Project Management Risk Analyzing
And Offering Competency Development
Program as a Mitigation Plan for
Camfil Farr Co.

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Project Management Risk Analyzing and Offering Competency Development Program as a Mitigation Plan for Camfil Farr Co.

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Abstract:

In this paper the project management risks will be studied at Camfil Farr and then project management competency development program will be proposed as mitigation plan.

There are a wide variety of risks types around project management subject but since on main risks should been focused, our study will be limited on those main risks and provide a risk questionnaire that contain ten questions to survey the risky situations related to project management at Camfil Farr.

Then analyze of result will be started that is gained from the company and with the help of tools such as histogram will be tried to find a suitable way to deal with these risks and based on this study our mitigation plan will be built.

In the risk management section, root causes of risk factors will be studied by cause and effect diagrams. It should be noted that, PMBOK 2004 will be used for definitions of project management and its framework for analyzing of project management risks and developing competency development program.

Key words: Risk, competency development program, Project management
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1. Introduction

A Guide to the Project Management Body of knowledge (PMBOK) is a USA base project management standard that was published by Project Management Institute (PMI). “A project is a temporary endeavor undertaken to create a unique product, service, or result” (PMI: 2004).

There are different terms that should be considered such as Temporary, Unique Products, Services, or Results and Progressive Elaboration. In the next paragraphs will be focused on the terms.

Temporary means that every project has a beginning and an end. Projects are not continuous activities. End of project is when the objectives of project have been achieved, or their objectives cannot be met, or the necessity of project is eliminated. It should be mentioned that temporary doesn’t mean short life cycle, it means finite duration. This project character is applicable for time limitation of product or result production and furthermore for working team that will perform the project (PMI: 2004).

According to PMBOK, another characteristic of project products, services, or results is uniqueness. A Project can create a product, services performed or a result such as research projects. If a project is not unique in one of the parameters such as deliverables, owners, design, it is not a new project but is just the repetition of another project. Furthermore, this is not to say that projects are totally unique whereas a project may have common things with other project or use their results or outputs (PMI: 2004).

The last characteristic of a project is progressive elaboration that is developing and performing the project in continuous steps. For example, scope and work breakdown structure (WBS) will be made more detailed as a project progresses and an understanding of the project goals and deliverables can be achieved.

In most of organizations will be deal with both projects and operational works. There are differences and similarities between projects and operational works. They have the same characteristics like to do by employee, have constraint and have planning, execution and control processes. In contrast, operations are continuously and repetitively, while projects as mentioned before are temporary and unique. Furthermore, there are basic differences between projects and operation goals. Projects after achieving their goals will be wound up whereas operation works will be continued by new determined objectives (PMI: 2004).

1.1. Project Management

“Project management is application of knowledge, skills, tools and techniques to project activities to meet project requirements” (PMI: 2004). The PMBOK define different processes for completion projects that are: initiating, planning, executing, monitoring and controlling and closing.

Project management has different steps. Firstly, a project management team should identify the stakeholders of projects and then identify the key stakeholders and their needs.
Stakeholder’s requirements are the base of Scope and objective definition. After scope definition, the management team should balance the demands for project key parameters such as quality, time and cost. Project scope, time and cost called “triple constraint” in managing projects (PMI: 2004).

Moreover, project management team should consider uncertainties that every project may deal with. Uncertainties have positive or negative effects on project goals and deliverable that should be managed. There are different approaches for dealing with project risks such as accept, transfer, avoid and mitigate that project management team select one of them or combination of them as a base of project stakeholders requirements and project goals.

1.2. The Project Life Cycle
For better control of project management usually project managers divide the projects in different phases called Project Life Cycle. Every project life cycle include different phases that connect the beginning of a project to its end. It should be noted that there are differences between project phases and a management process group (PMI: 2004).

![Figure 1-1 typical sequence of Phases in a project life cycle (PMI: 2004).](image)

Between the different phases, transitions will take place and deliverables of every phase after a review for completeness and accuracy use in the next phase. If the risks involved are acceptable we can start the next phase before the approval of previous phase deliverables.

There are different approaches for defining the project life cycles, in some organization there are standard established policies for defining project life cycles. In contrast, in some organizations project management team will be allowed to determine the project life cycle. A Project life cycles usually defines technical work that should be done in each phase, how the deliverables will be verified and validated, and also define the resources that should be used in every phase. It should be mentioned that the level of resource consumption in the beginning are low, in the intermediate the resource consumption peaks and will drop rapidly in the end of project. Uncertainty and project product final cost have the same manner in the different sections of every project phase, at the beginning is the highest and then it will be decreased as the project continues (PMI: 2004).
Figure 1-2 Typical project cost and staffing level across the project life cycle (PMI:2004).

Figure 1-3. Stakeholders’ influence over time (PMI, 2004).
2. Project Management Risk Identification

The aim of this thesis in the first stage is to identify risks in project management. These risks relate to both project definition and planning directly. After finding the sources of risk, in the next stages, it will be dealt with assessment of risk and offered the mitigation plan for those risks.

