TAMPEREEN
AMMATTIKORKEAKOULU

RISK MANAGEMENT IN CLIENT SPECIFIC PROJECTS IN OPTOFIDELITY OY

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ABSTRACT

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Risk management is one important part of project management life cycle. It should be carried throughout the entire project life cycle and to be monitored continuously, instead of generating a single plan for example in the beginning of the project.

The purpose of the thesis was to explain the benefits of risk management and to define the most critical part of project in client specific projects for risk management. Additionally, the research was done to explain the importance of systematic and transparent risk management during entire project life cycle.

The data for the research was collected by interviewing face to face seven people altogether from Optofidelity. One of the interviewees was purely a sales representative, two worked both in sales and as a project manager and four were solely project managers. The interviews were done to clarify the current situation as well as to understand the mindset towards risk management and to gather ideas how to develop it in the future.

The research showed that risk management in client specific projects in Optofidelity is not done properly and needs to be standardized. Among the interviewees, the understanding of the importance of risk management exists and as well does the willingness to develop the process. Rest of project team members still need emphasizing and guidance.

Outcome of the research was that by standardizing the process, it is easier to highlight risk management being part of every project team members work. It is a fact that project managers cannot accomplish risk management alone, they need the help of their project team, sales people and specialists, to mention a few. However, first a common agreement of how risk management should be accomplished in client specific projects in Optofidelity needs to be found in the upper level. After that it can be implemented further to the project teams.

Key words: risk, risk management, client specific project

CONTENTS

1 INTRODUCTION

Optofidelity is a medium size company working in the field of information technology and its core business is building robot assisted test and measurement systems for smart device ecosystems. Its customers are top global mobile and smart device companies around the world and in various industries. Other fields of industry that Optofidelity has great knowledge are for example machine vision and expertise in camera technologies.

Optofidelity was established by three friends in 2005 in Tampere and has come a long way since then. Today, Optofidelity has offices in three continents; the headquarters is still based in Tampere and there is an office also in Oulu. In addition, there are offices in China (main office in Shenzhen) and in USA (offices in Redmond and Silicon Valley. Figure 1 shows all Optofidelity's locations on a world map.

Figure 1. Optofidelity's locations around the world

Optofidelity employs over 120 people altogether, including the three founders. Optofidelity's turnover was over 21M€ in 2017. The development of turnover and personnel can be seen in Figure 2 and Figure 3.

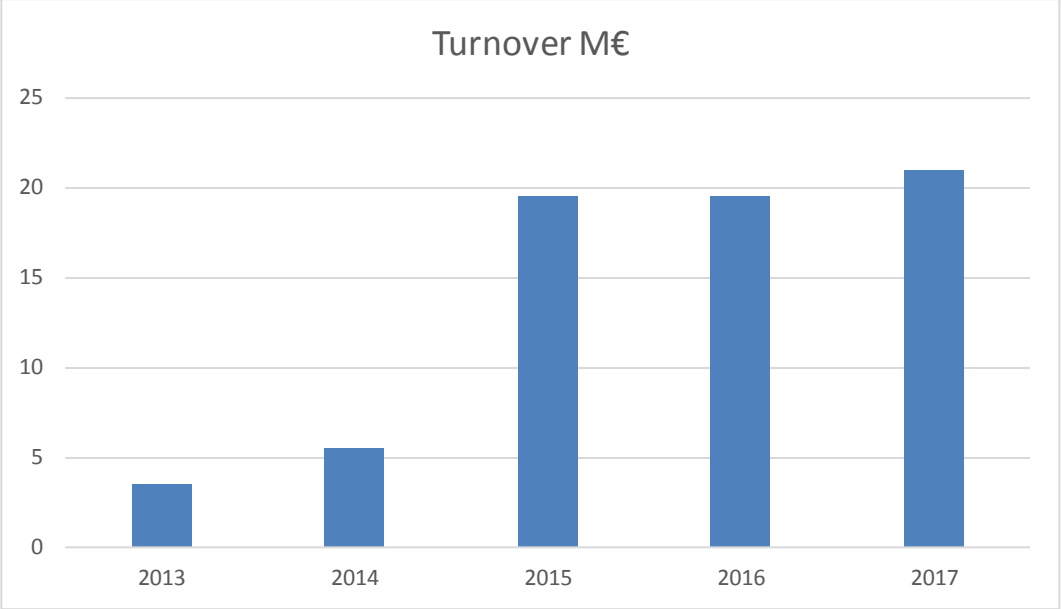

Figure 2. Optofidelity's turnover 2013-2017

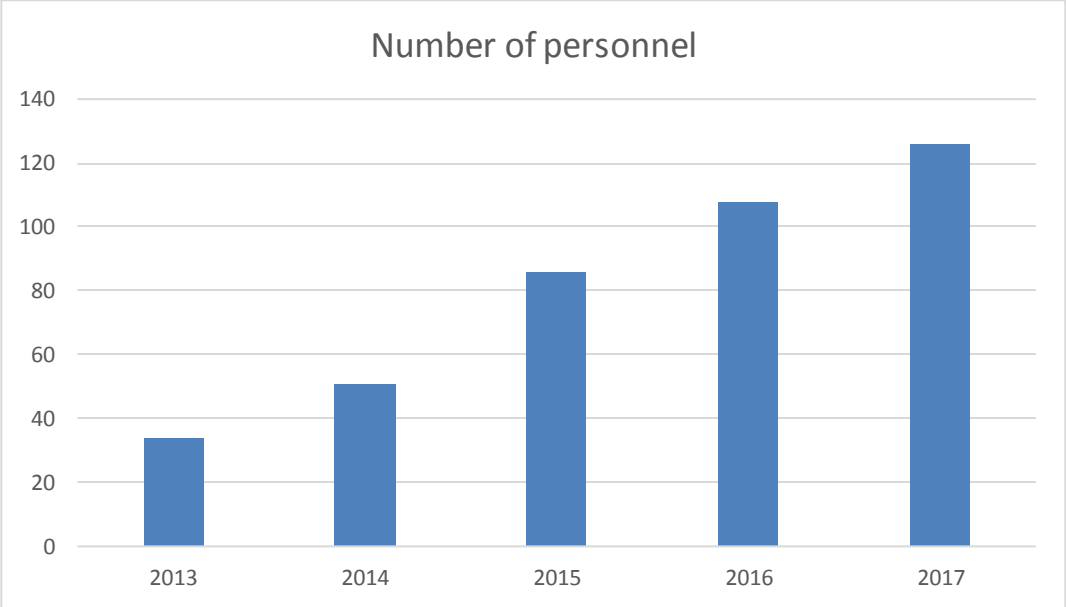

Figure 3. Number of personnel in Optofidelity 2013-2017

In 2017 Optofidelity was acquired by a Chinese company Changyuan Group Ltd and Optofidelity continued to operate like previously.

Optofidelity provides for example production testing solutions which combine software, robotics and camera technologies. These solutions are used by world leading smart device manufactures, vehicle infotainment as well as in industrial smart machinery. In addition to this, company also provides fully customized solutions to its clients. (Optofidelity 2018.)

During recent years, Optofidelity has been growing and expanding greatly. Growth has brought different kind of challenges with it. Due to rapid growth and agile working methods, company's project routines have been frenetic and sometimes not compatible when comparing how each project manager or business unit handles the project life cycle.

Projects, that this thesis is focusing on, are client specific projects. Client specific projects differ from e.g. mass production projects so that usually only one, or perhaps a few, systems are built. All the specifications come from the client in respect of their needs and purpose of use. Schedule is typically tight, and specifications might change or become more precise during the project.

Since Optofidelity operates in high technology field of industry, project risk management in the company needs to keep up with the changes. The rapidly changing world brings its own nuances and challenges to the risk management and Optofidelity needs to be alert and aware of these factors when planning, monitoring and developing risk management in projects.

1.1 Background

Company works in a field of high technology where several projects are made according to client's requirements and needs. Projects are challenging in many ways and time schedules are very tight in many cases. Usually client specific projects are breaking new ground and therefore risks can be surprising as well. When a project begins, it is possible there are some details which are not clear at that point, and which will still be specified during the project. Thus, it is difficult to estimate for example the costs of work load, not to mention the length of the project, in the beginning.

Even the requirements might change during the project by the client, as well as the needed components, which leads into new budgeting. Usually the deadline remains the same but might sometimes change due to changed requirements. It is also possible that the members of project team change during the project for different reasons. These all are important factors to be taken into consideration when risk management is in question.

Because of the rapidly changing scope of the project, requirements, specifications and even a project team, Optofidelity is using a mixture of traditional project management together with agile methods. It enables to follow the fast pace of multiple changes without effecting disastrously on the project. Like Highsmith (2002, xxiii) puts it: "Agility is the ability to both create and respond to change in order to profit in a turbulent business environment."

There are challenges when considering the client specific projects from the risk management point of view. Risks can occur in any stage of the project life cycle and they can be caused either by internal factors or tasks or by factors from outside the project. The severity of a risk and effect on the project can vary remarkably. The size of the project has its impact on the risk management as well.

In Optofidelity the project life cycle is divided roughly in three phases. Sales phase includes quotation phase, discussions with the client as well as with the possible project team, and planning of the project. Execution phase includes everything between the receival of the purchase order form the client until the accepted delivery and possible ramp up or delivery to the client. Warranty phase is pretty much self-explanatory. Figure 4 represents the simplified process of project life cycle in Optofidelity.

Figure 4. A simplified description of project life cycle in Optofidelity

In Optofidelity's projects, certain type of risk management has been done in some of the projects, but it is not systematic. It is important to clarify the need for carefully considered risk management to different stakeholders of the project life cycle. To increase customer satisfaction, as well as diminish stress from project manager and the whole project team, it is essential to find a suitable and practical way of doing project risk management. This would help the project team and all stakeholders to understand and underline the importance of risk management.

1.2 Objective and purpose of the research

According to Wysocki (2009, Chapter 16), a huge amount of information technology projects become distressed or fail. He states, that even during the years, the industry has not been successful in reducing the failure rate (Wysocki 2009, Chapter 16). Therefore, it is important to have an effective and functional risk management system as a part of project management.

