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Improving the Information Flow Regarding Customer Needs to the Electrical Engineering Department

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I would like to thank my employer – the case company of this study, and my instructor for enabling the focus and resources that this Thesis has required. I would also like to acknowledge those of my colleagues in the case company that has participated in the data collection phases through interviews, workshops and evaluation. They have been truly interested and enthusiastic towards the topic of this Thesis. Through the positive feedback and support that I have got from the key stakeholders, I have realized that the Thesis serves a real demand.

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This Thesis focuses on improving the information flow regarding customer needs from Marine segments to the Electrical Engineering department. The case company provides its services for Land and Marine applications all over the world – either as turnkey or instrument deliveries. End-customer delivery projects tend to vary significantly from each other due to local regulations and customer specifications. Therefore, the case company needs to deliver a unique system for each End-customer individually.

End-customer delivery projects for Marine segment call for a comprehensive understanding of customer needs by all the internal stakeholders in the case company. However, the communication distance from the customer via Sales and other functions is quite long and the detailed needs do not always come through the Electrical Engineering department or the message might be misinterpreted somewhere in the communication chain.

The approach to conducting research in this Thesis was an Action research with a combination of mainly two different research strategies. These two strategies are qualitative research and field study method. Data was collected within the case company through interviews, workshops and feedback. This study was conducted by analyzing the current state first, which guided the choice for relevant literature to help for proposing logical improvements.

In the current state analysis, findings suggested that the ease of communication is a key strength, whereas lack of communication across organizational borders, obstructions in information flow and insufficient collaboration structures were identified as key weaknesses. By the guidance of relevant literature and the help of stakeholder suggestions, several specific improvements were proposed to increase communication across organizational borders, enable transparency in information flow and improve cross-organizational collaboration.

The departmental inequality in knowledge of customer needs is typically a result of poor internal communication. If the internal information flow regarding customer needs is not sufficient enough, eventually the customers might be dissatisfied with their products or services. Inadequate internal information flow is recognized throughout the case company, and tangible improvements suggested in this Thesis are expected to be taken into use.

Keywords	Electrical Engineering department, Sales, Project department, information flow, communication, collaboration

Contents

List of Figures

1 Introduction

Today's world of internet access and mobile connectivity has changed the mind-set of customers. Customers are more aware and informed of potential service providers than ever before. This transition has forced companies to switch towards a customer focused approach where service providers must know the needs of their customers. Companies that have the best understanding of the customer needs typically succeed in the increasingly competitive world. Therefore, customer focus is an area which companies emphasize in their businesses in order to succeed.

Companies that are successfully implementing the customer focus in their day-to-day operations need to have an equal understanding of the customer needs throughout the company. Some companies state that they are very customer focused, but actually they might have a wide gap in understanding the needs of their customers between different stakeholders.

For example, sales representatives may be very well aware of the customer needs, but the back-office employees could be equipped with relatively limited knowledge of their customer needs. This inequality in knowledge is typically a result of poor internal communication of the customer needs. If the internal information flow regarding customer needs is not sufficient enough, eventually the customers might be dissatisfied with their products or services. This could be harmful for a company, because after all, customers pay the salaries of the company's whole personnel and usually dissatisfied customers do not repurchase.

1.1 Business Context

The case company of this study is a company, which is the global leader in the field of water mist fire protection. Water mist fire protection is competing against traditional sprinkler systems. When comparing the two different solutions, water mist fire protection is a more powerful solution in terms of water supply efficiency and fire suppression capabilities. Water mist fire protection was established by the case company in 1991 and it has been steadily gaining market share ever since.

The case company provides its services for Land and Marine applications all over the world – either as turnkey or instrument deliveries. Land and Marine applications are delivered either directly to the End-customer or via local distributors. Marine's direct End-customer interphase is typically a local distributor or a shipyard; rarely does end-user interphase or communication occur.

End-customer delivery projects tend to vary significantly from each other due to local regulations and customer specifications. Therefore, the case company needs to deliver a unique system for each End-customer individually. Product customization requires remarkable resources of personnel for example from engineering, who must have a clear understanding of the customer specific needs.

1.2 Business Challenge, Objective and Outcome

End-customer delivery projects for Marine segment call for a comprehensive understanding of customer needs by all internal stakeholders in the case company. The concerned stakeholders consist of Sales management, Sales support, Project management, Project engineering and obviously the Engineering department also. The Engineering department in the case company provides mechanical and electrical design for End-customer delivery projects, and especially the Electrical Engineering department requires intimate presence and information of customer needs.

However, the communication distance from the customer via Sales and other functions is quite long and the detailed needs do not always come through the Electrical Engineering department or the message might be misinterpreted somewhere in the communication chain.

The objective of this Thesis is to improve the information flow regarding customer needs from Marine segments to the case company's Electrical Engineering department. The outcome of this Thesis is an improvement proposal to improve the information flow regarding customer needs from Marine segments across cross-functional stakeholders into the case company's Electrical Engineering department.

1.3 Thesis Outline

The scope of this Thesis is to propose improvements to the information flow regarding customer needs from Marine segments to the Electrical Engineering department. As the customer needs from Land segments could be also studied, this Thesis is limited towards Marine based customers only. By focusing on improving the information flow, a specific action plan is excluded from the scope of this Thesis.

This Thesis is written in 7 sections. Section 1 in this Thesis provides an introduction to the study. Section 2 describes and defines the methodology used in this Thesis. Section 3 overviews the Current State Analysis (CSA) of the case company, while section 4 provides a Conceptual Framework (CF) from existing knowledge. Section 5 focuses on building a solution by combining the best practices found from the current state analysis and existing knowledge. Section 6 summarizes the validation process of the proposal. Finally, section 7 concludes the Thesis with recommendations and further actions for the case company

2 Method and Material

This section introduces common research methods that are utilized in this Thesis. Along with the methods that construct the foundation for the research approach, a plan for data collection plan is visualized. By combining the research approach and the data collection plan, a research design showing the different steps of the study is demonstrated accordingly.

2.1 Research Approach

The purpose of accurately defining the research approach is to realize and identify the barriers of a rigorous research. It also sets the perspective and guidelines the progress of the Thesis. The approach selected for this Thesis is an Action research with a combination of mainly two different research strategies. These two strategies are qualitative research and field study method, explained in more detail towards the end of this subsection.

Action research was introduced in the 1950s in a social-psychology work done by Kurt Lewin and it has been a recognized way of doing research ever since. The Action research approach is utilized to solve a practical challenge - usually aiming to improve and/or change current practices within an organization by a cyclical process. This process includes planning, taking action accordingly and evaluating the results. Action researches are common for researchers who work closely together with the employees – or practitioners of the case company. Therefore, within an organization, Action research gives an opportunity for the involved stakeholders to create knowledge. (Huang 2010)

Action research has a close relationship with qualitative research because qualitative data is collected from interviews, documents, workshops and other similar case company related methods which require participation from practitioners. Unlike quantitative research, qualitative research is not aiming to gather data from several sources and ultimately translating it into a statistical overview - rather it aims to identify variable details in a particular problem that requires further investigation.

Qualitative research has several characteristics that define this type of research. Probably the most common characteristics are; investigation of a challenge and developing

an understanding of the specific challenge, gathering data from a minor number of practitioners to enable detailed and in-depth views, and analysing the collected data in a way that would translate into a broader meaning of the challenge. (Creswell 2005)

In addition to qualitative research, field study is a supportive research strategy. Field study is an alternative option for desk studies. The main difference between these two is that field studies aim to gather primary data "from the field" and desk studies gather secondary data from relevant documents within the company or from other publications. (Blaxter et al. 2006)

Action research is considered the best approach to this Thesis, since the Thesis aims to improve a practical problem. Unequal knowledge of customer needs within participating stakeholders in a company is a practical and a commonly identified issue. The methods for data collection reflect the features of Action research, as practitioners' from the case company are invited to participate and their knowledge is utilized.

As Action research and qualitative research are linked closely to each other, it is a natural selection to utilize mostly the qualitative research method. Qualitative data is collected within the case company through interviews and workshops, which requires practitioners' participation.

In this Thesis, field study is applied as a supportive research strategy along with qualitative research. As a field study, mostly primary data is utilized and it is gathered from practitioners within the case company to ensure best insights. For this Thesis, the selection of a field study is quite evident as the involved stakeholders have the greatest knowledge and deepest understanding of the business challenge.

2.2 Research Design

This Thesis is planned to follow the progress illustrated in Figure 1. The Research design visualizes the steps of the Thesis, the data resources utilized for each part and the outcomes of the steps.

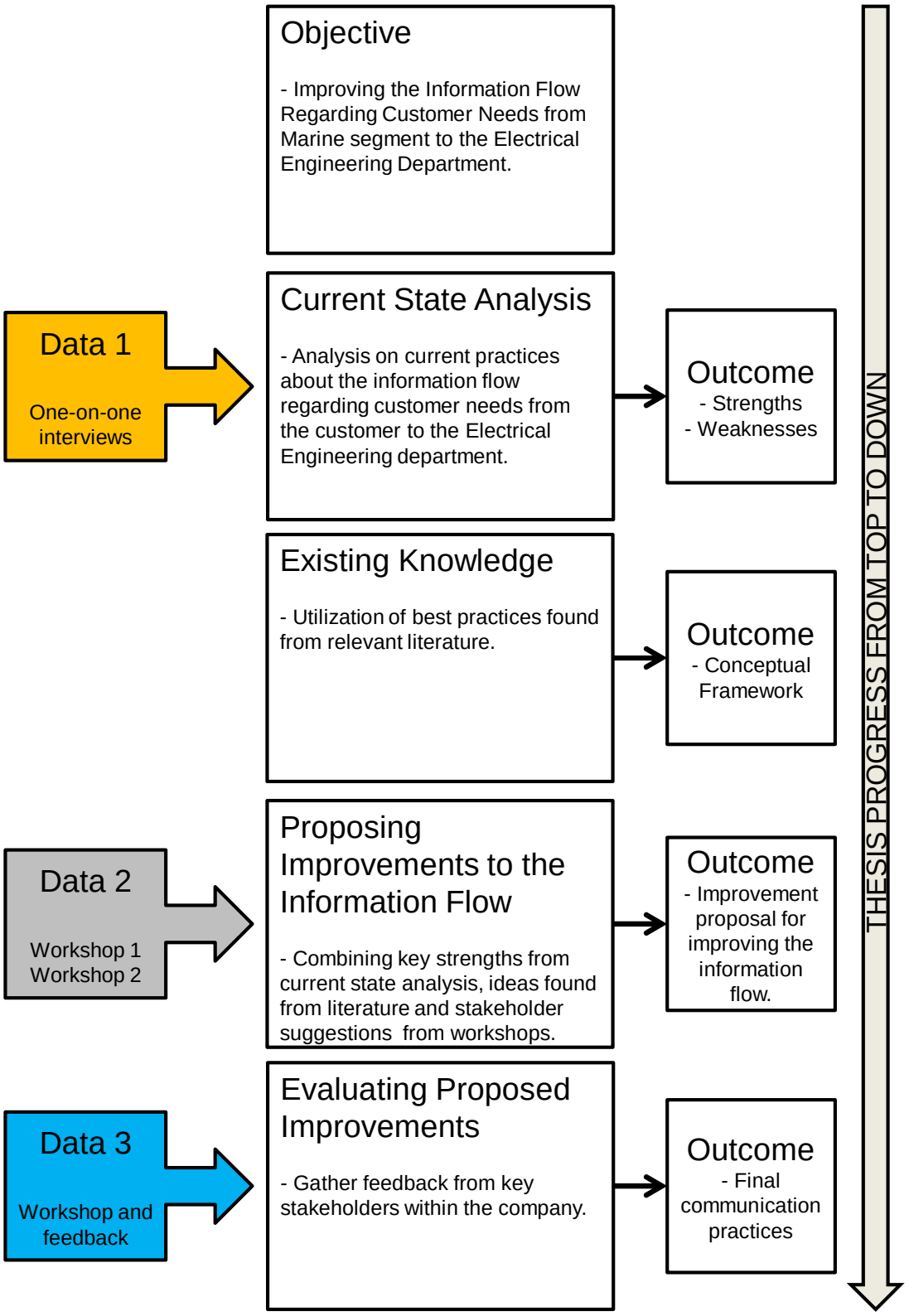

Figure 1. Research design of this study.

As demonstrated in Figure 1, this research kicks off by setting the objective. The objective is a crystal clear “target” of the Thesis or a statement a study is seeking an answer for. The objective is formulated as a result of business problem which exists in the case company.

Followed by the objective setting, this Thesis continues with the Current State Analysis (CSA) by the help of available data. The current state analysis focuses on current practices of seeking for information regarding customer needs and enabling the information to flow to the Electrical Engineering department in the case company. The current state analysis eventually reveals key strengths and weaknesses of the current practices.

The next step in the research is to review literature and summarize findings from existing knowledge. Weaknesses found from the current state analysis points to relevant literature that eventually should present possible solutions and ideas for improvement. The outcome of the literature review is the Conceptual Framework (CF).

With the conceptual framework in place, this research proceeds with proposing improvements to the information flow regarding customer needs. The improvements are co-created by combining the current strengths revealed by the current state analysis, ideas presented in the conceptual framework and available data. The outcome of this stage is an improvement proposal for improved information flow.

The next step is to evaluate the improvement proposal by gathering feedback for the proposed improvements. The proposed improvements are evaluated by their relevance, possibility for implementation and prioritization from the perspective of the case company. The outcome of this stage is a final version of the communication practices, which is modified according to the required adjustments.

2.3 Data Collection and Analysis

As the Research Design (Figure 1) suggests, data is collected in three phases of the Thesis. Data is collected to ensure a more potent footprint for decision-making procedures and provide deeper understanding of the issue at hand for the researcher. With the help of data, evidence-based improvements and decisions can be made in the latter parts of the Thesis. More specific details of the data are summarized in Table 1.

Table 1. Data 1-3 collection for this study.

	Data type	Role	Topic	Date	Length	Documented
1	One-on-one interview	Marine sales respondent 1.	Information flow regarding customer needs.	January 26th, 2017.	70 min	Field notes
2	One-on-one interview	Marine sales respondent 2.	Information flow regarding customer needs.	January 31st, 2017.	60 min	Field notes
3	One-on-one interview	Marine projects respondent 1.	Information flow regarding customer needs.	January 30th, 2017.	75 min	Field notes
4	One-on-one interview	Marine projects respondent 2.	Information flow regarding customer needs.	January 31st, 2017.	65 min	Field notes
5	One-on-one interview	Engineering respondent 1.	Information flow regarding customer needs.	January 26th, 2017.	80 min	Field notes
6	One-on-one interview	Engineering respondent 2.	Information flow regarding customer needs.	January 26th, 2017.	60 min	Field notes
7	Workshop 1	Marine sales and projects, engineering.	Building improved practces.	March 29th, 2017.	120 min	Field notes
8	Workshop 2	Marine sales and projects, engineering.	Building improved practces.	April 4th, 2017.	60 min	Field notes
9	Feedback and workshop	Engineering top management	Evaluate the improved practives.	April 12th, 2017.	65 min	Field notes
10	Feedback and workshop	Marine top management	Evaluate the improved practives.	April 12th, 2017.	70 min	Field notes

As shown in Table 1, mostly qualitative research is utilized for data collection. The study relies on six interviews, two workshops and two feedback sessions designed to have a balance between different organizations to ensure a more comprehensive view of the business challenge.

Data 1 is collected from the current state analysis stage. Six interviews are done in assistance for the analysis to ensure the most accurate description of the current practices. Each interview is carried out individually to facilitate open conversations which would reveal a wide range of strengths and weaknesses. The time consumed for each interview is between 60 and 80 minutes. Field notes are taken from the interviews. To ensure the most accurate results from the interviews, the participants were not introduced to the list of questions in advance and field notes made in the interviews were checked afterwards by the interviewee.

Data 2 is utilized when proposing improvements to the information flow regarding customer needs. Two meetings are arranged with the interviewees and workshops for stakeholder suggestions are held. The purpose of the workshops is to generate ideas for improving information flow regarding customer needs to the Electrical Engineering department. Eventually, the data collection details are analysed and relevant suggestions are embedded into the improvement proposal for improved information flow.

Data 3 is required when validating the improvement proposal for improved information flow. The available data in this phase is evaluation and feedback gathered from key stakeholders from the top management of the case company. Eventually, the evaluation and gathered feedback are analysed to form the revised, final communication practices.

The data collected to this Thesis was analysed by using Thematic content analysis.

3 Analysis of the Current Information Flow Practices in the Company

This section focuses on analyzing the current practices of the information flow regarding customer needs. After a brief overview of the analysis, this section proceeds by providing an organizational structure of the case company, a detailed project progress analysis and a description of the current information flow practices. Strengths and weaknesses of the current practices are presented and the section is concluded with a summary of key findings.

3.1 Overview of the Current State Analysis Stage

The current state analysis starts with the overview of the organizational structure of the case company. It allows to get an understanding of the context and structure of the departments within case company which is important for the topic of the study.

Next, the analysis focuses on the projects that the case company is involved in. After a brief overview of the services that the case company provides, the analysis describes the project progress of an *End-customer delivery project*. Departmental tasks in the progress and the lifecycle of typical End-customer delivery projects are also presented.

After that, the analysis concentrates on the detailed analysis of the current information flow practices. Information regarding customer needs flows into the case company mainly in three various occasions: information flow in *New projects*, information flow in *Project updates* and information flow of *General knowledge*. The three occasions are independently presented and analyzed to provide a comprehensive understanding of the current information flow practices.

Based on the findings from these steps, an analysis of key strengths and weaknesses in the current practices is done. After an individual analysis of the strengths and weaknesses, a summary of key findings is done accordingly.

The current state analysis is conducted with the help of available data sources. The data sources in this analysis are the interviews that are individually carried out with respondents within the case company. Interviews were chosen as the primary source of data, because previous documentation of relevant procedures does not exist in the case company. Respondents form a mixture of stakeholders from different organiza-

tions, which enables variable perspectives of the current practices. The interviewees are stakeholders from the Sales department, the Project department and the Engineering department, all of which are involved in the information flow regarding customer needs.

The purpose of conducting one-on-one interviews is to accommodate an open conversation of the current practices. As the respondents represent a variety of organizations in the communication chain, individual interviews enables for a deep insight into the current practices and a more reliable qualitative analysis. The logic of the interviews was to discuss the information flow in general and to seek for those occasions when information regarding customer needs is required in the Electrical Engineering department. By identifying the different occasions, a holistic analysis of the information flow practices, along with the strengths and weaknesses of the current practices can be addressed.

3.2 Organizational Structure of the Case Company

The case company is a matrix organization, which includes two organizations with a direct End-customer interphase. The two organizations with a direct interphase are Marine Business Unit and Land Business Unit. These two business units are backed up with several internal support functions, e.g. Operations, Finance and Customer Solutions Management to name a few.

Customer Solutions Management (CSM) is a support function, which provides technical support to internal organizations as well as the End-customers. Along with technical support, CSM is responsible for carrying out New Product Development (NPD) and project specific design for End-customer delivery projects. Project specific design consists of Mechanical and Electrical Engineering.

