks as they are facing *ad-hoc* situations within the run of the project, Contractors also under the contract have the most influence and most important role in the project. It is necessary to stress that while the Contractor undertakes the greater risk and responsibility, the Contractor also has the right to optimize its process. Bouckaert (2018) finds it crucial to stipulate in the EPC contract such provision that The Customer can only describe what is deemed as an outcome from the Project upon successful execution of the Contract. Additionally, to put that Clients' engineers or Advisors from Customers side shall not interfere in a too detailed way, in the project. (Bouckaert 2018.) If it is clearly pointed out in the EPC contract, it can help the project to minimize delays and avoid stressful situations between the parties.

As it is seen from the literature, the delays within EPC projects are caused by a number of reasons. Main focus is on timely equipment procurement and proper communication with Clients in an effort to bring to their attention the importance of keeping to schedules and consequences of changes within the scope of the project.

As the purpose of this thesis is to deliver a list of suggestions for managers to minimize and tackle delays within EPC projects, existing knowledge reviewed in this chapter was used to clarify and support the suggestions from Respondents that will be closely reviewed in the following chapter 5.

5. Building Proposal for Tackling Delays for the Case Corporation

This section merges the results of the current state analysis and the conceptual framework towards the building of the Proposal.

5.1. Overview of the Proposal Building Stage

After analyzing the current state of the project delays in the case company, the main weaknesses of its project process causing delays were identified. After that, best practice that is relevant to exposed issues was also explored and selected from literature.

The current state analysis resulted in uncovering several issues within EPC projects that contribute to delays. In this study, it seems necessary to focus only on most consistent and significant factors confirmed by the respondents and the literature. Based on identifying factors leading to delays during the current state analysis, possible solutions were discussed and formulated with help of the respondents in the following way.

Firstly, the respondents started contributing into the process of Proposal Building at the early stage of Data 1 collection. The respondents were asked to come up with ideas of improvement as soon as they disclosed the issues during interviews or delivering comments. This way seemed more efficient due to the respondents' tight schedules and easier to approach the matter while it is on the table. This way was also practical for those respondents who delivered comments as they had time to produce consistent data on issues and its resolution simultaneously.

Secondly, for the purpose of Proposal Building, the issues revealed by respondents were also analyzed through the lenses of existing literature. This way it was possible to find the ideas that would back up the respondents' points of view or, on the contrary, oppose or dismiss them. Literature review also helped to find new effective solutions on the matter for Proposal Building and analyzed statistical data on delays within EPC projects brought consistency of issues and its importance within EPC business in general.

Based on these inputs, the Proposal for tackling the delays in EPC projects was formulated. More details on the Proposal are provide below.

5.2. Drafting the Proposal

For developing the Proposal, the respondents were chosen based on their long experience in EPC projects helped in coming up with ideas on how to improve EPC process and minimize delays. The results are summarizing in Table 4 below.

As shown in Table 3, Proposal building starts with revising the issues disclosed by the respondents (column 1, Results of CSA). During CSA, the respondent 1 uncovered the EPC project activities procedures together with its weakness and issues that might lead to possible delays. Therefore, the main inputs for a Proposal Building are the ideas on improvement from respondents, followed by input for literature on the issues revealed by respondents.

Next, ideas selected from literature were infused, thus Data collection 2 was also guided by suggestions from literature and best practice on improving / developing this issue (column 2, ideas from literature). After that, Data collection 2 concentrated on identifying suggestions from the key stakeholders (column 3, Data 2, suggestions from stakeholders for the Proposal). It reports on what key stakeholders propose should be done to fix/ develop this issue.

Table 4 below shows the inputs for the proposal.

Table 4. Proposal building in relation to (1) findings from the CSA, (2) the Conceptual framework and (3) input from the stakeholders with suggestions how to tackle delays.

	*Key focus area from **CSA** (from **Data 1**)*	*Input from literature (**CF**)*	*Suggestions from stakeholders for the Proposal, summary (from **Data 2**)*	*Description of the suggestion (from **Data 2**)*
1	**Preparation at Initiation Stage/ Winning Bids**	a) Negotiating with EPC Contractors (Lifschitz et al. 2016) Maximizing your position, showing your competence, your power during negotiations.	a) preparation, an accurate and complete tender documentation ➡ proper MTO ➡ proper final price Confidence in cost calculations	PM suggests to prepare well for bidding, an accurate and complete tender documentation is a key in order to produce proper MTO list, because this list will make a base of the final price of the contract itself. Right bidding documents that are complete and precise show that bidding contender is confident in its cost calculations.
		b) PM Tips. (Hebert et al. 2015) Focus on details, accurate bidding documentation, research on previous similar projects, find out, call and talk to previous clients	Bring up from experience, about advantages, schedule, budget, revise make good suggestions. Use experienced professionals. Bring up your advanced technology, expertise. Prove.	PM advices for bid winning to show its best practices, best experience, make good suggestions in terms of budget. Prove that there is a possibility to deliver works others aren't able to provide. Bring up for negotiations professionals that have expertise in local legislation. Mention technology errors and ensure of having strategies for its mitigation.

	Preparation at Initiation Stage/ Winning Bids		Study of local standards	Respondent 2 specifies that careful study and application of local standards is a must step before starting design of the project. Especially, firefighting, process HSE requirements, its hundred percent required for the safe design of new facilities.
	Preparation at Initiation Stage/ Winning Bids		Assessment, investigation of location, construction	Respondent 2; Often ignored but important advance assessment and investigation on legal requirements, in particular on the construction area, location of the project, country.
	Preparation at Initiation Stage/ Winning Bids	Carrillo (2005) Lessons learned practices in the EPC sector . LL or lessons learned as a good practice for organizational learning and knowledge management. Persistent analysis of company's experience with following transformation of it into knowledge.	Study completed projects for future success	Good to have a thorough study of the projects once they are complete, analyze its issues and so on.

2	**Customers** **Interference** **Demanding customers, unrealistic deadlines, schedules and budgets**	Bouckaert (2018) To provision in Contract that The owner shall only comment what is expected as a result from the project only after the Contract has been completed.	In contract "full wrap" EPC contract takes 100 percent of responsibility for EPC works to explain during kick off meeting- that contractor is given full responsibility- meaning free to optimize, then not so much interference from Client.	Respondent 2 suggests to stand your ground, show that company's services are indispensable, bring up examples of understanding and recognizing the crucial values that matter most within the project.
			Let the Customer know of importance of timing and effect of CAPEX	When discussing terms of the contract and its deadline, it is possible when dealing with a Client who lacks experience in the area, to explain important issues that affect timing. That there are many factors that need to be paid attention to, that changes affect in changing of CAPEX. It will make Clients think do they really need this change or not
3	**Customers changing scope of works, interfering, demand for rework.**	Bouckaert (2018) suggests to provide in EPC contract: that Clients' engineers or Advisors from Customers side shall not interfere in a too detailed way, in the project.	Study Clients'/Customers' requirements. Be ready with Contingency plans, unknown risks appear Study of customer's requirements through interviews, case studies etc. to have a thorough inspection on what the customer wants/needs. Good for Clients in the first place to have a	It can be interviews, case studies, etc. Such studies reveal customers' desires and wants, in order to be ready for possible change scenarios or give possibility to advise the customers on coming advantages or disadvantages. The Customer can be unaware, its good for Contractor to play all possible scenarios for Customer so that he does not change mind later on.

			thorough research and analysis of project's objective.	
4	**Late site handover or incomplete FEED handover**	Adib (2019) It is important for project stakeholders to think in advance. Because of late handover or incomplete FEED data resulting in poor preparation for EPC works, as well as minor problems overlooked at the FEED stage can cause major time overruns when something has to be changed during EPC stages. On the problem of project re-work during EPC stage when actual legislation rules are revealed during M&C, Adib recommends to have M&C staff already in advance starting from FEED phase.	Make Clients aware of consequences of late handover and late documents delivery.	It is important to let Clients know that the value of the project is its due completion. What are the consequences of time overruns. Besides, for some reasons owners can complete Site handover to EPC contractor late resulting in project delay. This may cause significant changes later on causing huge delays. If site handover is late then feasibility studies, such as soil investigation etc start late. At the end it can happen that unusual soil conditions can result in changing scope of works. The earlier it is brought up into the table the better it is for the project. Even during the kick-off meeting with Clients it can be possible to let them know about possible outcomes of later handover. It is also possible to provide clients with examples of previous case studies showing what incomplete FEED data as well as late submission of documents or sites can lead to.

