Project Risk Management
- A Case Study within a Software Company

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This report provides an overview of Project Risk Management (PRM), which is a key part within project management. We performed a case study within a software company to improve their existing PRM process. The methods we used to perform the case study were interviews and a questionnaire. The objective of the case study was to understand the formal guidelines and the informal practices of managing risks in order to locate the lacks and flaws of PRM at the company. Alongside performing the case study, we studied project risk management in various references to build an overview of the characteristics of a successful model for project risk management. The characteristics of the successful model were compared to the data gathered from our case study and resulted in seven findings/weaknesses. To minimise these weaknesses we have suggested four improvement approaches. The improvement suggestions mainly consist of formal guidelines. Besides guidelines, proper Knowledge of PRM, a Risk Officer and clear Communication channels helps facilitate a more successful PRM.

Keywords:
Risk Management, Project Management, Project Risk Management, Case Study, Quality Management
ABSTRACT
(Svenska)


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1 INTRODUCTION

"Talent alone won’t make you a success. Neither will being at the right place at the right time, unless you are ready. The most important question is: Are you ready?"

- Johnny Carson [Hall 1998]

The quotation by Johnny Carson pretty much summarises what Project Risk Management (PRM) is about. It is about being prepared, or as Martyn Ould expresses it, “forewarned is forearmed” [Ould 1999]. This thesis is based on a case study conducted at a large software company. Throughout this report, the company where we conducted our case study is referred to as ‘the company’ due to confidentiality reasons.

The thesis aims at evaluating the PRM process at the company and discuss solutions to the weaknesses we find. The content of this thesis is outlined as followed:

Chapter 1: Introduction
This first chapter will give a background and a motivation description to this thesis and why PRM is important. Furthermore, research objectives, research questions and the research approach are explained.

Chapter 2: Project Risk Management
As a foundation for our evaluation, we discuss essential characteristics of a successful approach to PRM in this chapter.

Chapter 3: Case Study
In this chapter we explain the purpose of the case study along with our research methodology.

Chapter 4: Result of the Case Study
After having conducted the case study and analysed the ground data, the result (findings) is discussed and presented in this chapter.

Chapter 5: Improvements Suggestions
In this chapter we suggest improvements to the findings discussed in chapter 4.

Chapter 6 and 7 contain conclusions and an appendix.

Before continuing, we would like to thank everyone who made it possible for us to perform this master thesis and helped us throughout the work. Especially our advisors, Magnus Hansén and Conny Johansson, and all the people at the company who took their time to make sure we were given all the support and information we needed.
1.1 Background and Motivation

In the software industry, as in many other industries, much of the work is carried out in projects. As a company you would like to be as successful as possible with these projects. In order to be successful with a project you would like it to progress according to a predefined plan without any deviations. We all know that deviations do occur more or less often, and we all know that they some times are of a larger magnitude causing major problems to the project. These problems are very often quite costly to manage. The further a project progresses, the greater the investments and stakes of a project are. Therefore it is beneficial to manage problems as early as possible in a project to minimise those, many times, unnecessary costs.

Risk management is considered as one of the key parts within the scope of project management, and perhaps often, risk management is project management [Nicholas 2001]. Projects are managed by managing their risks [DeMarco 1997]. Risks exist in every project and the way of managing them has a decisive impact on the project outcome. PRM increases the likelihood of project success [Tilk 2003] [Stump 2003]. If risks are properly managed, the project will experience benefits like prevention of schedule delays, reduced project cost, more predictable schedules and better attainment of customer commitments [Compulink 2003] [CIS 2003]. According to the Software Engineering Institute a successful practise of risk management in one in which risks are “continuously identified and analysed for relative importance. Risks are mitigated, tracked, and controlled to effectively use program resources. Problems are prevented before they occur and personnel consciously focus on what could affect product quality and schedules.” [SEI 2003]

In the autumn of 2002 we attended a course called ‘Project Management’ [BTH 2002]. At this course, we had a task of interviewing project managers at different software companies with the purpose of identifying areas within project management that could be improved. It was this task that made us realise that risk management was something that could be greatly improved in the software industry since the majority of the companies we contacted, had a poor risk management process. We also realised, managing risks in a professional manner, would greatly improve the overall result of a project. Therefore we believe having a structured risk management process is essential at a larger company working with many large projects. Especially if the company has the goal of conducting the projects efficiently and achieving the best result possible. The interest of how project risk management is carried out in practice led us to the idea of conducting a case study of the risk management process at a large software company.

We believe, no matter how good you manage your risks, you can always manage them better and more efficient.

The company, where we carried out the case study, is certified by ISO¹. An external reviewer, commissioned by the ISO, audits the level of performance of different activities within the company at the annual review. Risk management is something the company has had remarks on and it could once again be a target. Therefore, it is of great importance that the PRM process is improved.

¹ See Abbreviations (chapter 7.6) for explanation.
1.2 Research Objectives

The main objective of this thesis is to identify and locate lacks and flaws of Project Risk Management (PRM) within the company. As many companies have a poor risk management process, as we mentioned in chapter 1.1, we would like to know not only which flaws and weaknesses there exist, but also which factors that causes them. Furthermore, we will identify possible improvement proposals to the lacks and flaws that we find. In short, the objectives of the thesis are:

- Identify flaws and weaknesses of project risk management within the company.
- Identify factors that contribute to these flaws
- Suggest improvement proposals to minimise those flaws.

1.3 Research Questions

According to our research objectives we have formulated the following research questions:

- How is the current formal and informal PRM process defined?
- What are the lacks and flaws within PRM?
- Which phase has the most impact on PRM?
- What factors cause those problems?
- What could be improved to minimise those problems?

1.4 Research Approach

The input for our research will come from both company internal information and external information. By company internal information, in this context, we mean information about how risks are managed formally and informally within the company. This type of information is found both among the employees, and also within project documentation. By external information we mean literature written within the subject of risk management and similar.

1.4.1 Research Roadmap

In order to answer the research questions and reaching our research objectives, our research was conducted according to the roadmap illustrated in figure 1.4.1. By following this roadmap, we considered ourselves to have enough information to improve the risk management process at the company, and that we could draw interesting and useful conclusions. The purpose and method of the case study, together with the method and criteria by which we analyse the case study outcome, will be explained in chapter 3.

In order to understand how risk management is actually carried out at the company, both formally and informally [defined in chapter 4.2 and chapter 4.3], we extracted information by using different research methods. The methods we used for the case study were interviews, a questionnaire and the study of company documentation, as shown in figure 1.4.1. The improvement suggestions were then based on the weaknesses found during the case study, focusing on the most problematic areas within the PRM-process.
Simultaneously as we conducted the case study, analysed weaknesses to come up with improvement suggestion, we studied literature within the area of risk management and similar. This study served as a tool of identifying gaps between PRM in theory and PRM carried out at the company.

1.5 Research Scope and Limitations

The outcome of this thesis will be a written proposal of improvements of the existing PRM process at the company. For instance activities for increasing the level of competence required for proper risk management, and relate these improvements to the existing project management model used at the company.

As this thesis has a fixed time budget it is impossible to cover everything fully. Our focus of this research is to identify weaknesses and not strengths of PRM at the company. Although it is almost inevitable not to find and look for strengths, when you search for weaknesses, we will not focus on them. Furthermore, we will probably not identify all weaknesses within the PRM process at the company, but our aim is to identify the most problematic ones.
2 PROJECT RISK MANAGEMENT

In this chapter we will break down the definitions of project risk management into smaller parts, and describe what each of them means and how they relate to each other. It is important and highly recommended for the readers to study this chapter before reading further more in this report due to constantly usage of these terms during this report.

2.1 Background

Risk management is an essential part of project management. Risks should be managed in each and every part of a project. A project manager should anticipate risks that might affect different parts of a project, or threaten the entire project [Nicholas 2001] [Sommerville 2001]. We will first describe what project management is before explaining what project risk management is. We will define what ‘project’ is, and then we will give a short description of how a project is managed and what activities usually are involved in the project management process.

2.1.1 Project Management

2.1.1.1 What is a Project?

According to Nicholas [Nicholas 2001], a project is a sequence of activities performed to reach a single and definable purpose, end-item or result. Each of these activities has to be performed in a way to fulfil the requirements that lead the production towards the end-item. An organisation, with its personnel and facilities, takes care of these activities. Projects developing software products have different kinds of activities such as designing, programming, testing and etc. The roles and responsibilities are defined for each activity, depending on the type of activity that is involved in the project [Sommerville 2001].

As mentioned earlier, within a project a sequence of activities is performed. It is also considered as the process of working to reach an end-item or a goal. This process contains several phases, called project life cycles [Nicholas 2001], see figure 2.1.1.1. The whole organisation begins its work in the first phase, moving towards the last phase to conclude the project, and that is where the main goal of the project is reached.

![Figure 2.1.1.1: A typical project life cycle model](image)

2.1.1.2 What is Project Management?
Managing a software development project is a very essential task that must be done with great care and careful planning [Pfleeger 1998]. In a project, there are some typical elements that should be managed: time, cost, resources, quality and scope [Dawson 2000].

Management staff consists of managers who have the responsibility of managing these elements. Examples of people involved in management activities are line managers, project manager, quality manager, configuration manager and etc. A project manager is set to manage the project team. The project manager has the responsibility to plan, direct and integrate the activities that each and every project member performs, towards the project goal [Nicholas 2001]. Project planning is very sensitive and important activity, which must be effectively managed because of its dependence to the progress of the project [Sommerville 2001]. Typical parts of a project plan are hardware and software resource requirements, work breakdown structure, project schedule and risk analysis. The project manager has also the responsibility of monitoring the progress of the project.

![Diagram of Management Staff]

**Figure 1.1.1.2**: An example of a typical software development project

2.1.2 Project Risk Management

Earlier, in 2.1.1.2, we talked about elements such as time, cost, resources, quality and scope that should be managed within a project. Risks are inevitable, and they exist in each and every activity for handling these elements.

2.1.2.1 What is a Risk?

The word *risk* comes from the early Italian *risicare* meaning, “to dare” [Hall 1998]. It is often experienced as a potentially negative or unwanted event that would have a reasonably known impact, which may or may not occur [Lichtenberg 2000].

Different literatures have defined risk as:

- “Possibility of suffering a loss”, [CMM 2001]
- “Risk is simply something which can go wrong”, [Sommerville 2001]
- “A risk is an unwanted event that has negative consequences”, [Pfleeger 1998]
2.1.2.2 What is Project Risk Management?

Risks may threaten the project, the product that is being developed of the organisation and some or all of them at once. According to Sommerville [Sommerville 2000], risks can be divided in three main categories:

- **Project risks**: risks which affect the project
- **Product risks**: risks which affect the quality or performance of the product being developed (for instance the software in a software development organisation)
- **Business risks**: risks which affect the organisation, developing the product

To understand the difference between each category, some examples could be given for each category. Examples of risks within a project could be software tool failure, hardware unavailability, management change and etc. Examples for product risk could be function failure and for business risk, technology changes. A risk could threaten both the project and the product, for example a requirement change, or all of the categories at once when for instance if an experienced programmer leaves its job. It can affect the project because the delivery of the developed system may be delayed. It could be a product risk because a replacement may not be as experienced and may make mistakes, and it could be considered as a business risk because the experience of that person will not be available for bidding for future business. [Sommerville 2001]

Within every project, there exist risks meaning there is a chance things would not turn out the way they were planned [Nicholas 2001]. According to Ould risk within a project is a threat to the achievement of one or more main aims of the project [Ould 1999]. Thus, not being aware of what kind of risks exist, how it affects different elements of a project and what will be the consequences of ignoring it, will damage the project seriously [Sommerville 2001].

Risks within a project can be classified in two categories: internal and external risks [Nicholas 2001]. The internal risks could be classified in two categories:

- **Technical risk**: the risk of not fulfilling time, cost or performance requirements
- **Market risk**: the risk of not fulfilling market needs or the requirement of specific customers

External risks within a project are the risks that affect the project by sources such as business risks from outside of the project. In this thesis, we only focus on the management of the internal project risks, illustrated in figure 2.1.2.2.

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**Figure 2.1.2.2**: An illustration of how risks are categorised within an organisation
2.2 The Need of Project Risk Management

Why should software companies spend huge amounts of money on something that is almost invisible? Why should the stakeholders invest in project risk management? We will discuss the answers in this chapter to clarify the importance and need of PRM.

2.2.1 The Importance of PRM

Nowadays, complex software systems are growing rapidly and the technology is advancing further and further. These factors make the existing risks grow, as the customers’ expectations on fully functional products remain unchanged [Hall 1998]. This makes it reasonable enough to force a software organisation to put more attention on risk management. If we only focus on project risk management, project problems such as schedule and cost overrun, can be mentioned as two simple consequences of poor risk management within a project [Sommerville 2001]. More serious consequences of unmanaged risks could complicate or even terminate a project. That is why it is important to manage the risks carefully and properly within a project [Hall 1998].

2.2.2 Project Risk Management – to what cost?

It is well known that managing risks within a project costs lots of money [De Klerk 2001]. The information of an uncertain event is very valuable for the investor or the decision-maker. Having control over the risks and having the possibility to affect the outcome of an event is also very valuable [De Klerk 2001]. These mentioned factors are more essential to consider when risk management must be performed within a large project.

Small projects do not need the same huge attention for managing risks, because the consequences of the risks are usually small and if the staff is highly motivated, they will overcome the difficulties related to the risks [Nicholas 2001].

2.3 Characteristics of a successful PRM model

In this chapter we will present a model containing characteristics to achieve successful PRM. After reviewing numerous references from different perspectives related to risk management and project risk management, we have collected common characteristics of PRM and merged them into what could be considered as a successful model. The core of the model contains series of PRM activities such as risk identification, risk analysis, risk planning and risk monitoring [see figure 2.3] These activities are facilitated by PRM principals such as motivation, risk reserve, documentation, risk officer, communication channels and training and education. The PRM activities and principals should be performed according to the PRM framework.

The main purpose of the model is to describe which essential issues and key activities should be performed within PRM. The focus is more on what should be done rather than how. We will discuss how some of these issues and activities should be performed when we discuss solutions to our case study findings [chapter 5].
This model is applicable for both single project management and multi-project management. In this report we focus on the multi project management since this type of project management is used at the company (at the moment we performed our case study). A multi-project is a large project consisting of several sub-projects. This PRM model that we present should be used both at the main project and each sub-project to achieve the fullest effect of its outcome. That means, each of these PRM attributes, i.e. PRM framework, principals and activities should be used both at the main project level and the sub-project level. More on how this should be performed will be described in chapter 5.

![Figure 2.3: An overview of the PRM model](image)

2.3.1 Project Risk Management Framework

A framework should be created in presudy phase and specify the strategies and how to implement risk management in the project for risk management activities such as identifying, analysing, planning and monitoring risks for the whole project lifecycle [Ward 1999] [Hall 1998] [Nicholas 2001].