The objective of the thesis is to clarify what are the benefits of project risk management and to define the most critical part of project where the risk management should be done particularly carefully. In addition, the goal is to explain why a systematic way of managing the risks during the complete project life cycle is advisable.

The purpose of the thesis is to find ways to make project risk management more transparent to the whole project team, as well as to the client, and rationalize the importance. Furthermore, to increase the understanding of the risk management as well as explain how understanding the importance makes risk management, mitigation and elimination easier. The core purpose is to amplify the knowledge of handling risk management in client specific projects. The aim of the research is to compare and analyze the collected data to the theory and find ways to improve and develop project risk management in Optofidelity.

Thesis, or parts of it, will be one part of project manager hand book which is now in process in the company. Its purpose is to make risk management in client specific projects a routine and something that is followed and revised during the project. The goal is to gather guidelines for project risk management which can be followed in all client specific projects at Optofidelity.

1.3 Research questions

In general, risk management consist of identifying, monitoring and mitigating or removing risks. In business, risk management means an organized process of managing uncertainty and threats as well as involving people to follow procedures and using tools to ensure obeying the risk management policies. (Jordão & Sousa 2010, viii; Pinto 2007,

221.) Projects usually work in an uncertain environment which forms the basis for project risk and to the need of risk management. (Pinto 2007, 221.) The understanding of project life cycle and continuous monitoring concerning risk management is vital in terms of avoiding the project to become distressed.

The importance of risk management in projects might not be clear to all project managers or members of project teams at Optofidelity. Like mentioned earlier, there is no systematic or standardized way for project risk management process in the company and sometimes it causes unnecessary turbulence to the projects.

Due to these facts, the following research questions have been identified and set to guide the research:

- Why should risk management be emphasized in client specific projects and what are the benefits?
- Which phase of the project life cycle is the most crucial one in terms of project risk management?
- How can project risk management be improved in this certain point?

An understanding of these matters is essential in building stronger and more structured way of project risk management process. It could also encourage greater participation and dedication to the subject and this way help project teams to be better prepared.

In order to find answers in the set research questions, a theoretical background was studied first. After a comprehensive study of reliable material and resources, an overview will be introduced in this research. Theory was collected in a form of appropriate literature. Theoretical framework will be introduced more specifically in the next chapter. Based on the theory, a guideline for face to face semi -structures interviews and empirical research was gathered.

1.4 Content of the research

In first chapter, a short introduction of the company is given, and some background is presented. First chapter explains the overview of the research in general; reason for the

research, research questions as well as the research approach. The aim of the thesis is also explained in the first chapter.

In chapter two, background theory is presented, which is essential when wanting to understand the aim of the thesis. Theory also gives a deeper understanding of project risk management. Furthermore, it provides the foundation for the speculation of the research results.

The third chapter describes which methods were used in the research and how data was collected and analyzed. It also explains why these methods were chosen. In this chapter, the reasoning for the selection of the interviewees is explained as well, and it unwraps the structure of the interviews more precisely.

Fourth chapter presents the output of interviews, in other words empirical findings. The empirical findings help to understand how Optofidelity currently handles risk management in projects. Through the results, it is desirable to better understand the current risk management process and to see where it should be enhanced.

Conclusions and suggestions are introduced in chapter five. Conclusions are based on empirical findings as well as the suggestions for future actions. Summary and discussion are presented in chapter six.

2 THEORETICAL BACKGROUND

An overview on theoretical frame work is introduced in this chapter. Many theories can be found when project management is in question and same applies to risk management. Quite many of them relate to Project Management Body of Knowledge – PMBOK 's different editions which could therefore be considered the bible of project management. PMBOK has been used as a reference in this research as well, but other references were gathered to get deeper insight on the matter.

2.1 Project life cycle

Inherently, project life cycle refers to time which is a common ground of project life cycle (Eduardo Yamasaki Sato & de Freitas Changas Jr 2014). Thus, every project has a beginning and an end. A project life cycle is a series of phases which a project goes through during its life time. Typically, a project life cycle defines the work needed to be executed in each phase and the people who should be involved in each phase. (Deenen 2007). PMBOK (2013, 56) divides the structure of generic project life cycle into four phases:

- starting the project
- organizing and preparing the project
- executing the project
- closing the project

Figure 5 illustrates the structure of generic project life cycle.

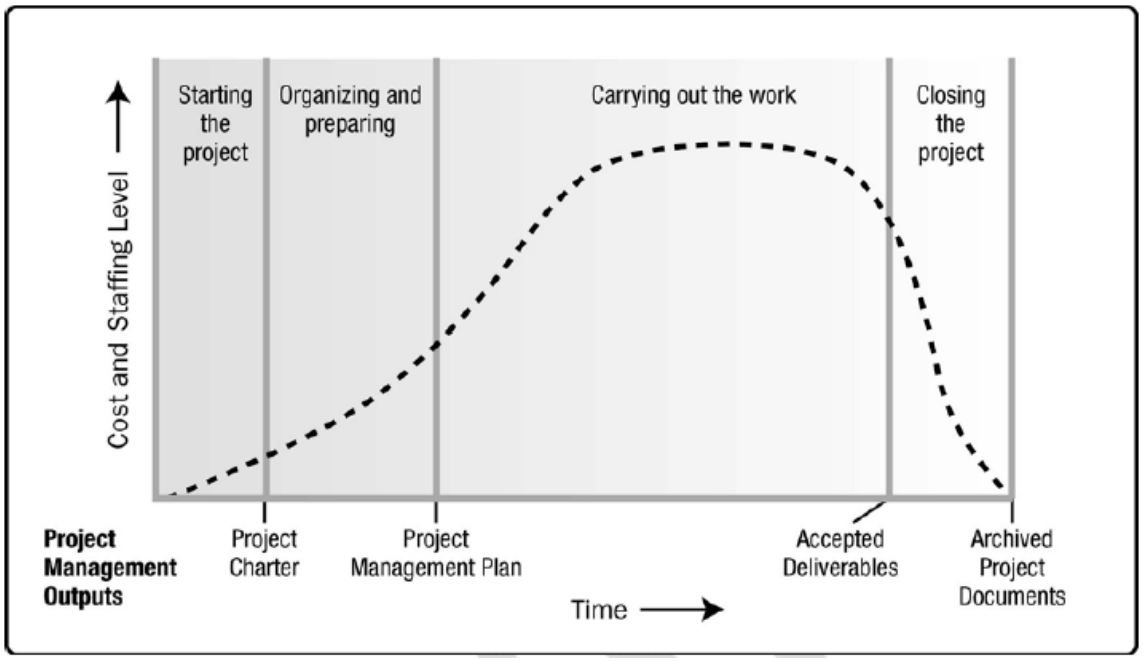

Figure 5. Structure of generic project life cycle (PMBOK 2013, 57)

In the first phase, the project will be evaluated to see what a project's financial return would be and if it helps the company to achieve its long-term strategic objectives (Hormozi, McMinn & Nzeoqwu 2000). An effective selection process is crucial for companys' prosperity (Oueslati 2016). In this phase, project mission is set, support from top management received (project is authorized) and project schedule and priorities are organized as well as the administrative procedures (Jiang & Heiser 2004).

The second phase is the phase where more precise plans are made for the project. This phase includes taking care of the iterative planning and executing the forming of the project team. Together with the project team, project manager plans the main activities to be accomplished during the project. In addition, a more detailed schedule, budget and resource plan is formatted in this phase. (Jiang & Heiser 2004.)

The execution phase is usually the longest phase as the actual work is done during this phase. This phase includes some main functions which are assuring the needed resources for each task, making sure the schedule is on time, monitoring and reporting progress, updating and revising plans and adjusting the new conditions. (Jiang & Heiser 2004.) Iterations and revising are included in this phase as well.

After execution, project closure or termination phase is followed. In between of these two phases, the project team has had a briefing with the client and guided them in operating

the new product or service. (Jiang & Heiser 2004.) Retrospective meetings are arranged in this phase to develop actions in coming projects.

2.2 Risk and risk management

According to Hillson (2009, 6) risk is an uncertainty that matters; uncertainty only becomes a risk when it matters. If the uncertainty exists but does not have an effect on the project, "it is a mere intellectual curiosity or irrelevance (Hillson 2009, 6). Risk means a probability of a fact that there could be difference between the expectations of what should happen and what happens in reality (Vanderjack 2015, 55). Risk is a complex, multilateral occurrence and always evolving (Gachie 2017, 165). Thus, risk management should evolve along.

If a company aims to grow, develop or gain something in general in a global business environment today, taking risks is required. When there are risks, there should also be risk management. Typically, because projects are unique, they face uncertainties and therefore contain risks, but like Lenfle and Loch (2010) mention, at the same time there are parts in projects which are relatively routine. Risks can occur at any stage of the project and their impacts may vary. To execute a successful project, an efficient management of uncertainties is required. (de Carvalho & Rabechini 2015, 322; Deenen 2007; Vik 2012, 1; Zwikael & Ahn 2011, 25, 32.) Because of the complexity of projects, risk management should play an important role in them.

Pinto (2007, 221) defines risk management as "art and science of identifying, analyzing, and responding to risk factors throughout the life of a project and in the best interests of its objectives". According to Kerzner (2006a,711), risk management is an act or practice of dealing with risk, which includes several different stages. Usually the effects are identified later than the occurrences. On the other hand, it is easier to perceive possible effects than to specify occurrences which might occur in the future. (Kmec 2011.)

Project risk management is explained by Besner and Hobbs (2012) as follows: "Project risk management is related to the set of practices and tools generally used to manage project risks." Pinto (2007, 221) states, that all projects have problems; the ones which fail and the ones which succeeds. It is only a matter of planning in advance. Therefore, it

is important to prepare for the possible coming occurrences since most likely some will occur.

Good risk management helps project managers and the project team to anticipate, mitigate and even remove potential risks before they occur and cause serious problems. When reviewing and planning a mitigation strategy, a competent risk control strategy will also identify incidences or situations which should initiate a response so that project manager can react in time, before a risk even becomes a problem. (Rakos 2005, 234.)