5	**Poor site feasibility study**			Respondent 3 notes shares that poor site feasibility study at the beginning, didn't find any problems and then when construction starts real problems occur. Solution for this can be a thorough and proper site analysis in cooperation with local geotechnical engineers competent in their own area. It is important to detect problems on time because remedial actions can take from months to years.
6	**Blaming game**	Bouckaert (2018) To provide in EPC contract: "The functional specification should not be prescriptive for methodology, specific supplies or detailed characteristics when not directly linked to the expected outcome". Lifschitz et al. (2016) Clear wording of EPC contract	a) Clear out responsibilities within the project b) Try to have as less stakeholders as possible to avoid complexity of communication and blaming	PM suggests to be clear on who is responsible for what within the project. Projects are complex with multiple players, then there is miscommunication and those responsible are hard to find. Manager from Owners side proposed to have as less stakeholders as possible without involving unnecessary parties in order to avoid blaming each other and making things more complicated.
7	**Payment from Customer**	Taneja (2020) Effective Project Management to Improve Cash Flow in EPC Companies: Managing projects by balancing between	Work 100% Good cashflow Financially prepared to bear costs before payment from Customer	Owner pays according to work done, therefore contractor needs to be active and work 100% and spend all the money paid by client for good cash flow. There is a need for strong financial footing, in order to deal with unprecedented ad-hoc costs.

		cash flow and profit margin for growth and stability		
8	**Accelerating procurement**	Baron (2018) a) LH equipment is always on the radar and there is a need to take into consideration all process equipment, The date when Equipment is ordered has direct impact on determining the duration of project itself. Importance of Vendors Equipment design ➡ Engineering design b) Importance of submitting POs ASAP. c) Good for POs to include information on terms that link payment to documents' submission and consequences, as Liquidated Damages if documents are issued and submitted late.	Critical schedule fixed early. Long Delivery Items attention. PO challenge Get quality quotes and info on conditions for Long Delivery Items, If approved PO released faster. Funding for LH equipment in advance; Equipment list prep Get standard equipment, it is easier	PM suggests to get critical equipment schedule fixed ASAP. Long Delivery Items cannot be purchased straight away, as per requirement. It can get more than a year or longer for specialized equipment. PO can take long, this is a big challenge. Issuing RFQ of the LLI ASAP. TBE, CBE to be finalized and PO placed. Thorough M&C of equipment delivery. PO and post ordering status to be maintained in line with the project baseline schedules. Think on funding in advance all the long delay items. Decide on the equipment list during Planning stage already. Get standard equipment, it is easier and faster for all. The equipment requirement shall be precise and clear, complete and concise.

As shown in Table 4, the following issues were discussed in the proposal building and the following ideas were proposed by the key stakeholders:

A. Proposal for Initial/Bidding stages

As it was revealed by the company's Project Manager, bidding part is very important because it is during tender stage that company either is granted a project or not. According to Shapiro (2015), negotiations are crucial and good preparation is a key. For a successful negotiating during bidding stages, it would be very helpful to let Clients know of their advantages and experience. Talk about previous projects, advise on deadlines and budget as it was mentioned during interview 2, that clients oftentimes come with unrealistic deadlines, schedules and budgets. This problem causing delays was also brought up by Respondent 5. Show that company's services are indispensable, bring up examples of understanding and recognizing the crucial values that matter most within the project. While clients are looking at service costs it would be good to prove that there is a possibility to deliver works others aren't able to provide. Bring up for negotiations professionals that have expertise in local legislation. Mention technology errors and ensure of having strategies for its mitigation.

As it was mentioned by Respondent 1, an accurate and complete tender documentation is a key in order to produce proper MTO list, because this list will make a base of the final price of the contract itself. Right bidding documents that are complete and precise show that bidding contender is confident in its cost calculations. According to the article on Project Management tips for EPC: The Bid Process, an author advices to focus on details, stresses on accurate bidding documentation and calls to research on previous similar projects, find out, call and talk to previous clients, as well (Herbert et al. 2015).

When discussing terms of the contract and its deadline, it is possible when dealing with a Client who lacks experience in the area, to explain important issues that affect timing. That there are many factors that need to be paid attention to, as engineers depending on procurers of equipment and necessity of obtaining equipment data from suppliers in order for engineers to continue with facility layout, also licensors part who provide with know how and chemical formulas and catalysts if it's a refinery.

Another issue raised during Interview 2, that while Contractor by signing a "full wrap" EPC contract takes 100 percent of responsibility for EPC works, however, Clients engineers or so-called technical advisors oftentimes interfere and complicate the process. In such case it is good to clear this at the early stages of cooperation, that 100

percent of responsibility brings also freedom to optimize and lead the game. Bouckaert in his Freedom to optimize under an EPC contract, states that its very important to put in the contract the provision that the owner shall only comment what is expected as a result from the project only after the Contract has been completed.

Respondent 2 also suggests to study Clients'/Customers' requirements. It can be interviews, case studies, etc. Such studies reveal customers' desires and wants, in order to be ready for possible change scenarios as well as possibility to make Customers aware of all possible outcomes of various scenarios. It was mentioned that is would be good to have a thorough study of the projects once they are complete, analyze its issues and so on. Often ignored but important assessment and investigation on legal requirements, in particular on the construction area, location of the project, country need to be considered when starting a complex EPC project. It was also mentioned by Respondent 5, that delays can occur if the Contractor is doing its project in an unknown location. From interviewee's practice, careful study and application of local standards is a must step before starting design of the project. Especially, firefighting, process safety and Health Safety Environmental (HSE) requirements, its hundred percent required for the safe design of new facilities.

B. Financial issues

When interviewing a project manager (interview 1 notes) it was mentioned that financially, there is a need for strong financial footing, in order to deal with unprecedented ad-hoc costs. Financing is usually made by payment in stages. Owner, if also dependent on bank loans, etc can delay payment, so the contractor needs to be prepared. There are cases when owner doesn’t pay any advance, in which case, reliance is only on company’s budget for the whole duration of project.

Owner pays according to work done, therefore contractor needs to be active and work 100% and spend all the money paid by client for good cash flow.

C. Accelerating procurement of equipment

As it was mentioned during interviews as well as in existing knowledge, ordering equipment early is crucial. Therefore, ordering equipment early shall be of priority at the early stages in order to unlock Engineering process as early as possible. As it was advised by a Project manager in Interview 1, it is crucial to accelerate equipment procurement at the initial stages of projects. Literature also reveals that, according to

Alhajri, the delays in equipment/materials delivery is the factor that is the most important in affecting the timely completion of the project.

Even though, it is the contractor that is causing it, the owner is able to help in avoiding this from happening by guaranteed issue of PO for all long haul items as well as thorough monitoring and controlling of the status of delivery monthly or even weekly. Respondent 1 highlights that the delay in procurement will definitely delay the project execution in turn completion schedule of the project will be compromised. Once the project is awarded immediately engineering related to the LLI and material that is required at the early stage of the project for underground piping and civil services need to be finalized. Contractor should issue the request for quotations (RFQ) of the LLI and important material to the competent vendors. The TBE, CBE are to be finalized and PO are to be placed to the competitive suppliers at the early stage of the project. The delivery of the equipment to be thoroughly monitored and controlled by the efficient logistics teams. Purchase ordering and post ordering status to be maintained in line with the project baseline schedules. Another way to enhance procurement can be to use single source or preferred suppliers, as it can save time if you cooperate with vendors whose practice you already know. Its important to obtain funding for Long Haul/Lead Items in advance. Though Baron states that LH equipment is always on radar and the attention should be paid to all process equipment. He particularly stresses the importance of Equipment Vendors, as they provide design of Equipment, they calculate the sizing. Before that Contractors simply cannot proceed on Unit designs.