As the objective of this Thesis is improving the information flow regarding customer needs from Marine segments to the Electrical Engineering department, the key focus in this Thesis is the communication between the three internal departments: the Sales department, the Project department and the Electrical Engineering department. Structurally, the Sales department and the Project department are a part of Marine Business

Unit and the Electrical Engineering department is a part of the support function Customer Solutions Management.

As the organizational structure is concluded with departmental roles and an overview of the structure of the case company, this Thesis proceeds to the next sub-section. Next sub-section focuses on the progress of an End-customer delivery project.

3.3 Progress of an End-customer Delivery Project

The case company provides its services for Marine applications all over the world – either as turnkey or instrument deliveries. Marine's direct End-customer interphase is typically a local distributor or a shipyard; rarely does end-user interphase or communication occur. End-customer delivery projects tend to vary significantly from each other due to local regulations and customer specifications. Therefore, the case company needs to deliver a unique system for each End-customer individually. Product customization requires remarkable resources of personnel for example from Engineering, who must have a clear understanding of the customer specific needs.

Based on the data gathered from the interviews, the chronological progress in an End-customer delivery project typically follows a seven-step model. The seven steps are pre-sales phase, project kick-off, project specific design, design freeze and material delivery, system modifications, installation and commissioning, and project closing as illustrated in Figure 2.

Figure 2. Progress of an End-customer delivery project.

As seen from Figure 2, first, in *the pre-sales* phase, the customer and the Sales department are in negotiation with the customer regarding diverse terms and project specific details. The project specific details concerns e.g. scope of supply, technical specification material delivery schedules, invoicing periods, etc. In the pre-sales phase, other departments are consulted on technical details when needed.

Next, the project is launched or *"kicked-off"* in a meeting, where representatives from the Sales department, the Project department and occasionally the Electrical Engineering department are present. In this meeting, the Sales department hands the project out to the Project department for execution and management. Relevant information about the delivery schedule, scope of supply and technical details is shared.

Third, *the project specific design* begins right after all relevant information and technical details are mutually agreed. The design phase might vary tremendously between different projects – some might require several months whereas some can be handled within days. During the design process, the customer can approach the Project department with issues that need to be updated before delivering the material – in other words, the project scope can change either from narrower or to wider during the design.

Fourth, as *the material delivery* date becomes close, a design freeze is set. A design freeze does not mean that no more modifications are done to the project scoping; rather it is the point when the current design will be utilized for manufacturing. All customer specific requirements are agreed between the Project department and the customer. It is the Project department's responsibility to ensure that all requirements are fulfilled in the current design. After the relevant material is sourced, assembled and tested, the material will be delivered to the respective customer.

Fifth, *the system updates* and modifications are usually made at some point of the delivery process. Mostly only projects with a narrower scope of delivery are carried out without any modifications during the project lifecycle. System modifications are made at various phases in the project lifecycle, but usually needs for updates appear after the material delivery as the project evolves the most between the material delivery and installation.

Sixth, *the field service* stage includes installation of the system after the material delivery. The time period between the material delivery and installation can vary significantly, but typically the project is on stand-by for months or even a year from the perspective of the case company. When the installation is finished successfully, it is time for the commissioning of the system. During the commissioning, fast-pace updates and/or modification are required on board.

Finally, as the system is successfully commissioned, the *project is closed* from the execution perspective. Feedback from the customer and commissioning field service is shared to the Sales department and Project department – whether it is positive or negative. Only rarely is the feedback shared with the Electrical Engineering department. The project closing does not include regularly appointed meetings, where the feedback would be shared and analysed across the stakeholders.

The lifecycle of an End-customer delivery project varies significantly depending on the scope of supply. In a straightforward and a simple End-customer delivery project, the seven step cycle can be handled in approximately six months, whereas larger and more complex projects can last up to five years. The progress and the lifecycle of an End-customer delivery project are important to address as background knowledge, which helps to understand the detailed analysis of the current information flow practices.

As the progress of an End-customer delivery project is concluded with an overview of the lifecycle, this Thesis proceeds to the next sub-section. Next sub-section concentrates on the detailed analysis of the current information flow practices.

3.4 Detailed Analysis of the Current Information Flow Practices

As the collected data from the interviews was analysed, an overview of the current practices in information flow was defined. The involved stakeholders in the communication chain consist of the customer and three of the case company internal organizations: the Sales department, the Project department and the Electrical Engineering department.

The Electrical Engineering department require information regarding customer needs in various occasions, all of which can be divided into three main categories: information regarding *New projects*, information regarding *Project updates* and information regarding *General knowledge*. All of the three occasions when information regarding customer needs is required by the Electrical Engineering department are discussed one by one below with an illustration of information flows.

3.4.1 Information Flow in New Projects

The first type of the information event when customer related information gets distributed and discussed is when a new End-customer delivery project is initiated. *New projects* fall into two different sub-categories - they can be either an End-customer delivery for a totally new project or an upgrade to an existing system. Both situations are carried out similarly and the information flows exactly the same way to the Electrical Engineering department, as illustrated in Figure 3.

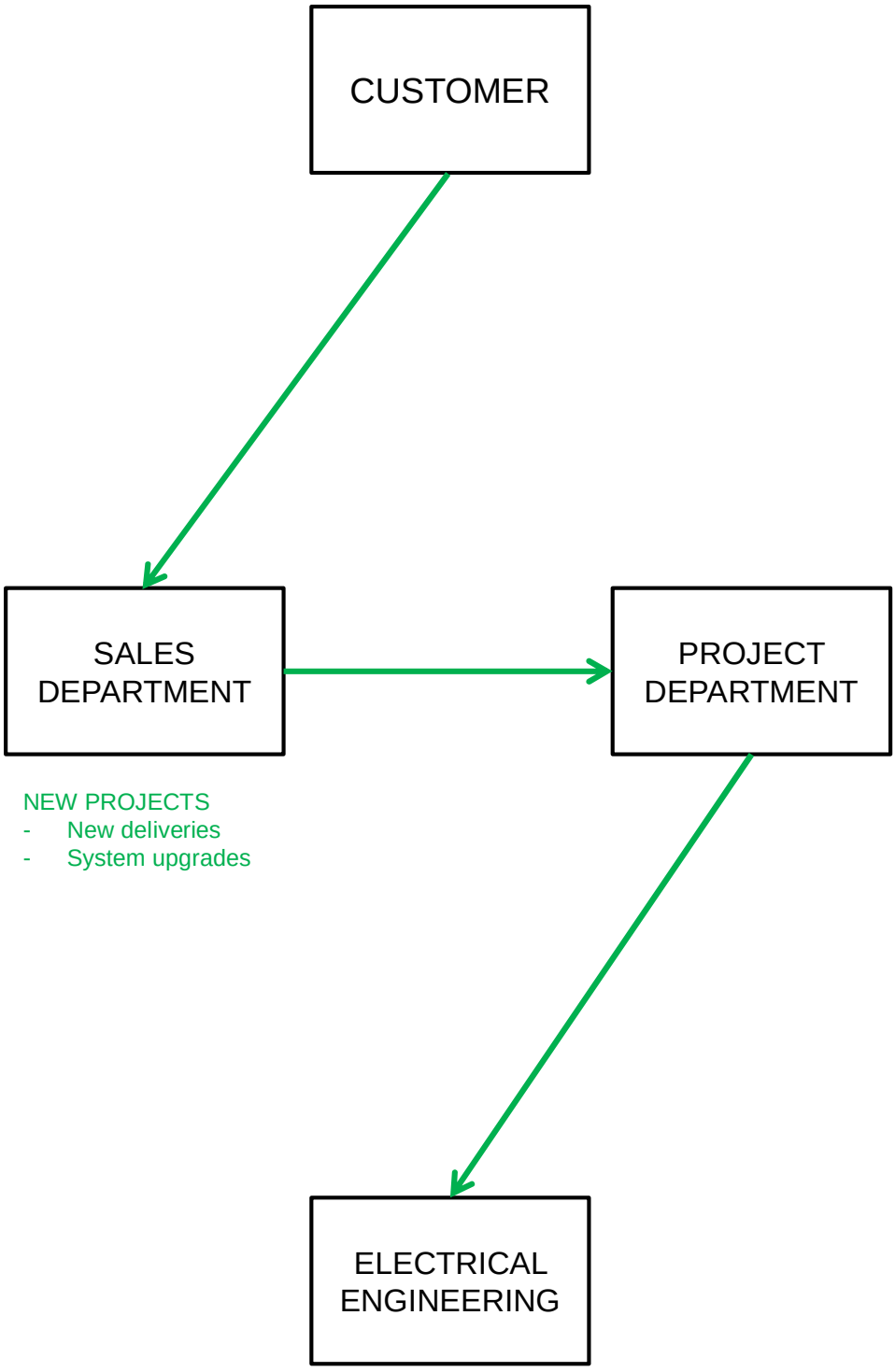

Figure 3. Information flow in New projects.

As seen from Figure 3, in the sales phase, the communication is initiated by the customer and is in direct contact with the Sales department. The customer and the Sales department agree on diverse terms and project specific details concerning e.g. material delivery schedules, invoicing periods, scope of supply, technical specification etc. A mutually confirmed purchase order is the moment of time, when the information of customer needs lands in the case company and at that time, the information is owned by the Sales department.

Right after a confirmed sale, a project kick-off takes place. At this moment, the Sales department shares the project specific information with other stakeholders. Specific information is listed in a datasheet, which covers customer requirements and technical details. However, rarely are all customer specific requirements known and usually some changes in the scope of supply may occur afterwards.

Gathering the accurate customer specific requirements and agreeing on technical details are the responsibility of the Project department in co-operation with the customer. When the Project department has received comprehensive information needed for the project execution, relevant information is eventually shared with the Electrical Engineering department.

In summary, along the information flow in *New projects*, the information flows into the case company from the customer and the information eventually lands to the Electrical Engineering department through the two case company internal departments: the Sales department and the Project department.

3.4.2 Information Flow in Project Updates

The second type of the information event when customer related information gets distributed and discussed is during project specific updates. Presently, *Project updates* can be done throughout the project, but typically between the kick-off meeting and field service. *Project updates* also fall mostly into two different sub-categories - they can be either additions or modification to the previously agreed scope of supply. Additions and modifications are handled case by case, and eventually the information flows to the Electrical Engineering department, as illustrated in Figure 4.

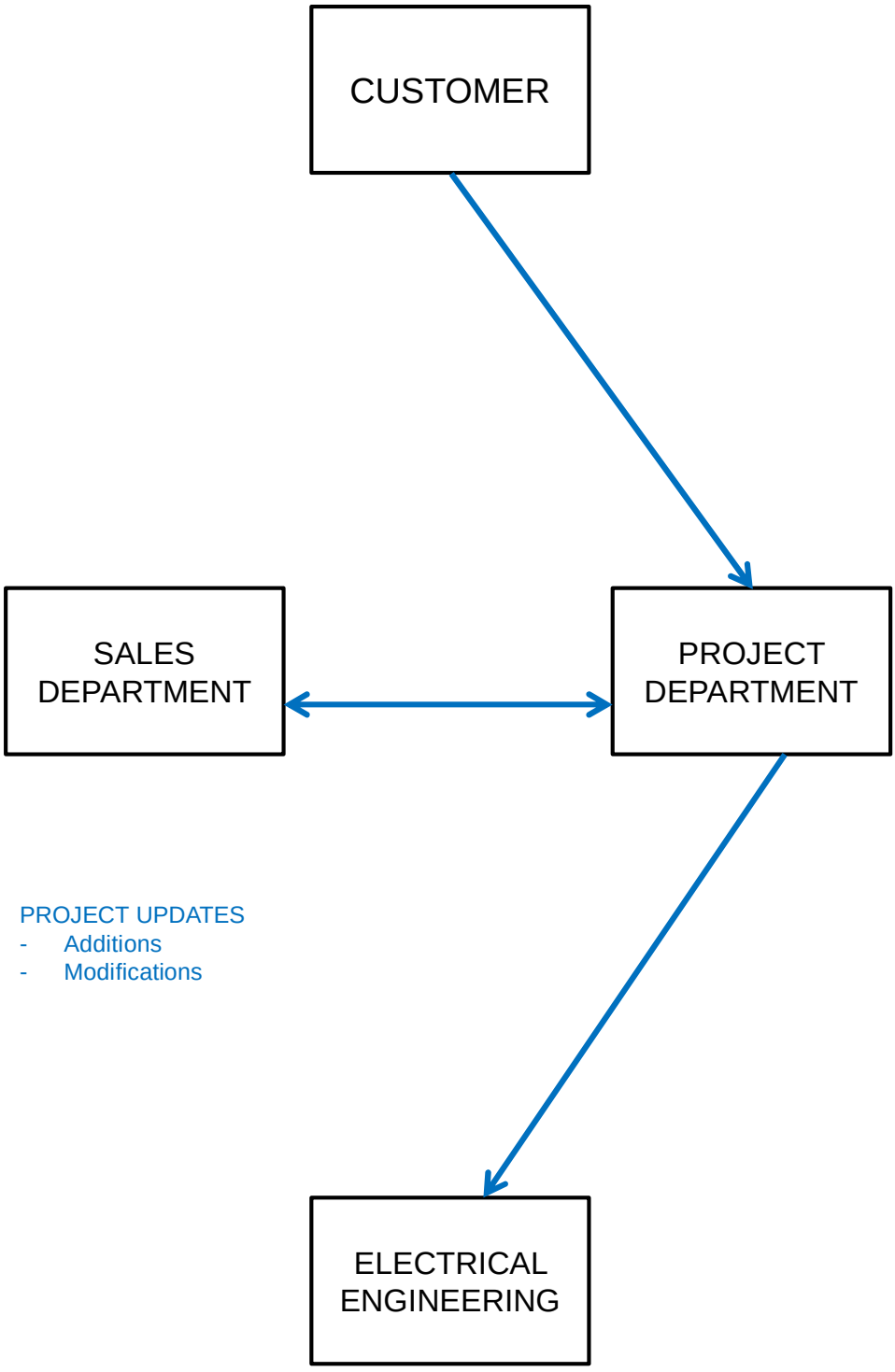

Figure 4. Information flow in Project updates.

As Figure 4 illustrates, *Project updates* are initiated by the customer. As a new project has been handed out from the Sales department to the Project department, in *Project updates* the customer is in direct contact with the Project department. The customer approaches the Project department with requests of specific additions or modifications. Therefore the information of customer needs lands into the Project department first.

Customer specific requests are handled case by case, depending on the quantity and the scale of the required updates. Minor updates can be delegated directly to the Electrical Engineering department for design modifications. However, most cases and definitely larger updates require discussion from the Project department with the Sales department, whether the updates impact the scope of supply or project expenditures.

After a mutual agreement on diverse terms by the customer, the Sales department and the Project department, the information regarding customer needs flows into the Electrical Engineering department. The information flows via the Project department, which explains the technical details and customer specific requirements that need to be updated accordingly. The information is shared variably towards the Electrical Engineering department depending on individual preferences.

In summary, along the information flow in *Project updates*, requests for updates are initiated by the customer. The customer is always in direct contact with the Project department and the information eventually flows to the Electrical Engineering department through the Project department.

3.4.3 Information Flow of General Knowledge

Finally, the third type of the information event when customer related information gets distributed and discussed is the information flow of *General knowledge*. Information flow of *General knowledge* falls into several different sub-categories - which can be project execution details, constructive feedback, installation and commissioning information, and customer satisfaction just to define a few. The target of sharing *General knowledge* is to increase internal awareness regarding customer needs. The information flow of *General knowledge* is illustrated in Figure 5.

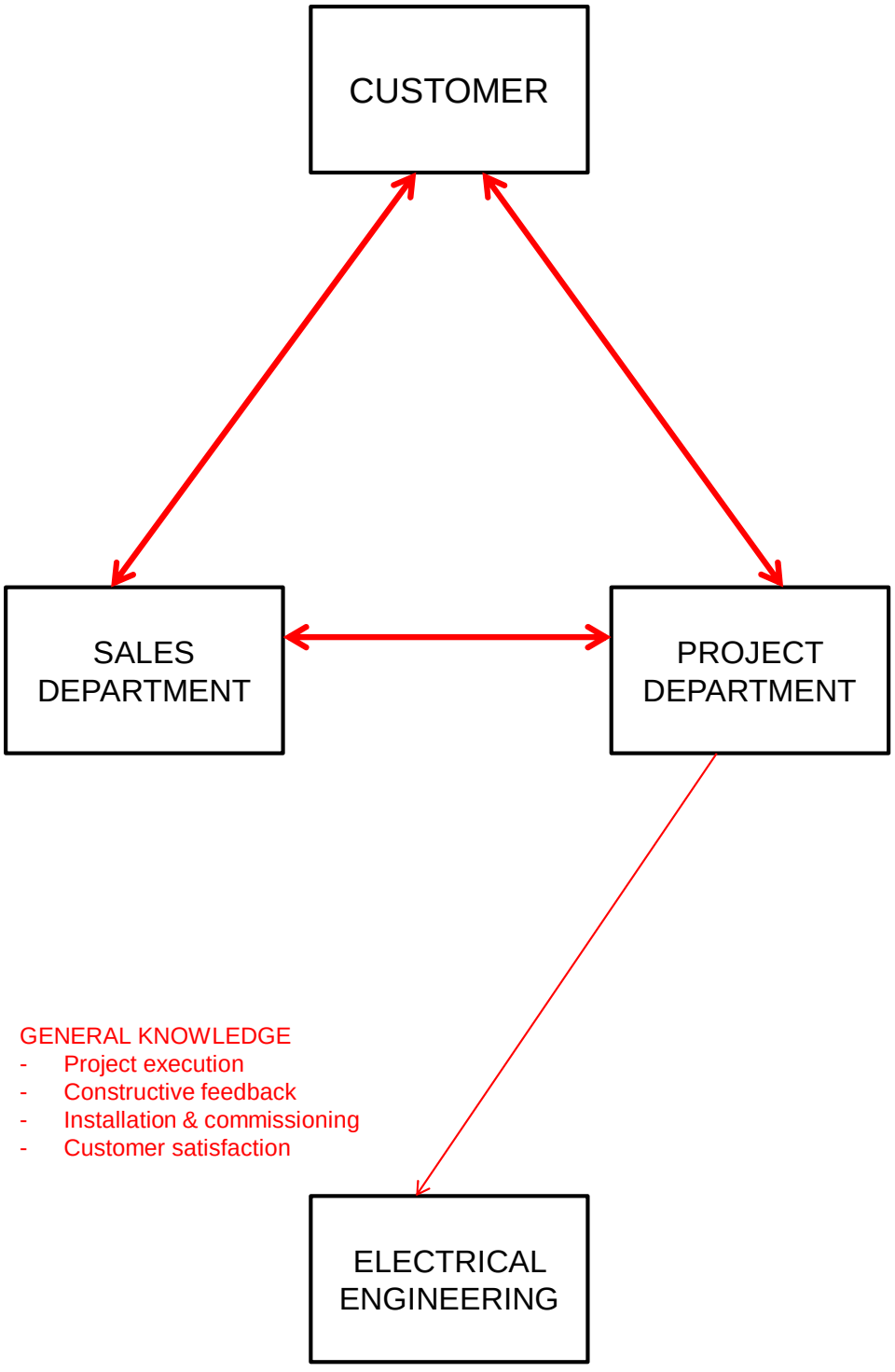

Figure 5. Information flow of General knowledge.