The nature and extent of the risks to be managed for each project should be determined. The method to develop risk management procedures, risk metrics and risk mitigation strategies should be defined at the start of the project. The method and criteria for how to manage and monitor each of the identified areas of risk should be defined as well [TickIT 2001].

The following tasks should be performed at the prestudy phase [Hall 1998] [IEEE 2001] [Nicholas 2001]:

1. Define the risk identification process: techniques, criteria, scope and resources
2. Define the risk analysis and assessment process: techniques, criteria and scope and resources
3. Define the risk planning process: strategies, criteria and scope and resources
4. Define the risk monitoring process: strategies, criteria and scope and resources

2.3.2 Project Risk Management Activities

The purpose of these risk management activities is to ensure risks are controlled and prevented from becoming problems. In figure 2.3.2a, Input is an item required for a process transformation that meets the process entry criteria. Output is a result of process transformation that has been successfully reviewed using process exit criteria. Techniques/Strategies are the methods the process uses. Process control is
2.3.2.1 Risk Identification

Risks should be identified way before they become problems and this information should be incorporated into the project management process. Any team member in a project should have the ability to identify risks within the project since each individual has particular knowledge about some parts of a project. [Compulink 2003] [Ward 1999]

Here are some examples of the most known identification techniques to achieve risk identification systematically:

- **Analogy** – It is a technique to review records, databases, summaries and project members’ notes and recollections from similar previous projects, for identifying risks [Nicholas 2001]
- **Checklists** – By creating lists of factors found in documentation from prior projects and previous experiences, risks could be identified. This technique could be used for the whole project life cycle, specific phases or tasks within the project [Sommerville 2000] [Nicholas 2001]
- **Work Breakdown Structure (WBS)** (see chapter 7.6) – Each work package, which represents a job, is reviewed carefully for recognition of potential problems with management, customers, suppliers, equipment and resource availability and technical problems. The processes or end-items in term of complexity, maturity, quality and currency or dependency are assessed for identifying internal risks (described in chapter 2.1.2.2), within each work package [Nicholas 2001] [Hall 1998]
- **Brainstorming** – With this method, risks are identified from the collective experience of project members in a meeting to share options and exchange ideas about possible problems in the project [Nicholas 2001] [Sommerville 2000] [Raz 2001] [Hall 1998] [IEEE 2001]
- **Survey** – A survey (if needed anonymously) could be used to identify risks and facts about risks from people, for instance by interviewing or using a questionnaire [Hall 1998] [IEEE 2001]

**Input:** The inputs to the risk identification process are uncertainty, knowledge, concerns and issues. Uncertainty is part of our assumptions and doubts, which we do not know. Knowledge is what we do know from our previous experience or education. Concerns are what we fear, caused by anxiety, uneasiness or worry. Issue an open item that is unresolved and we work (often with other people) to resolve [Hall 1998] [Risksig 2003].
**Process controls:** The process controls are project resources, project requirements and PRM framework. Depending on which technique is chosen to identify risks, resources in terms of cost, time and staff should be reserved from the project plan for risk identification process. Project resources set the scope of criteria for the risk identification process [Hall 1998].

**Output:** The output will be a list of risk statement, which is a description of an identified risk [Hall 1998] [Risksig 2003].

Risk categories should be used consistently for effective communication to stakeholders. Risks that are related may be combined for ease of analysis, monitoring, and treatment [IEEE 2001] [Ward 1999]. Some examples of risk categories are requirement risks, tools risks, people risks, technology risks and etc [Sommerville 2000].

Here are some examples of most essential risks that should be recognised and considered in software development, mentioned in TickIT [TickIT 2001]:

- Inaccurate estimates of recourses an the duration required for each activity
- High technical novelty, including novel methods, tools and supplied software
- Low quality or availability of supplied software and tools
- Low precision, accuracy and stability of the definition of the customer requirements and external interfaces
- Availability and the competence levels of the development staff

**2.3.2.2 Risk Analysis**

The purpose of analyse is to convert the data of identified risks into decision-making information about them. During the risk analysis process, each identified risk must be assessed and analysed [Sommerville 2000]. Analysis is a process of examining the risks in detail to set the scope and criteria of what we consider as risks, how they relate to each other [NASA 2003].

A list of risk profiles should be created, which include a description of each risk, likelihood, consequence, cost and schedule, impact and a prognosis that specifies the earliest visible symptoms that indicate the risk is materialising [Nicholas 2001]. The risk likelihood is a quantitative or qualitative expression of the chances that an event will occur. Quantitative expressions may include numerical scales or probabilities [IEEE 2001] [Nicholas 2001] [Hall 1998]. The risk impact is the negative effect that the risk would have on a project if it materialises. It can be expressed as a qualitative rating such as high, medium, or low and numerical.
measures for instance between 0.1 and 0.9 [Nicholas 2001]. The **risk consequence** is an outcome of an event, hazard, threat or situation. It is expressed by a function of the risk likelihood and the risk impact. The outcome may be a loss or a gain and may be expressed qualitatively or quantitatively [IEEE 2001] [Nicholas 2001] [Hall 1998].

**Input:** The risk statement is the input for the risk analysis process [Hall 1998] [Risksig 2003].

**Process controls:** The process controls are project resources, project requirements and PRM framework. Depending on which technique is chosen to analyse risks, resources in terms of cost, time and staff should be reserved from the project plan for risk analysis process. Project resources set the scope of criteria for risk analysis process [Hall 1998].

**Technique:** A risk profile with record of a risk’s current and historical risk-state information must be created.

Here are some examples of analysis techniques [Hall 1998]:

- **Risk exposure** – is the product of the likelihood and the impact.
- **Causal analysis** – determine the root cause of a risk, determine preventive actions and implement these actions
- **Decision analysis** – is used to structure and to represent real-world problems by models that can be analysed to gain insight and understanding

**Output:** The output will be a **risk list** with risk profile. A risk list is an inventory of risks that contains the relative ranking of the identified risks with their profile [Hall 1998] [Risksig 2003]. The risks in the risk should be prioritised and ranked in a way that the key risks, the most important ones (risks with moderate-to-high consequences), should be placed at the top of the list [Nicholas 2001].

![Diagram of risk analysis process](image)

**Figure 2.3.2.2:** An overview of input, output, process control and techniques for risk analysis

### 2.3.2.3 Project Risk Management Planning

The risk management planning process is an essential part of the risk management process. It is about taking heed of potential problems and how to deal with the risks [Ould 1999] [Ward 1999].

It is necessary to reach levels of control and quality assurance by addressing project roles, responsibilities and the level of competence and experience required compared with available resources [TickIT 2001].
At this stage, strategies to manage the identified and analysed risks should be decided. Here are some examples of strategies:

- **Avoidance and reduction strategies** – risk factors can be avoided or reduced by taking up some actions such as minimising system complexity, reducing end-item quality requirements, eliminating risky activities and etc. [Ould 1999] [Nicholas 2001] [Sommerville 2000] [Hall 1998]
- **Contingency plans** – by having a plan if the worst happens, you are prepared for it and have a strategy in place to deal with it [Ould 1999] [Nicholas 2001] [Sommerville 2000] [Hall 1998]
- **Accept risk** – if the cost of avoiding or reducing the risk exceeds the benefit, then accepting the risk and not doing anything about it might be right [Ould 1999] [Nicholas 2001] [Hall 1998]

**Input:** The risk lists with the risk profiles [Hall 1998] [Risksig 2003].

**Process controls:** The process controls are project resources, project requirements and PRM framework. Depending on which strategy is chosen to plan risks, resources in terms of cost, time and staff should be reserved from the project plan for risk planning process. Project resources set the scope of criteria for risk planning process [Hall 1998].

**Output:** The output will be a comprehensive risk action plan, which documents the selected approaches/strategies (actions) to manage each risk, the resources required, detailed description of roles and responsibilities and the planned date for each action [Hall 1998] [Risksig 2003].

**Figure 2.3.2.3:** An overview of input, output, process control and techniques for risk planning

### 2.3.2.4 Risk Monitoring

This statement from ISO, TickIT is very important: “Throughout a project, risks will change in both perception and severity and therefore these should be constantly evaluated” [TickIT 2001]. Monitoring risks means regularly assessment of each identified risk to see whether the risks has become more or less probable and if the effect of it has changed [Sommerville 2000]. It is a continuously action that must be taken to review the risk’s status and appropriate actions such as contingency planning and pre-emptive action have to take place [TickIT 2001]. During the project execution, risks should be assessed by regular and ad hoc reviews and risk management mechanisms [TickIT 2001]. The key risks must have a high prioritisation for this activity.
**Input:** The risk action plan [Hall 1998] [Risksig 2003].

**Process control:** The process controls are project resources, project requirements and PRM framework. Depending on which strategy is chosen to monitor risks, resources in terms of cost, time and staff should be reserved from the project plan for risk monitoring process. Project resources set the scope of criteria for risk monitoring process [Hall 1998].

**Strategies:** To continuously ensure each risk is assigned to a responsible party and report new risks and changes to current risks to all stakeholders are among key activities during this stage [Pmineo 2003].

**Output:** The output will be a risk status, which makes the progress of managing/following-up each risk, visible [Hall 1998] [Risksig 2003] [Ward 1999].

![Figure 2.3.2.4: An overview of input, output, process control and techniques for risk monitoring](image)

### 2.3.2.5 Continuous Risk Management Process

Project situation changes, therefore risk management must be an on-going activity, not something that is done once at the start of a project [TickIT 2001].

Figure 2.3.2.5 describes the continuous risk management process. Risks should be regularly reviewed and mitigation strategies updated [TickIT 2001]. During the continuous risk management process, new risks should be identified and analysed [Pmineo 2003]. The risk list with risk profile [chapter 2.3.2.2] must be updated. New evaluations and assessments must be performed for each risk and the prioritisation of the risks in the list should be updated. The existing (old) action plan must be updated and newly identified risks should be added on [chapter 2.3.2.3]. The risk status [chapter 2.3.2.4] should be updated as well [Hall 1998].
2.3.3 Project Risk Management Principals

The project risk management principals are considered to be key elements around the PRM activities. These principals provide support, formal guidelines and ensure that the PRM process is on right track and within control.

2.3.3.1 Risk Officer

Risk management and project management is considered to be almost the same [Nicholas 2001]. But in some occasions it could be beneficial to separate the two activities by declaring a person responsible for risk management, a risk officer or a risk manager, which is the same thing in this context.

Appointing a risk officer is something that is supported by several authors. Nicholas says, “a person whose principle responsibility is risk management should be appointed to the project” [Nicholas 2001]. Tom DeMarco says, “appoint a risk officer, one person who is not expected to maintain a can-do attitude” [DeMarco 1997]. Furthermore, Nicholas states that, “the risk officer should not be the same person as the project manager because of the involvement of psychological and political matters”. A common misperception of risk management is that “the project manager is best equipped to deal with risk” [Stump 2003]. A risk officer should not by himself identify and manage risks, but he should be responsible so that risk management is carried out according to project and organisational objectives. A risk officer is a person with responsibility for coordinating risk management activities [Hall 1998].

Assigning the role of risk officer could be a key ingredient to a project success [Hall 1998]. Hall also says that the role of a risk officer is needed in order to achieve objectives within the following areas:
Methods for risk management - Provide methods for systematic identification, mitigation and tracking of long-term issues.

Focus for management - Provide the project management team with a tool to focus on immediate project problem areas.

Insight for the customer - Provide customer insight into problem resolution

Trend information - Look at where your estimate at completion trend is going.

2.3.3.2 Risk Reserve

The likelihood of a risk materialising or a problem occurs is very large when looking at project performance statistics. According to David Tilk ‘50 percent of projects end up late or over budget. Twenty-five percent fail completely. And only 25 percent actually succeed’ [Tilk 2003]. Having a resource buffer to deal with risks as they materialise, the project will be better equipped for success. That is why the project budget and schedule should include a risk reserve [Nicholas 2001]. Estimating buffers must be done carefully because it is a risk itself. According to Nicholas, a too large risk reserve can actually increase time and cost of a project, and thus you may not benefit of using it.

2.3.3.3 Communication Channels

The risk communication must be a multi-way communication. Firstly, management needs information of which potential risks exist and status information from the project personnel that actually mitigate the risks. No one has better insight into risks than project personnel [NASA 2003]. Any team member in a project can identify project risks and each person has specific knowledge about different parts of a project.

Secondly, information of risk strategies and objectives need to be communicated to project personnel. This information needs to be recorded and available to all project personnel. The purpose of communicate this is for all project personnel to understand the project’s risks to be able to make effective choices within the project [NASA 2003] [Compulink 2003]. Communication and documentation are essential to the success of all other functions within the paradigm and is critical for managing risks [NASA 2003]. Furthermore, NASA describes what to do regarding communication during different stages of the risk management process, which is shortly summarised here:

- Identification - Risk statements are communicated
- Analysis - Impact, probability and timeframe attributes are communicated
- Planning - Action plans are compiled and communicated
- Monitoring - Reports designed to communicate data to decision-makers are compiled. Decisions made during control must be communicated and recorded to project personnel

A third communication channel is the communication between the project and stakeholders. Stakeholders, based upon their needs, shall periodically be informed of project risks [IEEE 2001].

One could also think of a fourth communication channel that could be beneficial. Communication channels between project members from different projects or sub-projects would increase the visibility of multi project risks.
Establishing easy communication channels for project teams, anonymous if necessary, could become useful for bad news to be communicated up the hierarchy [Nicholas 2001] [DeMarco 1997]. It is the ‘bad news’ that management should be aware of to be able to forecast and plan for it if necessary.

2.3.3.4 Documentation

By documentation in this context we mean both having a documented formal process of risk management and also the process of documenting risks during projects.

To record risks during projects could be very beneficial for future projects. The better the documentation of past projects, the more information available for planning future projects and identifying possible risks [Nicholas 2001]. Experience is an excellent teacher in risk identification and risk reduction, so sharing the experience with team members will help project personnel to improve their risk management skills [Prineo 2003]. By specifying procedures, the project is ensured that accurate project documentation is created [Nicholas].

2.3.3.5 Training, Education and Motivation

Preparation is the key to implementing risk management successfully according to Elaine Hall [Hall 1998]. She recommends starting risk training from the beginning, learning risk management concepts and vocabulary. Effective risk management also requires appropriate motivation, capability and experience, and also a clear understanding of what is expected in terms of process outcomes [Ward 1999]. Training and education is important in order to learn about risk management. But if you are not motivated you probably will not learn much. Project personnel need to be convinced that risk management activity will help them meet their own objectives [Ward 1999]. Training can provide the motivation for learning more about why risk management is important [Hall 1998]. The recommended approach for risk management training is to build on the team’s current knowledge and have them applied the concepts immediately [Hall 1998].
3 CASE STUDY

In this chapter we describe the purpose of performing the case study and the different methods that we used to gather data.

3.1 Background and Introduction to the Case Study

We performed our case study at a company that develops software products for mobile communication. The company has grown very rapidly the last years causing administration to somewhat fall behind. There is more room for improving the risk management process, according to the company. The amount of documentation, describing the company’s risk management process, is very limited. This was the main purpose of why most of our research is based on interviews.