Buying standard/practical equipment, which is easier for equipment layout and following assembly can also make a process easier and accelerate the stage.

The equipment requirement shall be precise and clear, complete and concise. Then can achieve fast performance and there is no need to redo anything or change that is time consuming, stressful and costly.

D. Late Site Handover and Late Documentation Submission

Respondent 3 mentioned the problem of clients postponing handover of key basic data, as FEED preventing engineering part from issuing orders, clients providing incomplete FEED data- this issue shall be handled at the beginning. Taking into consideration the existing knowledge and interviews, when it was mentioned that Customers, especially if coming from developing countries (Interview1 notes). It is important to let Clients know that the value of the project is its due completion. What are the consequences of time

overruns. Besides, for some reasons owners can complete Site (place where project is supposed to be carried out) handover to EPC contractor late resulting in project delay. This may cause significant changes later on causing huge delays. If site handover is late then feasibility studies, such as soil investigation etc start late. At the end it can happen that unusual soil conditions can result in changing scope of works. The earlier it is brought up into the table the better it is for the project. Even during the kick-off meeting with Clients it can be possible to let them know about possible outcomes of later handover. It is also possible to provide clients with examples of previous case studies showing what incomplete FEED data as well as late submission of documents or sites can lead to.

Literature analysis reveals that, according to Adib, M. it is important for project stakeholders to think in advance. Because of late handover or incomplete FEED data resulting in poor preparation for EPC works, as well as minor problems overlooked at the FEED stage can cause major time overruns when something has to be changed during EPC stages. On the problem of project re-work during EPC stage when actual legislation rules are revealed during M&C, risen during Interview 2, Adib recommends to have M&C staff already in advance starting from FEED phase.

Another problem can be when contractor performed a poor site feasibility study at the beginning, didn't find any problems and then when construction starts real problems occur (Respondent 3 notes). Solution for this can be a thorough and proper site analysis in cooperation with local geotechnical engineers competent in their own area. It is important to detect problems on time because remedial actions can take from months to years.

E. Responsibilities

As it was mentioned that for complex projects there is a problem of effectiveness, there might be cases when engineering/construction part and procurement part can have arguments especially when there are issues affecting timely completion. For this reason, as it was mentioned during interview 1, it is important to have management teams that are integrated to have clear matrix of responsibilities stated in scope of work, there is a need for interface activities to be coordinated carefully. Clarity in responsibilities is important in complex projects with multiple players. Same solution can be a remedy for blaming, which was brought up by Respondent 4. When project is complex with multiple players its is hard to find the one at fault.

As it was mentioned in Interview 2 that issues are oftentimes related to the Customer, the interviewee suggested: possible solutions to avoid design changes include study of customer's requirements through interviews, case studies etc. to have a thorough inspection on what the customer wants/needs. Given the afore said that changes in scope of works during project's implementation can cause delays, it might be good for Clients in the first place to have a thorough research and analysis of project's objective.

It would be good as well to study after a project is completed on what were the issues etc. Patricia Carrillo in her research study called Lessons learned practices in the EPC sector describes LL or lessons learned as a good practice for organizational learning and knowledge management. It is useful for persistent analysis of company's experience with following transformation of it into knowledge. This knowledge then can be open for all within the company in order to learn from previous mistakes and improve its performance in future.

According to Carrillo, BP corporation is using knowledge management called Retrospect for reflecting on previous activities. The study states that in order for a company to become a learning one it shall be trained in methodical problem solving, trying innovative approach and learn from experience of their own as well as of other EPC companies. So that this experience can be transferred into knowledge in an efficient way. For capturing its own experience it would be good to arrange a special meeting with right people, review the objectives and deliverables of the project, its planning and process itself. It is possible to ask such questions as what was positive and negative about the project? Let the participants share on what difficulties they had to face and record the meeting.

The second major issue causing delays was mentioned by Interviewee 2 as following : Proper assessment and investigation on legal requirements in the construction area (country) are often ignored, and many contractors try to impose their own standards. However, the practice shows that careful study and application of local standards is a must step prior to design. Especially, this is required for areas such as firefighting, process safety and HSE requirements, which are definitely required to ensure safe design of newly built facilities.

Next, section 6 reports on the validation of this proposal with the key stakeholders.

6. Validation of the Proposal

This section reports on the results of the validation stage and points to further developments to the initial Proposal. At the end of this section, the Final proposal and recommendations from the validator are presented.

6.1. Overview of the Validation Stage

This section validates the proposal developed in Section 5. Validation refers to key stakeholder evaluation (expert judgement) of the proposal using Data 3.

The objective of this section is to validate the initial draft proposal, that has been a product of review of Current State Analysis (Respondents interviews and comments) and inputs from literature on the issue of delays within EPC global projects.

First, it was necessary to find validating experts eager to review the proposal and share the ideas on its feasibility. Several validating candidates were approached. Eventually, two managers from the case company agreed to be the validators of the work.

Second, realizing the tight schedule of the validators it seemed necessary to present most efficient and compact data, in order to get a productive and wholesome validation. For this reason, table 4 containing the Proposal building in relation to findings from the CSA, the Conceptual framework and input from the respondents with suggestions how to tackle delays was sent to two validators. The validators were also asked to share on possible missed factors that need to be addressed as well, feasibility of the recommendations and suggestions on further development of the study.

Third, the initial Proposal was reviewed by the validators and comments were delivered.

6.2. Developments to the Proposal (based on Data Collection 3)

Data Collection 3 concentrates on identifying improvements proposed by the validation experts to the Initial proposal in Section 5. Data Collection 3 is strictly focused on the Proposal contents and seeks to finalize it based on the company feedback.

Table 5. Validation suggestions (findings of Data 3) for the Proposal. See in the last column.

	*Key focus area from **CSA** (from **Data 1**)*	*Input from literature (**CF**)*	*Suggestions from stakeholders for the Proposal, summary (from **Data 2**)*	*Description of the suggestion (from **Data 2** and **Data 3**)*
1	**Preparation at Initiation Stage/ Winning Bids**	a) Negotiating with EPC Contractors (Lifschitz et al. 2016) Maximizing your position, showing your competence, your power during negotiations. b) PM Tips. (Hebert et al. 2015) Focus on details, accurate bidding documentation, research on previous similar projects, find out, call and talk to previous clients	a) preparation, an accurate and complete tender documentation ➡ proper MTO ➡ proper final price Confidence in cost calculations	PM suggests to prepare well for bidding, an accurate and complete tender documentation is a key in order to produce proper MTO list, because this list will make a base of the final price of the contract itself. Right bidding documents that are complete and precise show that bidding contender is confident in its cost calculations. Expert 1: Usually Clients receive and evaluate Biddings in two stages, i.e Technical Bid Evaluation (TBE) and Commercial Bid Evaluation (CBE).Once the TBE is qualified then only CBE shall be opened. Considering this fact submission of bidding documents (TBE) with complete details along with all the key documents is very essential as mentioned and well covered by author. Expert 2: MTO list will surely allow all the interested parties to avoid going overbudget. This is especially important for the project owners, who want to have a fixed lump sum price. However, from the EPC contractors' point of view, to ensure final lump sum price, all factors should be evaluated. It is common that the contractors include contingency to avoid going overbudget.
			Bring up from experience, about advantages, schedule, budget, revise make good suggestions. Use experienced professionals. Bring up your advanced technology, expertise. Prove.	PM advices for bid winning to show its best practices, best experience, make good suggestions in terms of budget. Prove that there is a possibility to deliver works others aren't able to provide. Bring up for negotiations professionals that have expertise in local legislation. Mention technology errors and ensure of having strategies for its mitigation. Expert 1: Once the Clients called the Bidder for discussion on technical aspects and negotiation on commercial bids. Contractor is required to explain their capabilities and capacity in executing the project, bring up references, citing various examples and expertise that they have in various projects. Bidder is also required to earn the confidence of the Client in terms of executing the project within the budget proposed

				and author has very well highlighted these aspects. Expert 2: Highlighting all the positive points is necessary. Based on best practice all projects at the planning and execution stages should hold risk management workshops to understand common risk factors, but also to find mitigation plan for unexpected risk realization. Such workshops should not be limited to management teams, but all level specialists who can bring their ideas through brainstorming.