As seen from Figure 5, *General knowledge* that is initiated by the customer, such as satisfaction regarding delivery schedules, success of installation and overall flexibility of project execution flow into the case company variably. The customer either contacts the Sales department or Project department, depending on the issue at hand. Therefore the customer chooses the information channel, which suit best for the situation.

The information about *General knowledge* lands in the case company, regardless of which channel the customer chooses. The received information is shared openly across the Marine Business Unit in the Sales and the Project department, and the valuable feedback is used to build internal knowledge, which will be utilized in future challenges. It is also worth noticing that the information does not flow only from the customer towards the case company, sharing of *General knowledge* is bidirectional.

The information link between Project department and Electrical Engineering department is illustrated in Figure 5 with a narrower arrow for a purpose – information flow into the Electrical Engineering department is unregulated. The communication link towards the Electrical Engineering department is also somewhat muted, as most of the critically important *General knowledge* never flows into the department.

Summing up, along the information flow of *General knowledge*, information is shared unsystematically among the stakeholders in the communication chain. The information flow of *General knowledge* is shared openly between the customer and the Marine Business Unit internal departments: the Sales department and the Project department. Only occasionally the information flows to the Electrical Engineering department.

3.4.4 Summary of Information Flows

As the three individual main events triggering information's flows are analysed separately, all information flows are merged into the same figure to be able to realize the current information flow holistically. The Project department is responsible of delegating the information towards the Electrical Engineering department in all of the three different variations as Figure 6 illustrates.

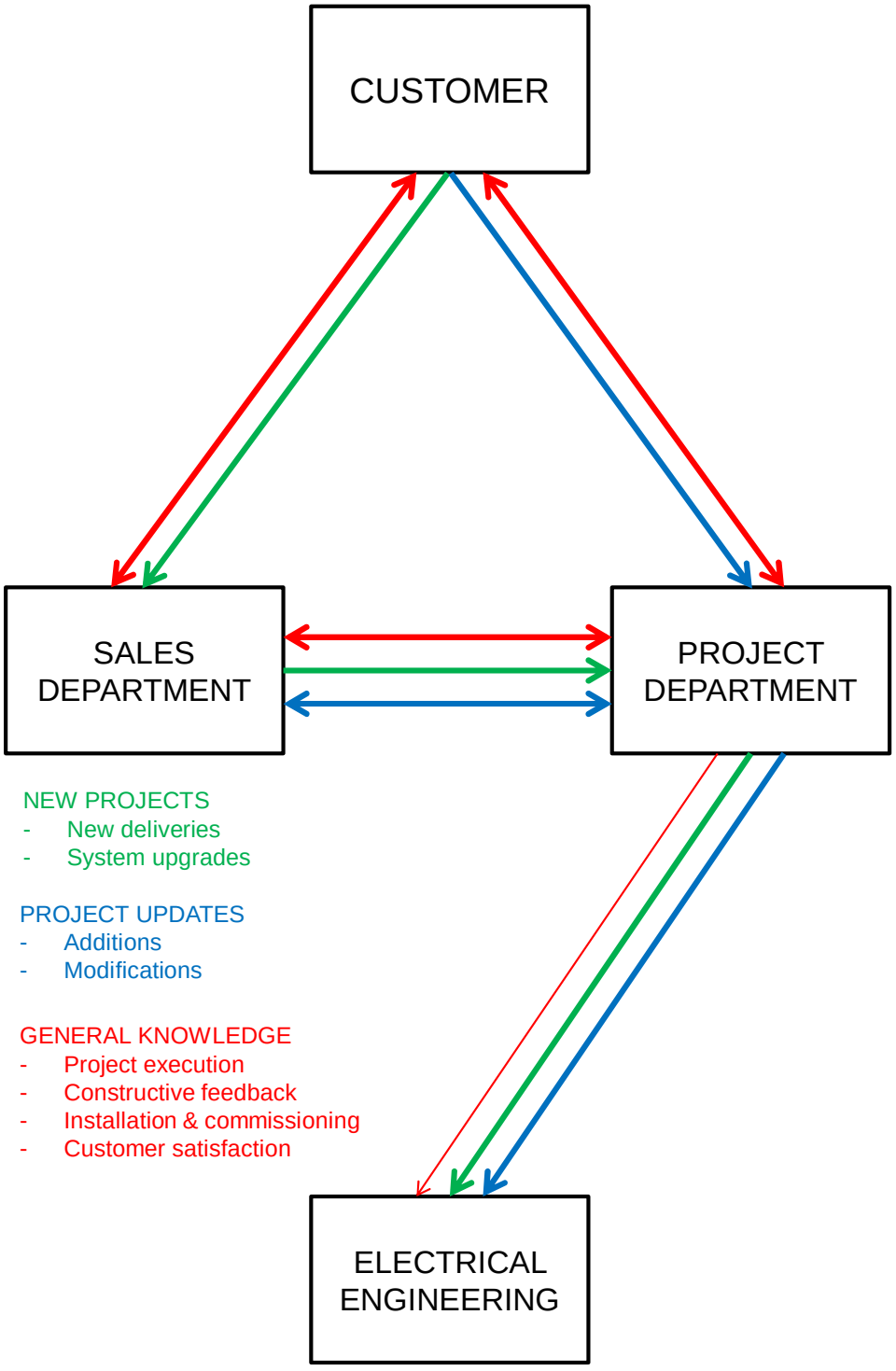

Figure 6. Summary of information flows.

As seen from Figure 6, the Project department is a key link in the communication chain. The Project department is linked in the communication chain in all of the three individual main events triggering information's flows. Additionally, the Project department is also responsible to share the information towards the Electrical Engineering department in the various main events triggering information's flows. Therefore the Electrical Engineering department is dependent on the information they receive from the Project department.

From the Electrical Engineering departments' perspective, most of the information events when customer related information gets distributed and discussed are "push-actions" from the Project department. "Pull-actions" of information flow regarding customer needs is done mostly by the Sales department and the Project department. Only when relevant project specific information is missing, the Electrical Engineering "pulls" for more information.

Typically, the Electrical Engineering department is not a part of the daily conversation with the customer. Direct communication between the customer and the Electrical Engineering department is not a common practice in the case company and therefore the Electrical Engineering department is only occasionally in direct contact with the customer regarding project specific needs.

It is also noteworthy that the Sales department and the Electrical Engineering department do not have regular conversations during *New project* sales phase. As the Sales Respondent 1 commented:

> *"Only rarely is the Sales department in contact directly with the Electrical Engineering department". (Respondent 1, Appendix 1)*

In summary, the current practices of the information flow regarding customer needs are conducted in three variations between the customer, the Sales department, the Project department and the Electrical Engineering department.

3.5 Strengths and Weaknesses of the Current Practices

When discussing the current practices of information sharing, in Data collection 1, the interviewees was also requested to pin-point the greatest strengths and weaknesses of the current practices. Examples of strengths and weaknesses are visible in Table 2.

Table 2. Strengths and weaknesses of the current practices.

STRENGTHS
• The possibility to utilize the Electrical Engineering department more, especially in the sales phase. • Bi-weekly meetings about sales projections and upcoming projects. • The benefit of dedicated resources for project execution and design and a company internal Electrical Engineering department which increases internal knowledge. • The close proximity of the key stakeholders in the same office facilities: it is easy to communicate between the Project department and the Electrical Engineering department. • Occasional tendency for an individual Electrical Engineer to work with the same customer.
WEAKNESSES
• Not a proper project team is in existence, which leads to the incapability of utilizing dedicated Electrical Engineers for deliveries to the same customers. • The Electrical Engineering department is not utilized during the project process enough (pre-sales, customer meetings, daily communication between the customer and commissioning). • The Sales department have insufficient standard offering materials of Electrical Engineering demands/requirements. • Lack of technical details in the project kick-off phase, which causes confusion and delays. • The Project department rarely knows what kind of information the Electrical Engineering department requires. • The obstructed information flow of the electrical specification (customer specific requirements). • The Project department as a center link in communication - variable communication methods and standards by individuals within the Project department. • Feedback from the project process is not informed properly and valuable feedback from installations and commissioning does not flow into the Electrical Engineering department.

As Table 2 shows, the summary of strengths and weaknesses identified from the current information flow practices includes a number of findings. The analysis revealed more weaknesses than strengths in the information flow regarding customer needs in the case company. Detailed description of strengths and weaknesses is given below.

3.5.1 Strengths

Strengths related to the information flow regarding customer needs were spotted from a relatively wide range, even though identifying these strengths was quite challenging at times and they were not that obvious for the interviewees. As the interviews went to the issues beneath the surface and conversations became more elaborate, strengths of the current practices could be noted.

First and foremost, there is a *possibility to utilize the Electrical Engineering department more* in the project execution phase. Especially beneficial the support would be in the sales phase, because then the Electrical Engineering department could guide the Sales department with the scope of technical details during pre-sales. Engaging in the sales phase would also enable for a clearer understanding of the up-coming projects and the Electrical Engineering department would be equipped with more information regarding the project scope prior to customer specific design process.

Second strength was the *bi-weekly meetings about sales projections and upcoming projects*, which prepares the Electrical Engineering department for the near future. Bi-weekly meetings with the Project department include an overview of up-coming projects in the pipeline. The purpose of the regularly scheduled meetings is to inform the Electrical Engineering department in advance about expected work-load and project variations. In the meetings, also detailed customer specific needs are discussed mutually to prepare for possible challenges in the project.

Third strength was *the benefit of dedicated resources for project execution and design, and a company internal Electrical Engineering department which increases internal knowledge*. The strength is resource dedication in project specific design. Dedicated resources are internal stakeholders in the case company, which can provide technical support and guidance with electrical matters in the project execution. Because of a company internal design team, internal knowledge regarding customer needs can be increased on a daily bases. As the Project department respondent 2 commented:

> *"Information regarding customer needs is in-house knowledge, which can be increased through working with the same customers". (Project department Respondent 2, Appendix 1)*

Fourth strength was *the close proximity of the key stakeholders in the same office facilities: it is easy to communicate between the Project department and the Electrical Engineering department.* All key stakeholders in the communication chain – excluding the customers of course, are located in the same office facilities. The close proximity of the key stakeholders enables for reliable and effective discussions with the Electrical Engineering department, and it lowers the barriers for mutual communication. Especially the Project department, which is the center link in the communication chain, appreciates the close proximity as the Project department Respondent 1 stated:

> *"In challenging and fast-pace issues, a project manager can receive technical support within minutes through face-to-face discussions". (Project department Respondent 1, Appendix 1)*

Fifth and final strength was the *occasional tendency for an individual Electrical Engineer to work with the same customer.* Customer specific delivery projects can vary significantly with each other, but usually most re-purchasing customers have similar requirements and needs throughout the diverse projects. The needs of *New projects* also reflect the specific details and variations done in the past. For an individual Electrical Engineer, working with similar projects with the same customer base helps to increase individual knowledge. Eventually, this tendency results into greater understanding of customer specific needs and for the capability of fulfilling them.

3.5.2 Weaknesses

Weaknesses of the current practices were more obvious for the interviewees – remarkably more areas for improvements were identified and they could be defined more accurately. Some of the current weaknesses are contradicting with the findings from strengths, as this is a result of diverse perspectives among interviewees from different internal departments.

The first contradictory finding comparing to the strengths was that *not a proper project team is in existence, which leads to the incapability of utilizing dedicated Electrical Engineers for deliveries to the same customers.* As this is also defined as a strength, ac-

tually it rarely happens due to a variety of reasons regarding resource allocation, project scope variations and unequal global trends in shipbuilding. At the moment, there are not dedicated project teams in the case company, which would handle similar projects for certain customer bases. In the current practices, *New projects* are allocated within the Electrical Engineering department according to individual work-load rather than experience and history with certain type of projects. This might lead to a lower level of understanding the needs of certain customer segments.

Another contradictory weakness was that *the Electrical Engineering department is not utilized during the project process enough (pre-sales, customer meetings, daily communication between the customer and commissioning)*. As it is possible to engage the Electrical Engineering department more especially in the sales phase, usually only the more challenging projects are handled with the help of Electrical Engineering department. Whenever discussions have not taken place and technical details are not confirmed with the Electrical Engineering department prior to sales phase, unwanted challenges might occur in the project design phase.

Third, the interviewees mentioned that *the Sales department have insufficient standard offering materials of Electrical Engineering demands/requirements*. The Sales department could operate fully independently without the help of the Electrical Engineering department with a comprehensive standard offering, which would cover customer specific needs. The internal knowledge than has been built within the Project department and the Electrical Engineering department is not documented clearly for the Sales department to utilize. The current offering materials or product portfolio is also outdated and updates in the component-level are not sufficiently communicated to the Sales department, which leads to *New projects* that are sold according to technical documentation gathered from past projects.

Fourth identified weakness is the *lack of technical details in the project kick-off phase, which causes confusion and delays*. Projects that are sold according to the history of previous deliveries or without knowledge of component-level changes in the system results to unclear project specific scoping. This will become inevitable in the project kick-off phase, where the project will be handed out to the Project department for execution without clear details of the customer needs. Especially in fast-pace deliveries, this will lead to general inefficiency through confusion and possible material delivery

delays. As the Electrical Engineering department respondent 1 pointed about the insufficient kick-off datasheet:

> *"Kick-off meeting is the starting point of a project launch. Kick-off datasheet is handed out, which usually does not contain sufficient information." (Electrical Engineering department Respondent 1, Appendix 1)*

Fifth, *the Project department rarely knows what kind of information the Electrical Engineering department requires*. In some cases, the details of project specific needs are listed in the generic electrical specification received from the customer. It is the Project department's responsibility to confirm the missing information either from the specification or from the customer. The Project department does not always have a clear understanding of what kind of details the Electrical Engineering department requires.

Sixth identified weakness is *the obstructed information flow of the electrical specification (customer specific requirements)*. The Electrical Engineering department would have the best knowledge of the electrical details, but the electrical specification is not always openly visible as the Sales Respondent 2 commented:

> *"The information flow of the existing electrical specification is somewhat obstructed to the Electrical Engineering department". (Sales department Respondent 2, Appendix 1)*

Seventh, *the Project department acts as a center link in communication – variable communication methods and standards by individuals within the Project department*. Stakeholders within the Project department have variable levels of understanding the electrical details that the Electrical Engineering department requires from the customer. Customer needs flow through the Project department and without regulated methods or standards of communication, technical details might get lost in translation.

Eighth identified weakness is that the *feedback from the project process is not informed properly and valuable feedback from installations and commissioning does not flow into the Electrical Engineering department*. As the Engineering Respondent 2 commented:

> *"Electrical Engineers are not informed about updates done during the commissioning. Positive and/or negative feedback is not shared openly". (Electrical Engineering department Respondent 2, Appendix 1)*

This citation illustrates the fact that the Electrical Engineering department is rarely a part of daily communication with the customer and therefore the information flow regarding *General knowledge* towards the Electrical Engineering department is filtered. Especially the important feedback from field operations – installations and commissioning – is not regularly shared with the Electrical Engineering department.

As the strengths and weaknesses of the current practices are concluded with analysis of the individual factors, this Thesis proceeds to the next sub-section. Next sub-section reveals the summary of key strengths and weaknesses.

3.6 Summary of Key Strengths and Weaknesses

As the individual weaknesses and strengths were analysed, they are summarized into larger-scale categories: a single strength and three weaknesses. Categorizing was done to group those weaknesses and strengths that suit for a certain category and common denominators can be identified from the different individual findings. Conclusions of key findings are presented in Table 3.

Table 3. Summary of key findings.

THE EASE OF COMMUNICATION WITHIN PART-TAKING STAKEHOLDERS

- The possibility to utilize the Electrical Engineering department more, especially in the sales phase.
- Bi-weekly meetings about sales projections and upcoming projects.
- Dedicated resources for project execution and design and a company internal Electrical Engineering department which increases internal knowledge.
- Close proximity in the same office facilities: it is easy to communicate between the Project department and the Electrical Engineering department.
- Occasional tendency for an individual Electrical Engineer to work with the same customer.

LACK OF COMMUNICATION ACROSS ORGANIZATIONAL BORDERS

- The Sales department have insufficient standard offering materials of Electrical Engineering demands/requirements.
- The Project department rarely knows what kind of information the Electrical Engineering department requires.
- Feedback from the project process is not informed properly and valuable feedback from installations and commissioning does not flow into the Electrical Engineering department.

OBSTRUCTIONS IN INFORMATION SHARING

- Lack of technical details in the project kick-off phase., which causes confusion and delays.
- The obstructed information flow of the electrical specification (customer specific requirements).
- The Project department as a center link in communication - variable communication methods and standards by individuals within the Project department.

INSUFFICIENT COLLABORATION STRUCTURES

- Not a proper project team is in existence, which leads to the incapability of utilizing dedicated Electrical Engineers for deliveries to same customers.
- The Electrical Engineering department is not utilized during the project process enough (pre-sales, customer meetings, daily communication between the customer and commissioning).

As summarized in Table 3, the key finding for the strength is *the ease of communication within the part-taking stakeholders*. This includes the possibility to engage the Electrical Engineering department more in the project execution, bi-weekly meetings for the near future preparation, dedicated resources for project design, close proximity in the same office facilities and the occasional tendency for individuals to work with the same customer base have similar features with each other. This ease of communication needs to be noticed as an enabler for reliable and rapid joint decision making, involving all stakeholders to share information regarding customer needs.

As for the weaknesses, *lack of communication across organizational borders* forms the first category. This includes the insufficient standard offering materials, lack of knowledge about Electrical Engineering information requirements as well as unregulated feedback and information flow regarding the project process. All in all, it shows distinctive elements of filtered cross-organizational communication. Organizational barriers are quite high for communication and department-internal information is not shared effectively.

The second category in the weaknesses is the *obstructions in information sharing*. Lack of technical details in the project kick-off phase, obstructed information flow of the electrical specification and Project department as a center link in the communication chain are individual areas of non-transparent communication. Whenever the information flow is not transparent, delays in the project execution will occur, critical information might be misinterpreted or even worse – project specific design is not done according to the customer needs.

Finally, the third weakness category is the *insufficient collaboration structures*. The incapability to utilize dedicated resources for certain customer bases and not engaging the Electrical Engineering department during the project execution – are features of the lack of teamwork across departments. Lack of teamwork among the Sales department, the Project department and the Electrical Engineering department will inevitably lead to a lower level of understanding customer needs, which eventually results to poorer customer satisfaction.

As the current state analysis is concluded with key findings, the Thesis proceeds to Literature Review. The three weaknesses identified in the current state analysis: lack of

communication across organizational borders, obstructions in information sharing and insufficient collaboration structures will guide the choice of literature in the next section.