Both Pinto (2007, 221) and Lock (2012, 107) state that the later during the project the risk occurs, the costly the consequences will be. Without a functional risk management plan, lot of time can be wasted for emergency measures in the middle of the project. In other words, preparing an effective risk management strategy in the beginning and using little time to do it, might save a significant amount of time and money later during the project. Figure 6 demonstrates how costs of changes and rectifying errors increase and impact of risks and uncertainty diminish the longer the project has been executed.

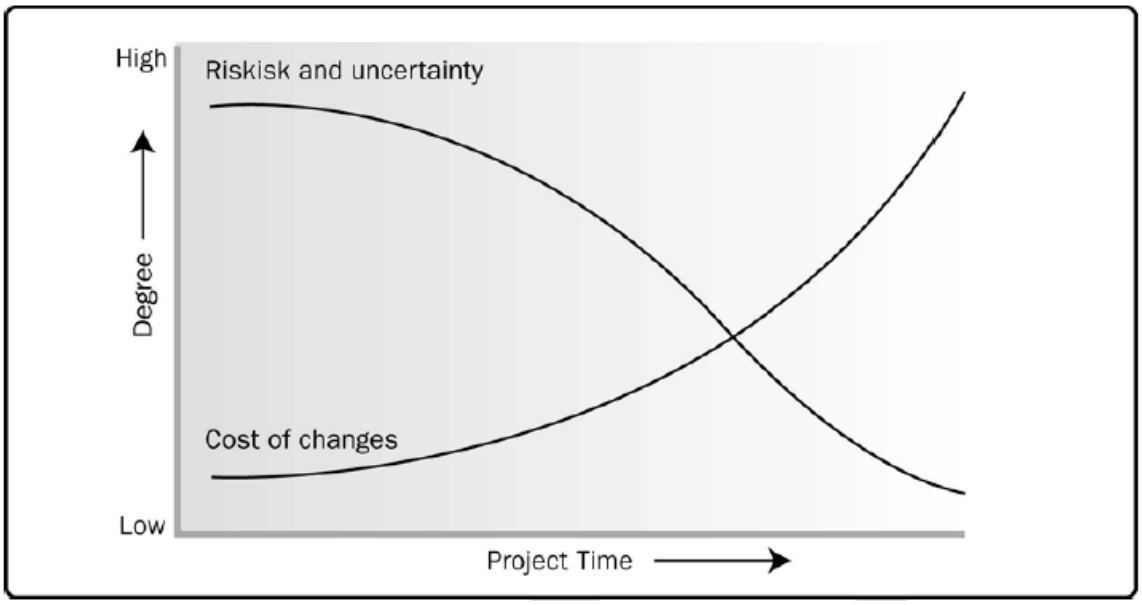

Figure 6. Impact of time in the degree of cost of changes and risks and uncertainty (PMBOK 2013, 58)

Risk management strategy helps project managers to react quickly to the occurring events, although the actual circumstances might differ from the plan. Consequently, the mitigation plan needs to be reviewed each time a new risk occurs, taking the actual situation into consideration. Regardless, the plan gives an efficient base for developing a reaction

to an unpredictable occasion. (Rakos 2005, 234-235.) Thus, the better the plan is in the first place, the easier the risk handling is when risks occur.

Most of the project risk management methodologies define risk management as a separate project management area. However, recent studies have shown that isolating risk management from other project management processes might prevent an efficient integration of risk management. In other words, taking a wider perspective and unifying risk management practices to other project management processes, as well as to company processes and practices, will support projects to succeed. (Zwikael & Ahn 2015, 33.)

2.3 Project risk management process

”The success parameters for any project are in time completion, within a specific budget and with requisite performance (technical requirement). The main barriers in achieving these are changes that occur in the project environment. The problem multiplies with the size of the project as uncertainties in project outcome increases with size.” Risk analysis should be done keeping the three factors of time, cost and quality in mind. (Prasanta 2002, 13, 16.)

Firmenich (2017) argue that project risk management is connected to each phase of a project, as well as team member and task. Lock (2012, 107) writes in his book Project Management, that project risks can be foreseeable or totally unpredictable and they can incur by several different causes. According to Lock project risk management process consists of identifying all the predictable risks, defining the severity of the risks, deciding how the impact could be mitigated or to prevent them completely. (Lock 2012, 107.)

Equivalent theories can be found from several different sources. Figure 7 below presents the project risk management process which it is created based on Kerzners’s (2006a, 709) definition. Definition is similar to Lock’s definition, except Kerzner adds monitoring and documenting phase to the process. A very similar definition is also described by for example Pinto (2007, 223). The core idea is that risk management process is an interminable cycle during the entire project life cycle.

PMBOK (2013, 268) present altogether 6 different steps in project risk manageemnt process; Plan risk management, identify risks, perform risk analysis (this step was actually divided in two steps, qualitative and quantitative), plan risk response and control risks. Firmenich, on the other hand, suggests five steps which should be repeated during the project life cycle. Fimenich's addition to the previous is risk classification as a third step. (Firmenich 2015.) Kerzner, Pinto and PMBOK include this step in analysing phase instead of stating it as a separate step of the process. In Figure 7 altogether five steps are summond and presented:

1. planning risk management
2. identifying the possible risks
3. analysing to estimate the the probability
4. planning and executing the response
5. monitoring the progress

(Kerzner 2006a, 709; Pinto 2007, 223; PMBOK 2013, 268.)

Figure 7. Project risk management process

Like Fimenich, both Kerzner (2006a, 709) and Pinto (2007, 223) argue that project risk management is a continuos process which should be followed during the whole project life cycle.

Basically, all risks should be evaluated regarding of two different elements. These elements are the probability that the event is going to occur and the impact of its occurrence. A simple equation can be concluded:

Probability x Impact = Severity

(Canty 2015, 111; Kerzner 2006a, 709; Pinto 2007, 222)

According to Canty (2015, 111) the probability of earlier stated risks can change during the project which leads to the fact that risks should be monitored and re-evaluated throughout entire project life cycle. Agile methods in risk management provides the opportunity to tackle risks as early as possible through iterations (Canty 2015, 111). The earlier the risks are identified and tackled, the smaller economical impact it has on the project.

2.3.1 Planning risk management

Planning risk management contains making the plan for a project of how to manage risk management activities. It is important that the plan is understood, accepted and supported by all project stakeholders. Accurate and precise planning helps to succeed in the next phases of project risk management. This phase should be started very early, and to be completed in the beginning of project planning. (PMBOK 2013, 270-271.) Generating a plan is the basis for a systematic risk management process.

2.3.2 Risk identification

In the risk identification phase all the likely risks will be identified. It is a systematic process to make sure all significant risks are discovered and listed. (Burke 2003, 258.) According to Pinto (2007, 223-224), risks usually fall into one or more of the following categories:

- financial risk
- technical risk
- commercial risk

- execution risk
- contractual / legal risk

Financial risks include for example large investments required, technical risks have different stages depending on the project. If the project contains unique or unproven technology, risks are greater than when making modifications to a standardized product. Commercial risk might appear when a project has been developed for a certain commercial purpose and it is difficult to foresee customer acceptance. Execution risk contains wide variety of uncertainties or unique circumstances which might have an influence on the project success. It includes for example geographical and physical risks as well as the personnel related risks (e.g. absenteeism, resignation, poor training, insufficient personnel). Contractual or legal risk usually exist in project where there are strict terms and conditions determined in advance. (Pinto 2007, 223-224.)

In addition to these risks, also the industry -specific risks should be taken into consideration. Industry-specific risks can be identified for example in brainstorming meeting among the project team. Additionally, top management and even the client can be involved in these meetings. (Melton 2008, 152; Pinto 2007, 224.)

Jafari, Rezaeenour, Mahdavi Mazdeh and Hooshmandi (2011) state that company cannot disregard the importance of internal knowledge in risk management. Hence, this leads to another method that can be used, which is an expert's opinion. This can be done by using a Delphi -method, which basically is a systematic and interactive forecasting method which relies on a panel of experts (Kerzner 2006a, 724; Linstone & Turoff 2002.) The simpler way of using the expert's opinion is to identify and consult a person or several persons inside the organization who have similar experiences and projects in the past or who have been in the company long enough to have a clear insight of project risk analysis (Kerzner 2006a, 724; Pinto 2007, 224). The more people are consulted, the wider perspective is received.

Third method is a method based on past history, which can be used not only to identify possible risks but their leading indicators as well. However, there is no guarantee that the condition that lead to project risks in the past, may be relevant in the current situation. Still, taking a look into the past projects can give useful information of key project risk

factors. (Burke 2003, 259; Pinto 2007, 225.) Thus, learning from the past and not reinventing the wheel again are valuable means and can save time, but should also be carefully considered keeping the current situation and conditions in mind.

To get a more comprehensive set of project risks identified and listed, a team-based approach can be used. It can also encourage the half-convinced or uncommitted members of the project team to activate and support project goals. Diverse backgrounds of the team members can give a different and wider perspective for risk identification. (Pinto 2007, 225.)

Risk identification should not be a one-time task, but risks should be actively monitored throughout the process. That said, this phase could be the most important part of the whole project risk management process. If a risk has not been identified, it will be excluded from further analysis and consequently not responded to. (Burke 2003, 258; Kerzner 2006b, 401.) It is better to identify too many and then concentrate on the ones with highest risk or probability than leave one out which might cause consequences to the project.

2.3.3 Analyzing the probability

The objective of analyzing the probability of risks is to gather enough information to estimate the likelihood of the identified risks (Kerzner 2006a, 727). The major output is a list of possibilities which should be seek and threats which need attention (Merna & Al-Thani 2008, 51). To do this, it is often necessary to convert the results into risk levels. Typically, they are a measure of the probability of occurrence and the impact of the issue. Usually these are presented as low (minimal impact on project), medium (some impact on project) and high (substantial impact on project). (Kerzner 2006a, 727, 729.) Project team should evaluate the listed risk in previous phase and place them in a relevant section according to impact and probability.

Figure 8 below is formulated after Kerzner's above mentioned statement, where green indicates low impact on project, orange moderate and red high impact.