Most of the knowledge of working in projects, using different developing models and working routines, is stored among the employees at the company. Templates do exist, but they have a thin outline containing merely headlines. I.e. they rely very much on the knowledge, skill and experience of the people that will work in the projects. Much of the information we needed, about how the process of PRM is implemented and performed at the company, was not documented to a sufficient extent. Because of this, we conducted interviews to extract this type of information. According to Jacobsen [Jacobsen 1993], interviews do not only supply information of the interviewee’s knowledge, but also experiences, opinions and values. This is helpful for identifying potential problem areas. Another reason for why interviews were used was that we wanted to discover how risk management was practised in industry.

The case study we carried out was divided in three main phases. In the first phase we established an understanding of the formal PRM process at the company through interviews. During the second phase we studied how PRM was implemented in practice, also through interviews. During the third phase we used questionnaires to highlight weaknesses in a more quantifiable manner. In addition to these phases we reviewed formal and informal project documentation.

3.2 Purpose of the Case Study

The main purpose of this case study was to gain an understanding of the PRM process at the company in order to discover weaknesses that we later could improve. The basis for this case study consisted of two series of interviews, a questionnaire and reviews of project documentation.

We conducted two series of interviews where we wanted to target different groups of people with different task, but all related to PRM in order to gain a broader perspective of how PRM was conducted at the company. The first target group was people working with process development, people responsible for designing the formal documentation and people working within other areas related to risk management. By interviewing these people we wanted too establish a good overview of how the formal PRM process was defined, while we at the same time gained a fairly good understanding of how the company organisation was
structured. By **formal guidelines for managing risks**, we mean, when the way of handling certain tasks is defined before the project lifecycle is started. By following the guidelines in the framework, the outcome of the performed task would then be expected to lie within the scope of the defined framework. Formal methods of performing a task require a certain way of documentation routine, specified within the framework.

The purpose of the second interview series was to identify the informal practices of the PRM processes. By **informal practices for managing risks**, we mean how risk management is carried out in practice locally within a certain project or group. The way risk management was handled ‘locally’ meaning the practices were not visible to the whole organisation. Informal practices include attributes such as competence and motivation. The people we wanted to interview during this phase were project managers. The reason to this is they knew best what informal practices are regularly used during the project life cycle. We also had the purpose of finding other documentation related to PRM, besides the formal documentation available to us.

![Diagram of PRM components](image)

*Figure 3.3: The picture illustrates what components we studied at the company in order to understand their PRM process and factors, such as competence and motivation, which influence how PRM is conducted.*

During the case study we decided to include another type of survey, a questionnaire. Some of the answers we received during the two interview phases were used as input for the questionnaire. This questionnaire was targeted at project members, and aimed at establishing another view of the PRM process.

### 3.2.1 Objectives of the Case Study

The expected outcome of the case study can be summarised in four goals. The main goals was to gain an understanding of...

1. …the organisational structure of the company
2. …the formal guidelines of the PRM at the company
3. …the informal practices of the PRM at the company
4. …the lacks, flaws, weaknesses and needs of PRM at the company

Fulfilling each of these requirements were necessary in order to achieve the main goal of this thesis, which was to come up with answers to the research questions, explained in chapter 1.3.
3.3 Case Study Method

In this chapter we explain the different methods and techniques we used to perform our case study at the company. We used methods such as interviewing key members of the organisation, measured the knowledge and experience of project members and project managers by a questionnaire and studied different project documentation.

3.3.1 Interview Techniques

Interviews are normally categorised into two types\(^2\): qualitative and quantitative interviews. Qualitative interviews involve simple questions aiming at giving very rich and descriptive answers, while quantitative interviews involve much data collecting, taking measures and making comparisons, i.e. simpler and shorter answers. Our approach was first to make a series of interviews, with a qualitative focus and then another series of interviews focused on a more quantitative method but still qualitative. This method, having a qualitative research approach followed by a quantitative one, is common approach according to Trost [Trost 1997]. Trost also states that qualitative interviews are most suited when you are trying to understand and find out something about a subject. That is the reason we choose to begin with a qualitative interview. According to Annika Lantz [Lantz 1993] four different types of interview questions exist:

- Open questions where the interviewee freely is allowed to express his/her thoughts (Qualitative)
- Open-directed questions where the interviewee seeks after knowledge/qualities limited within the context of the subject that the interviewee has predefined
- Half-structured questions where the respondent's experience of qualities and quantities of the subject will be discovered. The respondent also gives its view to those issues the interviewee finds important, linked to the subject. These types of questions are structured in a way where the combination of open and closed answers are expected to be received
- Structured questions where the questions are formulated in a predetermined way. The respondent gives answers to questions with predefined answer alternatives

In our research, we formulated our questions according to the half-structured method in the first series of interviews. The main goal of the first series of interviews was to understand the formal project risk management process, but we also wanted to gain quantitative information about the lacks and flaws of the existing PRM process.

All the interviews were performed during equal circumstances. They were performed at the company due to the fact that the interviewee feels more comfortable and relaxed when the interview takes place in a familiar environment [Trost 1997].

All of the interviews were recorded because it facilitated our documentation method and made it easier to analyse them afterwards. All the persons who were interviewed were asked whether they allowed us recording the interview or not,

\(^2\) These types of interviews are explained in many references such as (Trost 1997), (Lantz 1993) and (Wikström 2002)
something everyone approved upon. Recording the interviews was a major help for us because of the opportunity to pay more attention to the respondents due to less documenting during the interview. Also, we decreased the possibility of missing important details. A drawback of recording an interview could be that the respondent could feel insecure and uncomfortable with the visual presence of the tape recorder [Trost 1997]. We placing the recorder somewhere where it was not distracting the respondent during the interview solved this problem easily.

Besides the person who was going to be interviewed, both of us (the writers of this thesis) were present at all the interviews. One of us asked the questions and led the interview, while the other one continuously reminded of those detailed issues that were missed during the questioning, and also took care of recording.

There is a risk that the respondent would feel uncomfortable and inhibited when the interview is performed by two persons. But it could also be a positive manner of performing an interview, which needs high level of confidentiality, especially when the subject is sensitive and contains important issues [Trost 1997].

### 3.3.1.1 Interview Phase 1

The main objective of the first phase of the interviews was to build an overview of how the project risk management is designed formally. The questions that we arranged for this phase was used as a help to gain an understanding of the formal project risk management. The core issues of the content of these questions was studied and collected from literatures related to risk management. Six persons were interviewed during the first phase, each from different departments having different roles within the organisation. Departments and areas represented were such as:

- Administration (Quality and Security dep.)
- Customer Support (Process and Project - PoP)
- Operators

The purpose of choosing six persons with different roles, wide within the organisation, was to gain an understanding of how the formal PRM was designed and used/understood from different perspectives. The interview questions were formulated in a general way. The reason for this was to achieve an overview of organisational structure and the organisation-wide project risk management.

The first section of questions [Appendix 7.3], from the list of our interview questions were questions formulated in a way to gain information about the person's present work task, experience of risk management and his/her involvement with managing risks at the time.

The core section of the interview questions belonged to questions concerning formal risk management. The main goal of the questions that were asked in this section was to recognise how the process of the formal risk management was defined. The concluding section of the questions contained of questions regarding locating documents relating to risk management, and other people who could be useful to talk to concerning the content of our thesis.
### 3.3.1.2 Interview Phase 2

The main objective of performing a second round of interviews was to gain an understanding of how the informal project risk management was practised. To achieve a good result from studying what actually happens during the project lifecycle, as far as risk management is concerned, we decided that interviewing four project managers would be enough for us to give us a proper general overview. These people had experiences from different types of projects, both small and large projects, which would benefit us even more. The selection of project managers also represented different types of project managers, for instance main project managers from large projects, sub-project manager such as technical project manager etc.

The second phase of interview questions contained more questions than of the first phase. It also had more detailed questions with more focus on what kind of activities that took place during the informal PRM process.

The opening section of the questions [Appendix 7.4] of the second phase contained questions regarding how much experience and education the project manager had within the subject of risk management. The second section of the interview questions contained questions about what kind of activities, methods and strategies the project manager used to deal with risks. This section had more specific and detailed questions with focus on different activities of risk management, compared to the second section of the questions in the first interview phase. The concluding part of the interview questions contained general questions about project managers’ opinions regarding informal and formal project risk management, the model that were used for project management and discussion about those factors that caused problem for managing risks.

### 3.3.2 Questionnaire

While performing the interviews, we came to the conclusion of updating our research approach and to add another phase, or information channel. The addition we did was to do a questionnaire with the purpose of pinpointing certain problem areas that we identified during the interviews. The reason for this was to illustrate problems in a more quantitative manner.

The questions highlighted different aspects of risk management (see chapter 2.3) to measure project members’ and managers’ experience and knowledge of PRM, risk identification, risk follow-up and weaknesses of PRM [Appendix 7.5].

### 3.3.3 Access to Documents Concerning Project Risk Management

The documents that we were authorised to study were about the organisational structure, the formal development models such as Model X [see chapter 4.1.2] and documentation from one small and one large project. The documentation of projects consisted of many project reports such as risk analysis, project specification, requirement specification etc.
3.3.4 Purpose and Method Summary

<table>
<thead>
<tr>
<th></th>
<th>Phase one</th>
<th>Phase two</th>
<th>Phase three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose(s)</td>
<td>Gain an overview understanding of the company and its <strong>project model</strong>.</td>
<td>Gain an understanding of how <strong>PRM is used in practise</strong>.</td>
<td>Highlight the level of experience, knowledge and weaknesses of PRM within project groups.</td>
</tr>
<tr>
<td></td>
<td>Gain an understanding of the <strong>formal PRM</strong> at the company.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Locate related documentation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target group(s)</td>
<td>People working with formal methods, routines and project models.</td>
<td>Project managers</td>
<td>Project members</td>
</tr>
<tr>
<td>Method</td>
<td>Qualitative interviews</td>
<td>Qualitative / Quantitative interviews</td>
<td>Quantitative questionnaire</td>
</tr>
<tr>
<td>Number of interviewees</td>
<td>6</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Time per interview</td>
<td>Approximately one hour per person</td>
<td>Approximately one hour per person</td>
<td>Approximately 20 minutes per person</td>
</tr>
<tr>
<td>Questions</td>
<td>Appendix 7.3</td>
<td>Appendix 7.4</td>
<td>Appendix 7.5</td>
</tr>
<tr>
<td>Result</td>
<td>Chapter 4.1 and 4.2</td>
<td>Chapter 4.3</td>
<td>Chapter 4.4</td>
</tr>
</tbody>
</table>

Table 3.4.4: Purpose and method overview of the case study

3.4 Analysis Method/Criteria

In the previous chapter, we described the method we used to gather data. Now we will explain ‘how’ we analysed the gathered data to achieve the result of the case study.

This chapter provides descriptions of what methods were used to analyse the documented interviews from phase 1 and 2, the answers from the questionnaire and the internal formal and informal project documentation that we reviewed. As shown in figure 3.4, the purpose of this chapter is to provide a description of **how** we analysed the ground data gathered from the case study.

**Figure 3.4: An illustration of what data is analysed to achieve the result**
3.4.1 Criteria and Definitions

The purpose of this chapter is to define the scope of the criteria we limited us to for analysing the ground data. Also we defined what we mean by a certain phrase or statement.

Project Model, Formal Guidelines of managing risks, Informal Practices for managing risks and Findings are four main parts of the result of the case study, which will be comprehensively described in chapter 4. The criteria are defined as follow:

**Project Model**
The project model aims at giving an overview description of how projects are conducted by studying the ground data gathered from the case study.

![Figure 3.5.1a: An illustration of which data is analysed to achieve an overview of the project model used at the company](image1)

**Formal guidelines for managing risks**
The formal guidelines for managing risks describes how risks currently are managed formally, recognised by studying the ground data gathered from the case study. Examples of formal guidelines are documents describing certain models or rules that exist are available and visible to everyone working with risk management within the organisation.

![Figure 3.5.1b: An illustration of the way data is analysed to achieve an overview of formal guidelines](image2)

**Informal practices for managing risk**
The informal practices for managing risks describes how risks currently are managed informally, recognised by studying the ground data gathered from the case study. Example of informal practices could be that every project or sub-project documenting their risk management process ‘locally’ (within the project, or sub-project).
Finding

A finding is a statement that locates a weakness identified in the ground data, or a statement that specifies a certain part of PRM that exists today, that could become a weakness in PRM in future.

We defined a weakness when an activity or a principal cannot be identified or located within the ground data gathered from the case study, and is missing. It is also a weakness if an activity or a principal exists but does not functions the way it should compared to the description of the characteristics of the successful PRM model described in chapter 2.3.

We prioritised our effort to identify findings according to what we defined as ‘when a finding is recognised in all three categories of ground data, it receives the highest prioritisation’. The following table describes the prioritisation of a finding depending on were it is found. The findings are described in chapter 4.4.

<table>
<thead>
<tr>
<th>Priorisation</th>
<th>Finding Recognised in Ground Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I Q D</td>
</tr>
<tr>
<td>2</td>
<td>I Q</td>
</tr>
<tr>
<td>3</td>
<td>I D</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>5</td>
<td>Q D</td>
</tr>
<tr>
<td>6</td>
<td>Q</td>
</tr>
<tr>
<td>--</td>
<td>D [Note: we only analyse findings from documentation together with other ground data categories, not by itself]</td>
</tr>
</tbody>
</table>

Table 3.5.1: The table shows in which categories the findings are recognised and how they are prioritised.

I = Interview Phase 1 and 2
Q = Questionnaire
D = Documentation
3.4.2 Methods for Analysing the Ground Data

The purpose of this chapter is to define the methods we used to analyse the ground data gathered from the case study.

3.4.2.1 Interviews

The recorded interviews from phase one and two was first documented. During the documentation, sometimes questions were answered in a direct way and in some occasions, large overall descriptions were given. From those descriptions we identified and summarised answers related to our other questions. After documenting the interviews, we identified and categorised the content depending on the objectives we set. Our objectives were to understand the project model [chapter 4.1], learn what formal guideline for managing risks exist and how it is performed [chapter 4.2], and what are the informal practices for managing risks and how those were performed [chapter 4.3].

After documenting and categorising the content, we summarised the content of categories, and documented conclusions and statistics. The aim of summarising the content was to locate the important content directly related to our main objective of this action, to identify a finding. By drawing conclusions with statistics of how many people were involved in each statement of the conclusion, we arranged a list with sources for stating a finding [the findings are described in chapter 4.4].

3.4.2.2 Documentation

We looked at the document containing information about different parts of the organisational structure to gain an understanding of how the organisation is built.

As we had access to the documentation of one small project and one large project, we studied the documentation carefully and had the goal to locate and identify findings, based on:

- If the formal guidelines were used for documentation and overall PRM, and if so, how well they were implemented and documented (compared to the ideal model of PRM)
- If there existed informal practices for managing risks during those projects, and if so, how well they were implemented and documented (compared to the ideal model of PRM)

We took notes of the findings we identified and created one separate list for the small project and one for the large project.