4 Existing Knowledge for Improving Information Flow

This section seeks for ideas from existing knowledge and relevant literature to treat the weaknesses identified in the current state analysis. This section includes a brief overview of literature regarding improving the information flow in organizations and continues by discussing the selected topics from exiting knowledge regarding efficient communication across organizational borders, transparency in information flow and cross-organizational collaboration. Existing knowledge is utilized to find solutions for weaknesses identified in the current state analysis and to provide foundations for evidence-based decision making in the following stages.

4.1 Improving the Information Flow in Organizations: Three Core Elements

A vast variety of theories and practical actions deal with improving information flow in organizations. After reading and exploring them, there may be different perspectives taken. If approached from the organizational perspective, they can roughly be summarized into three core elements. First, efficient communication across organizational borders, second, transparency in information flow and, third, cross-organizational collaboration.

Efficient communication across organizational borders can be viewed as a barrier-free information flow across organizational borders. Communication across organizational borders can be considered only to affect company internal information flow. In fact, it does not restrict to a company's internal purposes only, rather it should include communication with the customer also. Barrier-free communication should consider the customer also, because the flow of information regarding needs and desires is typically initiated by the customer. The information of customer needs and requirements should consistently flow throughout the involved stakeholders within the company, regardless of organizational structure or hierarchy.

Transparency in information flow enables the key stakeholders to access databases and documents regarding general knowledge and customer information. In addition, in transparent information flow, key stakeholders are a part of open communication and knowledge sharing. Organizational structures and different procedures result to variable methods of sharing the available data. Therefore, transparency in information flow is somewhat closely related to communication across organizational borders. More

importantly, transparency in information flow should be regarded as reliable and unfiltered sharing of knowledge.

Cross-organizational collaboration takes into consideration the different organizations and departments within a company. The different functions of a company should be guided and encouraged to share a common target, which is to serve the customer. Cross-organizational collaboration is especially critical within project-teams and groups of experts from diverse organizations. By comprehensively uniting the part-taking individuals and departments, customer satisfaction will eventually increase through successful End-customer deliveries.

Thus, the topics are closely related to each other because each topic is an enabler for the proceeding one. In other words, efficient communication across organizational borders and transparency in information flow can be seen as necessary steps towards cross-organizational collaboration.

4.2 Efficient Communication across Organizational Borders

Today's customer-centric marketplace has been disrupted in certain industries with new levels of understanding the needs of the customer. Companies increasingly adapt to the customer-focused approach and implement different ways of recognizing the desires of the customers. Especially successful start-up companies have been able to understand and address the needs of the customers incredibly well. (Boyarsky et al. 2016)

Surprisingly often companies find it difficult to collect, analyze and act upon customer feedback. When feedback is collected from the customer, it is extremely important to really understand what the customer is saying. If a company misinterprets the message, corrective actions and improvements are built on unstable foundations. Companies that provide their services as business-to-business, typically gather customer feedback through stakeholders with direct customer interphase, such as sales channels (Fanderl et al. 2016:2). Feedback that is gathered only by the sales channels leaves room for error and therefore important insights might be misinterpreted or ignored.

Besides collecting and analysing customer needs, a company must listen to its customers intensively to understand the desires of the customer. Occasionally even closer customer participation might be beneficial as companies could also seek and encourage customers to join into their processes, since customers have constructive ideas for a company's service offerings (Merlo et al. 2013:2). A company should also engage with its employees to enable comprehensive and cohesive communication across organizational borders.

During the past decades, numerous companies have implemented cross-functional project teams as a standardized way of working. Cross-functional project teams bear potentially great benefits such as; increased productivity, distributed workloads and improved processes (Smart and Barnum 2000). Especially matrix-organizations utilize diverse functionalities and expertise to carry out customer delivery projects due to superior performance. Unfortunately often companies fail to reach the full potential and benefit from the efficiency of cross-functional project-teams due to insufficient cross-functional communication.

The Superior performance of cross-functional project teams is also a result of mixing experts from diverse backgrounds which have external contacts for their specific areas of expertise. If the level of increased external communication rises, the potential for fruitful performance increases as well. On the other hand, the level of performance can be harmed significantly if the internal communication is not sufficient across the key stakeholders. Therefore it is extremely important for companies to sufficiently communicate across organizational borders and share the external knowledge gathered from diverse sources. (Keller 2001)

One could easily conclude that more communication is always beneficial, but actually it is not quite that straightforward. It is true that the amount – or frequency of communication across organizational borders has a relationship on the performance of the project team. It is important to acknowledge that high levels of communication do not always result into higher performance. (Patrashkova-Volzdoska et. al 2003). Different methods of communication can impact diverse performance indicators, as e-mail is likely to be to most efficient overall and face-to-face communication is efficient for goal achieving. Due to the ease and rapidness of communicating via e-mails, a risk of overloading the recipients with information also bears in the method. Information overload may lead to the inability to prioritize, unclear scoping of content and overlapping knowledge.

As high levels of communication might be harmful, a company can also suffer from the lack of communication across organizational borders, which is a typical element of departmental silos within a company. Organizational silos represent a certain mind-set, which enables for horizontal, interdepartmental communication but cross-departmental communication either does not exist or is filtered. Diverse departments gather and withhold tremendous amounts of important information, and organizational silo-mentality constrains the sharing of that knowledge (Alberg 2007:1). It is crucial for a company with silo-mentality to break down the barriers, even though it may be fairly challenging.

Organizational silos may be established unintentionally over time, but they might be a part of the organizational culture. Even though project teams that consist of cross-departmental experts are involved in sustaining or creating the barriers for organizational silos, in fact the team members are crucial for breaking down the silos. By uniting the team members and establishing new operating procedures for cross-training, the stakeholders gain mutual trust and understanding (Engle 2013). An increased level of cross-departmental understanding also increases the individuals' broadness of knowledge regarding internal challenges and possibly alters the members' mind-set more towards a team-oriented approach.

A team-oriented approach is crucial for enabling a behavior to act together as "one company", rather than being loyal towards one's own organizations' goals only. For example, product development engineers that are in the back-office might be very committed towards the R&D-function, and not consider being that involved with functions that are in the customer forefront. Single-focus mentality might lead to individuals that adopt the silo-focus and internal competition, both of which disables collaboration. Impeding the single-focus mind-set requires tremendous amount of coordination, especially in the larger matrix-organizations. (Sy and Côté 2004)

Communication and effective sharing of knowledge across organizational borders is definitely important, but the management of such is not sufficiently covered theoretically. Based on the rather limited literature, a cooperative model has been designed and piloted, and afterwards successfully validated for applicability. Task orientation, interpersonal relationships and communication are associated with positive impact on information sharing capabilities (Ghobadi and D'Ambra 2012). A single factor that can

harm communication and task orientation is internal competition for tangible resources; therefore internal – political competition should be avoided.

4.3 Transparency in Information Flow

Transparency can raise questions of a company's privacy and whether their business secrets as well as intellectual property rights are at jeopardy or not. Modern technology has enabled an ever increasingly transparent and rapid spread of knowledge (Calvin 2015). Even though transparency and accessible information can be traditionally seen as a threat, it also has many advantages. For companies, it is beneficial to adapt towards a mind-set of transparent information flow, because after all it is becoming a trend in the corporate culture.

For start-ups and other newly established companies, transparent information flow and accessibility might be obvious from day one. For such companies it may be more logical to import a trendy way of sharing knowledge. On the other hand, for more traditional businesses it may be tougher and they suffer from data silos. These data silos are isolated locations of data, access is relatively restricted and it is rarely shared among other users (Wilder-James 2016:3). Data silos restrict employee accessibility to information and therefore constrain individual awareness regarding potentially critical information and internal communication.

Isolated contents of information and restricted access among conversations that are held behind closed doors create suspicion and result to misleading information (Hurwitz and Hurwitz 2015). Open and unfiltered communication will lead to increased mutual trust, higher motivation and ultimately result to a successful company. Without these open channels of communication, employees start to guess and might eventually consider suspicions. Rumours and information that is not shared openly can result to misleading information.

As today's competition has become increasingly tough where several fields and industries are packed with rivals, companies are forced to be more involved with the customer in service business (TEKES 2010). A company must have closer proximity and seamlessly cooperate with the customer, but a company needs to be also responsive. Responsiveness can be leveraged by accessible information and transparent

knowledge sharing among its employees. Furthermore, responsiveness is associated with more sufficient operating performance.

Responsive companies collect customer information and data from internal operations, which become vital when projecting the future. Customer information should be collected from a certain base of key customers; otherwise the information burden is quite vast and it difficult to handle. With a sufficient amount of relevant information, which is openly shared, a company can benefit from increased operating performance and react quickly upon market conditions. (Daugherty et al. 1995)

An efficient way to succeed in engaging a company's employees in sharing knowledge is to utilize the building blocks of Dialogue, Access, Risk-assessment and Transparency (DART). Typically DART is associated with engaging customer into co-creation with the company (Prahalad and Ramaswamy 2004:6). The building blocks reflect similar variables that can be also identified within a company's diverse organizations. Dialogue is an activity which means engagement, interactivity and willingness to act. This requires participation from all stakeholders. Dialogue does not restrain to listening only, it is also a learning and communication process between different stakeholders. Access refers to availability of a company's tools and information, for example manufacturing and quality processes. Risk-assessment is a probability factor of potential harm caused to the stakeholders. Transparency enables stakeholders to interact with organizations in ways that might even appear as intrusive.

Summing up, transparent knowledge sharing in an ideal system would have six steps: The number of transmissions must be minimized regarding knowledge, the knowledge base should be accessible by everybody, everyone should have permission to add knowledge, the knowledge base should be accessible at any time, the knowledge base should be intuitive to operate and the knowledge base should be usable at whatever language the user prefers (Anonymous 1998). The latter steps are more suitable for gathering knowledge from a database, but the first two - (a) The number of transmissions should be minimized regarding knowledge and (b) the knowledge base should be accessible by everybody – suits for transparent information flow and access for a group of people, e.g. a project team.

4.4 Cross-organizational Collaboration

In companies, an example of cross-organizational collaboration is a group of experts from various departments that forms a project team. Such project teams may achieve high performance and eventually improve a company's competitiveness in customer delivery projects when managed effectively. But in order to reach the full potential and high performance, challenges and changes are needed on a regular basis. Such challenges and changes may be: new assignments, regularly appointed meetings with internal – rival teams and even changes in personnel. Working in teams is not necessarily a project; rather it is a process of continuous development and innovation. To maintain the performance of these teams, it is mandatory to monitor and evaluate consistently. (McGreevy 2006)

A project team typically resembles the whole company in many ways but obviously in a smaller scale. In a company, project teams can be formed horizontally, vertically and the team can virtually include anybody from top management to part-time workers (Harris and Harris 1996). For example the team members are chosen from departments and organizations within the company, all of which have certain type of behavior and roles along with their expertise. The roles and responsibilities of each individual might be either very different or very similar. For more enhanced performance in working as a team, sometimes adjustments to the roles and responsibilities are required. In an ideal situation, a characteristically perfect multidisciplinary team would include the following roles: A chairperson, an innovator, a company worker, a resource investigator, a shaper, a team worker, a monitor evaluator and a completer. As complex and challenging as the formation of these characters might be the diverse roles and responsibilities just prove how teams can be formed within a company.

Project teams that are compiled from heterogeneous experts tend to share and utilize common knowledge effectively, even if the individuals would have physical distance from each other (Ratcheva 2009:2). Multidisciplinary teams, on the other hand, are not that efficient in sharing the diverse knowledge and reaping the benefits of such. To be able to improve the performance in this sector, sometimes new ways of working needs to be developed which require intense interaction from the members. Multidisciplinary knowledge can be successfully integrated through activities that span the team's boundaries.

All projects have certain risks, whether the project is a customer delivery project or a product development project, and whether the risk is technical or economical. The scale of the risk depends on the project itself and more importantly, how these risks are managed in the company behind the project. Effective risk management especially in the more complex projects require significant effort and action from management. A key tool for preventive and preparative action is efficient cross-organizational communication and collaboration. Because many risk factors may burst externally from the project team, especially sufficient cross-organizational collaboration enables for enhanced risk management and even detection capabilities. (Thamhain 2013)

Cross-organizational collaboration is argued to be efficient due to great performance, and indeed it has bears several benefits: speed of managing tasks, capability to solve complex problems, high levels of customer focus, creativity and internal learning possibilities. In order to realize the maximum potential of cross-functional teams, a team requires effective leadership qualities from the team leader (Parker 1994). Especially qualities such as technical knowledge and people-management skills are valuable. Teams needs to be guided towards shared goals regarding scheduling and project tracking. Often project teams fail to figure out the deliverable system as a whole, rather each individuals take care of their own field regarding the project. An effective team also needs boundary management to enable and ensure the flawless information flow across the stakeholders. Each team member should also be equally treated when considering performance appraisal, which is typically restricted internally for certain departments. When supreme performance is evident for a certain team, rewards and recognition should follow. Last but not least, managerial support is required to engage and encourage individuals, and to boost and sustain the team performance.

Great performance can be a result of certain other activities also, as performance management practices have been discovered to be linked with the strategic importance of collaboration relationships. As a matter of fact, contradicting to previous statements, communication and information sharing, boundary spanning interaction and performance measurement can be viewed as complementary practices (Dekker et al. 2016:17). Typically these three practices are adopted jointly to increase transaction characteristics and collaboration objectives, as companies consider their affect to be greater in combination than separately.

Effective cross-organizational collaboration might be tough to establish, if the existing collaboration structures seem to be inefficient. Blindfolded admiration and stubborn quest towards common goals and sound harmony might even obstruct teamwork. Certain periods of time are the more efficient moments to establish effective collaboration structures and one of them is conflict (Weiss and Hughes 2005). Conflict is a natural, inevitable and even necessary phenomenon which considers all companies at times. Conflict can be seen as a positive initiative towards removing critical barriers and thereby creating new levels of collaboration. Even though sources and patterns of conflict may be hard to identify for management representatives, with the help of several different strategies, collaboration can be achieved to its finest.

Cross-organizational collaboration can be improved by the use of organizational network analysis. The analysis can be used to identify gaps and barriers in collaboration and communication and to eventually measure the performance of cross-organizational teamwork. Organizational network analysis can be applied to five factors: Cross-organizational collaboration, mutual trust and communication, teamwork, culture change and to reveal patterns of effectiveness (Novak et al. P. 2011). As sum, a large network does not translate into an effective network, because information processing is done mostly by the employees. The ability to process information is not infinite for human beings, therefore it is crucial not to burden stakeholders with excessive information. Management must endorse cross-silo thinking, boundary spanning relationship building and they must also lead across the organization.

Cross-organizational collaboration can be drawn into a cycle of factors. By mapping out the inputs, processes, outputs and feedback, the quality of cross-organizational collaboration can be analyzed as illustrated in Figure 7 below.

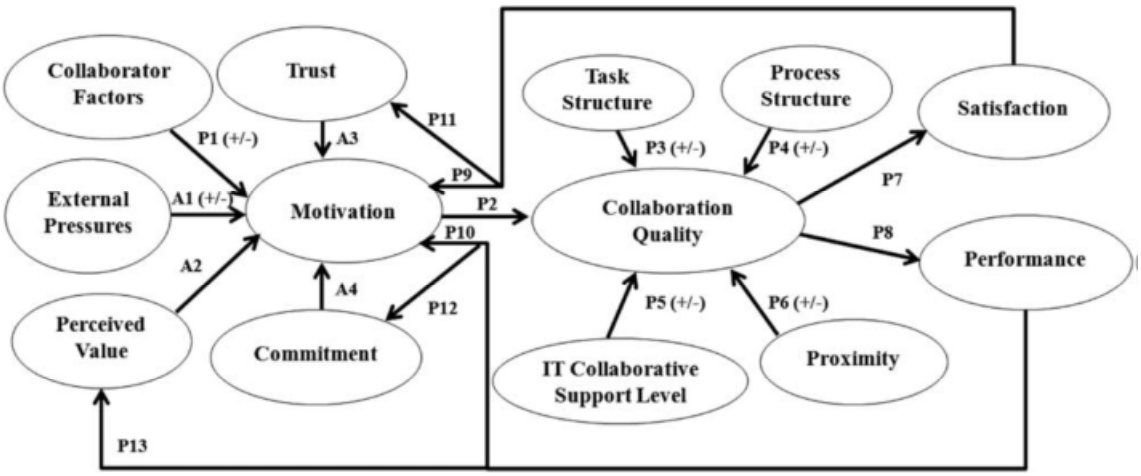

Figure 7. Motivational model for cross-organizational collaboration (Romano at al. 2010:11).

As Illustrated in Figure 7, main input for collaboration quality is motivation. A1-A4 represents individual variables, P1-P6 represents inputs to the process, P7 and P8 are outputs as P9-P13 are feedback propositions (Romano at al. 2010:11).

Once sufficient collaboration structures and progresses are achieved, individual employees should be encouraged to sustain the level of commitment. Commitment towards collaboration can be sustained by networking – creating them in the first place, to seek for more and to embrace them. Management should not be guiding employees on a daily bases, because then people might resist it due to the resemblance of a working task. Rather, managers should try to figure out ways to encourage and intrigue individuals to foster their networks. Gained trust and interest towards enlarging one's networks and relationships can be improved through network-building skills. (Baber et al. 2014)

As a summary, internal – cross-organizational collaboration is mostly and quite unanimously valued as positive and constructive for companies. Breaking down silos, cross-departmental training and intensive teamwork is regularly endorsed by the management. It is evidential that cross-organizational collaboration enables for increased sales, transfer of best practices, innovative product development and superior customer focus, regardless of potential resistance faced from the individual stakeholders. One could draw conclusions that increased cross-organizational collaboration is always beneficial, but it is not that straightforward. In fact, it can be quite the opposite, as companies can overvalue collaboration if they expect for even better results with ever in-

creasing collaboration structures. As a result of overenthusiastic collaboration building, the performance can decrease as well. Prior to designing and executing collaboration structures, a company should take into consideration the potential benefits of such, whether it will translate into a collaboration premium or not (Hansen 2009). A collaboration premium is positive when the projected financial figures defeats two cost-factors – opportunity and collaboration costs. If the collaboration premium turns out to be positive, a company can achieve benefits from cross-organizational collaboration.

4.5 Conceptual Framework

As ideas and existing knowledge has been pointed out from relevant literature, several key elements are highlighted. The key elements are linked with the topics of efficient communication across organizational borders, transparency in information flow and cross-organizational collaboration. By the help of ideas found from existing knowledge and relevant literature, a conceptual framework is built accordingly, as illustrated in Figure 8.