	Preparation at Initiation Stage/ Winning Bids		Study of local standards	Respondent 2 specifies that careful study and application of local standards is a must step before starting design of the project. Especially, firefighting, process HSE requirements, its hundred percent required for the safe design of new facilities. Expert 1: Studying and analyzing the local regulatory and administrative authorities of the Country where the project is proposed, which may directly or indirectly affect the project is one of the primary aspects to avoid the delay in execution of the project. The local regulatory authorities shall dictate the project engineering and the local commercial aspects such as income tax, VAT, Customs duty, Import duty, Visa requirements etc. shall drive the execution of the project. The author has briefly narrated these points. Expert 2: Inadequate evaluation of legal requirements can lead to loss of time and extra cost due to rework. This was the case with fire-fighting, HSE and HVAC requirements. Non-compliance with such requirements led to failure to obtain necessary approvals and permits. As a result, reworks on design and construction incurred additional costs and loss of time.
	Preparation at Initiation Stage/ Winning Bids		Assessment, investigation of location, construction	Respondent 2; Often ignored but important advance assessment and investigation on legal requirements, in particular on the construction area, location of the project, country. Expert 1: The environmental aspects play a very critical role in setting up the project in any country. The location of the project construction site shall be studied based on the information provided in the Invitation to Bid document. If

				needed a physical Site survey may also need to carry out in advance as mentioned by the Author. Most importantly the soil investigation report, geo-technology reports submitted by Client need to be well studied accordingly incorporated in the bidding.
	Preparation at Initiation Stage/ Winning Bids	Carrillo (2005) Lessons learned practices in the EPC sector . LL or lessons learned as a good practice for organizational learning and knowledge management. Persistent analysis of company's experience with following transformation of it into knowledge.	Study completed projects for future success	Good to have a thorough study of the projects once they are complete, analyze its issues and so on. Expert 1: Lessons Learned in previous projects shall be referred by the Bidder and the experiences and expertise obtained from the same need to be applied while preparing the bidding document as opined by the Author. It is always good practice to record the Lesson Learned as during execution of the project and compiling them in central data bank of the Bidder is essential, which shall be referred during the bidding of any other new projects Expert 2: It is very common when project is at the final stage human resources are assigned to other new and ongoing projects. However, before the core team members are distributed, it is essential to hold “lesson learned” workshop to form best practices for future projects. Ignoring this practice will cost the organization recurrence of issues, which cause additional loss of time and manhours for learning process.
2	**Customers Interference Demanding customers, unrealistic deadlines, schedules and budgets**	Bouckaert (2018) To provision in Contract that The owner shall only comment what is expected as a result from the project only after the Contract has been completed.	In contract "full wrap" EPC contract takes 100 percent of responsibility for EPC works to explain during kick off meeting- that contractor is given full responsibility- meaning free to optimize, then not so much interference from Client.	Respondent 2 suggests to stand your ground, show that company's services are indispensable, bring up examples of understanding and recognizing the crucial values that matter most within the project. Expert 1: Once the Bidder is awarded with the Project, the Bidder will become the EPC Contractor (Contractor). The Client will invite the EPC Contractor for a project Kick off Meeting. The Contractor’s Project manager along with all the discipline wise key personnel will attend the KoM. During the KoM Contractor will narrate how the project will be executed showing the overall Organization Charts, Execution plan and also Communication (Interference), Roles and Responsibility Matrix , wherein clearly mentions the involvement limit of the Client as mentioned by the Author. Expert 2: Delegation of responsibility from the project owners to contractors is not merely a matter of convenience. As EPC contractors, contractors’

				responsibility is to deliver 'turn-key' projects. This is possible when there is a clear interface management plan describing distribution matrix with work scope areas. The smaller number of involved parties (interfaces), the more efficient will be the project management processes. However, the owners usually still require weekly/monthly reports and/or meetings to overview the progress. Usually feedbacks from such meetings and/or reports may cause changes that affect the scope/time/costs, requiring the contractors demand signing change approvals.
			Let the Customer know of importance of timing and effect of CAPEX	When discussing terms of the contract and its deadline, it is possible when dealing with a Client who lacks experience in the area, to explain important issues that affect timing. That there are many factors that need to be paid attention to, that changes affect in changing of CAPEX. It will make Clients think do they really need this change or not. Expert 2: At the project initiation and/or planning stage it is possible to apply clients' demands. However, as progress reach certain stage, any change should be evaluated for time/cost impact. In such case, it is common to provide insight to the client by submission of cost-benefit analysis of change management.
	Customers changing scope of works, interfering, demand for rework.	Bouckaert (2018) suggests to provide in EPC contract: that Clients' engineers or Advisors from Customers side shall not interfere in a too detailed way, in the project.	Study Clients'/Customers' requirements. Be ready with Contingency plans, unknown risks appear Study of customer's requirements through interviews, case studies etc. to have a thorough inspection on what the customer wants/needs.	Respondent 2 suggests to study customers' requirements It can be interviews, case studies, etc. Such studies reveal customers' desires and wants, in order to be ready for possible change scenarios or give possibility to advise the customers on coming advantages or disadvantages. The Customer can be unaware, its good for Contractor to play all possible scenarios for Customer so that he doesn't During the execution of the project it is inevitable to receive the changes from the Client. change mind later on. Expert 1: However as explained by the Author it is always better to have close association and discussions with the Clients to know their requirements and changes which may be expected from their end and explain the merits and demerits of the changes. Contractor need to prepare a Change Management Procedure and get approved by the Client to avoid unnecessary changes as per the whims and wishes of the Clients. Expert 2: In post-Soviet area many clients develop document named 'Terms of Reference', describing major requirements for the facility to be

			Good for Clients in the first place to have a thorough research and analysis of project's objective.	designed/constructed. In some cases, such document is very general. This will require holding interviews/sending letters/signing minutes of meeting to formalize specific requirements. On the other hand, Terms of Reference can be too specific. In such case, the clients usually exclude possibility of assessing alternative solutions. In any case, all clients' requirements should be formal and signed by an authorized person(s). This will be the starting point or the basis of the project.
3	**Late site handover or incomplete FEED handover**	Adib(2019) It is important for project stakeholders to think in advance. Because of late handover or incomplete FEED data resulting in poor preparation for EPC works, as well as minor problems overlooked at the FEED stage can cause major time overruns when something has to be changed during EPC stages. On the problem of project re-work during EPC stage when actual legislation rules are revealed during M&C, Adib recommends to have M&C staff already in advance starting from FEED phase.	Make Clients aware of consequences of late handover and late documents delivery.	It is important to let Clients know that the value of the project is its due completion. What are the consequences of time overruns. Besides, for some reasons owners can complete Site handover to EPC contractor late resulting in project delay. This may cause significant changes later on causing huge delays. If site handover is late then feasibility studies, such as soil investigation etc start late. At the end it can happen that unusual soil conditions can result in changing scope of works. The earlier it is brought up into the table the better it is for the project. Even during the kick-off meeting with Clients it can be possible to let them know about possible outcomes of later handover. It is also possible to provide clients with examples of previous case studies showing what incomplete FEED data as well as late submission of documents or sites can lead to. Expert 1: Author has very clearly explained the difficulties and delays that may cause in late handing over of the project Site to the Contractor. In addition to this establishing the effective date of the Contract Start is also equally important for which Client is required to pay 10% advance payment of the Contract value. Delay in handing over the construction site not only delays the engineering activities but also delays in commencing the initial Temporary facilities works such as camp and office construction etc. Expert 2: In some cases clients prefer to leave site investigation and/or soil investigation as the contractors' scope. This is due to clients' unwillingness to be responsible for unknown subsoil conditions (rocks, loose or unfit soil layers, etc.). On the other hand, contractors will require additional time/cost for doing soil investigation.