3.4.2.3 Questionnaire

We reviewed each answer from the questionnaire we had received and generated a table, which showed a respondent’s answer-mark to each question in the questionnaire. After that, we measured the percentage of number of respondents who had chosen the same answer alternative, out of total number of respondents, answering each and every question.

We documented the data for each answer within each question and used the statistic to state a finding. The statistic was also used to back the other findings that we recognised from the interviews and documentation.
4 RESULT OF THE CASE STUDY

The result of this case study is described in four parts:

- Project Model
- Formal guidelines for managing risks
- Informal practices for managing risks
- Findings

The first part describes the organisation structure. The second and the third part describe how risks currently are managed, both formally and informally. The formal and informal parts only gives a short description how the PRM process looks like, and not what weaknesses that exist there. The last part describes the findings of the case study.

4.1 Project Model

The formal way of managing projects within the company is defined in a project management model called ‘Model X’. It is a framework designed for project management, emphasising on managing resources and overall decision-making. This model consists of six phases and is designed in such way that it covers the whole project lifecycle. This model is in use both for managing the main project by project managers and managing sub-project by sub-unit managers.

1. Idea Phase: The person or business area interested in starting a project describes an idea, its motive and the expected consequences. An outcome of this phase is an estimation of the time and resources needed in the prestudy.
2. Prestudy Phase: The prestudy manager describes the result of the prestudy and an analysis of the cost and income.
3. Project Planning Phase: Project manager (and other project members if applicable) describes how the project will be executed.
4. Execution Phase: The project is under way. The product is developed during this stage.
5. Conclusion Phase: The project manager (and other project members if applicable) concludes and assesses the project.
6. Follow-up Phase: At this stage the follow-up activities gets under way, such as gathering of what was good or bad during the project.

Model X emphasises, as mentioned earlier, on decision-making. As a project progresses throughout its lifecycle and phases, it is evaluated at certain “rounding marks” or “decision points” (RM). These points are placed between phases to act as a filter for quality control and easier prioritisation between projects. Upper management makes decisions on weather to continue, postpone or drop a project. The model, with its six phases and four RM, is illustrated in figure 4.1.2.

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3 ‘Model X’ is used throughout the report and it refers to the project management model used at the company.
4 RM is short for the Swedish word ‘Rundningsmärke’ that is used in Model X.
The formal documentation, of Model X, mainly consists of templates and checklists. The templates contain headlines with, in some cases, short descriptions of the purpose of the headline. The mandatory project documentation, relevant for our case study, is a Requirements Specification, a Prestudy Report, a Project Specification, and a Conclusion report. These documents are written according to the predefined templates, and it is these documents that are evaluated at the RM of Model X. The evaluation at the ‘round marks’ is conducted by going through the checklists. The checklists are only used to evaluate if something is documented or not, it does not evaluate the quality of the content.

Other documentation do exist, but since our focus is on risk management, it will not be covered in this thesis.

4.2 Formal Guidelines for managing Risks

Project risk management is not covered in a separate document in Model X. It is however mandatory to do a risk analysis. There exist a formal document describing how to perform a risk analysis. This document describes the method called ‘Minirisk’. The likelihood and consequence of each risk is rated with a numerical value. By multiplying the two numbers, a risk value is received. This document is however not available as a part of the formal development model at this moment (2003-03-03) and it is not used within the whole organisation.

During the first phase of Model X, Idea phase, nothing is mentioned of risk management. The requirements document template has a heading called ‘Risks of not implementing a project’, requiring an analysis of the risks of not carrying out a project or risks of missed business opportunities. The second phase, prestudy phase, contains a risk analysis headline in the template prestudy report. The project specification template, used in the Project planning phase, also contain the headline risk analysis. The only thing stated within these documents is that a risk analysis should be conducted. At the second “rounding mark”, RM2, the project specification is checked to secure that a risk analysis has been done. During the last two phases; conclusion and follow up, there exist no formal or unified documentation of risk management.
The organisational structure at the company consists of different sections; Business Areas, Cross Company Area, Customer Support and Operators. Within each one of these sections, there are departments with different roles within the organisation. Some of these departments have their own definition of risk management (more detailed than in Model X). Their methodology to manage risks is defined after the type of risks they deal with. For instance, the security department’s risk management model is defined in such way to deal with physical and information risks/threats and the Business Area handles risks that concern marketing (business risks) etc.

The organisation also contains different types of forums that function as line manager and are directly linked with each project. A forum called VP-forum, with line managers from each department as its members has the task of overall-planning and overall-decision-making regarding each project. They have the authority to decide whether a project should be started or not, and what priority it will receive if started. At this forum, general (high level) risks concerning each project are identified and discussed, and each risk is rated on a prioritisation scale matrix.

A Steering group is set up at the start of the project, which has the functionality of giving feedback to the project management, including risk management issues.

In conclusion there exist no common formal project risk management documentation support that is available to everyone. There is only a formal obligation that a risk analysis should be carried out. How the analysis is carried out is completely dependent on the project manager and the project team.

### 4.3 Informal Practices for managing Risks

Risks are mainly managed during three phases of Model X, during the prestudy phase, planning phase and the execution phase. In practise, risks are managed during two phases, as the activities of the prestudy and planning phase, concerning risk management, somewhat coincide.

#### 4.3.1 Risk management during the prestudy/planning phase

At the prestudy stage of a project, the project manager arranges a meeting that has the main objective of discussing issues regarding risk management. The manager invites representatives, sub-unit managers, from different units within the main project to participate in this meeting. Representatives are usually from different areas within the organisation, such as technical, marketing and customer service unit.

The main part of this meeting is dedicated to identify risks. Each of the representatives from different units, together with the project manager, has the responsibility to identify risks that impacts the whole project. The project manager uses brainstorming method for identification of risks. Each representative brainstorms risks and uses “yellow notes” to write down the risks. The project manager then puts together all the yellow notes on and starts a discussion until a general agreement is reached concerning the identified risks.

Each one of the sub-managers has the responsibility to identify the risks concerning their unit in a meeting with members of that unit.
Most often, sub-unit managers have a risk analysis meeting of their own together, with the members of that sub project. For instance, the technical project manager has the responsibility to arrange a meeting with his/her unit members to identify all the risks that concerns the technical part of the main project.

Sub-manager uses the brainstorming method to identify risks. Similar to the technique that is described above, each project member brainstorms risks and uses yellow notes to write down the risks. The sub-unit manager then puts together all the yellow notes on a white board and starts a discussion until a general agreement is reached concerning the identified risks. Each one of the project members has then the responsibility to manage the risks concerning their area of work.

Most of the project managers and sub-unit managers use a framework, ‘Minirisk’, as mentioned in chapter 4.2, to rank and describe each risk in a list, and also rate the likelihood and consequence of each identified risk. According to the ‘Minirisk’ framework, the rating scale for likelihood and consequence is between 1 and 10, where 1 has the lowest priority and 10 has the highest priority. By multiplying the two ratings of a risk, you receive a value between 1 and 100, called a Risk Value. Sometimes, a boundary Risk Value, e.g. 50, is set by the project manager and risks that gained a value above the boundary value will be considered as threats to impact the project and thus will managed. Risks with a value below the boundary value will not be managed with countermeasures. Sometimes, when a boundary value is not used to separate which risks that will be managed or not, project managers picks out the top risks and manages them. The top risks could e.g. be the five risks gaining the highest risk value.

The project manager then summarises the risks in a risk analysis chapter in the prestudy report.

4.3.2 Risk management during the project execution phase

During the risk analysis meetings, also countermeasures are discussed. These countermeasures, or action points, are the actual steps taken towards managing the risks during the execution phase.

The project manager and the sub-unit managers create lists, with Action Points. These action points are evaluated at project meetings, most often held once a week. At the same project meetings the risks themselves are sometimes discussed. The responsibility, in practice, to manage each risk is handed over to the project member whose work is related to the classification of the risk.

The sub-unit managers report the current status of the risks in weekly meeting with the project manager. Also the list with risks could be updated, rating of the risks could be updated and newly identified risks could be added to the list.

Depending on the type of risk and its rating the decision will be made to manage the risk, eliminate it or ignore it. The communication between unit members and the sub-unit manager of each sub-project and also the communication between the sub-managers and the project manager are handled by e-mail, telephone or in the project meeting, regarding managing the risks and feedback. If necessary, the project manager reports the status of those risks that could impact the whole organisation to the line-manager and awaits feedback.
## 4.4 Findings

After having gathered data from interviews (I), questionnaires (Q) and the documentation review (D), we analysed it as described in chapter 3.5. Our analyses resulted in several findings that we merged into seven ‘main’ findings. For example, finding 4 was originally two findings – no cost estimations and no prognosis. These findings/weaknesses are visible among project managers and project members and therefore changes would be more easily introduced since they are somewhat already understood. Our findings are as followed:

1. Poor formal guidelines for PRM
2. PRM is not prioritised: Lack of time and knowledge/experience
3. The risk analysis differs between projects
4. Incomplete Risk Profiles: no risk cost estimation and prognosis
5. Identified risks are poorly followed-up
6. Unclear reporting and communication channels
7. The project manager is also the risk manager

The findings are listed one at a time in table structures below. The row **Ground data** indicates the source of our finding. ‘I’ stand for Interviews, ‘Q’ stands for Questionnaire and ‘D’ stands for Documentation [chapter 3]. The row **Description and Cause** contains description of the finding and the causes of this finding. **Effect** is a description of the impact the finding has on the company and **Weakness** is a discussion of whether or not the finding really is a weakness.

<table>
<thead>
<tr>
<th>Finding 1</th>
<th>Poor formal guidelines for PRM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ground data (I,Q,D)</strong></td>
<td><strong>I</strong>: 75 % of the interviewees support this finding. <strong>Q</strong>: 68 % feel there is a great or very great need of a supportive risk management documentation <strong>D</strong>: There is no common formal risk management support available.</td>
</tr>
<tr>
<td><strong>Description and Cause</strong></td>
<td>Most risk management is carried out informally. Risk management has not been an area focused on and naturally no formal guidelines has been produced and made available to everyone. Although some guidelines do exist, like ‘Minirisk’, they have not yet been spread within the organisation. Another reason that poor formal guidelines exist is the company spirit, which relies very much on the experience and knowledge of project managers and project members rather than formal routines. Causes: - Company spirit - PRM not a high priority in project management</td>
</tr>
<tr>
<td><strong>Effect</strong></td>
<td>- Tough for new project members to understand how PRM should be carried out - Management staff or others wanting to review PRM documentation will spend time interpreting different informal techniques - Tougher to guarantee PRM quality without any ‘formal pressure’</td>
</tr>
</tbody>
</table>
**Weakness?**

There exist poor formal guidelines, concerning risk management separately, that project managers have to follow. A developing model, like Model X [chapter 4.1.2], somewhat works as a minor risk management model as it facilitates project control [Ould 1999], but it is not enough to ensure risks being managed properly as Model X is very limited from a PRM perspective.

As 68% from the questionnaire feel there is a great or very great need of supportive risk management documentation and a majority of the persons interviewed expressed the need for supportive guidelines, there obviously is a need for it.

---

**Finding 2**

<table>
<thead>
<tr>
<th><strong>PRM is not prioritised: Lack of time and knowledge/experience</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ground data (IQD)</strong></td>
</tr>
<tr>
<td><strong>I:</strong> 80% of respondents feel that tight schedule is the main factor that constrains proper PRM</td>
</tr>
<tr>
<td>60% feel that little knowledge about PRM is also an obstacle</td>
</tr>
<tr>
<td><strong>Q:</strong> 85% say that lack of time is the main factor that constrains proper PRM</td>
</tr>
<tr>
<td>55% say that they have little knowledge of PRM</td>
</tr>
<tr>
<td>90% wish to improve their knowledge of PRM</td>
</tr>
<tr>
<td><strong>D:</strong> --</td>
</tr>
</tbody>
</table>

**Description and Cause**

High rate of work and stress caused problem with PRM. 85% claim that lack of time is the main factor that constrains proper PRM. Also little knowledge about PRM could be an important reason of PRM not being prioritised highly among other project activities. 90% of those who answered the questionnaire wish to improve their knowledge about risk management.

**Effect**

Lack of time to manage risks properly leads the PRM towards handling risks when they occur or materialise and show themselves, by “ad-hoc management” or problem management.

According to Humphrey “many of the more sophisticated methods in modern technology simply cannot be performed by untrained and undisciplined professionals, regardless of their other talents” [Humphrey 2001].

Having experienced project members who have good knowledge about risk management will increase the quality of project risk management and help to minimise the danger of not identifying crucial risks. A problem occurs when the experienced staff is not available and the project manager has to replace them with other staff with weaker competence.

According to our investigation, all the project managers use the brainstorming method to identify risks. As described in chapter 2.3.2.1 project members who participate in the identification meeting should be experienced and have knowledge about PRM to be able to identify the ‘right’ risks. That means, if the project members do not have the proper knowledge or experience of PRM he will be less equipped to identify the essential risks that might effect the organisation.

The tight schedule, stress and knowledge could cause a ‘fade out’ of the PRM process, which could damage the risk monitoring/following up seriously, as the already identified risks’ status changes, and new risks threat the project.
Weakness?

According to 80% of those interviewed, and 85% of the ones who pointed out this in questionnaire, lack of time is a major obstacle, a factor that deteriorates the managing of risks. This can be considered as a weakness seen from the risk management point-of-view.

As we made studies at the company, we understood that the project managers lecture risk management for those project members who has little or no knowledge about risk management. This is carried out very informally and not all managers perform it. Little knowledge of PRM is definitely seen as a weakness if the organisation wants a proper PRM.

All these factors become visible when risks become problems and risk management turns into problem management and costs arise.

<table>
<thead>
<tr>
<th>Finding 3</th>
<th>The risk analysis differ between projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground data (IQD)</td>
<td></td>
</tr>
<tr>
<td>I:</td>
<td>33 % of the interviewees support this finding.</td>
</tr>
<tr>
<td>Q:</td>
<td>76 % experience differences</td>
</tr>
<tr>
<td></td>
<td>58 % experience the differences as negative (time consuming and demotivating)</td>
</tr>
<tr>
<td></td>
<td>25 % experience the differences as positive (stimulating and increase competence level)</td>
</tr>
<tr>
<td>D:</td>
<td></td>
</tr>
</tbody>
</table>

Description and Cause

Risk analysis is carried out in different ways depending on the type of project and project manager. Organisational objectives and priorities also have an influence on the differences.

In larger and high-prioritised projects, a more extensive risk analysis most often is carried out, but this is not always the case. Usually, in smaller projects the project manager performs the risk analysis by himself or herself.

Differences of how to carry out a risk analysis also exist between similar types of projects. Differences are for example identification techniques, analysis techniques and documentation techniques. Most often all risks are put together in a list without any categorisation.