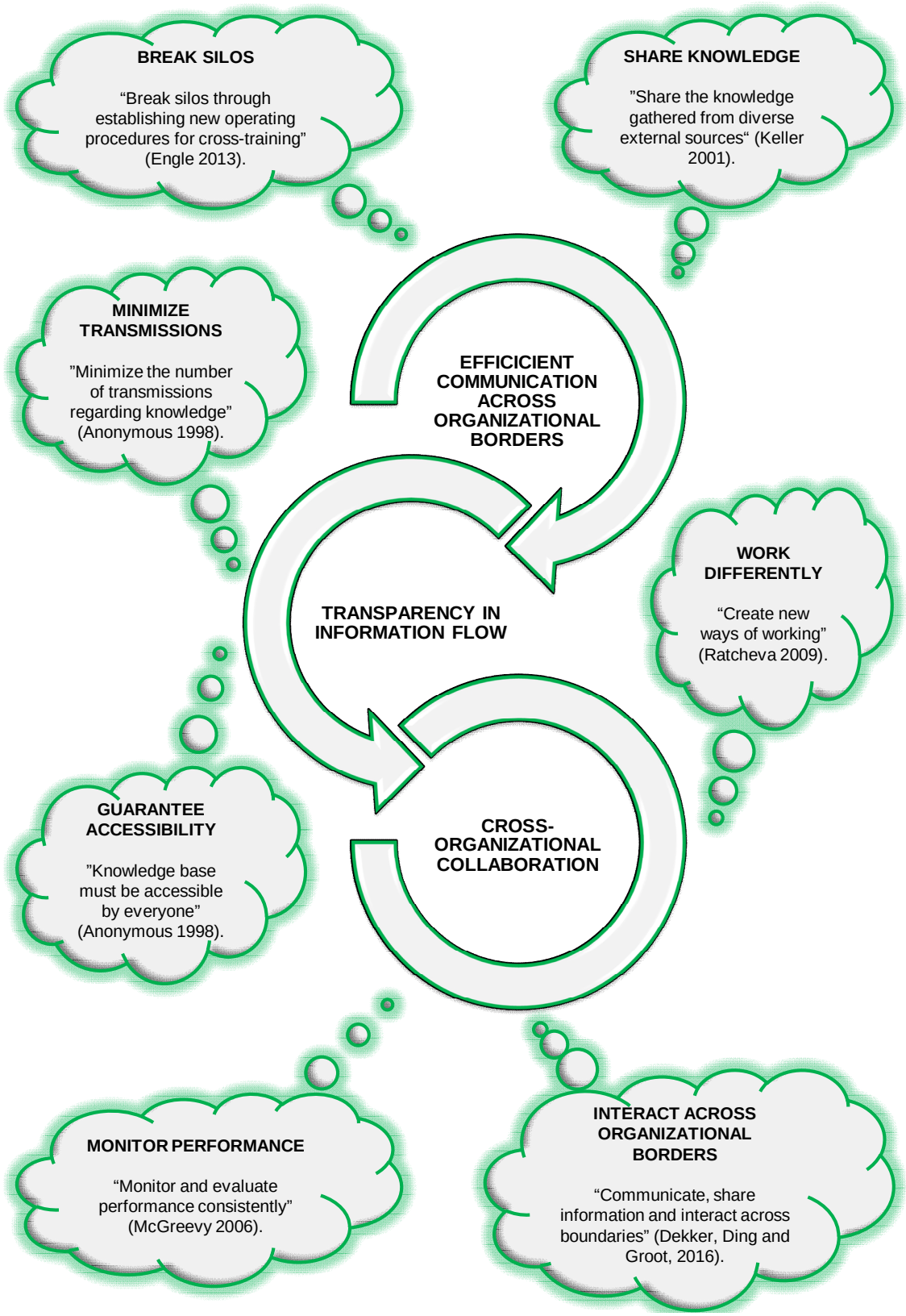

Figure 8. Conceptual framework for improving information flow.

As Figure 8 illustrates in a relationship example, *efficient communication across organizational borders* and *transparency in information flow* is required to enable *efficient cross-organizational collaboration*. These three areas are closely linked with each other, and if communication across organizational borders is not sufficient or information flow is obstructed, performance in cross-organizational collaboration is far from its full potential.

Based on exploration of available knowledge in Section 4, several ideas for efficient communication across organizational was identified. As illustrated in Figure 8, *break silos through establishing new operating procedures for cross-training* and *share the knowledge gathered from diverse external sources* are associated with a positive impact on information sharing capabilities.

As for transparency in information flow, relevant ideas were addressed. As illustrated in Figure 8, *minimize the number of transmissions regarding knowledge* and the *knowledge base must be accessible by everybody*. These ideas suits for transparent information flow and access for a group of people, e.g. a project team as well as open and unfiltered communication will lead to increased mutual trust, higher motivation and ultimately result to a successful company.

Finally, ideas for enhanced performance regarding cross-organizational collaboration are discussed. As illustrated in Figure 8, *create new ways of working*, *monitor and evaluate performance consistently* and *communicate, share information and interact across boundaries* can be viewed as complementary practices to increase performance in cross-organizational collaboration.

In summary, existing knowledge and relevant literature regarding improving information flow in organizations points to the topics of efficient communication across organizational borders, transparency in information flow and cross-organizational collaboration. The ideas identified from literature will guide the proposal building in the next phase of this Thesis.

5 Proposing Improvements to the Information Flow Regarding Customer Needs

This section merges the key strength from the current state analysis and ideas gathered from existing knowledge and relevant literature to facilitate the improvement proposal development. The Proposed improvements consider increasing cross-organizational communication, enabling transparency in information flow and improving cross-organizational collaboration. The purpose of utilizing previous finding is to develop evidence-based proposals guided by the current state analysis and the conceptual framework. The goal of this section is to reach the objective of this Thesis.

5.1 Overview of the Proposal Building Stage

The improvement proposal was developed in five steps. First, the improvement proposal focused on increasing communication across organizational borders in the case company. Second, the improvement proposal focused on enabling transparency in information flow in the case company. Third, the improvement proposal concentrated on improving cross-organizational collaboration between the key departments of the case company. Fourth, the proposed improvements also incorporated the discussion on the weaknesses of the current information flow, and inbuilt the key strength into the proposed improvements that were identified in the current state analysis.

The improvement proposal was developed with the help of available data sources, and the decision making was guided by the key strengths identified in the current state analysis and ideas found from existing knowledge and literature. The data source that was utilized for the improvement proposal was the two workshops with the case company internal stakeholders. The involved participants were chosen from key departments in the communication chain: the Sales department, the Project department and the Electrical Engineering department.

The purpose of carrying out the workshops with the chosen departments was to jointly generate ideas for improvements. As all of the three departments are highly involved in the information flow regarding customer needs and improvements are required from each department's routines, the most effective way of gathering data was the workshops facilitating stakeholder suggestions. The logic of the workshops was to discuss the weaknesses of the current information flow and suggest relevant improvements,

which were guided by the findings made in the current state analysis and ideas selected for in the conceptual framework.

Finally, the proposal ends with a summary of the proposed improvements. Based on the proposal building, there are also implications formulated for the project progress and information flow practices.

5.2 Increasing Communication across Organizational Borders

As for *Increasing communication across organizational borders* in the case company, several improvements were identified and proposed, as shown in Figure 9 below. These ideas were found to address the challenges of the current information flow and came from existing knowledge and relevant literature, as well as from the data gathered from the proposal building workshops. The improvement suggestions point to the following actions in order to improve information flow regarding customer needs in the case company.

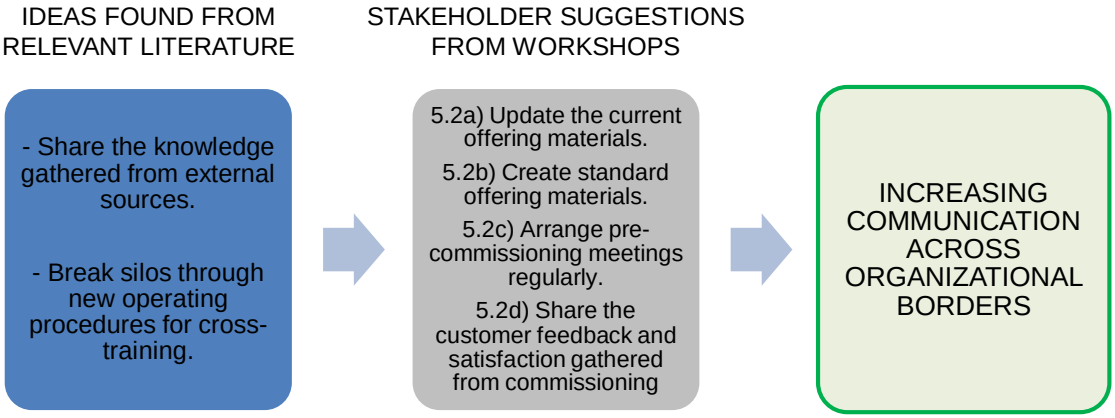

Figure 9. Increasing communication across organizational borders.

As seen from Figure 9, the tools to enable increased communication across the organization borders include: (5.2a) Update the current offering material, (5.2b) Create standard offering materials, (5.2c) Arrange regularly appointed pre-commissioning meetings regularly and (5.2d) Share the customer feedback and satisfaction gathered from commissioning.

First, *Updating the current offering materials* translates to co-operation between the Sales department and the Electrical Engineering department. The current offering materials consist of product datasheets and specific technical details, which needs to be updated for the Sales departments' use in the sales phase. With an updated offering material, the case company can provide clearer guidelines for the customers product-wise and it can decrease unwanted surprises regarding customer needs during the design phase and project execution. By sharing the knowledge gathered from diverse external sources, such as component-level changes and updates, communication across organizational borders can increase.

Second, as the current offering materials are updated, the case company will focus on *Creating standard offering materials*. The current offering materials are on a quite generic level, contrariwise the standard offering materials will be more specific and as one would expect – standardized. Standard offering materials will eventually suit for all customer bases in the Marine segment as an initiative for the Sales department's use towards negotiating about project specific requests as the Sales department Respondent 2 commented:

> *"Standard offering materials will provide the Sales department the proper documentation required in the pre-sales phase". (Sales department Respondent 2, Appendix 2)*

Third, *Arrange regularly appointed pre-commissioning meetings* can help to prepare for the commissioning by sharing information. The meeting request can be sent to the chosen Commissioning Engineer, the Project Manager and the Electrical Engineer. The meeting will enable information flow across organizational borders regarding possible updates done on-site or modifications that are required during the commissioning. The pre-commissioning meeting is an opportunity to create new operating procedures for cross-training and to share customer needs by each other. Eventually this can increase the key stakeholders' knowledge by breaking silos as the Project department Respondent 1 commented:

> *"A significant number of updates can be done between the material delivery and the commissioning, it is important to openly share information about them". (Project department Respondent 1, Appendix 2)*

Finally, *Sharing the customer feedback and satisfaction gathered from commissioning* can help to increase the awareness among the stakeholders regarding customer needs

after the commissioning is successfully carried out. Sharing feedback across organizational borders is a key for the involved stakeholders to learn and gain knowledge which can be utilized for the challenges in the future.

Thus, the proposal for *Increasing communication across organizational borders* includes several improvements: *Update the current offering materials*, *Create standard offering materials*, *Arrange pre-commissioning meetings regularly* and *Share the customer feedback and satisfaction gathered from commissioning*. Next sub-section focuses on enabling transparency in information flow.

5.3 Enabling Transparency in Information Flow

As for *Enabling transparency in information flow* in the case company, two improvements were proposed, as illustrated in Figure 10 below. These ideas were found to address the challenges of the current information flow and came from existing knowledge and relevant literature, as well as from the data gathered from the proposal building workshops. The improvement suggestions point to the following actions in order to improve information flow regarding customer needs in the case company.

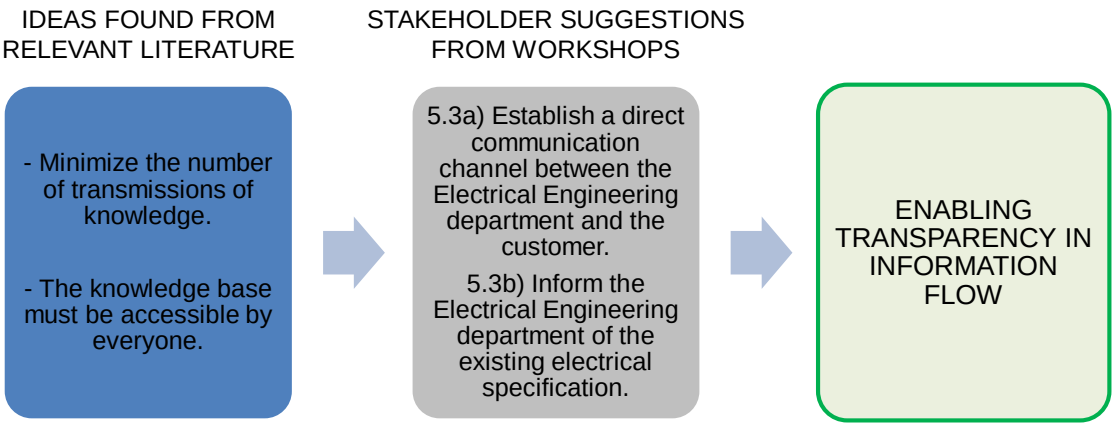

Figure 10. Enabling transparency in information flow.

As illustrated in Figure 10, the tools for enabling transparency in information flow are: (5.3a) Establish a direct communication channel between the Electrical Engineering department and the customer and (5.3b) Inform the Electrical Engineering department of the existing electrical specification.

First, *Establish a direct communication channel between the Electrical Engineering department and the customer* can improve transparency in information flow because the transmissions of knowledge are minimized. The idea is to connect the Electrical Engineering department closer to the customer and to decrease the Project departments' role as a communication link. The Project department still remains in the communication regarding electrical matters, but the customers are instructed to contact the respective Electrical Engineer instead of the Project Manager. The new communication method also can decrease the workload of the Project department as the Project department Respondent 2 commented:

> *"Project Managers might become overloaded with tasks that do not necessarily consider them". (Project department Respondent 2, Appendix 2)*

By creating the direct communication channel between the customer and the Electrical Engineering department, the probability of misinterpreting customer needs can decrease significantly.

Second, *Inform the Electrical Engineering department of the existing electrical specification* is a factor in enabling transparency in information flow. Despite the departments' close proximity and co-operation as well as frequent communication regarding customer needs, the Electrical Engineering department has the best knowledge of electrical issues. By informing the Electrical Engineering department of the existing specification and inserting it to a location which guarantees accessibility to everyone, the case company can reach to new levels of transparency in information flow.

Thus, the proposal for *Enabling transparency in information flow* includes two improvements: *Establish a direct communication channel between the Electrical Engineering department and the customer* and *Inform the Electrical Engineering department of the existing electrical specification*. Next sub-section concentrates on improving cross-organizational collaboration.

5.4 Improving Cross-organizational Collaboration in the Case Company

As for *Improving cross-organizational collaboration* in the case company, improvements were identified and proposed, as shown in Figure 11 below. These ideas were found to address the challenges of the current information flow and came from existing knowledge and relevant literature, as well as from the data gathered from the proposal

building workshops. The improvement suggestions point to the following actions in order to improve information flow regarding customer needs in the case company.

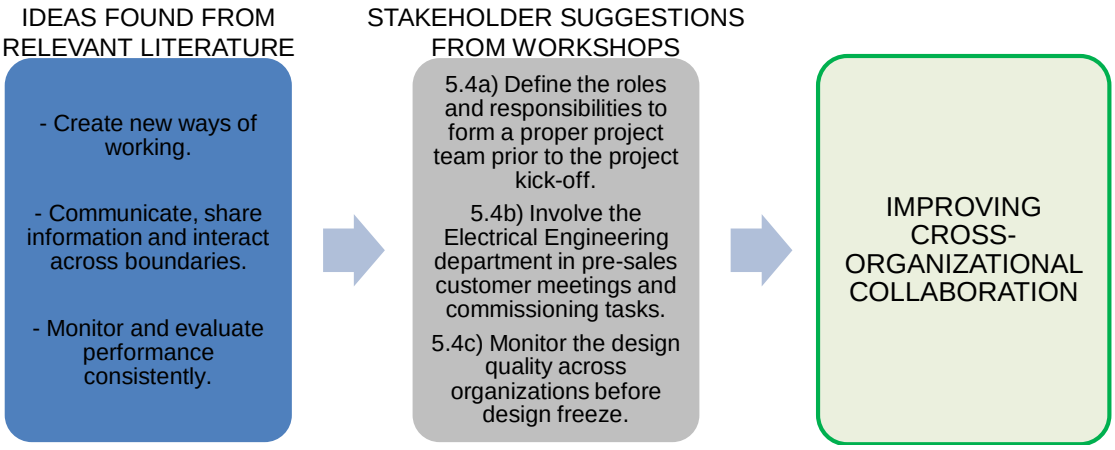

Figure 11. Improving cross-organizational collaboration.

As seen from Figure 11, the tools for improving cross-organizational collaboration include: (5.4a) Define the roles and responsibilities to form a proper team prior to the project kick-off, (5.4b) Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks and (5.4c) Monitor the design quality across organizational borders before design freeze.

First, *Define the roles and responsibilities to form a proper team prior to the project kick-off* enable the Electrical Engineering department for a closer participation already during the sales phase. When an individual Electrical Engineer is nominated to a project execution prior to the project kick-off, the respective Electrical Engineer is more aware of the project scoping and equipped with knowledge regarding customer specific needs. As a result, by creating a new way of working, or working differently, the project execution can be more efficient.

Second, *Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks* invites the Electrical Engineering department for closer cooperation with cross-organizational departments. By sufficiently communicating and sharing information as well as interacting across organizational borders, cross-organizational collaboration can improve. This doesn't necessarily mean that the Electrical Engineering department is obligated to participate in every single End-customer delivery project, rather it should be considered as variably reserved presence in pre-

sales meetings and occasional visits on-site during commissioning that will increase the knowledge regarding customer needs as the Electrical Engineering department respondent 2 commented:

> *"Commissioning tasks would increase the General knowledge of customer needs throughout the Electrical Engineering department". (Electrical Engineering department Respondent 2, Appendix 2)*

Third, *Monitor the design quality across organizations before design freeze* invites the Project department, the Electrical Engineering department and the Mechanical Engineering department to collaborate. The target is to evaluate both electrical and mechanical design quality and to confirm that the current design is done according to the customer needs. Consistent monitoring of the design quality can result to increased success rate of End-customer product quality and improved cross-organizational collaboration. Improved cross-organizational collaboration can also translate towards increased customer satisfaction.

Thus, the proposal for *Improving cross-organizational collaboration* includes the following improvements: *Define the roles and responsibilities to form a proper project team prior to the project kick-off*, *Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks* and *Monitor the design quality across organizations before design freeze*. Next sub-section incorporates the key strengths identified in the current state analysis to the current practices.

5.5 Integrating Key Strengths to the Current Practices

After the ideas and suggestions for improving the current practices were discussed with the stakeholders and co-created into the proposal, the key current strength identified earlier from the current state analysis were then inbuilt into the proposal. The key strength to inbuilt was the ease of communication. *The ease of communication* makes an important strength in the information flow in the case company since it can serve as a platform for the proposed improvements. The ease of communication facilitates towards all three elements of the proposal: *Increasing communication across organizational borders*, *Enabling transparency in information flow* and *Improving cross-organizational collaboration*.