				Lately some clients hire competent soil investigation contractors and require them to prepare the relevant reports. Later at the FEED and/or EPC stage such reports are handed over to contractors (including clients' disclaimers to avoid any claims). This allows to save time/cost required for soil investigation. However, even in this case, the clients should have competent engineers to evaluate the soil investigation reports prepared for them.
4	**Poor site feasibility study**			Respondent 3 notes shares that poor site feasibility study at the beginning, didn't find any problems and then when construction starts real problems occur. Solution for this can be a thorough and proper site analysis in cooperation with local geotechnical engineers competent in their own area. It is important to detect problems on time because remedial actions can take from months to years. Expert 1: Author well explained on the ramifications that may be encountered at later stage due to execution of the construction works based on the incomplete feasibility studies, which need to be taken in to account addressed at the early stage itself. Expert 2: See the comment from section 3. Early determination of the construction site and evaluation of its fitness will save both time and costs.
5	**Blaming game**	Bouckaert (2018) To provide in EPC contract: "The functional specification should not be prescriptive for methodology, specific supplies or detailed characteristics when not directly linked to the expected outcome". Lifschitz et al. (2016)	a) Clear out responsibilities within the project b) Try to have as less stakeholders as possible to avoid complexity of communication and blaming	PM suggests to be clear on who is responsible for what within the project. Projects are complex with multiple players, then there is miscommunication and those responsible are hard to find. Manager from Owners side proposed to have as less stakeholders as possible without involving unnecessary parties in order to avoid blaming each other and making things more complicated. Expert 1: Author intended to establish a communication protocols and interface management procedure at the early stage of the project. Whilst prepare these documents Author would like to consider only key stakeholders to involve in the project execution so that unnecessary back and forth communication, arguments and finger pointing can be avoided. Expert 2: Interface management plan and interface management workshops are among the solutions to identify stakeholders, their interests/demands.

		Clear wording of EPC contract		However, leaving stakeholders out of communication channel will only delay occurrence of problems. For example, if the construction site for an industrial facility has been allocated next to a residential area, there should be clear environmental study plan, including EIA report (environmental impact assessment). Such report should assess impact on the neighboring population. Based on such reports, interface management plan should be updated to identify the existence of residential areas and their residents. Their interests/demands should be assessed, including ways to compensate/relocate such residents to other safe places.
6	**Payment from Customer**	Taneja (2020) Managing projects by balancing between cash flow and profit margin for growth and stability	Work 100% Good cashflow Financially prepared to bear costs before payment from Customer	Owner pays according to work done, therefore contractor needs to be active and work 100% and spend all the money paid by client for good cash flow. There is a need for strong financial footing, in order to deal with unprecedented ad-hoc costs. Expert 1: Strong cash flow is very important for success of any project as pointed out by Author. In order to maintain sound cash flow, Contractor need to prepare progress measurement and invoicing procedure and get it approved by the Client. Contractor is required to execute the works in such way to avoid the negative cash flow of the project, while keeping buffer funds to manage the cash flow crunch at certain times of the project. Expert 2: Pre-qualification stage is necessary to form a pool of competent and financially stable contractors. By requiring submission of financial reports, credit assessment reports and/or bank guarantees, owners can assess the competence and financial stability of contractors. This stage should never be ignored.
7	**Accelerating procurement**	Baron (2018) a) LH equipment is always on the radar and there is a need to take into consideration all process equipment,	Critical schedule fixed early. Long Delivery Items attention. PO challenge	PM suggests to get critical equipment schedule fixed ASAP. Long Delivery Items cannot be purchased straight away, as per requirement. It can get more than a year or longer for specialized equipment. PO can take long, this is a big challenge. Issuing RFQ of the LLI ASAP. TBE, CBE to be finalized and PO placed.

		The date when Equipment is ordered has direct impact on determining the duration of project itself. Importance of Vendors Equipment design ➡ Engineering design b) Importance of submitting POs ASAP. c) Good for POs to include information on terms that link payment to documents' submission and consequences, as Liquidated Damages if documents are issued and submitted late.	Get quality quotes and info on conditions for Long Delivery Items, If approved PO released faster. Funding for LH equipment in advance; Equipment list prep Get standard equipment, it is easier	Thorough M&C of equipment delivery. PO and post ordering status to be maintained in line with the project baseline schedules. Think on funding in advance all the long delay items. Decide on the equipment list during Planning stage already. Get standard equipment, it is easier and faster for all. The equipment requirement shall be precise and clear, complete and concise. Expert 1: The Author has furnished in depth information on the Procurement and Subcontracting process required for the Project. The Contractor need to complete the engineering and Purchase Requisition (PR) for the Long Lead items (long delivery)/equipment as soon as Project is awarded. Special attention needs to be paid on these items even after the issue of the PO for their manufacturing, inspection, FAT (Factory Acceptance Tests), logistics, customs clearance, import conditions and delivery of the equipment at Site. The PO on bulk and Tagged items shall be continued during the execution of the project as per the Site requirement date. It is always better to incorporate the penalty clauses in the PO for late delivery in order to expedite the delivery as mentioned by the Author. Expert 2: Standardizing equipment size is a way to save both time and cost. This also allows early PO placement for critical items like LLI. However, there are additional factors involved. For example, for land-locked countries it is necessary to consider logistics issue for large process equipment, like columns or reactors. Equipment size is critical when transporting through rivers/roads for land-locked countries. Therefore, early planning is necessary for process items, including LLI due to the time required for their manufacture, but also for logistics issue.

As seen from Table 5, the validating experts delivered a professional, practical and sound solution to tackle the problem of project delays. The experts completed the approach brought up by the respondents and literature by highlighting factors that are crucial for timely completion of the projects and shared about professional procedures that help to avoid problems covered in this study.

As for preparation stage the experts uncover the details of project management procedures. Expert 1 shares that Commercial Bid Evaluation is done only after passing the Technical Bidding Evaluation, which supports the idea of importance of complete technical bidding data. Expert 2 mentions that MTO is especially crucial for the Customers so that not to go over budget and who are interested in fixed lump sum of contract. From contractors' side, it is important to consider thoroughly all the factors for defining total fixed lump sum price of the project.

Later on, validating expert 1 cites "The bidder is also required to earn the confidence of the Client in terms of executing the project within the budget proposed" and mentions the importance of having strong references to the company's previous successful projects. Expert 2 suggests to arrange risk management workshops to get to know common risk factors, as well as creating mitigation plan for unforeseen risk handling. In the expert's opinion, it would be good to involve not only managers but specials from all levels for brainstorming. Validator 2 mentions the importance of being in line with local regulations, because failure to do that will cause inability to obtain required approvals and permits. As a result, "reworks on design and construction incurred additional costs and loss of time", Expert 2.

It is stated by validator 1 that the local regulatory bodies will dictate the project engineering and the local commercial aspects as taxes, customs, etc. For this reason, it is crucial to study and analyze the local procedures related to the project. The necessity to study local environmental aspects, the soil report, geo- reports, to carry out site survey in advance was also covered by both experts. It is considered a good practice to record the Lesson Learned during execution of the project and compile them in central data bank. Expert 2 states that ignoring LL workshops will result in reoccurrence of issues and bring delays because of learning process.

Regarding Customers interference, demands and unrealistic expectations, the validating expert 1 suggests that during Kick-off Meeting the Contractor narrate how the project is

executed showing the overall Organization Charts, Execution Plan and Communication (including dealing with interference). Both validators appeal to Roles and Responsibility Matrix, wherein the involvement limit of the Client should be clearly declared and shall be accepted by the Client. Expert 2 also calls for smaller number of interfaces, clear interface management plan and necessity to handle reports and meetings to overview progress, because usually comments from such meetings and reports may cause changes affecting scopes and time.

On changes from Customer's side, there is a suggestion to have a close association and discussion with the Clients so that Customer is aware of their needs and changes. It is good to "explain the merits and demerits of the changes", as it is mentioned by the Validator. Additionally, there should be a Change Management Procedure approved by the Client so that to avoid unnecessary changes "as per the whims and wishes of the Clients". Expert 2 suggests a cost-benefit analysis of change management and also mentions the importance of signing the clients' requirements, which should serve as a basis of any project to avoid the possibility of assessing alternative solutions.

In order to avoid late site handover, the Country Manager stresses the importance of establishing the effective date of the Contract start for which the Client is required to pay 10% of advance payment of the Contract value.