The primary reason to these differences is the amount of time spent on risk analysis. Many projects suffer from tight time and budget constraints, resulting in that risk management is not something that is prioritised. In the questionnaire, 26 % said that risk identification never is given enough time. 58 % said that enough time is given, but rarely. How risks are documented “varies depending how much time we have”, as one of the interviewees said.

Causes:
- Tight budget constraints
- PRM is not prioritised by project managers
- No formal guidelines [finding 1]
- Lack of knowledge and motivation of PRM within the project [finding 2]

Effect

- Time consuming for project members to learn new techniques for every new project
- Demotivating
- Increases competence level
**Weakness?**

It is not a weakness that PRM differs between projects of different size and importance. The larger a project is, the more complex it often is causing it to be more error prone. But if we look at how the risk analysis is conducted between similar projects, we find that a majority of the project members do experience these differences as negative. By having different approaches to risk analysis, not only project members will spend time to interpret them, but also others interested in following up on the quality of projects.

**Finding 4**

**Incomplete Risk Profiles: no risk cost estimation and prognosis**

| Ground data (IQD) | I: | 100 % of the interviewees say that no monetary cost estimations are made during analysis |
| Q: | -- |
| D: | Weak risk profiles. No cost estimation or prognosis of earliest symptom found in risk analysis report |

**Cause**

A risk profile, as described in chapter 2.3.2.2, should also contain, besides description, likelihood, consequence and impact, the two attributes:

- risk cost estimations
- prognosis that specifies the earliest visible symptoms that indicate the risk is materialising.

No monetary cost estimation is performed for risks at any stage of the project life cycle. At the company, action point lists are used in projects to manage the project components, including risks. Resources in terms of time, cost and available staff is considered for managing risks.

The cause of why risk profiles are incomplete could be that PRM is not highly prioritised, and/or there is a lack of knowledge of PRM, described in finding 2.

**Effect**

- Difficult to know how to manage a risk because insufficient information of the risk.
- The risk response will be too late causing large costs

**Weakness?**

The purpose of performing cost estimation is the business of PRM, which is based on cost-benefit-analysis and return on investment [Hall 1998]. Knowing the cost of preventing a risk from becoming a problem, and the cost of it materialising, makes it easier to make more effective decisions. Also, knowing early symptoms of a risk materialising make it easier to know when to take preventive actions. Not having this information reduces the risk control, which means the possibility of making wrong decisions increase. That is a weakness.

**Finding 5**

**Identified risks are poorly followed-up**

| Ground data (IQD) | I: | 100 % of the interviewees support this finding. 78 % recognise that PRM fades out during the project life cycle. |
| Q: | 45 % think that risks are less good or not followed up at all in the projects within their area of work. 50% think that risks are never or rarely followed up. 39% in the questionnaire have recognised the follow-up process of risks is not good in general and 45% within their working area. 65 % think there is not enough time for follow-up the risks. |
| D: | Identified in the documentation of both the small and the large project, although the following-up process was better recognised in the large one. |
| Description and Cause | 50% answering the questionnaire feel that risks are never or rarely followed up. There are different causes for this finding. 65% answering the questionnaire feel that it is rarely performed because not enough time is given to follow up the risks. Another reason could be that there is a lack of knowledge of monitoring and following up risks as it should be, described in chapter 2.3.2.4. At the company, the risk follow-up strategy most often consists of following up upon risk countermeasures (action points) identified in the risk analysis. Often, there is no continuously mapping and updating the identified risks with the risk analysis report, as it should be, described in chapter 2.3.2.5. The identification and follow-up of new risks rarely happens and when it does happen, the newly identified risks are not analysed and planned as well and extensive as the ‘first-time-identified risks’.

This finding can be linked to finding 2 because PRM is not highly prioritised within the project activities, and finding 1 where it is described that risks are mainly managed informally. |
| Effect | The most serious effect would be that the risks become visible in form of a problem occurrence. Then it would become problem management and not risk management. Often, managing a problem is more costly than managing the risk to prevent the problem from occurring [Nicholas 2001]. |
| Weakness? | Yes – when risks are not closely watched and followed up they could materialise into problems threatening the already tight schedule and budget. It is a weakness not to know of potential harm to project success. |

| Finding 6 | Unclear reporting and communication channels |
| --- | --- | --- |
| Ground data (IQD) |  |
| I: | = 33 % of the interviewees support this finding. | Q: | According to the questionnaire there is no consensus on how risks are reported. | D: | -- |

| Description and Cause | There are no clear channels on how to report and communicate risks, both within a project and between projects [chapter 2.3.3.3]. Some risks are reported to the project manager who to some extent communicates the risks at project and upper management meetings. Project members who has the best insight into risks [NASA 2003], decide themselves if to report a risk or not. 40 % report the risks they assume important to the project manager according to the questionnaire. This could be a problem, as the project member might not know the risk could have an impact on other parts of the project or on other projects. |
| Causes: | - No formal guidelines [finding 1] |
| - No forums focused on multi project risks |
| Effect | - An identified risk in one project could be an unidentified risk in another project |
| - A risk in one project could have an impact on another project or sub-project |
| Weakness? | Yes – If an identified risk has impact on other projects and it is not communicated to those projects, then it is a weakness. |
**Finding 7**  
**The project manager is also the risk manager**

**Ground data (IQD)**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I:</strong></td>
<td>33 % of the interviewees support this finding.</td>
<td><strong>Q:</strong></td>
<td>68 % feel there is a great need and 11 % feel there is a very great need for someone besides the project manager to manage risks.</td>
<td><strong>D:</strong></td>
</tr>
</tbody>
</table>

**Description and Cause**

Most often the project manager also has the role of risk officer, although it is not explicitly defined. There is nothing wrong with having the project manager as a risk officer, but it can be beneficial to separate the two roles as described in [chapter 2.3.3.1](#). The role of risk officer/manager, along with other responsibilities, is sometimes given to a project member within the company, although this is very rare.

Causes:
- Lack of resources to have a separate risk officer
- Not enough experience/knowledge about the benefits of having a separate risk officer

**Effect**

- PRM not prioritised ([finding 2](#)) causing lower quality of PRM

**Weakness?**

It is not a weakness if the project manager is responsible of managing risks, especially in smaller projects, but it becomes a weakness PRM is neglected due to other project activities and risks are not continuously managed the way they should be. According to the questionnaire 79 % feel there is a great need for someone besides the project manager to manage risks.
5 IMPROVEMENT SUGGESTIONS

This chapter aims at giving solution suggestions on the problems discussed in the case study findings described in chapter 4.4.

When looking at the causes of the different findings, there are a couple of common causes among the findings. The most common causes of weak PRM, according to our findings, are the lack of formal guidelines, lack of knowledge/prioritisation of PRM and lack of resources. In order to overcome these difficulties the company should work from two angles (described in more detail later in this chapter). Firstly, the project members must be educated/trained to know and understand the benefits and importance of PRM and thus gain motivation to use it. Project members must also be educated/trained on how PRM is carried out in order to be successful. Secondly, a formal structure of how the PRM should be carried out must be visible and available to everyone to ensure a certain level of PRM quality is upheld. Our solution approach is divided into four strategies capturing the two angles: Formal guidelines/Model, Communication, Knowledge and Risk Officer. They are described in the following sub-chapters. Figure 5 illustrates how the solution approaches correlate with the findings.

Formal PRM guidelines/Model will help to provide an organisational-wide ‘set of rules’, ensuring better structure, better level of knowledge and easier communication. It includes for example more clear risk profile identification, containing earliest symptom and cost estimations. Communication Channels aims at providing a forum for risks to be communicated between projects and sub-projects. Knowledge describes the importance of providing the proper motivation for PRM to be better accomplished. Risk Officer aims at describing the advantages the company could utilise having somebody responsible of PRM.

Figure 5: Illustrates the connections between the findings and the suggested improvements
5.1 The Formal PRM Model

The main objective of the model that we present is to improve the existing PRM process at the company. By following the instructions of this PRM model, the lacks and flaws of the existing model will be reduced. The model is developed exclusively for this company based on their existing formal and informal PRM process, and could be used within its organisation without major adjustments. This model should be considered as a part solution to the following findings, described in chapter 4.4:

- Finding 1: Poor Formal Guidelines for PRM
- Finding 3: Risk analysis differs between projects
- Finding 4: Incomplete risk profiles: no cost estimation and prognosis
- Finding 5: Identified risks are poorly followed up

By using our suggestion for formal PRM guidelines, the PRM process within the company will be improved and more structured. If all projects use this model, the difference between projects in risk analysis will be at minimum. Cost estimation, prognosis and status of the risks are included in the model and also a detailed step-by-step risk follow-up/monitoring is explained.

According to ISO, TickIT, [ISO 2001], the supplier should have a quality plan that defines all the quality management activities and resources relevant to the project. At the company, the formal guidelines for project management are described in a document, ‘the quality manual’. We believe that if our suggested model is included in the company’s quality manual, the PRM process will be more visible for all projects and also the customers. Also the level of PRM quality of all projects using this model will be at a constant and even level of performance (see figure 5.1), if all projects involved (e.g. main- and sub-projects) use this model to its full stretch. In this chapter we present our model, called The PRM Model, as solution to the findings, described in chapter 4.4. The PRM Model is based on the characteristics of the successful model presented in chapter 2.3 and is considered as an improvement/completion for the existing Minirisk model at the company.

Figure 5.1: The figure on the left shows the existing level of PRM quality performance. The Quality Manual includes the existing formal project management containing some brief PRM. The figure on the right shows what happens when our suggested model, The PRM Model is merged into the quality manual.
There are many methods, strategies, techniques and models available. What we suggest as improvement approaches is what we think is the most proper and suitable ones, which we collected from the references we have been studying [Appendix 7.8], with the aim of overcoming the weaknesses of the findings described in chapter 4.4.

5.1.1 The PRM Model: Framework and Guidelines

The PRM Model consists of three main parts:

- Framework for PRM
- Guidelines for risk identification, analysis and monitoring/follow-up
- Guidelines for risk planning and monitoring/follow-up

As described earlier, The PRM Model is based on the successful model presented in chapter 2.3. As shown in figure 2.3.2.5 in chapter 2, there are several phases presenting the PRM process such as PRM framework, risk identification, risk analysis, risk planning and risk monitoring.

5.1.1.1 Framework for PRM

The purpose of having a PRM framework is to establish a PRM process. The PRM Framework should be established at the beginning of the project (i.e. the prestudy phase) and placed in the Quality Manual document, where all projects could access and use it. The PRM framework can be used both for single project management and multi-project management. In the framework the following points should be defined:

- All strategies, methods and techniques that will be used during each PRM activity such as risk identification, risk analysis, risk planning and risk monitoring, see table 5.1.1.1
- Resources required to implement and perform the PRM process. Resources are in terms of time and schedule for regular meetings regarding risk management, and who should be present at each meeting see table 5.1.1.1
- The criteria and scope for risk identification, risk analysis, risk planning and risk monitoring, see table 5.1.1.1

The framework for PRM is considered to function as a support/basis for Guidelines for risk identification, analysis and monitoring/follow-up, see chapter 5.1.1.2, and Guidelines for risk planning and monitoring/follow-up, see chapter 5.1.1.3. When all strategies, methods, techniques for scheduling, choosing the resources, and definition of different criteria are defined, then in upcoming steps during the PRM process, the project manager and other participants should decide/choose the appropriate strategy, method and/or technique from the framework to manage the risks. We will talk about how to choose a method and give examples in chapter 5.1.1.2 and 5.1.1.3.
### 5.1.1.2 Guidelines for Risk Identification, Analysis and Monitoring/follow-up

Guidelines for risk identification, analysis and monitoring are an improved version of the existing Minirisk model within the company. The aim of the guideline is to create a **risk profile** to achieve a better and more visible PRM. It should be used both within the main project and each of its sub-projects, in a multi-project environment. These guidelines are also applicable for usage within single project management.

The basis for the guideline is a table, containing various elements of risk identification activity, risk analysis and risk monitoring/follow-up. The result of using this guideline should be a document containing a risk list with risk profiles. We will explain the guideline step by step with example to help the readers to understand how identification, analysis and monitoring of risks should be performed in practice. We strongly recommend the users to follow all steps, but steps 2, 5, 6, 7 and 10 are the basic ones.

#### Table 5.1.1.1: An example of how a PRM Framework could be defined for projects

<table>
<thead>
<tr>
<th>PRM Activity</th>
<th>Strategy / Technique</th>
<th>Time and Schedule</th>
<th>Participants</th>
<th>Criteria / Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identification</strong></td>
<td>• Analogy</td>
<td>3 scheduled meetings during the whole project life cycle to identify new risks (Note: this could vary depending on the length and type of the project)</td>
<td>The project manager + Project members + Other participants such as risk officer</td>
<td>Risks that only concern the main project from all perspective (e.g. technical, marketing, economy, security, etc)</td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td>• Checklists</td>
<td>It performs at same time as risk identification</td>
<td>The project manager + Project members + Other participants such as risk officer</td>
<td>Limited to the descriptions in chapter 5.1.1.2</td>
</tr>
<tr>
<td><strong>RM Planning</strong></td>
<td>• Avoidance and reduction strategies</td>
<td>Continuously</td>
<td>The project manager and risk officer</td>
<td>Limited to the descriptions in the chapter 5.1.1.3</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td>• See chapter 5.1.1.2</td>
<td>Continuously</td>
<td>The project manager + Project members + Other participants such as risk officer</td>
<td>Limited to the descriptions in chapter 5.1.1.2 and 5.1.1.3</td>
</tr>
</tbody>
</table>

#### Table 5.1.1.2a: Guidelines for risk identification, analysis and monitoring/follow-up.

**Rank:** risks in the **Red Zone** should be closely tracked, in the **Yellow Zone** should be under observation, and in the **Green Zone** can be almost ignored. More on this, see step 10.
**Step 1: Risk Category**

To achieve more structure and better visibility of risks, they should be grouped and categorised. A category should contain a group of identified risks that their main purposes have a relation to the name of the category. Within a project, the first series of categorisation could be decided after different units, for instance Test, Design, Economy, Coding/Implementation, Hardware, Software, Support and etc. If the project thinks it is necessary, some or all of these main categories could contain several sub-categories.

*Example:* Software, see table 5.1.1.2a

**Check on follow-up:** When new risks are identified, if needed, create new categories to gain a better overview of risks.

**Step 2: Risk Description**

The risk identification activity happens at this stage. Identification techniques differ depending on which method you choose to identify risks. The main purpose of all the identification methods is the same: consider risks before they become problems and to incorporate this information into the project management process [NASA 2003]. By using the method that is chosen from the PRM framework, all risks should be identified and placed in the related category.

*Example:* The project participants at the first meeting decide to use the Brainstorming method to identify risks for this project, after reviewing all the strategies mentioned in the PRM framework. They believe that Brainstorming method is the most proper method to use at this project because of its simplicity and effectiveness suits everyone involved in the PRM process.