Moreover, as the three involved departments – the Sales department, the Project department and the Electrical Engineering department – that are involved in the information flow have close proximity to each other in the same office facilities, the ease of communication also serve as additional strength and removes the physical barriers for frequent communication and helps more intensive collaboration.

The proposal incorporates improvements to address the weaknesses in the current information flow, namely: (a) seven core ideas from existing knowledge, (b) suggestions from the stakeholders, such as *Update the current offering materials*, *Establish a direct communication channel between the Electrical Engineering department and the customer* and *Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks*; and finally, (c) the strength (the ease of communication).

By embracing the ease of communication and viewing it as an enabler towards the proposed improvements, the case company can improve the information flow regarding customer needs to the Electrical Engineering department. The proposal, after incorporating the strength, is illustrated in Figure 12 below.

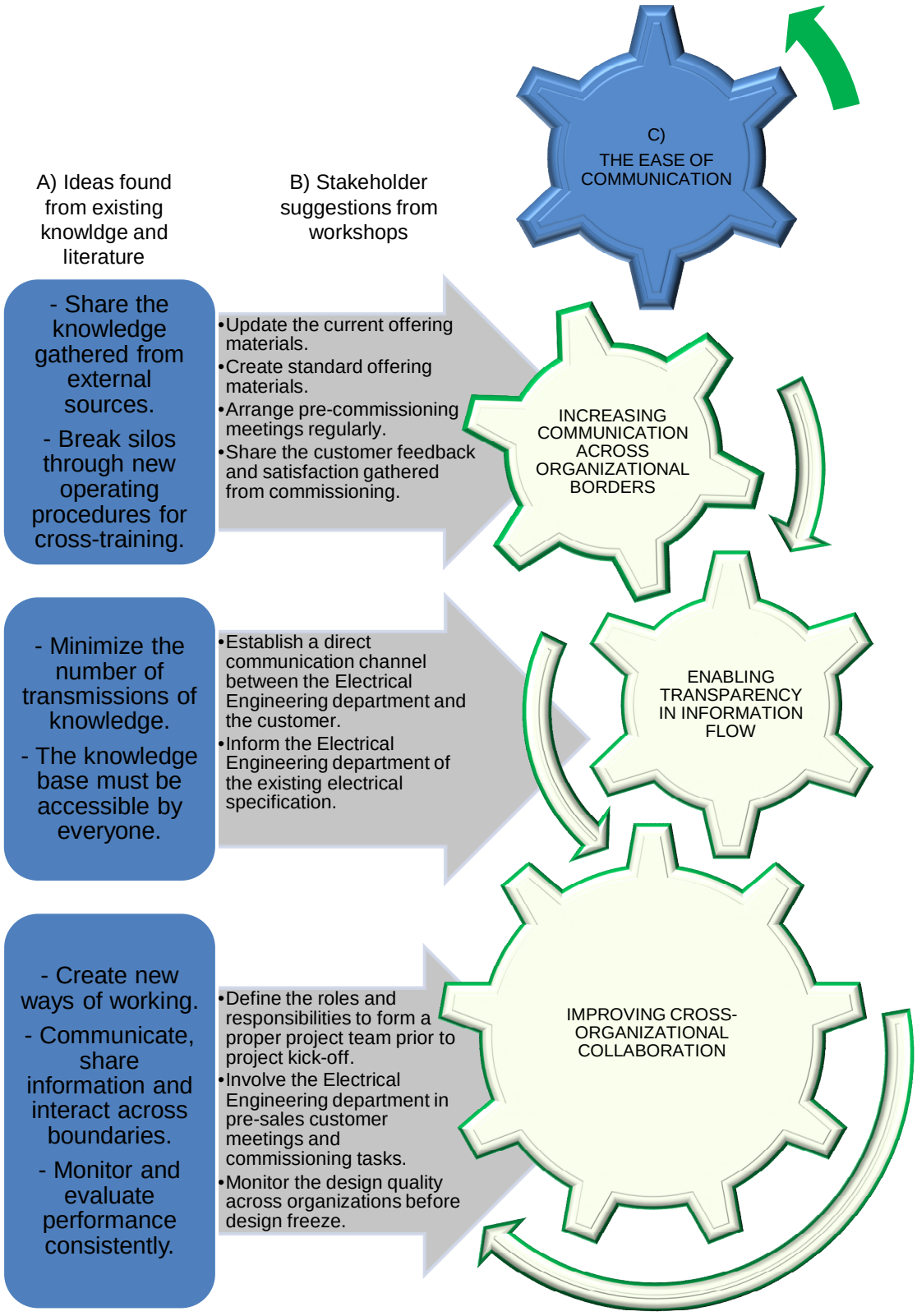

Figure 12. Initial proposal for improving information flow in the case company.

As illustrated in Figure 12, the proposal for incorporated improvements targets to improve the three core elements, which are *Increasing communication across organizational borders*, *Enabling transparency in information flow* and *Improving cross-organizational collaboration*.

As the developed proposal for improvements with the integrated key strength is concluded, this Thesis proceeds to the next sub-section. Next sub-section reveals the summary of the proposed improvements.

5.6 Summary of the Developed Proposal for Improvements

The proposal for improving the information flow regarding customer needs to the Electrical Engineering department affect throughout the lifecycle of *an End-customer delivery project.*

As illustrated in Figure 13 below, in the *End-customer delivery project*, the proposed improvements can be divided into themes to enhance the total project lifecycle. The stage related improvements, to each stage in an End-customer delivery project progress, include: (1) pre-sales, (2) project kick-off, (3) project design, (4) material delivery, (5) system updates, (6) field service and (7) project closing.

First, in *the Pre-sales* stage*,* two improvements are proposed, first, (5.2a) to Update the current offering materials, and second, (5.2b) to Create standard offering materials. The current offering materials and the standard offering materials are dedicated for the Sales departments' use, and therefore the materials affect at the first stage of an End-customer delivery project.

Second, as for *the Project kick-off* stage, again two improvements are proposed (5.3b) to Inform the Electrical Engineering department of the existing electrical specification and (5.4a) to Define the roles and responsibilities to form a proper project team prior to the kick-off meeting. The kick-off meeting is the suitable occasion to inform of the existing electrical specification, but ideally the project team formation takes place prior the meeting.

The seven themes of improvements in the *End-customer delivery project* can be viewed as a seven step-model, as shown in Figure 13 below.

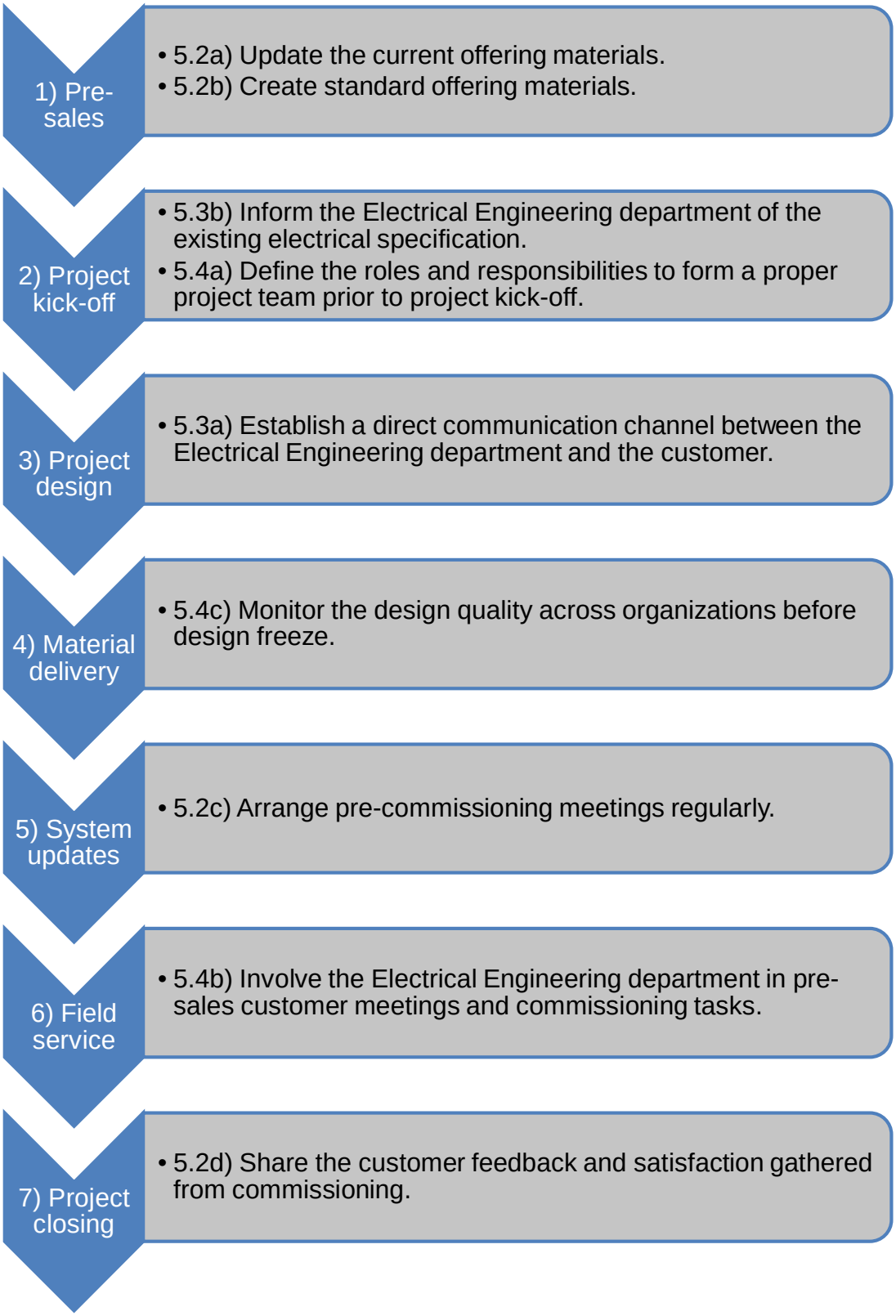

Figure 13. Initial proposal for improvements in the project progress.

As shown in Figure 13, following the first two steps, the third step includes the improvements related to the *Project design* stage. At this stage, a single proposed improvement is proposed (5.3a) to Establish a direct communication channel between the Electrical Engineering department and the customer. The communication channel is opened at some point of the project specific design, preferably immediately after the kick-off meeting.

Fourth, as the *Material delivery* closes, an improvement is proposed (5.4c) to Monitor the design quality across organizations before design freeze. Monitoring the overall design quality should consider several other stages of an End-customer delivery, such as field service stage and during project closing stage. Instead the proposed improvement is dedicated for certain project specific deliveries that need to be monitored before the material delivery.

Fifth, in the *System updates* stage, a single proposed improvement is proposed (5.2c) to Arrange pre-commissioning meetings. Pre-commissioning meetings are proposed to be arranged ideally quite close but before the commissioning. By arranging the meeting preferably a week in advance to the commissioning, the Commissioning Engineer and the Electrical Engineer can share information, update the required modifications accordingly and inform each other of upcoming challenges.

Sixth, during the *Field service* stage, an improvement is proposed (5.4b) to Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks. Obviously, the proposed improvement could be duplicated to consider also the pre-sales stage, but the involvement in commissioning tasks by the Electrical Engineering department is viewed as more important.

Finally, as the *Project closing* is timely, the final improvement is proposed (5.2d) to Share the customer feedback and satisfaction gathered from commissioning. The feedback gathered from the Commissioning Engineer and the customer should be shared openly in the project closing to increase knowledge regarding customer needs.

In summary, some of the proposed improvements can also affect several other steps, e.g. *Establishing a direct communication channel* between *the Electrical Engineering department and the customer*: Ideally, the new communication channel is valid from the project kick-off meeting through the field service. Also *Monitoring the design quality*

should be done during the project closing as well. Obviously also *Involving the Electrical Engineering department more in pre-sales meetings and commissioning tasks* should be duplicated to consider pre-sales phase. As seen from the proposal, the suggested improvements are linked to the specific project progress stage they affect the most.

Most importantly, a majority of improvements consider the very early stages of the project execution. During the early stages of an End-customer delivery project, the greatest amount of the highly important and critical information regarding customer needs flow into the case company. Therefore it is important to have a special focus on improving the information flow regarding customer needs *in the first steps* and tackle the identified challenges accordingly.

In addition to incorporating individual improvements into the current End-customer delivery project process, new ways of communicating are required. In other words, *new communication channels* are proposed to facilitate the new way of communicating. In relation to the customer needs, an improved approach of controlling the information flow is needed between the internal departments of the case company that are involved in the communication chain.

The proposed new communication channels include a channel between the Sales department and the Electrical Engineering department as well as a channel between the customer and the Electrical Engineering department. The proposed new communication channels affect two information events when customer related information gets distributed and discussed, which were introduced in Sub-section 3.4. These two occasions are information flow in *New projects* and information flow in *Project updates*.

The proposed new communication channels do not overwrite the existing ones that were identified in the current state analysis. But rather they aim to facilitate an alternative complimenting way of communication. The improved approach of the established communication channels is proposed in Figure 14.

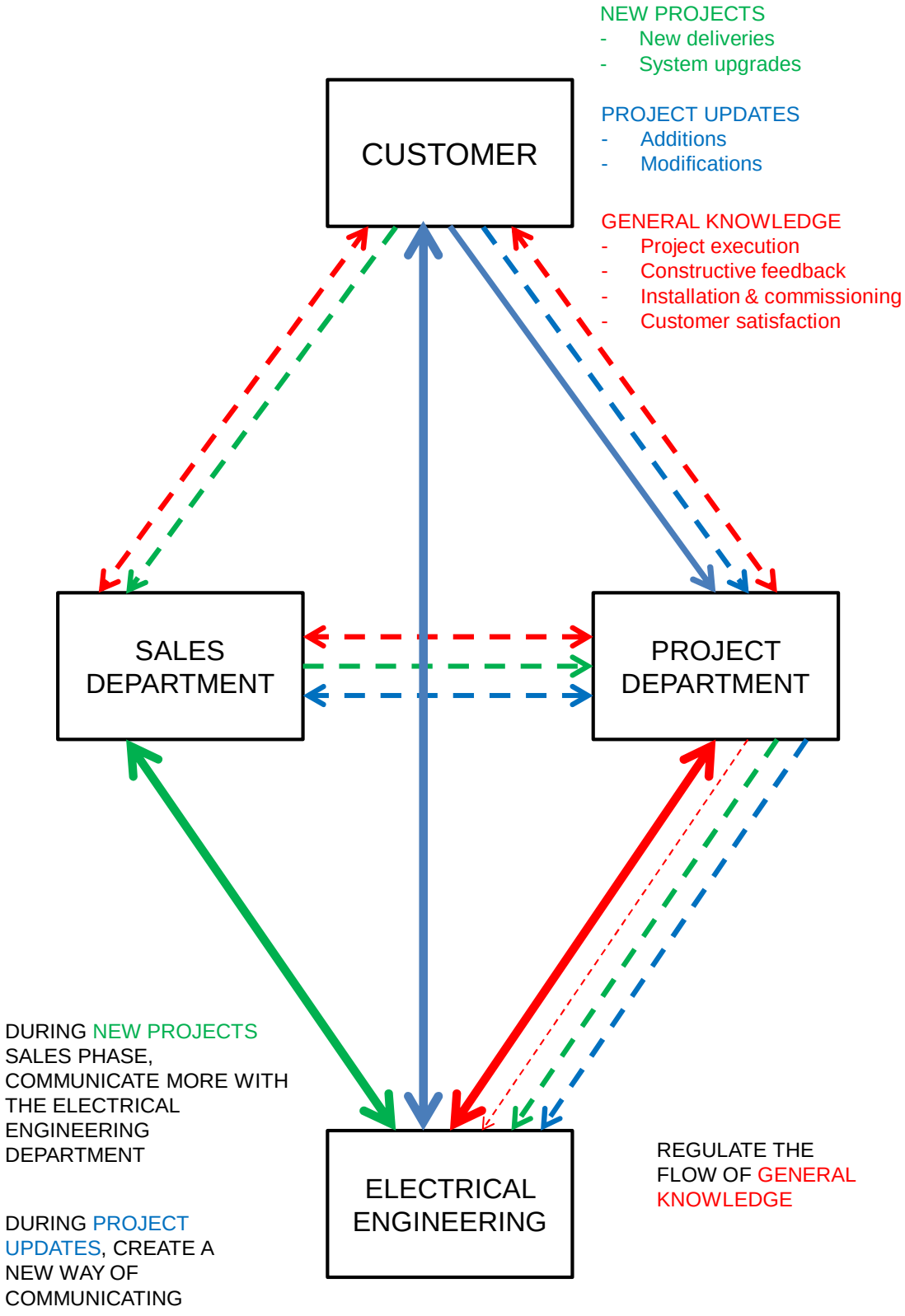

Figure 14. Initial proposal for the new communication channels for improved information flow.

As seen from Figure 14, two totally new channels are established from the customer and the Sales department towards the Electrical Engineering department. The established communication channels are visible as solid lines, and the communication channels identified in the current state analysis are dashed.

The first new communication channel between *the Sales department and the Electrical Engineering department* decreases the amount of misleading information when handing out the project specific information from a department to another. During the sales phase, it is important to enable direct communication between the Sales department and the Electrical Engineering department instead of relying on the Project department as a communication link, as the beginning phases of an End-customer delivery project is the period of time when misinterpreting the customer needs cannot occur.

The second new communication channel *between the customer and the Electrical Engineering department* allows for transparent communication regarding electrical matters. The Project department will remain in the daily communication, but rather than just delegating information regarding customer needs, the Project department will be a passive stakeholder in the communication only to keep track of project expenditures and to be aware of updates in the project execution.

Next, delegating the information regarding *General knowledge* towards the Electrical Engineering department remains to be as the Project departments' responsibility, but the information flow will be regulated. Important information regarding project execution, installation and commissioning progress, and constructive feedback needs to flow constantly to the Electrical Engineering department.

In summary, the established communication channels enable the Electrical Engineering department to get involved more closely in the project execution. In addition, the new communication channels facilitate the internal departments of the case company to increase barrier-free communication regarding customer needs. In the end, they aim to improve the information flow regarding customer needs to the Electrical Engineering department.

Next, the Thesis proceeds to validating the proposed improvements. The proposed improvements are evaluated with the help of key stakeholders.

6 Validating the Proposed Improvements

This section validates the proposed improvements in Section 5. The purpose of validating the proposed improvements was to evaluate the proposed solutions and to gather feedback whether the proposed improvements are relevant for the new practices of the case company or not. The goal of this section was to sharpen the proposed improvements for enhanced communication practices proposed in Section 5 into a more specific and accurate roadmap.

6.1 Overview of the Validation Stage

The validation phase was done in two steps. First, further developments are made to the improvement proposal that was discussed in the previous section. The target was to provide more accurate improvements to the proposal, along with the prioritization and possibility for implementation of the improvements.

Second, based on the improvements that were developed further, the final proposal for the improved communication practices was formulated. The summary contains the proposed improvements along with the departmental roles in the project progress. After the final proposal is presented, recommendations for next immediate steps are given.