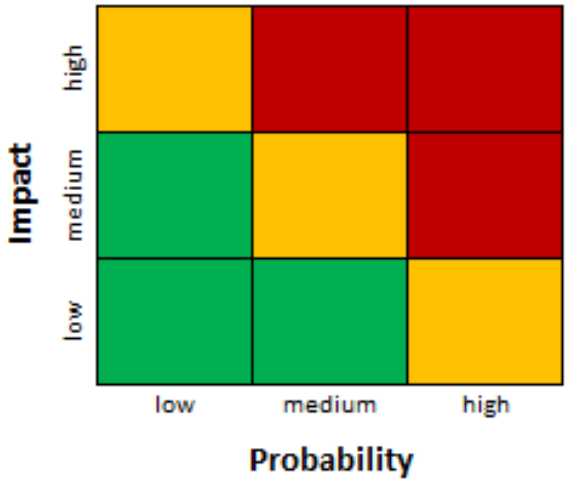

Figure 8. Impact chart

To get objective results, the definitions and procedures should be agreed on beforehand, and used similarly each time. When all listed risks are placed on the chart, the risks which have been placed on red area are the issues requiring priority management. (Kerzner 2006a, 729, 731; Merna & Al-Thani 2008, 75-76.)

2.3.4 Planning and executing response

Risk handling includes certain methods and techniques to deal with the identified risks. It also identifies who is responsible of the risk issue and provides an estimate which resources is needed when handling the risk. A critical part of risk handling includes processing and selecting suitable mitigation options and designated execution approaches for selected risk issues, which usually are ones with medium or higher risk levels. (Kerzner 2006a, 742.) If these risks were marked in Figure 8 they would be marked on orange and red areas.

Kerzner (2006a, 743), Merna and Al-Thani (2008, 52-53) and PMBOK (2013, 296) all mention four main risk mitigation strategies which can be used in projects which are accepting, avoiding, reducing and transferring risk. Pinto (2007, 228) mentions four strategies as well, but instead of avoiding, Pinto mentions sharing the risk as one method. Pinto also separates sharing and transferring as different methods, when others seem to think

they mean the same thing. Surprisingly, Pinto does not mention avoiding a risk at all. Thus, altogether five methods can be acknowledged, and they are:

- accepting risk
- reducing risk
- avoiding risk
- sharing risk
- transferring risk

There can be many smaller things which can go wrong during the project. If the effect for the project is minor or the probability is low, these risks can be accepted and ignored. However, accepting the risk should not be a passive project management behavior, but it should be conscious choice involving active behavior (Kerzner 2006a, 743; Lock 2012, 115; Pinto 2007, 229). In other words, according to Pinto (2007, 229) the decision of accepting the risk should be a reasoned calculation.

Instead of seeking to eliminate the source of the risk, risk mitigation attempts to reduce or minimize the risk by either lowering its probability or lessening the impact – and in some cases even both (Kerzner 2006a, 744; Merna & Al-Thani 2008, 53.) Obviously, it is often more effective to take actions as early as possible to reduce the probability or impact than to act when the risk has already occurred (PMBOK 2013, 296). The later the risk is acknowledged, the costly it will be to the project.

Avoiding the risk on the other hand involves a removal of a certain threat or protect the project from its effect. This could mean for example elimination of the source of the risk, changing the project management plan or avoiding projects that expose to certain risk. (Merna & Al-Thani 2008, 52; PMBOK 2013, 296.) One possibility is to shut down the project for good, although this option is quite radical. If risks occur in an early phase of the project life cycle, they might be avoided by more specific requirements, getting more information, improving communication or finding expertise. (PMBOK 2013, 269.) Avoiding the risk is probably the most common way of how risk management is seen to be accomplished.

When sharing the risk is in question, a risk is allocated proportionately between each party of the project. In this case, each party bears part of the risk in a project, and this can be

agreed contractually. When a risk cannot be reduced, it might not have to be accepted, but it could be transferred. (Pinto 2007, 229-230.) One popular technique of transferring the risk is insurance. However, in this case only the financial consequences are transferred, the responsibility for managing the risk remains (Merna & Al-Thani 2008, 54; Pinto 2007, 230). Another example is fixed-price contracts with suppliers or project penalty clauses which companies use to transfer risks (Pinto 2007, 230). The difference between sharing ang transferring risk is that by the latter, the complete risk could be transferred to another party but by sharing, some of the responsibility is still on projects responsibility.

2.3.5 Revising and monitoring progress

In this phase, the efficiency of risk handling actions is evaluated. It compares how the actual process went compared to the original project plan (Firmenich 2015). It can lead to creating new basis for risk handling process, updating the existing one or re-evaluating the already identified risks. Sometimes even new risks might appear when monitoring the process. The primary thing in risk monitoring process is to create an indicator system for the project which can be used to evaluate the status of the project. The indicator system should alarm of the potential issues early, to give possibility to react on time. (Kerzner 2006a, 747-748.) Constantly optimizing the risk response improves the effectiveness of the procedure over the project life cycle, and this is the main benefit of this phase (PMBOK 2013, 299).

Documentation in this phase is important as well. It helps the future project teams to identify potential risks, learn how to react to them and see the possible outcomes on beforehand. This is helpful especially for the new, not so experienced project managers. (Pinto 2007, 232.) Thus, a database can be formed for utilization of following projects.

3 RESEARCH METHODOLOGY

In this chapter the methods of gathering the empirical data and analyzing it is explained. Reasoning behind methodological approach is explained and way of collecting empirical data is introduced. This chapter reveals the process for interviews and reasons for choosing the interviewees. In the end of the chapter, the ways of analyzing the data is explained.

3.1 Methodological approach

Both quantitative and qualitative approach were considered in the beginning of this research. Quantitative research usually contains surveys or observation of population and comparing the results to the rest of the population, while qualitative approach normally contains interviews and form results which are in non-qualitative form or in a such form which cannot be analyzed in quantitative way. (Kothari 2004, 5.) By doing interviews, a wider perspective on the subject is reached even though a survey would contain open questions. Interviews gives the opportunity to ask more detailed questions if needed during the conversation, to get deeper understanding of what the interviewee wants to say. Body language can be read as well. Although, the interviewer interprets everything subjectively, which needs to be taken into consideration when analyzing the data.

The qualitative data collection method was chosen due to the fact that the best way of getting a realistic and comprehensive view of the current situation of project risk management in Optofidelity, is to interview the people who work on the field in question (Kuada 2012, 94; Saldaña 2011, 33). The existing theory gives the basis for understanding of the issue, and qualitative data collected gives an insight of the extent to how far the theories explain the research issues and simultaneously provides new perspective (Kuada 2012, 100).

The goal of qualitative interviewing is to gain a deeper understanding of the experiences of the interviewee (Kuada 2012, 98). One important thing to consider when doing qualitative research and interviews is, that the questions are set in a way that the research gives adequate answers (Brinkmann 2013, 48). The interview questions were set based on the presented theory.

To get an insight how company's risk management has been done currently, internal face to face interviews were executed within the company to complete the research. Open questions were written down to give the direction for the interviews, but they were not followed strictly. Basically, all the questions were asked during the interview from each interviewee but sometimes in a different form adapted to the situation.

The next step after setting the questions was to choose the interviewees.

3.2 Data and methods

As both Saldaña (2011, 33) and Kuada (2012, 94) state, the interviewees should be individuals who are able to provide substantive answers and responses to the questions. Thus, after the questions were set, altogether seven interviewees were chosen to be interviewed: six selected project managers, of which some are involved in sales as well, and one sales representative. Some of the interviewees have a longer career in Optofidelity and some have just started. They work in different business unit and all of them work with client specific projects. This gives variety and a wide range of insight of the matter and combines the company expertise and fresh point of view on the subject.

The selected interviewees have personal experience of the matter, as Saldaña (2011, 33) emphasizes is important when choosing the interviewees. These interviewees are all part of the project life cycle and they have been or should be involved in risk management in the projects. The interviewing process is described in Figure 9.

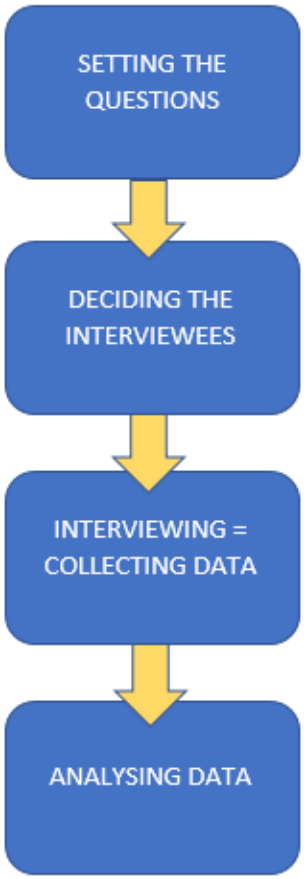

Figure 9. Interviewing process

The interviewees were selected purely at random out of the group of project managers and sales representatives from two out of three Optofidelity's business units. Reason for choosing the interviewees only from two business units is, that these business units' projects are mainly client specific. The third business unit has mass production projects and risk management process differs from client specific projects.

Interviews were agreed, and the topic was given on beforehand, but questions were not revealed before the interview. This was just to make sure the interviewees were not influenced by the questions and give the opportunity to the conversation to build up on its own. On average the interviews lasted about an hour.

The method of the interviews was semi-structured interview, which means that a framework for the theme and topics was set and some guiding questions thought in advance, but interview was not included and steered only by strictly specified questions (Saldaña 2011, 32). In other words, the topics discussed may spontaneously vary around the theme.

The interviewer could take part in the interview by asking further or more precise questions but should not influence or particularly lead the answers (William & Trochim 2006, 63.) Semi-structured method was chosen because it gives the opportunity for the conversation to flow freely, and for the interviewee to answer more broadly and openly to questions without directing the answers to a certain direction. Questions were set in an open question form, making sure that the interviewee could not answer by using only one or two words.