Expert 1 agrees on the effect of poor site feasibility study that might occur at the later stage if the construction works are done based on poor feasibility study. It shall be taken into consideration and addressed as early as possible. Expert 2 narrates the proper process of soil investigation when The Customer shall hire a professional investigator to perform the work and also ability to properly assess soil investigation reports provided for them by other parties.

For the blaming game, it is a good practice to establish a communication protocol and interface management procedure at the beginning of the project, considering only key stakeholders to engage in the project execution to avoid finger pointing and unnecessary back-and-forth communication. Expert 2 suggests that interface management plan and interface management workshops help to resolve problems and to identify stakeholders and their interests. "However, leaving stakeholders out of communication channel will only delay occurrence of problems", Expert 2. There is an example when the construction site for a plant has been located close to a residential area, then there must be an

environmental impact assessment. Based on such reports, interface management plan needs to be updated to determine the existence of residential areas in the neighborhood. "Residents interests/demands should be assessed, including ways to compensate/relocate such residents to other safe places", expert 2.

While covering the financial part of the project, it was agreed that strong cash flow is crucial and one of the measures for sound cash flow is Progress measurement and effective invoicing procedure. Also, there is a need to keep buffer funds to tackle cash flow crunch at times during the run of the project.

Having a great experience in procurement, validating manager 1 focuses on the necessity of completing the Purchase Requisition (PR) for Long Lead Items as soon as the project is awarded to the Contractor. "Special attention needs to be paid to PR even after the issue of PO for their manufacturing, inspection, FAT, logistics, customs clearance, import conditions and delivery of the equipment at Site." The expert specifies that is it always better to include the penalty clauses in the PO for late delivery as it was suggested by Baron, 2018. Validating expert 2 agrees on the solutions for procurement and identifies an existence of other factors. For example, in land-locked countries it is necessary to consider logistics issues for process equipment of large sizes, like reactors or columns. Size of equipment is crucial during transportation through rivers/roads for landlocked countries, like Kazakhstan. For this reason it is required to do early planning for process items, including LLI due to logistics issues that are country specific.

Additionally, the experts were suggested to answer three questions on other suggestions and ideas on improvement of this study. It was possible to get the replies from validating expert 1. Questionnaire with the responses from validating expert 1 is provided in Appendix 6.

In general, based on the replies of validating expert 1, the topic of this study was well covered. However, it is mentioned that projects are different in nature and depend on the location. The requirement was to focus on the schedule risks and management of the Safety, as well as quality aspects of the Project as these factors might affect indirectly the timeline of the project if not in line with the project requirements. "It is very important to maintain the Zero defects and Zero accidents in the project by which schedule of the project will not be disturbed", Expert 1. It was stated that the case corporation is thoroughly applying PMBOK guidelines to address the challenges that projects face. The

Proposal is found to be useful and "would be a ready reckoner under various aspects that involve the bidding stage", expert 1.

6.3. Final Proposal

The summary of the final Proposal consists of the list of recommendations in visuals created based on the factors that were exposed during the Current State Analysis, Existing Knowledge and input from validating experts.

Figure 3 Recommendations to address poor preparation at Initiation/Bidding

Current State Analysis **Factor causing delays** Poor preparation at Initiation/Bidding stage Loosing Bids
Conceptual Framework **Defining remedies** Proper preparation for negotiations Precise and accurate bidding documentation
Final Proposal **Defined actions** Have an accurate and complete tender documentation, both technical and commercial; Prepare well for negotiations: • Be ready to show your experience, capacities, reference projects; • Be ready to earn the confidence of the Client in terms of executing the project within the budget and timeframe; Being ready to know well the Customer, the location, standards, previous experience; having a practice of recording the Lessons Learned during any project, so that you can refer to them during the bidding for other projects; considering all factors for final contract price; arranging Risk Management Workshops; mitigation plans for tackling unexpected risks for all level specialists; compliance to local regulations – proper obtaining of approvals and permits

Figure 4 Recommendations to address Customers' Interference, changes, blaming

Current State Analysis

Factor causing delays

CUSTOMERS INTERFERENCE, CHANGES, BLAMING

Conceptual Framework

Defining remedies

Specific provisions in Contract limiting interference and changes

Final Proposal
Defined actions

Clear communication structure/ Protocol;
Roles and Responsibility Matrix with clear involvement limit;
only key stakeholders involved in project execution;
playing all possible scenarios for Customers;
having close association and discussions with Customers;
getting to know Customers well and building trusting relationships;
having a complete signed documentation of requirements/ assignments to avoid changes;
Time/cost impact evaluation;
Cost-benefit analysis

Figure 5 Recommendations to address Customers' late submission/handover and poor feasibility study

Current State Analysis **Factor causing delays** CUSTOMERS LATE SUBMISSION/HANDOVER POOR FEASIBILITY STUDY
Conceptual Framework **Defining remedies** M&C staff already in advance starting from FEED phase
Final Proposal **Defined actions** Providing clients with clear examples of previous case studies showing what incomplete FEED data, late submission of documents or sites, as well as poor feasibility study can lead to; a thorough and proper site analysis in cooperation with local geotechnical engineers competent in their own area.

Figure 6 Recommendations to tackle financial issues

Current State Analysis **Factor causing delays** FINANCIAL ISSUES
Conceptual Framework **Defining remedies** Managing projects by balancing between cash flow and profit; margin for growth and stability
Final Proposal **Defined actions** Constant good cash flow; buffer funds

Figure 7 Recommendations how to address late procurement

Current State Analysis

Factor causing delays

LATE PROCUREMENT

Conceptual Framework

Defining remedies

need to take into consideration all process equipment;

equipment design ➡ Engineering design;

importance of submitting POs ASAP

Final Proposal
Defined actions

Accelerating procurement;

starting ordering needed equipment as soon as a project is awarded;

issuing RFQ of the LLI ASAP. TBE, CBE to be finalized and PO placed;
thorough M&C of equipment delivery;
PO and post ordering status to be maintained in line with the project baseline schedules;

thinking on funding in advance for all the long delay items;
Deciding on the equipment list during Planning stage already;

getting standard equipment

having precise, clear, complete and concise equipment;

considering country specific logistics issues

7. Conclusion

This section contains the conclusion of this study.

7.1. Executive Summary

The objective of this thesis is to create recommendations for managers helping to tackle delays within global EPC projects. Nowadays Engineering Procurement and Construction business faces increasing competition and harsh geopolitical situation. Global EPC projects are challenging, complex and timely completion is pivotal for the success. Therefore, it is imperative for the companies to know how to accelerate its EPC process in the most effective way. The projects are meant to revamp/expand the existing facilities by constructing new process units. This task brings a complex volume of requirements, rise challenges of project design and deliverance on time. Delays result in penalties and have a negative impact on the image of the company.

Because of the importance of timing during the project, it seemed necessary to identify main reasons of delays. What are the factors leading to time overruns within global EPC projects? To find out the answers, the current state analysis of case corporation was conducted. Five respondents that are the experienced and certified managers of the case corporation shared their experience and ideas on the topic of delays. After analyzing their suggestions, a certain amount of related literature was reviewed as well. As a result of the analysis it was possible to identify main factors causing delays. Those factors were put together in an Initial Proposal with possible solutions to the problems of delays within EPC global projects. The Initial Proposal was presented then to two validating experts in the field of EPC. Eventually, taking into consideration the comments from experts, the Final Proposal was created containing the list of recommendations for addressing delays within EPC global projects.

Based on the analysis carried out during this study, there are a number of factors affecting time overruns within global EPC projects. A thorough preparation for the projects at its initial/bidding stages is crucial as it is then that the project might be awarded to the Contractor, this stage also serves as the base for the whole project. The respondents of this study as well as experts from literature find it pivotal to present a complete bidding technical documentation. Another important part of this initial stage is

proper negotiations with Clients. Its time to show company's best practices and experience. The analysis suggests that proper study of the local standards where the project is carried out will help to avoid delays big time.