When a risk is identified, a *risk statement* should be described. A risk statement is an informative way to describe the risk specifying the cause of the concern and its impact. Risk statements should contain two parts: the condition and the consequence. The condition-consequence format provides a complete overview of the risk that is critical during mitigation planning [NASA 2003]. It is read as follows:

*Given the <condition> there is a possibility that <consequence> will occur*

The *condition* component is what is currently causing concern and should be something that is true or highly possible to be true. The *consequence* component is the intermediate and long-term impact of the risk.

*Example of an identified risk:* Given the software tool shipment from the supplier is delayed, there is a possibility that the project’s deadline will be missed

*See table 5.1.1.2a*

**Check on follow-up:**

- Check if the identified risk has changed its attribute, i.e. if the existing description is still valid or not. Update the risk description if you sense any changes
- If you feel that the changed attribute of the existing identified risk now belong to another risk category, move it to that category
• Once the project manager/risk officer or any project member has identified **new risks**, these risks must be added to the existing risk list for analysis. Remember that risk identification is **not** a one-time activity! It should be performed continuously.

**Step 3: Risk ID**

The purpose of giving an ID to each identified risk is that you do not have to explain the risk every time you need to refer to it. By giving each identified risk an ID, you could simply just mention the *name of the risk category and the risk ID*. By using ID for risks, the traceability of risks will increase.

*Example*: Ri 1, Ri 2, etc. See 5.1.1.2a

**Check on follow-up**: --

**Step 4: Prognosis of Earliest Symptom**

A prognosis that specifies the earliest visible symptoms that indicate the risk is materialising would be very significant and useful for knowing how to manage and control. By having this information it would be very beneficial to deal with the risk at early stages as possible to avoid major damages. Once the risk becomes a problem then you have to deal with the problem and its arising cost.

*Example*: Software: Ri 1: the supplier has only one week to ship the software tool, see 5.1.1.2a

**Check on follow-up**: When previewing of the existing identified risks for update happens, the prognosis of the earliest symptom of the risk should be checked and if necessary, updated

**Step 5: Likelihood**

As mentioned in **chapter 2.3.2.2**, the risk likelihood is a quantitative or qualitative expression of the chances that an event will occur. In this model we use quantitative expressions with numerical scale (probability) from 0.1 to 1.0. As shown in table 5.1.1.2b [Larsson 2000], a scale should be chosen for the identified risk, depending on when/if the risk would materialise. The reason for why we chose this scaling system is that the risk cost and time estimation will be more precise.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Probability of the risk materialising</th>
<th>Probability of the risk materialisation occurring</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>Unlikely</td>
<td>1 in 1500000 (≈0.0001%)</td>
</tr>
<tr>
<td>0.2</td>
<td>Low</td>
<td>1 in 150000 (≈0.001%)</td>
</tr>
<tr>
<td>0.3</td>
<td>Low</td>
<td>1 in 15000 (≈0.01%)</td>
</tr>
<tr>
<td>0.4</td>
<td>Moderate</td>
<td>1 in 2000 (0.05%)</td>
</tr>
<tr>
<td>0.5</td>
<td>High</td>
<td>1 in 400 (0.25%)</td>
</tr>
<tr>
<td>0.6</td>
<td>High</td>
<td>1 in 80 (1.25%)</td>
</tr>
<tr>
<td>0.7</td>
<td>High</td>
<td>1 in 20 (5%)</td>
</tr>
<tr>
<td>0.8</td>
<td>High</td>
<td>1 in 8 (12.5%)</td>
</tr>
<tr>
<td>0.9</td>
<td>Very High</td>
<td>1 in 3 (33%)</td>
</tr>
<tr>
<td>1.0</td>
<td>Very High</td>
<td>≈1 in 2 (50%)</td>
</tr>
</tbody>
</table>

*Example*: Software: Ri 1, Likelihood: 0.7, see 5.1.1.2a
Check on follow-up: In follow-up/monitoring process the likelihood of the identified risk must be reviewed and if necessary updated.

**Step 6: Impact**

As mentioned in chapter 2.3.2.2, the risk impact is the effect that the risk would have on project (or different parts of it) when is materialised. In this model we use quantitative expressions with numerical scale from 0.1 to 1.0. As shown in table 5.1.1.2c, a scale should be chosen for the identified risk, depending on what will be the effect when the risk materialised.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Category (Impact)</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>Very Low</td>
<td>Invisible</td>
</tr>
<tr>
<td>0.2</td>
<td>Low</td>
<td>Minimal</td>
</tr>
<tr>
<td>0.3</td>
<td>Minor</td>
<td>Minor</td>
</tr>
<tr>
<td>0.4</td>
<td>Moderate</td>
<td>Small</td>
</tr>
<tr>
<td>0.5</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.6</td>
<td>Significant</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.7</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>0.8</td>
<td>High</td>
<td>Major</td>
</tr>
<tr>
<td>0.9</td>
<td>Critical</td>
<td>Critical</td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td>Catastrophic</td>
</tr>
</tbody>
</table>

*Example:* Software: Ri 1, Impact: 0.6, see table 5.1.1.2a

Check on follow-up: In follow-up/monitoring process the impact of the identified risk must be reviewed and if necessary updated.

**Step 7: Consequence**

As mentioned in chapter 2.3.2.2, the risk consequence is an outcome of an event, hazard, threat or situation. It is expressed by a function of the risk likelihood and the risk impact. The outcome may be a loss or a gain and may be expressed qualitatively or quantitatively. In this model we use quantitative expressions.

*Example:* Software: Ri 1, Consequence: (Likelihood 0.7) x (Impact 0.6) = 0.42

See table 5.1.1.2a

Check on follow-up: If during the follow-up process the likelihood or impact, or both, were updated then the risk consequence measure should be recalculated.

**Step 8: Risk Cost Estimation**

Risk cost estimation is the measurement of the cost of the risk for when it is materialising, i.e. the risk consequence on the project cost, called *risk cost*, RC [Nicholas 2001]. Risk cost is the expected value (the risk likelihood) of the estimated cost for risk correction, called *corrective cost*, calculated as:

\[
\text{Risk cost} = (\text{Corrective cost}) \times (\text{Likelihood})
\]

RC will give the project management an estimation of the risk costs, and help to plan actions against the risk (for more information about risk action planning, see chapter 5.1.1.3).

*Example 1:* Let us assume that the corrective cost for the risk that we assume might materialise, due to the delay of the delivery of Software tool components, is 1 000 000 SEK. The risk cost, RC, will be:

\[
\text{Risk Cost} = (\text{Corrective cost 1 000 000}) \times (\text{Likelihood 0.42}) = 420 000 \text{ SEK}
\]

Also good to know:
The expected project completion cost, EC, can be calculated by adding the risk cost to the project baseline cost estimate, BCE:

Expected project Cost = (project Baseline Cost Estimate) + (Risk Cost)
The corrective cost could be estimated by studying the damage of the risk materialising the project resources such as time and schedule in man-hour.

If the corrective cost cannot be estimated, then the expected project cost, EC, can be calculated this way:

\[
\text{Expected project Cost} = (\text{project Baseline Cost Estimate}) \times (1 + \text{likelihood})
\]

Note that this way, the risk cost cannot be estimated, and therefore an estimation of the expected project cost is calculated to see how much the risk will affect the project cost in total, when it materialises.

We recommend the project manager (or risk officer) together with representatives from the economy department calculate the risk cost and the total expected project cost if the risk is materialising.

Example 2 (continuation of Example 1):
We assume the project baseline cost estimate, BCE, is 7 000 000 SEK and the expected project completion cost, EC will be then:

\[
\text{EC} = (\text{BCE} \times 7 000 000) + (\text{RC} \times 420 000) = 7 420 000 \text{ SEK}
\]

If the corrective cost cannot be estimated, then the EC will be:

\[
\text{EC} = (\text{BCE} \times 7 000 000) \times (1 + \text{Likelihood} 0.42) = 9 940 000 \text{ SEK}
\]

Check on follow-up: If the corrective cost or/and likelihood is changed, then the risk cost should be recalculated during the follow-up.

Step 9: Risk Time Estimation
Risk time estimation is the measurement of the duration of when a risk is materialising, i.e. the risk consequence on the project duration, called \( \text{risk time} \), \( \text{RT} \) [Nicholas 2001].

Risk time is the expected value (the risk likelihood) of the estimated time for risk correction called \( \text{corrective time} \), calculated as:

\[
\text{Risk time} = (\text{Corrective time}) \times (\text{Likelihood})
\]

Example 1: Let us assume that the corrective time for the risk that might materialises, due to the delay of the delivery of Software tool components, is 4 weeks.

The risk time, RT, will be:

\[
\text{Risk Time} = (\text{Corrective time} 4) \times (\text{Likelihood} 0.42) = 1.68 \text{ weeks}
\]

Also good to know:

The expected project completion time, ET, can be calculated by adding the risk time to the project baseline time estimate, BTE:

\[
\text{Expected project Time} = (\text{project Baseline Time Estimate}) + (\text{Risk Time})
\]

The corrective time could be estimated by studying the time of delay for the risk materialising, and the project resources such as time and schedule in man-hour.

If the corrective time cannot be estimated, then the expected project time, ET, can be calculated this way:

\[
\text{Expected project Time} = (\text{project Baseline Time Estimate}) \times (1 + \text{likelihood})
\]

Note that this way, the risk time cannot be estimated, and therefore an estimation of the expected project time is calculated to see how much the risk will effect the project time in total, when it materialises.

We recommend the project manager (or risk officer) to calculate the corrective time in co-operation with the upper management.

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Example 2 (continuation of Example 1):
We assume that the project baseline time estimation, BTE, is 20 weeks and the expected project completion time, ET will be then:
ET = (BTE 20 weeks) + (RT 1.68) = 21.68 weeks

If the corrective time cannot be estimated, then the ET will be:
ET = (BTE 20 weeks) x (1 + Likelihood 0.42) = 28.4 weeks

Check on follow-up: If the corrective time or/and likelihood is changed, then the risk time should be recalculated during the follow-up.

Step 10: Rank Risks

After analysing each identified risk, the risks should be ranked. The ranking of the risks should be based on each risk’s estimated cost, time and consequence value. Risks should be prioritised after the greatest consequence value. Risk consequence is a very important factor to decide the risk ranking, but other factors such as likelihood, impact, costs and etc should be observed as well for decision of risk ranking.

Risk limit is a value based on the consequence value of the risks, to separate the ‘more important’ risks from ‘less important’ ones. We recommend that two risk limit values should be decided. The project manager and/or risk officer should define the risk limits. The first limit value is to separate the most important and crucial risks from other ones. All risks with a consequence value above this risk limit value should be placed in a ‘Red Zone’. For instance, all risks with consequence value over 0.7 should be monitored and followed-up regularly, see table 5.1.1.2a, ‘Rank’.

The other risk limit value should be decided for those risks that could become serious ones. All risks with a consequence value above this risk limit value should be placed in a ‘Yellow Zone’. For instance, all risks with consequence value above 0.5 should be monitored and followed-up occasionally, see table 5.1.1.2a, ‘Rank’.

If, for instance, the risks in the red zone are monitored 2 times during 8 weeks, then the risks in the yellow zone could be monitored once.

Risks with low consequence value are considered to be in a ‘Green Zone’, and do not need to be monitored often. If the risks in red zone are monitored 4 times during 16 weeks, the risks in yellow zone 2 times, then the risks in green zone could be monitored once. How often the risks in the different zones should be monitored is up to the project to decide, these figures are just examples.

Note: as mentioned earlier, it is up to the project manager (and/or risk officer) to decide how often the risks should be monitored. A routine for systematically risk monitoring should be implemented in the project.

Example: Ri 1 was ranked as number one in the last list, now its consequence value has changed and there are two other risks that top the list at this moment, that means Ri 1 now should be ranked as number three

Important: All the identified risks, above the Red and Yellow Zone, which have any link/relation to any other projects or sub-projects, should be handshaked with the concerned project or sub-project [see chapter 5.2].
Check on follow-up: The ranking of the risks should be renewed depending on the changes in the list. That means the risks should be reprioritised. New risk limit values should be decided after each update, because the values might have been changed.

Step 11: Last Updated

The date of the latest update of the risk profile elements (i.e. prognosis, likelihood, impact, consequence or cost estimation) should be noted. The date should show when was the last time each risk was reviewed and updated.

Check on follow-up: The last date should be changed to latest date at follow-up.

5.1.1.3 Guidelines for Project Risk Management Planning and Monitoring/follow-up

Guidelines for risk planning and monitoring are an improved version of the existing Minirisk model described in chapter 4.2. The aim of this model is to create a risk action plan to achieve a better and more visible PRM. It should be used both within the main project and each of the sub-projects, in a multi-project environment. These guidelines are also applicable for usage within single project management.

Note: at the company there are many projects that use action point lists (AP-lists). In that AP-list they usually merge risk management with other activities. It is up to the project management to decide to separate risk management from the AP-list and have two documents, i.e. an AP-list with regular project management activities and a risk action plan document. This concerns both multi and single project management.

The basis for this guideline is a table, containing various elements of risk planning activity and risk monitoring/follow-up. The risk action plan is strongly related to the risk list with risk profiles. The latest version of the risk list document should be used as input data to the risk action plan, see figure 5.1.1.3a.

We will explain the guideline step-by-step with examples to clarify how planning and monitoring of risks at this stage should be performed in practice. We strongly recommend the users to follow all steps, but steps 2 and 3 are the basic ones. It is up to the project manager (and/or risk officer) to decide which risks should be prioritised and included in the risk action plan. We strongly recommend that all risks within the red and yellow zone should be included in the risk action plan.
**PRM Action Plan**

<table>
<thead>
<tr>
<th>Risk Category: ID</th>
<th>Mitigation Strategy: Action(s)</th>
<th>Responsible Person(s)</th>
<th>Status</th>
<th>Deadline</th>
<th>Last Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software: Ri 1</td>
<td>Reduce risk: contact the supplier</td>
<td>Amir, Mikael</td>
<td>At the moment we’re in contact with the supplier to track our order</td>
<td>2003-01-29</td>
<td>2003-01-23</td>
</tr>
</tbody>
</table>

*Figure 5.1.1.3b: Guidelines PRM Planning and monitoring/follow-up*

**Step 1: Risk Category and ID**

Here the risk ID from the belonging risk category from the **risk list** should be fetched. This way, the risk does not have to describe again.

*Example: Software: Ri 1, see table 5.1.1.3b*

**Check on follow-up:** --

**Step 2: Mitigation Strategy and Action(s)**

At this stage, a strategy to mitigate the risk should be decided from the defined ones in the PRM Framework. The decision must be based on the factor that ‘what is most beneficial for the project’ in terms of available resources and budget. The mitigation strategy and a description of actions to manage the risk should be included in the table alongside the risk category and ID, see table 5.1.1.3b.

*Example: Software: Ri 1, Reduce risk: contact the supplier*

**Check on follow-up:** It is very important to check the latest version of the risk list document to see whether the risk analysis, in terms of likelihood, impact, consequence, risk cost/time estimation value or the ranking/prioritisation has been changed/updated. If it has been changed, then the existing strategy should be reconsidered and decisions must be taken to see whether if it is necessary to change the strategy to mitigate the risk.