Interviews were done in a relaxed manner and more in a form of a conversation than an interview. They were done individually on pre-arranged, face to face meetings and although it might have an influence on the interviewee's answers (Blaxter, Hughes & Tight 2010, 196), was recorded. Additionally, notes were done in case of any malfunctions during recording, as advised by Saldaña (2011, 39). All the interviews were done in Finnish as it is the native language of the interviewees as well as the interviewer. The interview questions are shown in Appendix 1. In the beginning of the interview, the background for the thesis was explained briefly and the confidentiality of the interview agreed.

Blaxter and al. (2010, 196) emphasize that taking notes might disturb the conversation and make the interviewee feel uncomfortable or more aware of his/her answers but at the same time point out it is a way to get an immediate record of key points and lessens the sorting work later. They also say that it is a complex process to listen, ask questions and make notes all at the same time (Blaxter & al. 2010, 197), which made the recording important as well. It gives the opportunity to return to needed phases of the interview and check again what was said.

Due to the above-mentioned facts, and because the idea was to create an easy-going environment for the interviews and let the conversation meander instead of strictly steer the or limit the conversation, the methods of documenting the interview was explained to the interviewees in the beginning of the interview. The permission to record and make notes was asked orally from each interviewee as well.

All the interviews were done in a short period of time to have the possibility to refine the questions asked to the next interview if something important came out during the previous interview. It is also easier to remember the nuances and hidden meanings when the interviews are fresh in the mind of the author.

The time frame for the interviews was following:

- 1st interview 6.9.2018
- 2nd interview 10.9.2018
- 3rd interview 11.9.2018
- 4th interview 11.9.2018
- 5th interview 12.9.2018
- 6th interview 12.9.2018
- 7th interview 13.9.2018

3.3 Analyzing data

What need to be considered when doing qualitative interviews is that personality has effect on the data. When people are in question, the interpretation of meanings can be different depending on the person and things can be misunderstood. It should also be taken into account that the interviewee cannot be absolutely sure the answers and narrations are honest. (Kuada 2012, 100; May 2002, 205; Schostak 2006, 76.) Even the way interview questions are set, might have an impact on the answers (May 2002, 205). The fact that Optofidelity has a project management training just finished in the company, can also have an influence on the answers.

After the interviews, the data was analyzed and compared with the theory. Auerbach and Silverstein (2003, 31-32) explain coding as one way of organizing the data. This means transferring the raw data into a theoretical narration; putting the data back together in a new way after breaking it down and conceptualizing it (Auerbach & Silverstein 2003, 31-32; Kleinke, Wallace & Martin 2015, 99). The coding method was used in this research when analyzing the collected data.

Taking these facts into consideration, the data was reviewed and analyzed, keeping the objectivity in mind. Auerbach and Silverstein (2003, 33.) emphasize there is no one right way of analyzing the collected data. They highlight that as long as the analysis can be supported by the data, it is correct despite the fact that there could be other interpretations as well. (Auerbach & Silverstein 2003, 32). Therefore, the methods in analyzing the data or to strictly follow some certain method was not considered highly important.

Keeping Auerbach and Silverstein's (2003, 32) earlier mentioned remark in mind, no other specific method of analyzing the data was used in this research. Instead, the data was analyzed, compared and mirrored to the theory by using common sense and general knowledge. The findings and conclusions will be presented later in the thesis.

4 EMPIRICAL RESEARCH FINDINGS

This chapter contains empirical findings of the research. Interviews are unwrapped more closely and outlined in the following paragraphs. Findings have been gathered under the following themes:

- current situation
- positive findings
- challenges
- reasons for challenges
- the most important phase
- tools in use
- development ideas
- role of a client
- other findings and remarks

The content of each theme is explained from project risk management -point of view and are presented more closely on the following pages.

4.1 Current situation in terms of risk management

All interviews began with a same question: "How is risk management conducted in the projects you are involved in?". It was known already in the beginning of the research, and mentioned in the introduction -chapter, there is no common or agreed way of doing risk management in Optofidelity. The ways of conducting risk management was varied by a person depending on their conscientiousness and character. The answer to the first question was similar by six of the seven interviewed: Risk management is not done well enough currently.

Even though there is no one right or perfect way for risk management, it became very clear in the interviews that systematic way of doing risk management in the company is

missing but very much needed and wanted. Project managers understand and see the benefits of risk management but are not sure if other project team members see it as important or even understand all the benefits which could be achieved by it.

Generally, the phases of risk management process, introduced and explained in chapter two, mainly two are in use; identifying risks and analyzing the probability, leaving the process of interminable circle incomplete. These phases are marked in green in Figure 10. These phases are lacking documenting or sharing the information and are mainly done by the project manager or the sales person alone. Collaboration is missing.

Figure 10. Phases of risk management in use in Optofidelity

Although these phases are in use, in some cases it seems they are used unconsciously or automatically without recognizing the phases. Meaning, that even though actions taken might fill the characteristics of mentioned phases, phases are not knowingly executed or documented nor are they part of any process or mechanism.

That said, there are exceptions and some of the interviewees are implementing more organized way of conducting risk management. Risk management is a part of weekly and/or daily work. Iteration and risk check are brought up continuously and threats and risks are spoken openly among project team. Mitigation strategies are thought in some cases but

usually mitigation activities are done when risks appear, not planned beforehand. These two phases are marked in orange color in Figure 10.

Sales representatives recognize some risks when they are preparing a quote to a possible client. From time to time, they consult the project manager who is thought to handle the project if it realizes, but mainly they identify and analyze risks on their own. At least this was the idea project managers had. After the purchase order has been received from a client, project manager maps out the main risks he/she can recognize. In some cases, experts from the project team is consulted. Rarely do project managers receive a handover of recognized risks from a sales representative.

Reviews are done in some projects concerning risk management, but it could be in use more widely. Doing reviews means, that risks are talked and recognized with an outsider. By outsider, a person who is not part of an existing project team, is meant.

After the purchase order has been received from a client, very often it is only project manager who recognizes the risks by himself/herself or picks the possible threats from the team meetings or other conversation, where they are not directly brought up. In other words, project manager needs to have the skill to "read between the lines". There might also be a case that a member of a project team does not understand the meaning of a certain matter in his/her own work to somebody else's work, which could realize as a risk later during the project.

One of the interviewed project managers brought up the concept of risk-driven project management. What the person meant was, that it is a conscious decision from the project manager that risks will be analyzed, and the mitigation plan is made when the risk occurs. Meaning that no risk management plan is prepared in the beginning of the project. According to this project manager, this method has worked relatively well when in use but was admitted it creates distraction and delays. This method also limits the alternatives for mitigation activities as the time is limited and actions need to be executed fast.

4.1.1 Positive findings in risk management process

The interviews showed that some project managers execute risk management knowingly throughout the entire project, bringing the subject up in daily or weekly meetings. They have a constructive way of handling risk management and they are using some tools that are available for risk management in the company. At least two of the interviewees have even created their own tools or templates.

Interviews reveal that technical risks are recognized relatively well in the beginning of the project, which is important as client specific projects usually are extremely technical. Technical risks are typically very critical, and it is important to be aware of them. Another thing that seems to be quite well recognized in risk management -wise is critical components, their lead time and how these will affect the project schedule. Extra attention is given to monitor these components during the project and the lead time is considered in the quotation phase.

Everyone agreed that risk management is important, and it should be part of projects all the way from the beginning until the end. Organized way of conducting risk management is needed and seen as a positive thing. Everyone of the interviewees were ready to put on effort on risk management if a coherent and unanimous way was found.

At least one of the interviewed project managers take the client along in risk management as soon as possible when the project begins. The client is also a part of the process weekly and risks are openly talked about in the meetings. According to the project manager, this makes the co-operation and keeping the client up to date where project is, much easier.

Direct feedback was received from several of the interviewees that the interview gave them new perspective to risk management, highlighted and reminded of the importance of it and made the interviewees think about risk management more deeply. Interviews were very interesting and eye-opening to the interviewer as well, and extremely fruitful for the research itself.

4.1.2 Identified challenges in risk management process

According to the interviews, merely the word 'risk management' was said to occasionally create a negative impulse in project team. It is seen as something which does not take the project any further, just a time-consuming part with zero worth. Some might even feel uncomfortable in raising the risks up concerning their own work. They might think it is seen as incompetency. Understanding the importance of risk management at times comes through experience and expertise. If a person has been in a situation where they have seen how planning a head have solved many problems or helped mitigating risks, it is understandably more meaningful for them to take risk management more seriously part of their own work.

Understanding the big picture widens the perspective and leads to the possibility to see how own work affects on other team member's work. It might help team members to recognize risks which are not related to their own work. This is something that comes along the experience as well and might be difficult for the younger team members.

In some cases, when dealing with new innovations, client provides improper scope definitions or might not want to share enough details about the product or project. Reasons for why a client might not want to share more detailed specifications are for example that they do not want to spread information on the new product despite the nondisclosure agreement. They are protecting the secret to be revealed out on too many people's attention and/or spreading out too soon. Other reason is that they might not be so clear of the possibilities of what can be reached with the project and might want extra features after getting familiar during the project.

This might lead to changing the specifications or even the functions of the product and the direction where product should be going. Which leads to the fact that time might have been wasted and that the estimated amount of work raises remarkably. Depending on how the project has been sold (hourly work or fixed price) and the size (= powerfulness) of the client, it might be impossible to make changes to the already sent quotation.

Although some parts of risk management process were conducted during the projects, documenting was missing in most of the cases. The benefit of documenting was understood, and the importance seen by the interviewees, but for some reason it has not been

done. The role of careful documenting becomes especially important, when a person resigns and leaves the company. If a project manager or an expert have not documented actions done in the project, it is difficult to try to understand afterwards what and why certain decisions or conclusions have been made.

After all, poor documenting is not the case in all projects. Interviews evidenced that there are exceptions and that there have been projects where documenting was done exemplarily and well. What was pointed out is that one reason for good documenting is that there was enough time for it.

In the interview, interviewees were asked if they had lessons learned -meetings, in terms of risk management, in the end of projects where they could talk about what went wrong, what went well and what was learned. It appeared that project teams had retrospective meetings but rarely was risks or risk management talked in these meetings. Interviewees admitted that it would be a good routine to go through in the future.