Customers were called as the root cause of the delays. They interfere and bring out unrealistic deadlines and schedules. As a prevention it would be a good practice to introduce a clear interface management plan describing distribution matrix with work scope areas and involvement limits. The importance of close association and discussion with the Clients of their requirements and desired changes is determined by the respondents. It is vital to bring to Clients' attention the consequences of their changes to avoid unnecessary changes. Another factor leading to delays is a poor site feasibility study. The suggestion to address these issues is a thorough and proper site analysis in cooperation with local geotechnical engineers competent in their own area. Late site handovers can be dealt with by establishing the effective date of the start of the contract and make sure that the Client is aware of the consequences of late handover. One of the main factors that will help mitigate delays is accelerating procurement. It is pivotal to deal with purchase orders as soon as possible and keep an eye on the equipment delivery during the whole project execution.

The experts validating this study noted that main factors of delays were covered and can be implemented. The feedback was to identify the importance of schedule risks and management of the Safety and quality aspects of the project as it is important to maintain the zero defects and zero accidents, by which the schedule of the project cannot be disturbed. A path to lead further research in Bidding/Initiation is suggested.

Despite that global EPC corporations can refer to standard guidelines like PMBoK to tackle delays, global EPC projects are challenging and unique. They are limited by local features and peculiarities. This study uncovers examples that are more specific in nature and helpful in facing challenges.

7.2. Managerial Implications

While uncovering the factors that affect delays, several respondents mentioned Customer as a root cause of delays. Customers interfere too much, customers blame the Contractor. This problem can be avoided by building trusting and honest relationship between a Client and a Customer.

First of all, project manager needs to pick a good team. To make sure that his/her team are on board with the leader about the objectives of the project as well as shares the idea of Customer's value and business ethics. This is especially important, because the rest can be learned. If the team sees Customers as a value, it will not be hard for them to invest time into knowing the Customer and the related aspects of project. The Customer will see Contractor's genuine interest and eagerness to know Customers needs and requests. It will be the base for trusting and honest relationship. This will help reduce changes, interference and pointing fingers.

Second, making sure that the teams knows of the factors that can hinder timely completion of the project.

In general, PM needs to cover both practical matters as well as good communication and relations with Clients.

7.3. Thesis Evaluation/Research Quality Criteria

The initial objective of this study was to develop recommendations for managers that would help to avoid delays within EPC global projects. The expected outcome was a created list of guidelines tackling the problem of delays.

During the Current State Analysis, most important factors causing delays were covered by the Respondents, the factors and its importance were also supported by the discovered literature and certain ideas on how to address such problems were introduced based on suggestions from the Respondents and literature. Despite, that the validating expert accentuated a good coverage of the problems related to delays, regarding the suggestions, it seemed that the case corporation already has a solid efficient approach to the problem of delays without any necessary need for improvement.

Based on the validator's data, the corporation is equipped with the procedures that are consistent and based on its experience.

In regards to the study work, there were some issues with the topic, as, first of all, it is too broad and it would be better to focus on something more specific so that its possible to deliver the data that is more deep. For example, the topic of issues at the bidding stage could be a separate topic that would cover the aspect deeper. Also, as the respondents uncovered issues in the areas that are not an area of expertise of the researcher, it required additional analysis of the areas in order to get grasp of the things.

Another problem is its sensitivity. The study shows the disadvantages and weak points of the company straight away. For this reason, when the search for possible candidates for interview began, there was rejection and unwillingness to cooperate. It would be better to analyze the matter of delays focusing on timely delivery, not delays, like the topic of Timely Completion of Projects.

Besides, the study was based only on interviews, it would be good to use supporting documents. However, in our time of data protection and data policies in the corporations, it seems that it will always be an issue if the topic of the research is on some negative sides of the company.

From the point of view of evaluation criteria, this study utilizes validity and credibility. The validity of the research is complete with evidence. In view of absence of supporting documents, the evidence can be provided by the consistency of the data of the respondents, supporting data from literature, as well as final validation of data by two experts.

7.4. Closing Words

When deciding on the topic of thesis, it was decided to write on the topic that is of current interest and related to a career path. This study introduced the researcher to various aspects related to Project Management, not only practical, as the need of procurement acceleration or proper complete technical bidding documentation, it also uncovered issues that cannot be handled by the technology or AI of the future. It is, the soft skills, the ability to build trusting strong relationships with the Customer, make it so that the Customer trusts you enough to not interfere or blame. This study reminded of the need to find value in the Customer and to put the Customer's needs first for the eventual benefit of the whole project.

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APPENDIX 1

Respondent 1 Interview Notes

Good to take up any project and work with it.

Bidding - bidding division, through notification, marketing team, getting business first. Project notification, previous project info, announcements, to get biz. Buy bid, viable executable, background of company, good for company image, nature of work, commercial dept. can bid, buy bid, paper notification, size of project , specs.

After that decide if they bid or not. Financial supplement

Client own money or sponsored

Many Manhours important

Commercial dox

Prepare for bidding

Cost

Good or bad? Analysis, feasibility study

Find out project manager makes team to bid

Loosing in bid

Negotiations important- preparation is key. Bring up from experience, about schedule, budget, revise make good suggestions. Use experienced professionals.

One time lost because could not explain their advantages as client was focused on expensive services cost. Bring up your advanced technology, expertise. Prove…

Bidding documentation- full and exact. MTO important. Then sure in its costs estimations

Technical team is preparing specs

2 parts technical bid n commercial bid

Technical bid viability feedback to commercial dept

Then costing engineering

Commercial bid

Awarding based on bids technical needs to be qualified

Quality point of view technical capability

After technical

Commercial 1 tier 2 tier bid

If 2 qualified 10 bidders price list out lowest (L1)

Owner has his basic price

Check commercial qualified

If not realistic

Evaluation team from client
Letter of Intent LOI LOA award- award certificate with effective date
Detailed contract agreement IMPORTANT
L123 meeting, lots of correspondence
Detailed contract agreement IMPORTANT
Date is important penalty if overdue
Project manager nominated
Team selection
Shareholders role, want best result without knowing details
Manhours
Project deliverables what is required, inputs by engineers
Planning schedule Level 1
Sponsored by bank, loans more interest
Baseline schedule (how to do something)
Detailed schedule I 1234
Scope of work given by owner facilities
Important to clear out responsibilities especially for complex projects
Problems if liabilities and responsibilities are unclear that might bring additional costs.
Engineers develop detailed scope
Package
Initiation biz plan project charter duration
Planning start executing schedule with scope of work detailed with timing
What to do
Planning
Basic blueprint from client, procurement engineers decide what to procure, where to keep
Detail engineering
On paper drawing deliverables
Approval
Start procurement
Procurement division
Poor planning and scheduling- delays!
Critical schedule fixed . Long Delivery Items cant buy straight away, as per requirement
Long duration can get after a year or longer specialized equipment
PO can take long – challenge

Try to get quality quotes and info on conditions for long deliv items, easier if jt is approved PO released faster.
Issuing RFQ of the LLI ASAP. TBE, CBE to be finalized and PO placed.
Thorough M&C of equipment delivery. PO and post ordering status to be maintained in line with the project baseline schedules.
Think on funding in advance – long del items
Equipment list
Get standard equipment- easier and faster for all
RFQ, bidding
Construction begins
Most large part and riskiest, major costs, mostly cant make changes, not many options
Land grading, stay of workers on site
Survey of location how many people where they stay
Temp camps
Resources where to take – developing countries no skilled people mobilize people
More cost to get skilled people high pay
Countries no infrastructure , no facilities bring from other countries tools procrastinate, clients don't know procedures and standards
Study what skills n infrastructure needed
Cultural issues, strikes no system unseen challenges cant account. Country specific challenges.
Arguments between teams, inside
Arguments with Client, cultural.
Tropical condition force majors
Unknown risks
Contingency methods but unknown risk appear

Execution- construction listing of items, how to
Work with partners vendors, easier, work faster
Monitoring and controlling from beginning execution
Continuous cycle, safety, HSE plan do act and
Fatal incidents delays
Maintain planning
Monitor timeline
If missed alternate methods

Increase manpower

Close out
Requirement from owner
If no certificate then date is not closed
Close all procurement all
Whether all deliverables are done
Procurement all received
Close procurement order
All jobs concluded
100% should be done as per contract
cos still they cant use the facilities
for last 20% of project give 80%of efforts
inspection during execution
invoicing
contract agreement
payment procedures
advance payment
on pro rata basis
if advance payment
invoicing planning
no good cashflow
need to do busy and use all the money
job needs to be done at full
good cashflow
cash crench
invoice cycle needs to be agreed on payments
pay interest for balance amount
no permit for work manpower standby
apply for charges

Inter-reliance and interdependence- complicated.
Engineering depends on procurement as they select vendors and order equipment.
Procurement under QA standards and its team. Time consuming – negotiations, compliance.