The validation phase was conducted as two evaluation and feedback workshops that gathered together the key members from the top management of the case company – Engineering and Marine. The chosen members were not part of the stakeholders utilized in previous data collecting stages.

The purpose of carrying out two evaluation and feedback workshops was to evaluate the relevance of the proposed improvements. By facilitating two individual workshops with new participants, the validation becomes stronger through different approaching angles and perspectives of feedback. Therefore, evaluation and feedback was chosen to validate the proposal. The logic of the workshops was to go through the proposed improvements one-by-one in detail and to weigh the immediate importance of them. In addition, the next practical steps that are needed towards implementation of the improvements were discussed and formulated.

6.2 Further Developments to the Improved Practices Based on Feedback

Based on evaluation and feedback gathered from the validation workshops, the improvements proposed in Section 5 were recognized as relevant to the case company and they were weighed as important issues, most of them with high prioritization. Therefore new adjustment was limited to quite a few further developments regarding *Increasing communication across organizational borders*, *Enabling transparency in information* and *Improving cross-organizational collaboration*. They are discussed in more detail below.

6.2.1. Increasing Communication across Organizational Borders

For increasing communication across organizational borders, the revised practices for improving information flow regarding customer needs along with their prioritization are illustrated in Figure 15 below.

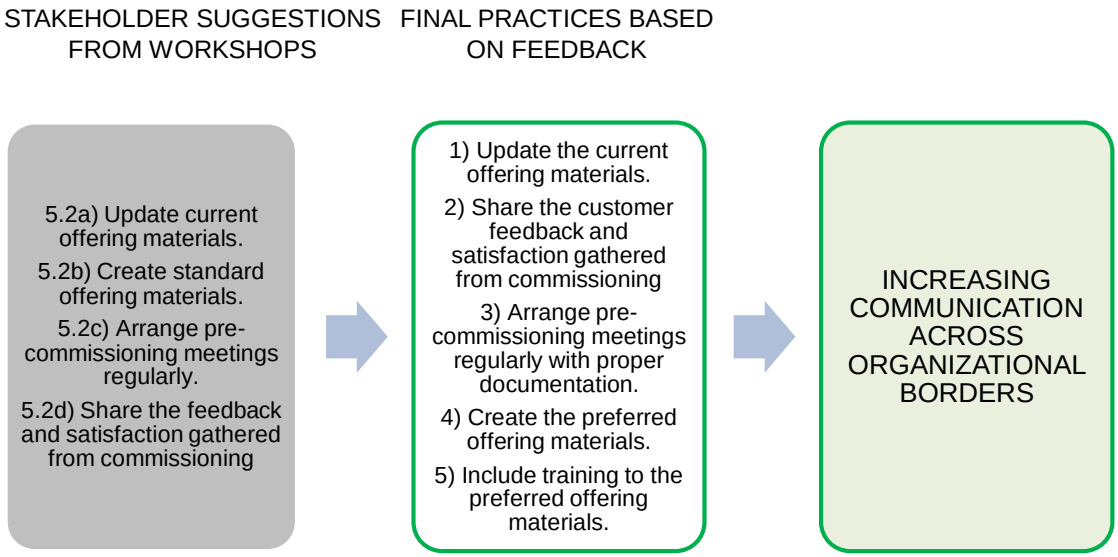

Figure 15. Increasing communication across organizational borders (based on feedback).

As illustrated in Figure 15, the more accurate and precise improvements are: (1) Update the current offering materials, (2) Share the customer feedback and satisfaction gathered from commissioning, (3) Arrange the pre-commissioning meetings regularly with proper documentation, (4) Create the preferred offering materials and (5) Include training to the preferred offering materials.

First, *Update the current offering materials* was placed on the top in prioritization. Updating the current offering materials was valued as the most important immediate action due to the high demand from the Sales perspective.

Second, *Share the customer feedback and satisfaction gathered from commissioning* was suggested to be next in prioritization due to the high impact on improving the *General knowledge* of customer needs within the Electrical Engineering department. In addition, *Arranging pre-commissioning meetings* was suggested as a regular action next in chronological order due to the value the improvement beholds.

Third in the priority was to *Arrange pre-commissioning meetings regularly with proper documentation*. It was suggested that, prior to the meeting, special attention is required in generating proper documentation of customer needs and electrical updates done after material delivery and sharing the generated documentation in the pre-commissioning.

Fourth, *Create the preferred offering materials* related to previously proposed standard offering materials. Standard offering materials are changed to the preferred offering materials due to the incapability of full product standardization for customers in the Marine segment. The case company is working on product standardization, which serves as a platform towards specific End-customer customization.

Finally, *Include training to the preferred offering materials* related to the preferred offering materials. As the preferred offering materials are created, training for the Sales department is required. As the Engineering respondent commented:

> *"Training will increase cross-organizational knowledge about how certain changes in project scoping affect the project specific design". (Engineering Respondent, Appendix 3)*

This statement means that training increases communication across organizational borders and enables for sharing perspectives of departmental issues when certain modifications or deviations are required.

6.2.2. Enabling Transparency in Information Flow

For enabling transparency in information flow, the revised practices for improving information flow regarding customer needs along with their prioritization are illustrated in Figure 16.

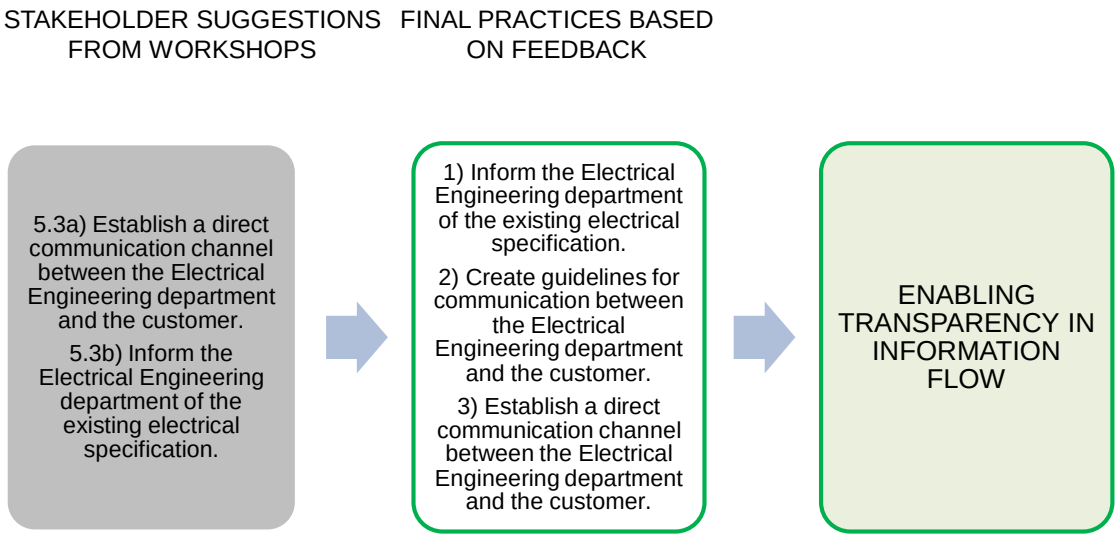

Figure 16. Enabling transparency in information flow (based on feedback).

As illustrated in Figure 16, the more accurate and precise improvements are: (1) Inform the Electrical Engineering department of the existing electrical specification, (2) Create guidelines for communication between the Electrical Engineering department and the customer and (3) Establish a direct communication channel between the Electrical Engineering department and the customer.

First, *Inform the Electrical Engineering department of the existing electrical specification* was placed on top in prioritization due to its ease of implementation. During the project kick-off meeting, the Sales department and the Project department informs the participating Electrical Engineer of the specification and its location.

Second, *Create guidelines for communication between the Electrical Engineering department and the customer* related to the proposed new communication channel between the Electrical Engineering department and the customer. Creating guidelines was added as an added improvement, as communication between the Electrical Engi-

neering department and the customer requires standardization because the Project department needs to be informed of the conversations taken place and the Project Manager must be in charge of the project budgeting.

Third, *Establish a direct communication channel between the Electrical Engineering department and the customer* related to transparency in information flow. After the project kick-off as the project is handed out from the Sales department to the Project department for execution, the Project Manager introduces the chosen Electrical Engineer to the customer.

6.2.3. Improving Cross-organizational Collaboration

For improving cross-organizational collaboration, the revised practices for improving information flow regarding customer needs along with their prioritization are illustrated in Figure 17.

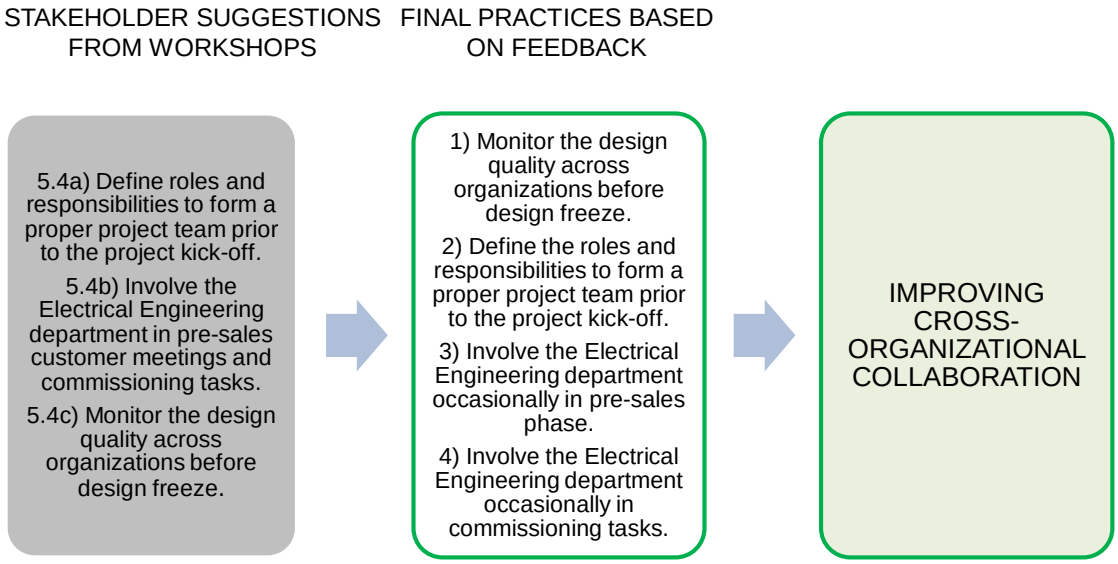

Figure 17. Improving cross-organizational collaboration (based on feedback).

As illustrated in Figure 17, the more accurate and precise improvements are: (1) Monitor the design quality across organizations before design freeze, (2) Define the roles and responsibilities to form a proper project team prior to the project kick-off, (3) Involve the Electrical Engineering department occasionally in pre-sales phase and (4) Involve the Electrical Engineering department occasionally in commissioning tasks.

First, *Monitor the design quality across organizations before design freeze* is placed on top in prioritization. It is the first implementable improvement due to its simplicity and rapidness. Arranging a quick meeting is a joint effort from the Mechanical Engineering department, the Electrical Engineering department and the Project department. The second implementable improvement is to *Define the roles and responsibilities to form a proper project team prior to the project kick-off* due to the high impact of preparing the Electrical Engineering department of the upcoming *New project* specific details.

Next in prioritization was to *Involve the Electrical Engineering department occasionally in pre-sales phase*. This improvement proposal was limited to occasional participation due to time resources and efficiency regarding the Electrical Engineering department as the Marine respondent commented:

> *"The Electrical Engineering department cannot be involved in every single End-customer delivery project due to the high workload". (Marine Respondent, Appendix 3)*

Finally, *Involve the Electrical Engineering department occasionally in commissioning tasks* which is closely related to the Electrical Engineering departments' *involvement in pre-sales phase*. As well as pre-sales customer meetings, commissioning tasks are typically abroad and both of them require a remarkable amount of presence from the participating stakeholders. For an Electrical Engineer this translates to several days that the on-going electrical designs for various End-customer delivery projects remain to be on hold. Therefore the participation and involvement of the Electrical Engineering department in the pre-sales phase and commissioning tasks should remain quite low, yet existent.

Even though participation in the pre-sales cases and commissioning tasks requires several hours or even days and therefore puts other projects on hold, it benefits the Electrical Engineering department through increased knowledge of customer needs. This increased knowledge can be leveraged in future projects by identifying the challenges in advance and taking them into consideration in the early phases of an End-customer delivery project.

6.3 Summary of the Final Communication Practices

Based on the findings from the current state analysis, ideas found from relevant literature, stakeholder suggestions for improvements and through validation workshops for gathering feedback, the final communication practices were formulated. The summary of the final proposal for the improved communication practices are shown in Figure 18.

As shown in Figure 18 below, the summary of the final proposal for improving communication practices includes the departmental roles and responsibilities. The departmental roles and responsibilities are embedded into the stages of a typical End-customer delivery project progress: (1) pre-sales, (2) project kick-off, (3) project design, (4) material delivery, (5) system updates, (6) field service and (7) project closing. The final proposal suggests that:

First, in the pre-sales stage *the Electrical Engineering department* is the responsible department to *Update the current offering materials*, *Create the preferred offering materials* and *Include training to the preferred offering materials*. Updating the current offering materials, creating the preferred offering materials and including training accordingly is the Electrical Engineering departments' responsibility, as the department has the best knowledge of product specific details. In the pre-sales stage, *the Sales department* is the responsible department to *Involve the Electrical Engineering department occasionally in pre-sales phase*.

Second, in the project kick-off stage *the Project department* is responsible to C*reate guidelines for communication between the Electrical Engineering department and the customer*. In the same stage *the Sales department* is responsible to *Define the roles and responsibilities to form a proper project team prior to project kick-off* and a *Joint effort from all* departments is required to *Inform the Electrical Engineering department of the existing electrical specification*.

The seven themes of improvements in the *End-customer delivery project* can be viewed as a seven step-model, as shown in Figure 18 below.

	THE ELECTRICAL ENGINEERING DEPARTMENT	THE PROJECT DEPARTMENT	THE SALES DEPARTMENT	JOINT EFFORT FROM ALL
1) PRE-SALES	Update the current offering materials. Create the preferred offering materials. Include training to the preferred offering materials.		Involve the Electrical Engineering department occasionally in pre-sales phase.	
2) PROJECT KICK-OFF		Create guidelines for communication between the Electrical Engineering department and the customer.	Define the roles and responsibilities to form a proper project team prior to project kick-off.	Inform the Electrical Engineering department of the existing electrical specification.
3) PROJECT DESIGN		Establish a direct communication channel between the Electrical Engineering department and the customer.		
4) MATERIAL DELIVERY				Monitor the design quality across organizations before design freeze.
5) SYSTEM UPDATES		Arrange pre-commissioning meetings regularly with proper docuentation.		
6) FIELD SERVICE		Involve the Electrical Engineering department occasionally in commissioning tasks.		
7) PROJECT CLOSING		Share the customer feedback and satisfaction gathered from commissioning.		

Figure 18. Final proposal for improving communication practices to improve the information flow.

As shown in Figure 18, following the first two steps, the third step includes the improvements related to the *Project design* stage. At this stage *the Project department* is the responsible department to *Establish a direct communication channel between the Electrical Engineering department and the customer*.

Fourth, in the material delivery stage a *Joint effort from all* participating stakeholders and departments is required to *Monitor the design quality across organizations before design freeze*. Monitoring should be initiated by the Project department, as the respective Project Manager is in charge of project scheduling.

Fifth, during the system updates stage *the Project department* is the responsible department to *Arrange pre-commissioning meetings regularly with proper documentation*. Furthermore, as mentioned earlier in this Section, creation of proper documentation is a joint effort from all key stakeholders; it is not only the Project departments' responsibility.

Sixth, in the field service stage *the Project department* is responsible to *Involve the Electrical Engineering department occasionally in commissioning tasks*.

Seventh, as the project closing stage is at hand *the Project department* is responsible to *Share the customer feedback and satisfaction gathered from commissioning*. Sharing the feedback and satisfaction gathered from commissioning is the Project departments' responsibility, as the department receives the feedback and arranges the on-site commissioning tasks.

Most of the proposed improvement can be implemented to the daily operating procedures except for *Creating the preferred offering materials*, *Including training to the preferred offering materials* and *Involving the Electrical Engineering department occasionally in pre-sales phase* as well as in *commissioning tasks*. *Creating the preferred offering materials* and *Including training to the offering materials* cannot be implemented immediately, because of a *Product standardization project* in the case company, which remains to be work in progress. *Involving the Electrical Engineering department* more *in the pre-sales* phase as well as *in commissioning tasks* should be also implemented in the future as the Electrical Engineering department is currently heavily loaded with project specific design tasks for various End-customer delivery projects.

6.4 Next Steps

As for the first step to the case company, an action plan needs to be created for the proposed improvements. The action plan should include guidelines for implementation as well as more specific roles and responsibilities for taking initiative within the departments. The action plan should also consider equally all of the three departments involved in the communication chain: The Sales department, the Project department and the Electrical Engineering department.

As for the next step to the case company which enables to implement two of the improvements that cannot be immediately imported to the daily routines, *the Product standardization project* should remain as a top priority. *The Product standardization project* is a part of New Product Development in the case company, which combines hardware and software optimization for all End-customers in the Marine segment. The finalization of the *Product standardization project* is on high demand in the case company, which will eventually be beneficial for all of the three internal departments.

After finalization of *the Product standardization project*, the highly valuable *preferred offering materials* can be created and *training* can be included accordingly. The case company also needs to create a favourable solution which enables *the Electrical Engineering departments' involvement in the pre-sales phase and commissioning tasks*, but without jeopardizing the current End-customer delivery projects that currently require vast resources in the design phase.

In summary, the final proposal for the improved communication practices consists of a number of individual improvements rather than a certain kind of communication process. The proposed individual improvements as well as the proposed new communication channels discussed in Section 5 were approved with minor modifications. An action plan needs to be developed for each department, which contains the internal roles and responsibilities, because initiating the individual improvements are designated as "push-actions" from each department. Eventually, the individual improvements needs to be embedded to the daily operating practices to improve the information flow regarding customer needs to the Electrical Engineering department.

As this section is concluded with the validation of the proposed improvements, the Thesis proceeds to conclusions. Conclusions summarize the key findings made in this Thesis and suggest further actions to the case company.

7 Conclusions

This section concludes with the findings made in this Thesis. In addition to the findings, comprehensive recommendations are given to the case company for future actions. Furthermore, this section includes also an evaluation of the Thesis.

7.1 Executive Summary

This Thesis focused on improving the information flow regarding customer needs from Marine segments to the Electrical Engineering department. The case company provides its services for Land and Marine applications all over the world either as the turn-key or instrument deliveries. End-customer delivery projects tend to vary significantly from each other due to local regulations and customer specifications. Therefore, the case company needs to deliver a unique system for each End-customer individually.

Although the End-customer delivery projects for Marine segment call for a comprehensive understanding of customer needs by all internal stakeholders in the case company, presently, the communication distance from the customer via Sales and other functions is quite long. In practice, it means that the detailed needs do not always come through the Electrical Engineering department or the message might be misinterpreted somewhere in the communication chain.