4.1.3 Reasons for challenges in risk management

Some reasons for why risk management has not been made systematically yet was discussed. One of the biggest reasons was hurry, which originate from too tight project schedules. There is no time for documenting the findings or the recognized risks properly. Very often risks are just recognized, understood and then left in the remembrance of the project manager. Occasionally they were remembered only when the risk was realized. Nonetheless, hurry as a reason was seen slightly as an excuse by the interviewees.

Another significant, but genuine reason was, that there is no unanimous way of conducting risk management. Risk management has not been a compulsory phase as a systematic process of project risk management, or there is no process at all for doing it. There are some tools for risk management, but these tools have not been commonly agreed to be used. Some of the interviewed people use one tool and others another. Yet again, a consistent way is missing.

One relevant point, which came up in the interviews, was the confrontation of time and money in risk management, especially in quotation phase. It was discussed that the controversy between how much time should be used in risk management before the business is definite, and the benefits of proper risk management, is a problem. It was understood by the project managers, that sales personnel do not want to use too much time on risk management in the beginning when it is not certain that the client will place a purchase order.

4.1.4 The most important phase in terms of risk management

The interviewees were asked in which phase they think risk management is the most important in. Phases given as an example are the three mentioned in introduction as how Optofidelity has divided the projects in and described in Figure 4 (sales, execution and warranty). This seemed to be a difficult question and made the interviewees to ponder quite some time. They were deliberating between sales and execution. It was obvious that warranty phase was not considered as the most important phase in terms of risk management.

One point of view was that if the crucial risks are not recognized in sales phase, it might have a major effect on the project success. It also depends on the project and what is included. Risk management is different in purely software projects compared to a project where a product is developed as well, not to mention mass production or standardized products. If there are severe or too many risks recognized in the sales phase, the project should not be quoted at all. And if risks management has not been done properly in this phase, project is quoted and sold, there might be major financial losses ahead.

Nevertheless, risk management was seen important in execution phase as well. Risks recognized in this phase could cause for example rescheduling the project, which could mean financial losses as well as losing credibility in the eyes of a client. In worst case, not noticing a major risk might even cause injuries. It was a common understanding among each interviewee that each phase contains different essential risks.

4.1.5 Risk management tools in use

The interviewed people who were doing risk management in a little bit more organized way, were using for example risk severity analyzing tool. Basically, this tool was a light excel sheet, created by the project manager, where it is possible to feed the needed information and the sheet calculates the severity automatically, using the same formula as mentioned in chapter 2.3. Another tool some are using is risk matrix chart, similar but little wider as the one demonstrated in Figure 8. Risk matrix chart is available for all in Optofidelity as a template, but not in use by many.

All the interviewed project managers were familiar with a project charter template which could be found from the tool called Confluence. Confluence is one of the main project handling tools in Optofidelity. Project charter has different parts for different functions included in project management, and risk management is one of them. Filling the project charter should start already in quote -phase, meaning it is on sales persons responsibility to begin the process. According to the interviews, project charter is not always filled in the beginning and that is why the usage of the charter is forgotten or neglected when purchase order is received from a client and project begins. However, the charter is seen as a useful tool when used correctly.

4.1.6 Role of a client in risk management

There were controversy opinions how client should be taken along in risk management and if it can be done at all. Once again, it depends a lot on the type of the project and a client as well. If the project is client specific, it is more likely that client is included in the risk management. If the project is delivering a standardized product, it would not seem professional to the client if risks were talked about openly especially when making the quote.

On the other hand, in client specific projects, it is important to include client it the process. Client might have useful information about critical components and their lead time or relevant suppliers. They might even be able to loan a component which is known to have long lead time. This way it is possible for the project to continue and develop without delays.

What should be considered when thinking to include client in project risk management process is that it could be easier for the client to accept for example delays in the project if the risks are spoken openly in the beginning. If it is brought into everyone's knowledge in the beginning, that a component has e.g. 5 weeks delivery time but there is a possibility that it is delayed even longer, the client is more understanding when this risk realizes. Or if there is a situation when there are two components to be chosen for the system where the first one has better functionality but might not be suitable and there is a possibility another option needs to be tested as well, which naturally might have an effect on lead time. If this is communicated to the client in the beginning, they can even choose the component themselves or accept the delay in lead time.

Of course, there are some risks which cannot be openly spoken, for example personnel related risks in the company. These risks include for example limited number of experts in some specific niche area. When several projects realize where they all need the same expertise and there is only small number of professionals, certain prioritizing is needed which might cause delays to some projects.

When it seems that a client is not sharing enough information for the project to proceed, one way to get more information is to talk to the client face to face. Project should arrange meeting with the relevant people from client's project team. It is easier to get answers and more information when talking face to face than by email. The client might be more open when no documentation is left behind of the conversations. Face to face meetings are also more personal than a phone call or Skype-call and body language can be read as well. To be able to meet face to face often enough, it requires being close to the client continuously. Keeping the project team in the company informed is important in these cases.

Keeping the project team informed might become challenging when the team is scattered to different locations. There are projects where sales personnel are located in US, technical staff in Finland and ramp up is happening in China. Only time difference itself brings challenges and exact documenting is extremely important in these cases to avoid delays in project progression.

An important thing to remember, if a client is taken along in the risk management process, is to document everything carefully that has been talked and decided. This makes it easier

to return to the decisions afterwards, if needed. In situations where there could be misunderstanding or disagreements, it is useful to have a document where to refer to.

4.1.7 Development ideas for risk management

Everything starts from understanding the importance of risk management. As this is not the case among all the project team members, an idea of a general training for basic risk management for all personnel came up in the interviews and would be an idea to think about. This way risk management could slowly be brought into everyone's daily work automatically without forcing it. Usually, the better a person understands why things need to be done, the better the results are. Forcing only causes resistance.

One thing which was considered with at least three of the interviewees was, that could risk management be added on the quote? The idea was that a quote would openly show a certain amount of time which is reserved for risk management during the project and there would be a price for it. What was discussed as well, was if there is time calculated purely for risk management already or not. Basically, it should include in project management, but the question, if risk management was considered in it, was left unclear. It was also speculated how would a client react if risk management was added on the quote as a separate function and if they would accept and order that function. The reasoning behind this was, that if a client would order risk management as a separate function, there would be time allocated for it as well and perhaps risk management would be done in a more organized way. On the other hand, risk management should be a part of project management and that way automatically included in the process. It might not be taken well by clients if it was added as a separate function on a quotation.

As mentioned earlier, sometimes there are risks which result from the small number of experts in a certain special area. Risk realizes when there are several projects running at the same time, needing the same specific knowledge or someone gets ill or decides to leave the company. This has led to a need of a mitigation activity of duplicating knowledge. It means that there is always a substitute for a special expert in projects. In some projects there are a duplication of information in use already. Meaning, that even though some time might be wasted, another person keeps up with the project just in case

and learns the areas where special knowledge is needed so that he/she could cover for the person when and if the time comes.

Talking about risks with a different word or way within the project team, was one of the ideas that came up in the interviews. It was discussed that perhaps it would be easier to think about the risks, if in the beginning of the project, the team arranged a meeting where they think together things that needs to happen so that the project fails. The idea was to take a reverse perspective on the matter. Perhaps this would be a lighter approach to the subject and bring more results. This way of thinking could be something to be implemented in the general way of thinking throughout the entire project team and project. In theory part of the research, it was mentioned that including project team in risk management process, it gives wider perspective and different backgrounds help recognizing different risks.

One thing that was discussed as well, was reviewing the recognized risks in the quote or sales phase by the sales person with at least the intended project manager and perhaps even the whole intended project team, should be made as a habit. It could help the sales person to adjust for example the work time estimation to give more time to the project team to execute. It could also give a better insight for the project manager about the project and help him/her to understand the big picture.

4.1.8 Other findings/remarks considering risk management

Project manager cannot be responsible of risk management by himself/herself. They need the help of a project team and a sales representative in recognizing the possible risks. What was commonly agreed is that project manager should be the person who handles the risk management process and is responsible for it. It was discussed that Optofidelity is not big enough company yet to have a separate department of people for doing risk management, like some big corporations might have. Project manager needs to have the constant big picture of the project, and this includes risk management.

Collecting a so-called risk bank was seen a contradictory thing. By risk bank, the author means an archive of realized risks, how they have been mitigated and reasons behind the decisions by each project. On one hand, it was seen that risk bank would help project

managers to check which risks have already been recognized and mitigated if a similar project was about to begin. Or to help new project managers to understand the risks in general in client specific projects in the field Optofidelity works in. It allows the opportunity to develop risk management in the company and suitable way of reporting to sales or upper level management about the matter.

On the other hand, the practical execution and updating the risk bank would be yet another thing to eat away project manager's time. Searching information from the risk bank might be challenging, depending on the way of executing it. Essentially risk bank was seen a good idea but more functional way, according to the interviews, would be conversations with other project managers and with the project team. This raises up a concern of silent knowledge and risks behind the matter and how the importance of documenting is seen.

What appeared during the interviews was, that there has already been a workshop at least in one of the business units to teach and talk about the essentials of risks and risk management. In this workshop, the basics or risks and risk management was covered but for some reason it was not embedded to daily actions. Hence, another workshop would probably not bring any success either or at least the execution should be different to the earlier one.

One tool which came up in the interviews and seemed to be useful in terms of documenting risk management, but was not in use yet, was called Big Picture. There is an opportunity for all project members to add risks in a form of 'tickets' into the system. What was seen beneficial in this tool was, that everyone could add risks there when the threat is identified and suggest mitigation activities. It might lower the bar for raising these matters into team's knowledge and the information would be available to the entire team continuously. Using these tickets was seen as an easy and fast way and it also leaves a history behind where to return if needed.

"Go boldly where no one has gone before" is one of five company values in Optofidelity. What came across in the interviews was, that from risk management point of view, perhaps this value has been implemented too recklessly. When going into new field of business or working with new innovations, risk management should be extremely well taken care of. Improper risk management or disregarding it, could lead to major financial losses. On the other hand, it was agreed that go boldly -way of thinking has brought Optofidelity

where it is today. And it is a fact there are always risks involved when doing business, especially in the field of new technology and innovations.