**Step 3: Responsible Person(s)**

The project management has to decide who should have the responsibility to manage/monitor the risk.

*Example: Amir, Mikael*

**Check on follow-up:** The project manager and/or the risk officer should check if the responsible persons maintain their responsibilities. Usually, the project managers ignore this point due to the fact that they trust their team members. It is recommended the project manager do regular checks upon each responsible team member, despite the trust he/she has on his/her team member, to remind them of their task in risk management, if necessary. Today, risk management is considered as a ‘side task’ next to the team member’s main working task at the company. Therefore the responsibility of managing/monitoring a risk can easily be ‘forgotten’ or postponed.
Step 4: Status

At this stage, the responsible person should report the latest status of the risk to the project manager or the risk officer.

Example: Amir and Mikael report: ‘At the moment we’re in contact with the supplier to track our order’, see table 5.1.1.3b

Check on follow-up: The project manager (or the risk officer) should regularly check the status of the risk for any news, by contacting the responsible persons. If anything new was reported, the risk status should be updated in the document.

Step 5: Deadline

The project manager (or the risk officer) should set up a deadline for the task that he/she gave to the team member.

Example: at 2003-05-29 Amir and Mikael should report to the project manager (or the risk officer) exactly how much the order will be delayed, so that the management can decide what to do next.

Check on follow-up: Project manager (or the risk officer) should check that if the planed action will be delayed for any reason, and possibly consider changing the date of deadline, or choosing other method/approaches to make the deadline.

Step 6: Last Update

The date for latest update or change for each planned risk action should be set.

Check on follow-up: Check for any update or change for each planned risk action. If changes were made, change the last date to the current date that changes were made.

5.2 Communication Channels

This improvement suggestion is directly connected to finding 6: “Unclear reporting and communication channels”. The purpose of this improvement suggestion is to ensure risks being communicated to the “right people” throughout the project lifecycle. Open communication of risks helps an organisation to resolve risk, avoid problems, reduce work, and provide focus [Hall 1998].

In order to have good risk communication, the first thing to do is to establish a positive climate among project members for communicating risks. Having a good risk communication climate involves having knowledge and motivation of PRM benefits, as discussed in chapter 5.3, and also to be aware of common risk communication problems. There exist many problems that affect how risks are communicated. Being aware of some of these problems and dealing with them will create a more positive climate. Listed below are some of the common problems of risk communication discussed by Robert Kirkpatrick [Kirkpatrick 1993]:

- No one discusses risk willingly
People want to know about risks from people working “below” them, but they are reluctant to talk about risks to people “above” them.

- **There is an inability to communicate about risk**
  The right people would not know about the risk or the right people would not listen.

- **Geographical distances makes risk communication more difficult**
  The likelihood of communication of two people is reduced by 90% if separated more than approximately 50 meters.

- **Many people will not share their opinions in the presence of supervisory personnel**
  People are afraid of giving a bad impression.

- **Technical advise on risks often is ignored when decisions are made**
  Technicians and management focus on different things.

- **The concept and definition of risk varies**
  Speaking very different risk languages there likelihood of misunderstandings increase

- **Shooting the messenger of bad news is not uncommon**
  People avoid delivering bad news if they can. Project managers sometimes require a solution presented to them together with the risk. This may result in risks, from people without solution proposals, not being communicated

After having established a positive risk communication climate, the channels of how risks are to be communicated, should be implemented in the organisation and made visible to the projects. Figure 5.2a figure 5.2b illustrates where risk communication channels should be present.

*Figure 5.2a: The figure illustrates communication within a project. ‘Others’ could be internal and external stakeholders etc.*

*Figure 5.2b: The figure illustrates communication channels between projects. A risk communicator acts as an interface between two projects or sub-projects.*
The ground philosophy of risk communication is that everybody should be involved, or at least know how to communicate risk and when.

Our suggestion, on how communication of risks should be carried out at the company, is as follows. Within projects, risks are identified and communicated at project- or risk- meetings according to The Model in chapter 5.1. Besides this, the responsibility role of a “risk communicator” should be appointed for each project and sub-project, for example to the risk officer described in chapter 5.4. This risk communicator will be the one that all risks are reported to within the project. The responsibilities of the risk communicator do not include mitigating risks etc. The only responsibility is to notify those influenced of or interested in the risks at hand. Thus, the risk communicator will be a façade, or interface, towards other projects or sub-projects (figure 5.2b) concerning risks.

During the risk analysis phase in The PRM Model (chapter 5.1), all risks should also be verified for the possibility of influencing other projects or sub-projects. Those risks that are believed to have effects on other projects or subprojects are communicated by the risk communicator to each risk communicator of those other projects (see figure 5.2c). The other project replies which risks it wants further updates from. A recommendation for the risk communicators of all projects is to have regular meetings to discuss each project’s relevant risks.

The role of risk communicator is somewhat like the liaison role described by John Nicholas [Nicholas 2001]. The liaison role is designated to a specialised person linking two departments together, i.e. a form of organisation integrator. The roles of two risk communicators could also be compared with an implementation of the software design pattern observer/observable, which is used in order to allow communication between loosely, coupled objects [Javaworld 2003]. Risk communicator Y, the observer, notifies risk communicator X, the observable, which risks he/she is interested in being updated on whenever the status of a risk changes. Risk communicator X then notifies all of his/hers observers, for example risk communicator Y, when a status change on a risk of interest occurs.

5.3 Knowledge

All of the findings are somewhat connected to the cause ‘lack of knowledge’ or ‘PRM not prioritised’. The main reason of ‘why PRM is not prioritised’ and ‘not given enough time’ is the lack of knowledge of that PRM actually can save time.
and money. The purpose of improving the knowledge of PRM within the organisation, is to provide motivation for it and answer questions like ‘why should it be used?’ and ‘what can I benefit from it?’ etc. Another purpose is to provide the knowledge of PRM definitions, tools etc to guarantee PRM is carried out according to the PRM goals that is set up by the company.

If a company is serious of improving their PRM process the first thing to do should be to increase the project members’ knowledge of the benefits of PRM. Understanding the benefits of PRM and how it could make project members’ work more efficient, will most likely increase the motivation of using it. Training is essential to raise the awareness and understanding of PRM, which provides the motivation and ability to perform the PRM process [Hall 1998]. Furthermore, resources must be allocated to PRM in order of project members to understand its importance. When the administration allocates resources to develop policy, it demonstrates the importance of it to the organisation [Hall 1998].

5.3.1 What should be improved

Education, training and experience contribute to people’s ability to manage risk. People’s motivation for change must be sufficient to overcome barriers to adopting something new [Hall 1998]. Much of the groundwork of managing risk is already in place at the company. There exists a lot of experience of working in projects and dealing with risk, and according to the result of the questionnaire, 90 % say they want to improve their knowledge of PRM, which indicates that motivation to increase their knowledge about PRM exists at the heart of the company.

The level of knowledge of PRM needs to be improved in order for project members to:

- Feel they will benefit from using it (gain motivation)
- To use PRM techniques like they should be used (gain skill)

Also, training must be suited towards whatever PRM policy the company decides to implement.

5.3.2 How should it be improved

Adopting new routines take time, and a company should not rush and expect PRM to be adopted by everyone immediately. As illustrated in figure 5.3.2, establishing company commitment on a new policy is a process that takes time. The dots in the figure indicate different levels of commitment. After first, having got in contact with the new policy, the different levels that follow are: Awareness, Understanding, Trial use, Adoption and Institutionalisartion.

![Figure 5.3.2: An illustration describing how organisation commitment increases over time [Hall 1998]](image-url)
To obtain the required commitment for organisational change towards better PRM, the need and benefit of risk ethic must be communicated. Risk ethic is the rules of conduct that characterise proper risk management philosophy rules [Hall 1998]:

- Take responsibility for risk
- Do not blame people for risk
- Communicate risk to the right people
- Be proactive in managing risk
- Learn from unexpected outcomes

A thing to remember is that only people who are appropriately motivated will continue to assess and control risk. A problem with PRM is that the outcome of it is almost never recognised and ‘visible to eyes’ if it is positive. But if risks become problems and costs arise, then PRM will certainly take the blame. Progress in managing risk should therefore be rewarded through periodic recognition [Hall 1998].

Preparation is the key to implement the risk management successfully. Understanding the building blocks of fundamental knowledge in risk management will enable you to adapt to situations as they change [Hall 1998]. Thus, the first thing to start with is to train PRM concepts such as the ones described in chapter 5.1.1. Elaine Hall [Hall 1998] suggest the following training modules to provide risk management instruction:

- PRM concepts
- Risk analysis methods
- PRM process
- PRM measures
- Proactive PRM

A recommended approach for training is called “Just-enough” training, which builds on current knowledge. With Just-enough training, the people will not feel overwhelmed by the amount of information they receive. They should understand there is a development path and know where they are on the path [Hall 1998].

Those who attend training should immediately be able to apply the knowledge learned to increase their skills in managing risk, which is called “Just-in-time” training [Hall 1998].

To summarise how to gain knowledge and motivation for PRM, the things to do should be:

- training project members on the benefits and techniques of PRM
- allow them use that knowledge very short after training.

A prerequisite is that the company set aside money on it and let everybody know PRM is something to be taken seriously.
5.4 Risk Officer

This improvement suggestion is directly connected to finding 7: “The project manager is also the risk manager”.

As described in chapter 2.3.3.1, when discussing characteristics of a successful PRM model, it is sometimes beneficial to have a separate role for PRM, a risk officer. If a company want to implement successful PRM, routines like the ones described in chapter 5.1 are helpful. One way to coordinate the routines and PRM activities is to create the role of risk officer [Hall 1998].

The risk officer could be a person working with PRM routines and methods on a quality administrational level within the company, or he/she could be working with PRM within single or multiple projects. Having a separate role for PRM, just like configuration management and quality management who have separate roles, helps to provide more focus on PRM.

Having a separate risk officer could be especially helpful when a more thorough PRM is required, e.g. in large projects or in projects of great importance.

The risk officer must be able to command respect from senior level management and technical individuals for them to listen to the judgement of the risk officer. The risk officer should be a senior-level technical person with a broad enough background to understand all the variation of risks that come up and have the ability to discuss these with the people involved. The risk officer must not be an expert, because he or she is not responsible of mitigating the risk [Hall 1998].

Main work activities for a risk officer are the following according to [Hall 1998]:

- Complete documentation - Document the definition of risk coherently on a risk management form
- Consistent evaluation - Evaluate risk consistently to enable comparison with other risks
- Correct mitigation plan - Develop a mitigation plan to reduce the probability and consequence of a risk that is accurate and makes sense technically. Back up the numbers presented by supporting data or rationale
- Coordinate responsibility - Tag the risk to someone to ensure that none of it becomes lost. Hold those who are responsible accountable for risk management

We have discussed some of the risk officer’s activities in The PRM Model in chapter 5.1.

Other activities the risk officer should be involved in are for example:

- Setting up PRM training activities for project members
- Lead risk analysis meetings
- Continuously evaluate PRM

The risk officer will continuously instruct the organisation of the importance of communicating risks and highlight the problems of not communicating and stimulate the use of risk communication channels as described in chapter 5.2.
Of course there are more activities for a risk officer, but by just having the role of risk officer and letting him/her to be responsible of those mentioned activities is a very good first step towards better PRM.

5.5 Summery of Improvement Suggestions

Our improvement suggestion for the findings described in chapter 4.4 is divided into four main categories: The PRM Model, Knowledge, Communication and Risk Officer.

The PRM model is a model we suggested to improve the weakness of poor formal guidelines, stated in several findings. The model is developed after the suggested characteristics of a successful model, described in chapter 2.3 and its fundamentals are based on the Minirisk model currently used within the company.

The PRM model consists of a framework describing definitions of different PRM activities, strategies, methods and techniques, guidelines for risk identification, analysis, planning and monitoring. In order to implement The PRM Model successfully some other aspects must be considered as well. First, the knowledge of the benefits of why PRM can make the daily project work better must be understood. Second, project staff must be trained in PRM techniques. Furthermore, there must exist a climate in where risks are communicated. PRM must be placed in focus for it to be improved, this is especially important in large projects. One way to put focus on PRM is to appoint a Risk Officer.
6 CONCLUSIONS

This thesis work was based on a case study about project risk management in a software company. The main objective of this work was to identify the current project risk management process at the company and improve it. I should be pointed out that our conclusions are based on studies conducted on one single company. Despite that, we believe our conclusions are applicable to many other similar companies.

PRM has not been an area focused on within the company, and thereby no formal guidelines have been produced. Our case study shows that there is a great need of supportive risk management documentation. In order to manage risks in a cost-effective way, firstly the motivation and understanding of the benefits of PRM should exist within the organisation. Secondly, the skill to manage risks should be possessed. Our case study shows that there is a need of education on both PRM benefits and PRM tools/techniques. There are differences between projects on how risk analysis is conducted. By having different approaches to risk analysis, not only project members will spend time to interpret them, but also others interested in following up on the quality of projects. A majority of the project members do experience these differences as negative. The risk profiles that are created at present, lack important information in order to make sure effective decisions are made. For example, knowing the cost of preventing a risk from becoming a problem, and the cost of when it materialises, makes it easier to make more effective decisions. Also, knowing earliest symptoms of when a risk materialises make it easier to know when and if there is a need to take preventive actions. Not having this information reduces the risk control, which means the possibility of making wrong decisions increase. Most often there is no continuously mapping and updating of the identified risks, and identification and follow-up of new risks rarely happens. When risks are not closely watched and followed up, they could materialise into problems threatening the already tight schedule and budget.

There are no clear channels on how to report and communicate risks, both within a project and between projects. If an identified risk has impact on other projects and it is not communicated to those projects, then it could create problems, which easily could be avoided. It is not a weakness if the project manager is responsible of managing risks, especially in smaller projects, but it becomes a weakness when PRM is neglected due to other project activities, and risks are not continuously managed the way they should be. According to the questionnaire 79% feel there is a great need for someone besides the project manager to manage risks.

The problems we identified have very similar causes. The root cause is that there is lack of knowledge about the PRM and its benefits. The knowledge of PRM should be improved to achieve a high level of PRM performance. Also not knowing about the benefits, or ignoring them, affect the PRM process in the way that PRM will not be a prioritised activity. Lack of time and resources is said to be a major cause of not prioritising PRM. This indicates that the benefits have not been understood. Most often you must spend money to save money. Be proactive instead of reactive because risks sometimes turn into problems and problem management is more costly than risk management.

It is very difficult to say which phase (Identification, Analysis, Planning and Monitoring) has the most impact on PRM within the company. All phases are essential in order to have a successful PRM process. All phases are very much
dependent on each other and without one of them we have a broken circle. For instance, if risks are not identified, then it will have serious consequences on the project, if critical risks materialise. Much of the groundwork is laid in the analysis phase, and if risks are not thoroughly analysed, it will be difficult to make good planning decisions and monitor them. The money invested in identification of risks is often ineffective without a proper follow-up activity. Also, as a project progresses, more knowledge about risks occurs and it is really important to analyse and monitor them thoroughly and continuously.