The objective of this Thesis was to improve the information flow regarding customer needs from Marine segments to the case company's Electrical Engineering department. The outcome of this Thesis was the improvement proposal to improve the information flow regarding customer needs from Marine segments across cross-functional stakeholders into the case company's Electrical Engineering department.

The approach to conducting research in this Thesis was an Action research with a combination of mainly two different research strategies. These two strategies are qualitative research and field study method. Data was collected within the case company through interviews, workshops and feedback. The study was conducted by analyzing the current state first, which guided the choice for existing knowledge and relevant literature to help for proposing improvements to the current information flow.

In the current state analysis, findings suggested that the ease of communication is the key strength, whereas the lack of communication across organizational borders, ob-

structions in information flow and insufficient collaboration structures were identified as key weaknesses. By embedding the key strength into the improved communication practices, based on the guidance from relevant literature and with the help of suggestions made by key stakeholders in the workshops, several specific improvements were proposed. These improvements focused, first, on increasing the communication across organizational borders, second, enabling transparency in information flow, and third, improving cross-organizational collaboration. The target in the proposal was to tackle the weaknesses identified in the current state analysis. These weaknesses related to the lack of communication across organizational borders, obstructions in information flow and insufficient collaboration structures.

To assist the proposed improvements, new communication channels are also proposed to be established and some of the existing ones are regulated accordingly. The new communication channels aim to improve the most typical information events when customer related information gets distributed and discussed, which include: information flow in *New projects*, information flow in *Project updates*, and information flow regarding *General knowledge*.

It was also identified that the proposed improvements require “push-actions” from all key stakeholders from the case company: the Sales department, the Project department and the Electrical Engineering department. These “Push-actions” and departmental roles need to be quite equally divided by the involved departments, and the implementation of the improvements requires participation by all three internal departments involved in the communication chain.

Presently, the inadequate internal information flow is recognized throughout the case company, and tangible improvements suggested in this Thesis are expected to be taken into use. The proposed improvements were evaluated as highly important and relevant to the purposes of the case company to enhance internal communication. The proposed improvements were validated through evaluation and feedback gathered from key members in the top management. The validated improvements affect throughout the typical End-customer delivery project lifecycle, most of which consider the early stages.

By implementing the proposed improvements, the case company can enhance the daily communication methods and eventually improve the information flow regarding customer needs from Marine segments to the Electrical Engineering department.

7.2 Managerial Implications

The proposed improvements for improving internal communication practices and improving the information flow regarding customer needs from Marine segments to the Electrical Engineering department, call for further practical steps in the case company. These practical steps relate to the current practices, suggestions for implementation of the proposed improvements and recommendations for future actions. Five practical steps are suggested below.

First, in order to import and test the proposed improvements, the case company should focus on creating an action plan which includes the department internal roles and responsibilities. As soon as the individual roles and responsibilities along with the action plan are in place, the case company should pilot the improved practices individually in any End-customer delivery project. By testing the improvements as quickly as possible, the case company can alter the operating culture and improve the information flow regarding customer needs.

Second, as for the future action, the case company can emphasize sharing the gathered feedback from commissioning between the three internal departments, which was one of the proposed improvements. Sharing the gathered feedback is an important aspect itself, but the feedback that is more on the negative side could have an even deeper focus from the internal departments involved in the communication chain regarding customer needs. In this scenario, the case company should define the roles and responsibilities for analyzing the negative feedback and develop guidelines how to improve accordingly.

Third, the case company may consider introducing an additional stage in an End-customer delivery project progress, which would be beneficial in defining the roles and responsibilities in the early phases of an End-customer delivery project. A suitable solution would be *a Pre-kick-off meeting*, where the very likely successful sales cases would be introduced to the participating stakeholders. In a Pre-kick-off meeting the participating stakeholders could share ideas and identify possible pitfalls in the current

project scoping. The scoping could be modified afterwards to be more accurate if needed. Nevertheless, a Pre-kick-off meeting would invite the stakeholders on a regulated basis to involve in the project execution, where the stakeholders would be more equipped with customer specific needs and details. A Pre-kick-off meeting would also strengthen and regulate the communication between the Sales department and the Electrical Engineering department.

Fourth, the case company could define the Electrical Engineering departments' involvement in the pre-sales phase and commissioning tasks more accurately. This made one of the proposed improvements and it was valued as a highly important in both the proposal and validation stages. However, it cannot be implemented currently due to the vast resources required in the project specific design tasks for various End-customer delivery projects. In the future, the case company could define pre-sales and commissioning participation as Electrical Engineering departments' responsibilities and set the milestones for individual Electrical Engineers accordingly. For example, participation in a pre-sales case and/or a commissioning task could be an annual requirement for every individual Electrical Engineer.

Finally, the case company should remain focused on finalizing the Product standardization project as soon as possible. The Product standardization project allows for *creating the preferred offering materials* for the Sales departments use. The preferred offering materials do not necessarily overwrite the updated current offering materials, but they are distinctively more comprehensive and accurate. The preferred offering materials also includes *cross-organizational training* which enables for sharing different perspectives of customer needs.

7.3 Thesis Evaluation

The objective of this Thesis was to improve the information flow regarding customer needs from Marine segments to the Electrical Engineering department. The outcome of this Thesis was an improvement proposal to improve the information flow regarding customer needs from Marine segments across cross-functional stakeholders into the case company's Electrical Engineering department. Thus, the objective and the outcome are linked with each other.

As for the quality of the research process and the outcome, the evaluation for this Thesis focuses on four criteria which are relevance, logic, validity and reliability in order to ensure credibility and quality of the Thesis results. By addressing these four evaluable criteria, the Thesis follows a framework for rigorous research. These criteria are discussed one by one below.

7.3.1 Relevance

Relevance means a close relation to the addressed business issue. In other words, the research needs to be rigorous while being relevant to the focus group – the case company (Näslund et al. 2010).

In this study, relevance first and foremost relates to the identification of the business challenge in the case company. In this study, relevance is first evident from identifying the business challenge in the case company which needs to be improved. It is identified as a common, persistent and distracting problem that should be improved. When moving forward with the Thesis, relevance is ensured by addressing the identified problems in the current state analysis findings, and the solutions are backed up by relevant findings from literature. Finally, the proposed improvements are built on from and in relation to the outcomes of all previous stages. Summing up, in this study relevance is ensured by connecting the business challenge to the planning and actions in collecting data, through findings from the current state analysis and literature suggestions, to the proposed improvements

7.3.2 Logic

Logic means that the cause-and-effect reflects each other regarding actions, decisions and solutions. Identification of the research questions or business challenge and properly designed data collection plans are key denominators in enabling methodological rigor. (Eisenhardt et al. 2016)

In this study, logic is ensured by looking specially into fitting the different pieces of the study together – starting from the business challenge, the objective and the outcome needs to connect them logically with each other. At the end, the outcome of the Thesis was separately evaluated as for meeting the objective. Logic also required grounding

choices in selecting data collection sources and methods. In addition, the same grounding was provided for the choice of literature and theory sources, with selecting those sources that provide comprehensively defined concepts and help establish relationships between the discussed constructs into a logical conceptual framework. This construct is further applied for grounding the proposal building.

7.3.3 Validity

Validity of research can be defined in many ways, but in a qualitative research it has close relationships with the tool selection and data collection. The tool selection is important to enable utilization of practical solutions that are applicable. An important aspect is to interpret a variety of different sources, which allows interpretation of alternative explanations. Saturation and triangulation of the collected data is easier to evaluate, is the researcher is an insider in the case company. Basically, validity in this perspective is a measure of trustworthiness, rigor and quality (Golafshani 2003).

In this study, validity was ensured by taking these steps: first, the tool selection is made by analysing a variety of different sources to ensure triangulation and second, data collection is done through an amount of stakeholders to ensure saturation. A sufficient number of sources were taken into account and a variety of diverse point-of-views was considered. Additionally, the data collection became more accurate, because informants were allowed to check their answers after each data collection phase. Therefore, a satisfactory number of literature sources data collection details enable a solid evidence-trail throughout the study.

7.3.4 Reliability

Reliability relates to transparency and objectivity. The utilized data needs to be clearly visible in the research and findings need to be linked to the available data. A measurement for comprehensive reliability of any research would be a test whether the same research would be repeated and concluded with the same findings when assessed by another person or not (Quinton and Smallbone 2006).

In terms of validity and reliability, this Thesis strived to be trustworthy, transparent and objective. Collected data was gathered from sources that are key stakeholders regard-

ing the subject, the data was presented clearly and the data was analyzed objectively. As an insider, the researcher took an objective perspective especially when collecting data.

7.4 Final Words

The scope of this Thesis was to develop improvements to the information flow regarding customer needs from Marine segments to the Electrical Engineering department. As the case company could benefit from improving the information flow regarding customer needs from Land segments, this Thesis is limited towards Marine based customers only. Further investigation is required, whether the proposed improvements concluded in this Thesis are applicable for customers from Land segments also.

Furthermore, by focusing on improving the information flow, a specific action plan is excluded from the scope of this Thesis. An initiative towards an action plan is waiting as the next practical step and the author of this study is looking forward with high hopes of development continuation.

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Appendix 1.

Summary of Results from Data Collection 1

Sales department - respondent 1

Current communication practices

- Customer queries usually has requirements of technical details. Marine sales offers a “stardard package” of electrical deliverables. Afterwards negotiations follows with more specific technical details.
- After the sales phase, communication is primarily done via the PM’s, not the sales organization. PM is in charge of the budget, therefore the PM handles out the changes done during the on-going project.
- Rarely the customer is in direct contact with the Electrical Engineering department. Usually in the larger projects, the customer is in direct contact. Electrical Engineering deparment do not participate in the pre-sales meetings with the customer.

Strengths

- Marioff has an own Electrical Engineering department.
- The occasional projects, when the EE is in direct contact with the customer.

Weaknesses

- Electrical standard offering is not available for sales representatives.
- Electrical Enginreering participation not as sufficient as preferred during the pre-sales phase.

Sales department - respondent 2

Current communication practices

- Electrical specification is received from the customer, which is reviewed by the sales department. The electrical specification is a generic specification, rather than a fire protection specification. The specification is not always easy to apply and the information of the specification does not always reach the Electrical Engineering department.
- Electrical Engineers are not dedicated in the pre-sales phase. In the ideal situation, and if the resources would allow it would be beneficial to have an Electrical Engineer from the beginning for example supporting the reviewing of the specification in the sales phase.
- If systems are updated, project department is in charge and in contact with the customer. Project Managers contact the sales representatives which makes the offers accordingly.

Strengths

- Close proximity in the office. the information flow between Electrical Engineers is good.
- Dedicated Marine support personnel.

Weaknesses

- The information flow of the existing electrical specification.
- The lack of an arranged project closing meeting, where general knowledge could be shared.

Project department - respondent 1

Current communication practices

- Project Managers are the center of communication between the customer and the Electrical Engineering department after the kick-off meeting. The meaning of the kick-off meeting is to hand out the project to the project department from the sales representative.
- Certain customers have comprehensive technical specification, including electrical specifications. Project Managers are responsible for evaluating the technical specification and forwarding relevant information to the dedicated electrical engineer.
- During installations and commissioning, feedback from the field services is directed to the project department, not the Electrical Engineering department.

Strengths

- The close proximity of the project department and the Electrical Engineering department.
- The ease of communication.

Weaknesses

- Electrical Engineering department is not utilized to their maximal potential (not involved in project execution, sales and commissioning that much).
- Electrical Engineers should be more critical and involved in the kick-off meeting. Kick-off meetings are arranged in fast-pace, which makes it hard to prepare.

Project department - respondent 2

Current communication practices

- Kick-off meeting is the starting point, which briefly describes the scope of delivery. Regarding electrical equipment, this meeting reveals limited knowledge of needs or electrical specification. After the kick-off meeting, project department takes charge of the customer interphase.
- Knowledge of customer needs is “in-house knowledge” and it flows between certain project stakeholders. Same personnel tend to know the needs of certain customers because Marine has a lot of repeat customers. Issues may occur when these stakeholders mix with different customers/projects.
- In general, Electrical Engineers are not that aware of the project process.

Strengths

- The tendency for Electrical Engineers to work with the same customers , if possible.
- The possibility of daily face-to-face conversations.

Weaknesses

- Lacking project specific information in the beginning (kick-off), especially in the quick-pace deliveries.
- Project department as the center link in communication, project managers and sales do not know exactly what kind of information the Electrical Engineering department requires.

Electrical Engineering department - respondent 1

Current communication practices

- Kick-off meeting is the starting point of a project launch. Kick-off sheet is handed out, which is usually missing information. Detailed information that is not known yet, is the responsibility of the project managers to collect from the customer.
- Marine sales rarely contact responsible persons within the Electrical Engineering department prior the sales phase to make sure of; technical details, specs, schedules…
- Valuable feedback from installation and commissioning is not sufficient.

Strengths

- Electrical Engineering department is available to support in the sales phase.
- Face-to-face communication is easy, because stakeholders are working in the same facilities.

Weaknesses

- Cross-organizational communication is not sufficient possibly due to organizational silos.
- Mutual understanding of technical details do not meet effectively enough.

Electrical Engineering department - respondent 2

Current communication practices

- At the beginning a kick-off sheet is handed out with false or misleading technical information. Sales support function provides the information, according to which the project is sold. Electrical Engineering department and commissioning representatives does not give enough valuable feedback from previous projects. A project is most likely sold incorrectly in the first place without proper technical documentation.
- Electrical Engineering department might not receive valuable specification requirements or is not reminded about certain updates, even though project management has the information.
- Problem solving and issues found from existing deliveries are not communicated on a general level, instead commissioning engineers and project managers try to solve issues case by case.

Strengths

- Bi-weekly meetings about Marine sales and future projections.
- Face-to-face contact from the project department, when modifications/updates are needed.

Weaknesses

- A regulated communication link is missing towards the Electrical Engineering department.
- Design freeze should be required. This enables the customer to know until when can certain updated be done.

Appendix 2.

Summary of Results from Data Collection 2

Workshop 1 and 2 Data Details for increasing communication across organizational borders

Weaknesses for the lack of communication across organizational borders, which were identified in the current state analysis

- The Sales department have insufficient standard offering materials of Electrical Engineering demands/requirements.
- The Project department rarely knows what kind of information the Electrical Engineering department requires.
- Feedback from the project process is not informed properly and valuable feedback from installations and commissioning does not flow into the Electrical Engineering department.

Suggestions for increasing communication across organizational borders

- Standard offering material should be created, when the product standardization project (NPD) project is released (Sales department Respondent 2).
- Standard offering material should also be updated, such as signal lists and common details of electrical cabinets (Project department Respondent 1).
- Regularly appointed meeting with commission team prior to commissioning. A great number of updates can be done between the material delivery and the commissioning (by all stakeholders).
- Feedback from commissioning afterwards (Project department Respondent 1).

Workshop 1 and 2 Data Details for enabling transparency in information flow

Weaknesses for obstructions in information sharing, which were identified in the current state analysis

- Lack of technical details in the project kick-off phase., which causes confusion and delays.
- The obstructed information flow of the electrical specification (customer specific requirements).
- The Project department as a center link in communication - variable communication methods and standards by individuals within the Project department.

Suggestions for enabling transparency in information flow

- Connect Customer and the Electrical Engineering department, increase direct communication. Information about the channel should be introduced by the Project Manager and jointly agreed communication methods should be applied. 80% Ideal situation (Project department Respondent 2).
- 20% should be operated case-by-case. Some cases may overload the recipients (Project department Respondent 2).
- Electrical specification should be inserted to a certain place in the project folder and location should be communicated to the Electrical Engineer. During the project kick-off (Project department Respondent 2)?

Workshop 1 and 2 Data Details for improving cross-organizational collaboration

Weaknesses for insufficient collaboration structures, which were identified in the current state analysis

- Not a proper project team is in existence, which leads to the incapability of utilizing dedicated Electrical Engineers for deliveries to same customers.
- The Electrical Engineering department is not utilized during the project process enough (pre-sales, customer meetings, daily communication between the customer and commissioning).

Suggestions for improving cross-organizational collaboration

- Engage EE's in the pre-sales phase (Sales department Respondent 1). Increased participation in sales phases and commissioning which enables for cross-organizational collaboration.
- Project Manager, Mechanical Engineer and the Electrical Engineer should evaluate/check the current design before release – monitor performance and a new way of working (Electrical Engineering department Respondent 1). Before or after the design, because mechanical and electrical design doesn't always proceed on a similar schedule.
- EE's should participate occasionally but regurarly commissioning regarding one's own projects. This would increase the knowledge of an Electrical Engineer (Electrical Engineering respondent 1).

Appendix 3.

Summary of Results from Data Collection 3

Feedback and evaluation from Engineering Respondent

Summary of the proposal for developed improvements

•<u>INCREASING COMMUNICATION ACROSS ORGANIZATION BORDERS</u>

- Update current offering materials.
- Create standard offering materials.
- Arrange pre-commissioning meetings regularly.
- Share the customer feedback and satisfaction gathered from commissioning.

•<u>ENABLING TRANSPARENCY IN INFORMATION FLOW</u>

- Establish a direct communication channel between the Electrical Engineering department and the customer.
- Inform the Electrical Engineering department of the existing electrical specification.

•<u>IMPROVING CROSS-ORGANIZATIONAL COLLABORATION</u>

- Define roles and responsibilities to form a proper project team prior to project kick-off.
- Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks.
- Monitor the design quality across organizations before design freeze.

Feedback for the proposal of the developed improvements

- Standard offering materials needs to be included with proper training. The Sales department needs to be informed, how certain changes in project scoping affect the design.
- In the project closing stage, the gathered feedback should be shared of course, but how can we improve our performance based on feedback? That is something that we need to focus on.
- These improvements are relevant to our needs, and we are looking towards implementation.

Feedback and evaluation from Marine Respondent

Summary of the proposal for developed improvements

•<u>INCREASING COMMUNICATION ACROSS ORGANIZATION BORDERS</u>

- Update current offering materials.
- Create standard offering materials.
- Arrange pre-commissioning meetings regularly.
- Share the customer feedback and satisfaction gathered from commissioning.

•<u>ENABLING TRANSPARENCY IN INFORMATION FLOW</u>

- Establish a direct communication channel between the Electrical Engineering department and the customer.
- Inform the Electrical Engineering department of the existing electrical specification.

•<u>IMPROVING CROSS-ORGANIZATIONAL COLLABORATION</u>

- Define roles and responsibilities to form a proper project team prior to project kick-off.
- Involve the Electrical Engineering department in pre-sales customer meetings and commissioning tasks.
- Monitor the design quality across organizations before design freeze.

Feedback for the proposal of the developed improvements

- Project closing process is not regulated. We have the tools and materials, but we need to regulate the process further.
- Standard offering material as a term is not valid, we prefer the term: ”preferred offering materials”.
- Guidelines needs to be created for communication between the Electrical Engineering department and the customer.
- All sales cases cannot be discussed with the Electrical Engineering department due to the high workload in end-customer delivery projects.
- All improvements are relevant and serves a real demand.