5 CONCLUSIONS AND SUGGESTIONS FOR FUTURE ACTIONS

Conclusions based on the interviews are presented in this chapter. In addition, recommendations for the future actions in terms of risk management in client specific projects in Optofidelity are introduced in the current chapter as well.

5.1 Conclusions

Although risk management is seen as an important phase in project management and the benefits are understood, it is still neglected and done superficially by sales representatives as well as project managers. Underlining the importance of risk management for project team has not been successful either. It became clear that a unified way, and a mutual understanding to follow it should be found in terms of getting risk management to the next level.

One risk category which was clearly best identified and mitigated was technical risks. The reason for it probably is that usually client specific projects are technical projects, so the risks are both familiar to the project team and crucial for the project success to be identified. Technical failures, malfunctions or faults cause biggest problems and are easily noticed. Which is why it is a positive thing that identifying and mitigating technical risks are in good control.

The question of which phase is most important in risk management was probably the most difficult to answer by all interviewees. As mentioned earlier, each phase got different challenges which effects on project success. Major risks are important to be recognized in sales phase and mitigation strategy should be thought over, before making the decision to quote. If this is not done, and large number of risks are identified only in the execution phase, it is too late to cancel the project. In worst case, the entire project might end up unprofitable or even impossible. Nevertheless, sales representatives might think it is not worthwhile to use a lot of time for identifying risks and documenting them, when preparing the quotation, if it is not sure a client will make the purchase order later. This leads to a question if the sales personnel understand the importance of risk management well enough?

In execution phase it is important to identify the risks which might lengthen the schedule and perhaps even lead a project to fail. When working with a new innovations or technological implementations, it might be difficult for example to get the needed components fast. When a critical component is missing, the whole project might stop because testing is not possible and moving forward is impossible without testing. Sometimes a decision needs to be done between projects and experts included in these projects. There might be projects starting which could have more financial importance for the company and which might have higher priority when choosing the project team.

In warranty phase, the rapid support is needed if failures or malfunctions appear. Fixing them accordingly depends on the available components and personnel. In a way, it is the last chance to make the client happy and leave them with a good image of the company. Thus, it is difficult to compare the importance of risk management in these phases as the risks and their affects might be completely different.

Risk management should be continuous work which project manager alone cannot conduct. Sales representative should make a comprehensive risk management plan before quoting the project and give an inclusive handover to a project manager when project realizes. Should project managers be strict and demand the sales phase risk management plan in the beginning of the project? It would force the sales personnel to take it as one of the routines when making the quote.

Another controversy is the issue of time and money. How much time to use on preparing a comprehensive risk management plan in the quotation phase, when the business is not certain yet. In a way, it is understandable not wanting to use too much time on identifying risks and thinking about the mitigation strategy before there is a purchase order. But in some projects, it might be too late to start with a risk management plan after the project is sold. It could prove out to be a mistake to have sold the case in the first place. Perhaps there are few too many risks, and mitigation is so difficult that it is impossible for the project to succeed.

Not only sales personnel and project managers are included in risk management. They both need a project teams help, and specialists often play a crucial role in it. They have the insight for example the special knowledge needed in a certain type of a project as well

as the unique components or technologies required. In a client specific project, especially if a completely new product or solution is created, it is important to take the client along in the risk management process. Equally important is to keep the communication open and frequent with the client to be able to receive as much information as possible, particularly if the client seems to be concealing information.

One thing which was left the author wonder was the role of a client in risk management process. It is clear it is not possible in all projects to include client in the process in quotation phase but when it would be possible, it is still not always done. To include client, it would ease the analyzing process and planning the mitigation activities in some cases. Client could give more perspective on planning risk management as well as help mitigating risks. In other words, it would diminish the work to be done by sales representative and/or project manager. Why is it not done in all client specific projects when possible?

When the scope and specifications are unclear, and project includes new, unconfirmed technology, it would be unwise to leave the client out of risk management process. Surely client understands the benefits as well and would willingly be a part of the process. This probably is something which needs enhancement in the company.

Lack of documentation and amount of silent knowledge considering risk management is something which needs to be noted as well. Even though the project world is busy and risk management is scattered, the importance of documenting should be emphasized. Perhaps time management should be different to reserve time for documenting as well. Or maybe when understanding the significance of risk management is wider, documenting becomes self-evident?

The fact that there has already been a workshop where risk management was the subject, raises the question why the attitude towards risk management has not changed. Is it because of lack of motivation to do risk management? Or could it be lack of example shown? One of the interviewees raised up a thought, that perhaps engineers do not feel comfortable using new working methods if there is no process for it. Processes are often seen as rigid way of following procedures, but it might be true that in a company where majority of the personnel are engineers, processes are needed, in terms to absorb new working methods.

Communication between people in different phase in project life cycle needs to be improved. It would optimize time management when same risks and mitigation plans would not need to be identified by several people in a same project. It would also make the project management more fluent and give a better general view on risk management all the way in the beginning. Communication between a project team and project manager should be enhanced as well. When the team supports the project manager in risk management and vice versa, becomes risk management smoother and more transparent for everyone.

Even though risk management process would be handled perfectly, there are always threats and risks which cannot be seen in advance. This was well known by all the interviewees. It made the author wonder if it could be one reason or an excuse for neglecting risk management? If there are anyway going to be risks which needs to be evaluated and mitigated in mid-air, and problems to be solved when appearing, does it give a reason to leave risk management in poor attention?

5.2 Suggestions for future actions considering risk management in client specific projects

When discussing with the interviewees, interesting and useful ideas came up, and three of them were chosen by the author to be the ones for future actions. Chosen actions are the following:

- finding a mutual way for managing risks in client specific projects
- finding an easy-to-use -tool for managing risks used by everyone
- spreading the understanding of importance of risk management to everyone included in client specific projects

Suggestions were limited to three, since it is a reasonable amount of actions to be taken in the beginning. If there are too many changes to be completed, usually it only creates chaos and implementation fails. Implementing small changes slowly is normally the best way to succeed. This way there is not many new actions to be absorbed all at once and the resistance is smaller. These chosen actions also support the research questions which were set in the beginning.

Another thing to remember is, that not all the three can or should be executed simultaneously. Change should be started first in the upper level and then spread forward to rest of the company. When sales personnel and project managers have adopted the new way of thinking about risk management and executing it, it is easier to lead by example.

Each chosen idea is discussed more closely in coming chapters.

5.2.1 Finding mutual way for managing risks in client specific projects

Having all key people, e.g. sales people and project managers, to agree on unified way of managing risks in client specific project is a must to provoke the change. The change begins from the upper level and is put into practice by sales representatives and project managers. It is on their responsibility to get things started and they all need to commit to same objective. Forcing people to do this will not help in succeeding. The change needs to be understood and agreed by everyone.

First thing to do is to have an open discussion with key people in terms of conducting risk management and to find a common agreement on starting to put more effort on risk management in projects. It could be a meeting where everyone can openly share their opinions and perspectives and where matters are discussed freely. Experiences and examples should be shared as well. Someone with more experience in risk management could share their viewpoints, knowledge and best practices.

The agreed process should be easy enough to follow and tools in use should be easy to find and use in practice. There should also be time allocated for risk management instead of just adding it on top of everything already required to be done.

To make the risk management fluently an important part of the project management process, first the project management should be systematically and unanimously executed in Optofidelity as well by all the project managers and sales representatives. One easy way to do it is to agree that the partly forgotten project charter is the main tool to be used to document projects. The filling of the charter begins in the quotation phase by the sales person and it should be filled conscientiously and precisely. This way, also the risk management part would automatically be handled, documented and shared. When a purchase

order is received from a client and project begins, every time a sales handover by the sales person to the project manager should be arranged. In this meeting, a project charter would be a great tool to help going through the issues which are already considered in the sales phase and to create a project plan, including more precise schedule, budget, risk management plan etc. By using a project charter, a retrospective will be arranged in the end of the project and an end report will be created as well. The templates to be used should be agreed to be similar in each project to create a solid process.

5.2.2 Tool for risk management in client specific projects

The templates in use for managing risks in Optofidelity seemed to be indefinite and vague. The interviewees were hoping for an easy-to-use -tool for risk management process which would not require too much time to use and was simple to handle. More guidance was desired as well.

An example of a suggestion for a template for risk management is introduced in Figure 11. It is based on the simplified project life cycle which was introduced in Figure 4, as well as on the theory and empirical research. The template is meant to be a checklist and a tool for generating a risk management plan already in the beginning, when preparing a quote. Using the template would also improve the communication between the responsible person of each phase.

By filling the template presented in Figure 11 a risk bank would also be generated automatically. The history would be saved for later, and people could look back to it if needed. This template could be added to Confluence as a part of project charter and it could serve the needs of not just client specific projects, but mass production or standardized product projects as well.

Figure 11. Risk management plan template

To understand the idea of the template, a more specific explanation follows. On the left, all the basic categories of risks are listed. This way it might be easier to go through the possible threats, analyze the probability and then add them in the template. Good thing to remember here is, that analyzing the impact of the risk should be done elsewhere and only the major risks are listed in this template.

Three phases of a simplified model of project life cycle are shown in green, orange and blue columns. Above these columns, the main responsible role is mentioned. It does not mean that the person in that role is solely responsible of risk management in that phase. It means that this person is the corresponded and person in charge and should take care of filling the template.

Underneath each risk category there are rows for specifying the risks more closely. Rows can be added when needed. The idea is to specify on a correct row underneath a correct column. 'HANDOVER' is written in between each column to remind that a comprehensive handover of a risk management plan should be done between the person in charge of the phase ending and the phase beginning, when moving from a phase to another.

On the right there are columns for mitigation plan. Again, the most usual ways of mitigating risks are listed. Arrows illustrate how the mitigation plan should be written in a correct row and column. Colors are used only for visual purposes.

An example of how template should be used in practice is shown in Figure 12. There is one risk identified in sales phase and two in execution phase. Risk identified in sales phase has been decided to accept, mitigation activity described under mitigation plan and in accept -column. One risk identified in execution phase will be reduced and the other one transferred, actions described more closely in the correct columns.