2.1. Risk

In projects, any unwanted occurrence related to work, is considered as a risk. Among the different ways to present these risks, one of the simplest way was chosen.

Two main factors produce all kind of risks. One of them is the consequences of that unwanted occurrence and the other is the probability that the occurrence might occur. Although these two factors have significant differences but they are related. it can be dealt with risk for a large number of events as an accumulation (‘‘macro-risk’’) or for an event individually (‘‘micro-risk’’).

Since in this thesis it will be tried to have more emphasis on project managers and their competencies, micro-risk approach was chosen for dealing with risk. From the perspective of the manager of a single project, there is only one project and the manager should focus on managing risks one by one at first.

2.2. Micro-Risk Management

For the manager of a single project, there is only one project with only one result. The mission of project risk management, especially when it comes to a single project, is to provide a suitable plan which meets project goals and decreases the expected consequences. The project manager should be able to control and manage the possible variation in the project result by using this plan (Kendrick, 2003).

One type of possible variation may occur in the project time. The distributions in Figure 1-3 represent expected duration of time for two similar projects. Although the mean of these two distributions is equal but the statistical variance of distribution B is much lower than
distribution A, which means that the possibility of closing Project B in expected duration is much higher than Project A. Since the project risk has a direct relation with the level of uncertainty, the wide range of expected duration for project A implies higher risk (Kendrick, 2003).

The project team should primarily be aware of sources of variation and try to decrease them in order to bring project risks under control. Generating distributions such as those in Figure 2-1 requires repetitions many times and since it is impossible during a real project, a project risk analysis heavily relies upon prediction and assumption of the ranges.

2.3. Planning For Risk Management
Failed projects are categorized in three main groups. First, projects which have completely unrealistic objectives. For example, since designing an antigravity device is impossible because of a lack of proper technology such a project is condemned to fail. The second group of doomed projects have realistic deliverable but the rest of the objective is unrealistic. Building a house with three floors in one week using two part-time workers is such a project. The majority of failed projects are in the third group. These projects have realistic objective but since insufficient thought is put into the work, useless results have emerged (Kendrick, 2003).

Applying project risk management provides capabilities of distinguishing and dealing with all these groups. For the first group of failed projects, project risk management provides enough data to redirect project objective in a realistic way. For the second group, project risk management proffers reliable proofs for discussing around some objectives which have problem of unreality to improve those objectives.

If sufficient attention is put into the project risk management, the situation, which occurs in the third group, will be avoidable. Project risk management decreases the amount of uncertainties, reworks and defects in the projects and leads people’s activities into an efficient way which moves the project forward. Since projects, which are in this group, fail because of weak execution, project risk management makes this execution more efficient and also improves project decisions (Kendrick, 2003).

2.4. Risk Types
In order to deal with problems, which sometimes cause failure mode during projects, related project risks should be categorized. Since every project has three main constraints, which are scope, schedule, and resources, in this thesis work, we categorize surveyed project risks in the same way.
3. Identifying Project Scope Risk

When a project is in its beginning stages, especially when the project scope has been defined by the project managers, the probability of existence of risk is very high. Since we want to categorize risk based on project main elements (scope, schedule, and resources), risks in these steps are categorized in scope risk category and usually this category is considered at first because of its importance. Also when it comes to different failed project groups, the first group, which doesn’t have a realistic objective, becomes the worst case, because this kind of project is impossible in reality. By recognizing and classifying project scope risk, project managers can find whether the project’s objective is achievable or not. When there are meaningful scope risks in projects, project managers should make essential decisions as soon as possible (Kendrick, 2003).

Generally, scope risks are categorized into two main branches: change risks and defect risks. Although unknown risks, especially in the defect risk category, are not completely removable but the project managers can mitigate these situations by defining project deliverables in a better way and reviewing WBS precisely.

3.1. Change Risks

Scope change risks are categorized, based on different executing and planning steps in the project, into three main categories.

*Scope creeps*: required activities which cause changes during project execution.

*Scope gaps*: required activities which are added to the project late.

*Scope dependencies*: required activities which are not predicted at the project start time (Kendrick, 2003).

The first category, *scope creeps*, is the most outstanding category within change risks. The main root cause for these kinds of risks is unclear scope definition and the main impact of these risks is slipping time and money estimations. Changed specifications or specifications, which are not in line with the project objective and are added while the project is executed, may cause these risks. The efficient way of dealing with these risks is improving and offering better project scope definition by people who have a holistic view of the project especially the project managers (Kendrick, 2003).

Breaches in project scope cause another kind of risks which are called *scope gaps*. From several root causes of these risks, missed requirements, which are in disguise at the preliminary project stages, are more significant. In some cases, because of unavailability of some project stakeholders at the primary stages of project, which comes from the nature of the project, gaps in project scope may unavoidable. However, in most cases, gaps can be revealed by searching for deficient sections both in scope definition and breakdown of project work (Kendrick, 2003).