In order to overcome the most evident problems, minimise the weaknesses, and improve the current level of PRM performance, we have presented our solution approaches, which are divided into four strategies: Formal guidelines/The PRM Model, Communication, Knowledge and Risk Officer.

**Formal PRM guidelines** help the organisation to provide a set of rules to achieve better structure, better level of knowledge and easier communication. As formal guidelines, we presented a model called The PRM Model to describe how the PRM process should be carried out, ensuring a certain level of PRM quality is upheld. The PRM Model consists of three main parts:

- Framework for PRM, which is for establishing a PRM process and a support for other PRM activities
- Guidelines for risk identification, analysis and monitoring/follow-up, which presents how to create a risk profile to achieve a better and more visible PRM in 11 steps:
  
  Step 1: Set up risk categories  
  Step 2: Identify and describe risks  
  Step 3: Give each risk a unique ID  
  Step 4: Specify a prognosis of earliest symptom for each risk to indicate when the risk is materialising  
  Step 5: Decide a numerical value for the risk likelihood  
  Step 6: Decide a numerical value for the risk impact  
  Step 7: Calculate the risk consequence  
  Step 8: Calculate the risk cost estimation  
  Step 9: Calculate the risk time estimation  
  Step 10: Rank and prioritise risks  
  Step 11: Note the latest date for last update of each risk’s attribute

- Guidelines for risk planning and monitoring/follow-up, which presents how to create a risk action plan to achieve a better and more visible PRM in 6 steps:
  
  Step 1: Fetch the risk ID from the belonging risk category  
  Step 2: Choose a mitigation strategy and describe the action(s)  
  Step 3: Decide the person(s) responsible to carry out the action(s)  
  Step 4: The responsible person should report latest status of the risk to the project manager/risk officer  
  Step 5: A deadline should be decided for when the task given to the responsible person should be accomplished  
  Step 6: The date for latest update or change for each planned risk action should be set

The PRM Model should be placed in the Quality Manual at the company and made available to everyone at the company.
Communication Channels aims at providing a forum for risks to be communicated within a project or between projects. The purpose of this improvement suggestion is to ensure risks being communicated to the “right people” throughout the project lifecycle. All risks that are believed to have effects on other projects or subprojects will be visible and communicated to that project with the use of risk communicators.

Knowledge describes the importance of providing the proper skill and motivation for better PRM performance. Preparation is considered to be the key activity to implement and perform PRM more successfully and with a higher level of quality. Understanding the building blocks of fundamental knowledge in risk management will motivate people. Training is very important to increase the knowledge and understanding of PRM, which also provides the right motivation to perform the PRM process successfully. To adopt fresh methods and routines take time, and an organisation should not rush into it and expect their level PRM performance rises over night.

The aim of having a risk officer within the company is to have a person responsible for the entire PRM process. Among activities that the risk officer should be involved in are setting up PRM training activities for project members, leading the risk analysis meetings and continuously evaluate PRM. One of the most important reasons to have a risk officer is to relieve the pressure of project manager’s shoulder, so that he/she could focus more on other project management activities. Having a separate risk officer is highly recommended for large projects, especially those that are threatened by great risks. Finally, if you want to manage projects more successfully it makes sense to prevent problems from occurring, since the cost of problem management is often greater then the cost of risk management. A good way to make risk management more successful is to break it out as a separate role within projects in order to highlight its importance.

Once again, we would like to give our warmest thanks to all the people who helped us throughout this thesis work. Thank you!

6.1 Future Work

After studying many different literatures and articles, we discovered that risk management is a very wide and comprehensive subject. Therefore we could not cover all the aspects within this thesis. We believe that there is always room for future work. For example, more techniques, methods and strategies can be introduced within the guidelines. Also, the guidelines themselves can be evaluated and further refined. Questionnaire and interviews can be performed again at the company after a couple of years renew and update the model towards the “changing” needs.

An interesting thing to do, would be to conduct these interviews and the questionnaire on other companies. Doing that would give us more information to draw conclusions about common flaws of PRM within the software industry as a whole, not only on one company as in this thesis. Furthermore, conducting interviews at companies that do have similar improvement suggestions already implemented, would give us data about how beneficial these improvements are.
7 APPENDIXES

7.1 Guidelines for Risk Identification, Analysis and Monitoring

Input: Strategies, techniques, methods [chapter 5.1.1.1] [chapter 5.1.1.2]

Output: Risk list with risk profiles [chapter 5.1.1.2]

Reminder Points:

1. All the identified risks, above the Red and Yellow Zone\(^5\), which have any link/relation to any other sub-projects, should be handshake with the concerned sub-project at the risk analysis meeting at the main project. **Note:** for the single project risk management, this Reminder Point should be ignored.

2. Each time the list is updated, the list should be sorted after the new ranking number.

3. Apply Configuration Management for the risk management documents.

<p>| Risk Category: | | |
|---|---|---|---|---|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>Rank</th>
<th>ID</th>
<th>Risk Description (Risk Statement)</th>
<th>Prognosis of Earliest Symptom</th>
<th>Risk Cost Estimation</th>
<th>Risk Time Estimation</th>
<th>Likel. (L)</th>
<th>Imp. (I)</th>
<th>Cons. (L x I)</th>
<th>Last Updated</th>
</tr>
</thead>
</table>

<p>| Risk Category: | | |
|---|---|---|---|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>Rank</th>
<th>ID</th>
<th>Risk Description (Risk Statement)</th>
<th>Prognosis of Earliest Symptom</th>
<th>Risk Cost Estimation</th>
<th>Risk Time Estimation</th>
<th>Likel. (L)</th>
<th>Imp. (I)</th>
<th>Cons. (L x I)</th>
<th>Last Updated</th>
</tr>
</thead>
</table>

\(^{5}\) See chapter 5.1.1.2, Step 10 for description
7.2 Guidelines for Project Risk Management Planning and Monitoring

Input: Strategies, techniques, methods [chapter 5.1.1.1] + Risk list with risk profiles [chapter 5.1.1.2]

Output: Risk action Plan [chapter 5.1.1.3]

Reminder Point:

- Apply Configuration Management for the risk management documents
7.3 Questions for the Interview Performance, Phase One (2003-02-07)

Introduction

1. What is your current work task and title?

2. Tell us about your previous experiences of RM at this company.

3. Describe your participant at the PRM process.

Project Risk Management (PRM)

4. How have you defined the current PRM process within the company?

5. Tell us about how you have defined RM at the prestudy phase.
   - Describe how risks are identified.

6. Tell us about how you have defined RM at the execution phase.
   - Describe how risks are assessed.

7. Tell us about how you have defined RM at the follow-up phase.
   - Describe how the previous experience of RM is used.
   - Describe how reporting of risks takes place.
   - Describe how risks are measured/eliminated/reduced and etc.
   - Describe how feedback is given to the risks that are reported to the upper management.
   - Describe how the risk measures are followed up.

8. Describe how the role and responsibility are defined within the PRM process.

9. Do you venture to improve the level of competence of the project members and managers within the field of RM? If yes, how do you do that and how much do you put effort into that?

Conclusion

10. Do you have any documents that you think could be interesting and useful for us?

11. Who do you recommend we should contact for more information about the PRM at this company?

12. What is your definition of risk management?
7.4 Questions for the Interview Performance, Phase Two (2003-02-25)

Introduction

1. What is your current work task and title?

2. Tell us about your previous experiences of RM:
   - Previous experiences within small and large projects? How many?
   - Do you any education within RM? Other previous experiences at other places except at this company?

Project Risk Management (PRM)

At the prestudy phase:

3. Describe how risks are identified.
   - What methods do you use to identify risks?
   - What type of risks gets identified within a project? And by person with what roles?
   - How do you document those identified risks?
   - How do you categorise those risks?
   - How do you analyse those risks?
   - How do you estimate the costs related to those identified risks?

4. Describe how the role and responsibility are defined.

5. Describe how you plan RM ahead of upcoming project phase:
   - Do you plan how risks should be managed?
   - Do you plan how the role and responsibility should be defined for managing risks?

At the execution phase:

6. Describe how you track risks in the execution phase.

7. Describe how risks are reported.

8. How often do you update the list containing risks?

9. Do you perform new risk analysis?
   - If yes, does it happen systematically?

At the follow-up phase:

10. Describe how risks are measured:
    - How are the risks reduced? What methods are being used?
    - Depending on what basis/circumstances are risks being eliminated are ignored? What methods are being used?

11. How does the communication happen between the person who identifies a risk and the project manager?
12. Describe how feedback is given to the risks that are reported to the upper management.

13. Describe how the risk measures are followed up.

Conclusion

14. Do you think the Model X, which currently is being used at the company, is good enough for PRM?

15. Do you think the risks are managed more ‘ad-hoc’ or by control?

16. Describe which factors cause problem for not being able to have an effective RM?

17. How often a dedicated risk manager is used for RM? Depending on what basis/circumstances you choose such method to manage risks?

18. Do you have any documents that you think could be interesting and useful for us?

19. What is you definition of risk management?
7.5 Questionnaire for Risk Management (2003-03-17)

The total number of persons who received the questionnaire: 31
The number of persons who responded to the questionnaire: 20 (67%)

Background

1. Gender:
   65% male   35% female

2. Which department/field do you work in?

3. What are your main tasks within a project?

4. How many minor projects (less than 30 persons) have you been participated in? The interval of the total number of minor project the respondents have been participated in, varies between: 0 – 50 (one person answered 0) The intersection of each respondents participated in amount of minor projects: 11,2

5. How many major projects (more than 30 persons) have you been participated in? The interval of the total number of major project the respondents have been participated in, varies between: 0 – 10 (one person answered 0) The intersection of each respondents participated in amount of major projects: 4,9

6. Is risk management needed in a project?
   80% Yes, always   20% Yes, sometimes   0% No

Experience

7. How much experience do you have of managing risks within a project?
   0% Very much   35% Great
   65% Not much   0% Nothing at all

Knowledge

8. How well is your knowledge of risk management?
   0% Very good   45% Good   50% Little
   5% No knowledge at all

9. Do you think you need to improve your knowledge about managing risks within a project?
   25% Yes, a lot   65% Yes, a bit   10% No

10. How do you recognise the level of knowledge of risk management have been within the project team?
    0% Very good   40% Good
    60% Not very good   0% Not good at all

11. Do you think your team members need to improve their knowledge for risk management?
    16% Yes, very much   84% Yes, a little   0% No

12. Do you think the project managers need to improve their knowledge for risk management?
    12% Yes, very much   16% Yes, a little   63% No
Participating in PRM

13. How often do you take part in meeting concerning identification of risks at the prestudy phase of a project?

- 0 % Always participate
- 30 % Often participate
- 55 % Sometimes participate
- 15 % Never participate

14. How good is the structure for analysing risks?

- 0 % Very good
- 75 % Good
- 25 % Poor
- 0 % Very poor

15. Do you, as a project member, recognise any differences for performing risk analysis, between different projects with equal size?

- 24 % Yes, very much
- 52 % Yes, a little bit
- 24 % No differences

If yes, describe how these differences affect you:

- 8 % The level of competence rises
- 17 % Stimulating
- 8 % Reduces the motivation
- 50 % Demands time
- 25 % Other reasons

16. Do you think there is enough time for performing the risk identification?

- 0 % Yes, always
- 16 % Yes, Often
- 58 % Yes, but rarely
- 26 % Never

17. How often do you participate in risk management activities during the execution phase of a project?

- 5 % Always participate
- 40 % Often participate
- 30 % Sometimes participate
- 25 % Never participate

18. Do you think there is a need to have a guideline for risk management activities, i.e. risk identification?

- 5 % Yes, very great need
- 63 % Yes, great need
- 32 % Yes, a little
- 0 % No

Risk Measurement / Reporting Risks

19. How do you handle a situation when you discover a risk that was not identified during the meetings?

[More than one alternative was permitted for answering]

- 55 % I report all the risks that I discover directly to the project manager
- 40 % I report only the risks that I personally judge are important to the project manager
- 5 % I manage all the risks that are newly discovered by myself
- 10 % Other ways:
  - I discuss the situation with the project manager and if the risk does not concern the project much, I manage it aside other activities
  - Answer from a sub-project manager: I bring up and mention the risk in the group meeting between the sub-project managers. If we found a solution, we inform the project manager, if not, we discuss this directly with the project manager

20. How do you manage the identified risks?

[More than one alternative was permitted for answering]

- 65 % I manage the risks according to the plan, and report them to the project manager
- 5 % I manage them according to the plan, but do not report them to the project manager
5% I authorised to manage the risks the way I want, and always report the result to the project manager
10% I authorised to manage the risks the way I want, and not always I report the result to the project manager
20% Other ways:
- The project manager manages the risks and report them to the upper management
- There exists no structured follow-up
- I “own” the risks that exist within the area, which I am responsible for, and manage and report them primarily to the sub-project manager for analysis and decision-making, and then to the project manager if it is necessary
- I report those risks, which should be escalated, to the project manager

Risk follow-up

21. How often do think the risks are followed-up?
   0% Very often
   50% Often
   20% Rarely
   30% Never

22. How good do you think is the risk follow-up performance?
   11% Very good
   50% Good
   33% Poor
   6% Very poor

23. Do you think the organisation members dedicate enough time to follow-up the risks?
   0% Yes, always
   32% Yes, often
   36% Yes, but rarely
   32% Not at all

24. How well do you think are the identified risks followed-up within your department?
   0% Very good
   55% Good
   30% Not very good
   15% Not good at all

25. Who do you think has the responsibility to follow-up the risks?
   [More than one alternative was permitted for answering]
   35% I follow-up the risks, commissioned by the project manager
   65% I think the project manager should follow-up the risks
   0% I do not think the risks should be followed-up
   30% Other answers:
   - I think the sub-project manager should follow-up the risks
   - I “own” the risks that exist within my area, and I am responsible for following-up them
   - It is unclear who has the task of do what, concerning the risk follow-up

Other issues concerning PRM

26. Which factors do you think cause problem for not being able to have an effective PRM?
   [More than one alternative was permitted for answering]
   85% Lack of time
   45% Knowledge about the risk
   40% My knowledge of PRM
   25% Project manager’s knowledge of PRM
7.6 Abbreviations

ISO International Standard for Organisation, is a network of national standards institutes from 145 countries working in partnership with international organisations, governments, industry, business and consumer representatives [ISO 2003].

PRM Project Risk Management

RE Risk Time

RC Risk Cost

RM Swedish for RundningsMärke (Decision point in ‘Model X’)

VP-forum Swedish for Verksamahetsplaneringsforum (A forum for planning project time and resources at the company)

WBS Work Breakdown Structure is a system engineering effort, used to determine the work necessary to achieve performance specifications and subsequent work schedules and cost estimates [Nicholas 2001].

7.7 Definitions

The company The company were we conducted the case study

Minirisk Model The PRM model currently used at the company

Model X The definition we used throughout the report of the project management model used at the company

The PRM Model One of our improvement suggestions for the company

7.8 References


[Sommerville 2001]