Figure 12. Example template

By using the template, it is easier to identify and categorize risks and keep track on actions. A follow-up part could be added as well, where the realized risks could be documented, as well as comments on how well the mitigation plan worked. It could be called for example the follow-up report of project risk management and it could be added on the same template.

5.2.3 Spreading the understanding of importance of risk management in client specific projects

Changes require a general transformation in a way risk management is seen and conducted in the company. It would need a completely new way of thinking and new attitude

towards risk management. It is easier said than done and requires baby steps and common agreement as well as commitment.

After finding the common agreement on how risk management should be executed and implementing them in action in upper level, the rest of the personnel included in project work should be joined in the process. As mentioned before, a sales person or a project manager cannot accomplish risk management alone. They need the help of their team to get an inclusive overview of it and to keep up with the changes during the project.

Of course, for the project team, risk management is not as intense as for project manager for example. Project team's job is to bring up the possible threats they might recognize in the beginning and right away during the project, when the possibility of a threath is noticed. Project team members should also look further than just their own field, in terms of recognizing threats within their work which might cause trouble to another team member or to the project. In other words, widening their perspective and taking a certain responsibility of the success of a project as a project team member.

What is needed is an overall change in the way of thinking and seeing risk management throughout the people included in project work. It is not an easy change to accomplish. It requires time and effort. One thing to do would be teaching new incoming employees the new way of thinking right from the beginning. It should be included in introduction phase when they join the company.

For the people already working in the company, implementing a new way of working might be more difficult. Telling people what to do and expecting them to follow the orders immediately, usually does not work. Reasons behind the change need to be understood and the benefits of it as well. As mentioned earlier, engineers might also need a process to follow to feel comfortable and confident.

The idea of turning the aspect around might work in a kick off meeting, where project scope and everything included in the project is explained to the team. To have a conversation or a brainstorming session of what could go wrong in the project could raise fruitful ideas of possible risks, and absolutely something to be experimented. It is then on project managers responsibility to recognize the actual threats from the mass of ideas. But this method would probably not work during the rest of the project life cycle.

All members of project team should be able to identify the significant and considerable threats or risks instead of just reporting everything that comes to their mind. Especially if risks are reported in a written form to a tool. In a daily or weekly meeting, it would be different if things were spoken aloud and even the smallest risk were disclosed. But it would take a lot of time from project team to write everything down and then from a project manager to go through them all.

Recognizing the actual risks requires experience as well as understanding bigger picture, so for the younger team members it might be difficult. It needs practice, and it is why risk management should be transparent and spoken openly among the project team. Lessons learned -type of meetings after finalizing the project is a great place to go through these things. For example, the following questions could be talked:

- Was risk management plan successful?
- Which risks were recognized in the beginning and which ones of them occurred?
- Did the mitigation plan work?
- What where the risks that could have been identified in the beginning but appeared during the project?
- Were there any unrecognized but significant risks which occurred during the project?
- How to improve risk management in a next project?

Going through the above questions could help the team to understand better what is expected from them in terms of risk management in a next project. It also brings up the importance of risk management as well as shows that risk management truly is a part of the project and everyone's work includes recognizing risks and understanding their impact.

6 SUMMARY AND DISCUSSION

Currently, risk management in client specific projects is done partially and/or without recognizing the process. Risk driven project management, in some cases, is a conscious choice, but more often it is only a state where risk management has ended up because there is no systematic way followed in the company. Sharing the information between sales representative and project manager and project team is incomplete. Understanding the importance and risk management itself is incomplete as well and needs reinforcement. Currently, it seems that risk management is seen as a compulsory but time-consuming part of the project life cycle and it is done vaguely and only half way, not giving it the attention which it requires.

By proper risk management, project can achieve many benefits. When risk management is started already in the sales phase and a handover is given to the project manager when project begins, it gives more variety of planning the mitigation actions during the execution phase. It helps making suitable responses for effective project management. Usually the mitigation activities turn out to be more economical, if the plan is made as early as possible. There is more time to prepare, many options available, activities are more efficient and project teams can feel more secure to proceed. The probability for keeping the schedule is bigger which leads to more satisfied clients.

The reasons behind inadequate information flow in terms of sharing the risk management actions done by the sales person and sharing them to the project manager or the project team, was something that left the author to wonder. Perhaps it is the sales team, who need more insight and deeper understanding of risk management and the importance of it? It is on their responsibility to, for example, begin filling up the information to the project charter where risk management is included. Clearly, more thorough sense of responsibility is needed from sales representatives, but from project managers alike.

In sales phase, it is also important to identify the major risk for the project and decide the mitigation strategy. If this is done properly, it is easier for the project manager to continue with the risk management process, to monitor risks, identify new risks, analyze, make plan for managing them and to revise the entire process continuously; to master the complete circle or risk management process.

It is certain that risk management needs to be taken to a next level in Optofidelity. What is positive is, that all the interviewees agree. It is an excellent starting point and gives the change better chances to be successful. The change requires determination and commitment.

Now is a perfect time for forming a new, unanimous way for managing risks in client specific projects. The project management -training in the company is finished and it has probably raised other development areas in the field of project management. Project management handbook is under development and the goal is to create a coherent means for project management overall and as risk management is one part of project management, the change in it is also included in the process. Understanding and knowledge already exists, it is only the common agreement and determination that needs to be added.

Risk management is only one part of project management and to make risk management systematical, also project management methods should be organized and agreed to be done similarly throughout the company. Some suggestions are shortly described in the previous chapter but not intensively dig into as it is a completely different case and would require more research to be done. It is also a fact that presently, project management tools and methods are under development in the company and moving to a more coherent direction.

6.1 Self-assessment

The author had an opinion of how risk management is done in the company already before the research. The research findings were both predictable and surprising. What was predictable is, that risk management has not been done systematically or by using the same tools by all project managers in client specific projects. It was also known that documenting is lacking consistency and discipline. Although the risks of what poor risk management and documenting might bring are known, the will or the ways to improve the situation is missing.

Positive surprises were for example the fact that two or three of the interviewees were implementing risk management in a quite organized way already. Another surprise was how many tools there already are for risk management which would help in the process.

The reverse side is, that there are many tools and still they are not used. The author's opinion is, there should be one main tool to be used cohesively by all.

It would have been beneficial for the research if at least one or perhaps two more purely sales representatives were interviewed. Now there was only one person who was purely a sales representative and two persons who did both sales and project management. Choosing more sales personnel among the interviewees would have given deeper understanding of the risk management done in quotation and sales phase. The interview questions should also have been adjusted slightly more for them to gain more specific and beneficial information.

Order of the interviews could have been arranged differently as well. Now in the last few interviews, some interesting points came up from project managers concerning sales process. It would have been worthwhile to have at least one sales representative to be introduced last. Then again, the situation could have been the other way around even though this was the case. New point might have risen in the interview of a sales person and needed an insight from a project manager.

When thinking about how well the interviewees were chosen, another thing needs to be said. The sales representative who was interviewed and who just started at Optofidelity, gave interesting point of views. The person did not yet have much insight on how risk management is handled in Optofidelity but had strong ideas of how it should be done. This person had evidently done risk management in a very organized way in the past.

However, this sales representative's perspective was purely from mass production or standardized product point of view. The process is different for standardized product and for a client specific product. For example, the persons opinion in taking a client a part of risk management process in the sales phase was, that it would not be a good idea. It would not make the company seem professional if risks were raised into the knowledge of a client at this point. Nevertheless, although this surely is true, but in client specific projects it might be crucial to have a conversation with the client of possible upcoming risk already in the sales phase. Some valuable points may raise which might have an affect on how and on which value the project will be quoted. Still, the person also disclosed proficient ideas and opinions on risk management process, which could be used in client specific projects as well.

In the beginning of the research, the research problem was discussed with a project manager who was responsible for the upcoming project manager handbook. The objective was agreed together, and research questions were approved by this project manager. Unfortunately, during the research the project manager decided to resign and the project of producing the project manager handbook was handed over to another person. This new person had a little bit different point of view of what was wanted from this research. The research already being quite far, it was decided it will continue the way it was agreed on the first place. Otherwise it would have meant amendments to the research questions, which could have changed the entire concept and basically meant that research was to be started again from the beginning.

The resignation also left the author alone with the research, meaning that the support from the company or guidance during the research was missing. This was not necessarily a bad thing from the author point of view. It gave more freedom for the author to proceed with the research as the vision was clear and objective was understood. There also were not any moments during the research when the author felt more guidance was needed. Although, the outcome might be different of what was wanted in the first place.

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APPENDICES

Appendix 1. Interview questions

Open questions to give a guideline and frame for the interviews

1. Miten riskienhallintaa on Optofidelityllä nyt tehty?
    - onko tiimi mukana?
2. Onko asiakas mukana projektin alussa / aikana riskien kartoittamisessa?
    - pitäskö olla, mitä hyötyjä?
3. Mitä mieltä seuraavasta väittämästä: riittävällä ja asianmukaisella suunnittelulla on mahdollista eliminoida kaikki riskit projekteista
4. Hallitaanko riskejä koko projektin läpi ja miten?
5. Kuka tekee riskienhallintaa projekteissa / kenen pitäisi tehdä
6. Mitä prosessiin sisältyy
    - tehdäänkö lessons learned -tyyppistä kartoitusta projektin lopuksi?
    - onko kerätty ’riskipankkia’?
7. Onko riskienhallinta tärkeää, miksi?
8. Miten tiimi suhtautuu riskienhallintaan?
    - Miten ymmärrystä voisi lisätä?
9. Pitäisikö prosessia parantaa ja miten?
10. Onko riskienhallinnasta ollut hyötyä aiemmissa projekteissa, kerro tarkemmin?
11. Onko ollut tilanteita joissa riskienhallintaa olisi pitänyt hoitaa projekteissa paremmin, kerro tarkemmin?
12. Missä kohtaa projektin elinkaarta pitäisi erityisesti kiinnittää huomiota riskienhallintaan?
13. Onko nyt käytössä riskienhallinta -työkaluja, kerro tarkemmin?
14. Miten mielestäsi ideaalitilanteessa riskienhallinta olisi projekteissa hoidettu?