If project is big, more parties more complicated. More difficult to manage.

APPENDIX 2

Respondent 2 Interview Transcript

What are the main reasons of project delays?

Document delivery stages important

Demanding Clients

Location issues, collision

Delivery refusals

Not in line with Gost

Administrative

Disagreements on technology- catalyst example

Arguments on suppliers, systems

-Changes initiated by the Client of project, who is also able to make new legislation as the client is a state company.

-Client interferes too much – solution during kick off to clear out contractor given full responsibility- meaning free to optimize, not so much interference from Client

Demanding customers

Documentation in Russian which takes time

What can be done to avoid delays? Possible solutions

Study of customer's requirements- can be interviews, case studies etc.

thorough inspection on what the customer wants.

Good to study after projects is done. issues etc.

Also good assessment and investigation on legal requirements- construction area, place of project, country- because often ignored

Many contractors imposing own rules.

From practice- careful study and application of local standards is a must step before start design.

Especially firefighting, process safety and HSE requirements, 100 percent required to for safe design of new facilities.

Customer just change of mind- rework, then bring to attention changes in CAPEX, timing delays- penalties

new legal requirements - lead to the delay of the project schedule and cause extra costs for owners.

APPENDIX 3

Respondent 3 Comments

So many factors influence for delays from few months to years. As per my experience with HEC, reasons for delay:

A. FROM CLIENT

1. Change of scope of work
2. No payment to EPC
3. Political sanctions
4. Late site handover to EPC contractor
5. Poor FEED design basis

B. FROM EPC CONTRACTOR

1. Delays in EPC designs
2. Poor designs
3. Delays in procurement
4. Working with incapable subcontractor

C. UNUSUAL & COMPLEX SITE CONDITIONS (both Owner and EPC)

1. Poor selection of site by Owner
2. Poor study on Feasibility and FEED stages by Owner
3. Not informing the history of site (made ground and type of soil used such as contaminated soil or uncontrolled fill for site preparation) and unusual behavior of soils after excavation such as ground settlement & ground water influences.
4. Late handover site, EPC contractor perform detail site investigation. Then if they found unusual soil conditions, there is big argument for scope change and variation order.
5. Most importantly, if EPC contractor did not find problems during their poor investigation, then during construction Foundation settlement occur...to take remedial actions need months to years some situations.

Corona update

1. 50 % employees working from HOME in alternate days.
2. No meetings in closed rooms.

3. Most of meetings within the company, with Owners and PMC and Vendors are conducting through MS Team or Skype or Zoom. It results increase of meetings times than face to face meetings. Miscommunication. Bad communication issues.

4. Pregnant women employs are asked to work from HOME every day.

5. All employees should wear mask during working hours.

6. Temperature measurement are taken from all the employees. If finds some one high temperature, then COVID19 test is performed. Yes. Projects got delayed much. -Newly awarded once on hold last 9 months -some ongoing projects also delayed about 4 months.

APPENDIX 4

Respondent 4 Interview Notes

With Deputy Processing Engineering Manager of a Kazakh state oil refinery – Owner
Interview was originally in Russian.
Translated and transcribed as follows:
Kazakh State Oil Refinery located in Pavlodar city. The situation was that we did a project on refinery modernization in 2013 with a planned deadline of 2016, it actually completed in December 2017. 1 year delay.
Reasons: Main Contractor for EPC was RomInServ (a Romanian EPC company bought out by same Kazakh state oil refinery), RomInServ hired a Subcontractor a Korean corporation GeTech for Engineering and Procurement works, for Construction works another Russian subcontractor was hired. In Kazakhstan there is no modern engineering companies, for this reason GeTech was hired

1. Main reason of delay was different engineering practice. GeTech had technical practice as per International standards of EPC works, while in ex-USSR countries there are their own standards and norms, according to which projects are performed. Therefore, an additional subcontractor- a company-adaptant had to be hired, the company that knows exUSSRs procedures and can assist Contractor in executing project according to local standards, as it shall be done. It all took time for a Korean Contractor to get to know local standards- delay during FEED stage- around 6 months. The it was that like Korean Contractor would make engineering design and a company-adaptant corrects and adapts it according to local norms. This caused delay. Kazakh refinery couldn't accept documentation prepared by Korean Contractor for a long time as it was not in conformance to local standards.
2. Delays were because of Vendor and Contractor during Procurement stage. Vendors were from different countries, including Russians. Russians did equipment according to GOST (Russian standards) and Contractor did all drawings according to ASME (International standards). Re-work had to be done, another 6 months.
3. Check what contractor is doing. Oftentimes Contractor would report to Client that all is good, no problems and then at the end problems occur. It would be good to have a representative manager present with Contractor at all times to check what is actually happening.

4. Best way for a smooth and timely completion is when there is only Owner and Contractor. When there are too many subcontractors, adaptants, advisors, there is too much argument , parties blaming each other, conflicts. Too much time to agree on things. Write out who is responsible. Clear out this matter
5. When project is International there is a language barrier causing delays as well. Not so many competent technical translators. More complicated process and interaction.
6. There should be a constant control and check to identify issues in order to solve them as soon as possible and/or take measures to avoid delays- responsibility of Project manager as well as a Manager from Owners' side constantly present during project.
7. Last thing causing delay was that Scope of Works had to be changed because the Project's objectives were changed as well as its budget.

APPENDIX 5

Respondent 5 Comments

Delay in EPC Project: Usually delay in EPC Projects are caused by following reasons:
1. Too optimistic planning of EPC phase, which may leads to delay as engineering and construction teams struggles to meet deadline.

2. Completely new territory in terms of location, country of EPC execution. EPC Contractor finds difficult to understand local codes and standards especially in CIS countries where, Codes and standards are in Russian language also approval authority creates hurdle to give clearance to the project

3. During Bidding phase, if ITB (invitation to bid) documents are incomplete and if Owner doesn't resolve the Bidder's query this will lead to delay in execution of the project.

4. Delay in supply material from subcontractor to main Contractor.

5. Pandemic effect:

a. As we are forced to work from home, the design review meeting with owner which occurs face to face takes longer (estimated consumed 20% more time) considering these meeting lasts for a month or even more.

b. Manpower deployment to construction site is delayed due to unavailability of international flights. c. Fabrication and shipment schedule of long-lead items are severely affected.

APPENDIX 6

Questionnaire

Validating Expert 1

1. Other suggestions and ideas on improvement of project and minimize delays? Anything missing?

Author has very well covered on the aspect that could delay the project at various stages such as engineering, procurement and construction. There would be always great and different challenges in executing any project as each project is different in its nature and location of the Project. In addition to the delays covered by the Author it is also required to focus on the schedule risks and management of the Safety and quality aspects of the Project. Though the safety and quality aspects are not directly involved in delaying the project, however these aspect have very high potential in delaying the project when they are not in line with the project requirement. It is very important to maintain the Zero defects and Zero accident in the project by which schedule of the project will not be disturbed.

2. Can these suggestions be implemented in your company? Is it important to implement them? How can they be implemented?

The suggestion mentioned and coverage made by the Author are very helpful in academic purpose, however in real scenario the project execution and completion includes variety of challenges. The suggestion made by the Author have been thoroughly applied in our Project. Our projects have been implemented as per the PMBOK (Project Management Body of Knowledge) guidelines.

3. What do you think should be further developed in the proposal? How do you find the table, is it useful?

Most of the points that could be added and incorporated in the proposal stage are briefly covered above and this table would be a ready reckoner to under various aspects that involve during the bidding stage. It also provides a path to lead further research and development of the bidding process of an EPC project.