Some kinds of change risks aren’t revealed even by sensible analysis. This category of change risks goes to *scope dependencies*. One of the significant specifications of this group is that
they change suddenly while other project activities and supporting process are in a steady state. Among several causes for this group of risks, project infrastructure changes such as hardware upgrades should be mentioned. Doing some precise inquiries in project infrastructures and their requirements can help to reveal many dependency risks.

3.2. Defect Risks
Defect risks are mostly related to project hardware failures. Root causes for these failures are in a wide variety. In some cases, projects may face an untried and new technology which is useless for projects because of its unreliability. In other cases, some elements, which are produced by the project or purchased for the project, fail to work. Problems related to hardware quality are also categorized as defect risks. In this case, usually, hardware fails to fulfil required standards which are essential for project. Other scope risks, potential defect risks can be predicted and avoided by more focusing on project scope definition and developing work breakdown structure (Kendrick, 2003).

3.3. Defining Deliverables
One effective way to deal with scope risks, especially change risks, is to define deliverables holistically. Defining project deliverables provides early clues for project managers to uncover risk sources in project.

A good approach for defining project deliverables consists of identifying all project stakeholders, whom must be agreed on by the project scope definition. A common cause for the majority of project scope risk is lack of involvement of some key project stakeholders, when the project scope definition is generated. Since it may be impossible to involve some of people who will participate in project in later steps, project managers should engage all representatives of different project stakeholders, who are available, and must agree on the project scope definition. In this step, project managers should think about identifying project stakeholders over the whole project life cycle not just some specific stages (Kendrick, 2003).
4. Identifying Project Schedule Risk

Serious scope risks are main reasons for putting project beyond the bounds of possibility but there are also some other kind of risks which may change the status of a feasible project into failed mode. Project schedule risks and project resource risks are in these categories.

4.1. Sources of Schedule Risk

The sources of schedule risks are categorized, based on different executing and planning steps in the project, into three main categories.

*Delay risks* are generated when expected things for the project, including a part, required information or a decision, come after the proper time (Kendrick, 2003).

*Dependency risks* are generated when missed association between two or more project factors or unpredicted input affects project schedule. (This group of risks and another dependency risks group, which mentioned before in section 3.1, are different. Scope dependency risks mostly affect project deliverables) (Kendrick, 2003).

*Estimating risks* are generated when inadequate estimated activity duration causes the activity remains incomplete (Kendrick, 2003).

4.2. Delay Risks

Delay risks have a wide variety of different root causes. Although delivery and availability problems are frequent root causes for this kind of risks but there are also some other causes such as defective parts which take times to replace or repair.

In some cases, if an essential decision or action isn’t made quickly, the project may fall behind the schedule and delay risks occur. Insufficient information accessibility, obstacle in report delivery, time lags within project communication and misunderstandings, especially in international project teams, also can cause delay risks in projects (Kendrick, 2003).

Although some delay risks seem to be considered as unknown risks but by considering project requirement in each step of project plan carefully, project manager can uncover and predict many of delay root causes.

4.3. Dependency Risks

Although each project has many different dependencies but dependencies on other projects, especially in large project, and on supportive processes or devices are more outstanding.

Managing several connections and interfaces, which exist between smaller projects within large projects, sometimes become very difficult. In order to manage these large projects, sometimes considered as program, project managers should synchronize the timing of schedule dependencies to prevent a project schedule being passed by other projects because of their interactions. If a project manager can analyse interactions between smaller projects and then identify and manage probable links between them, he or she can uncover many of these kinds of risks (Kendrick, 2003).
Other dependencies that may cause project timing problem are support problems. Failure in required project hardware services, poor access to information, service or human resources and unawareness of project teams about a scheduled suspension of operation because of maintenance are considered as support problems. Project managers can reveal many of these potential support problems by surveying the environment of project carefully (Kendrick, 2003).

4.4. Estimating Risks
Among different types of schedule risks, estimating risks are more visible and people, who engage in various steps of project, usually aware of their existence and effects. In most case, rapid changes in the project make project estimating difficult and applying routine improvement advice useless. If the project situation doesn’t change continuously, historically based estimations are reliable (Kendrick, 2003).

Judgement problems are main causes for estimating problems. Overoptimistic and overpessimistic estimations are considered as a judgement problem. Dealing with estimating risk sources requires a reliable archive of history and good knowledge of the project plan and project execution especially when they break down. Worst-case analysis is not only an effective strategy for uncovering optimistic estimating but also it can be used for identifying new potential risk sources (Kendrick, 2003).

Estimates in projects which include new technology or new staff or both of them usually have poor quality. New experiences are always risky so project managers should be aware of them when they prepare project timelines.

During the project planning process, most of the schedule risks are revealed. Improving estimating processes, identifying connections and interfaces and applying worst-case analysis strategy, help to prepare comprehensive project schedules (Kendrick, 2003).
5. **Identifying Project Resource Risk**

Although a wide variety of resources are considered as project resources, a technical project, needs to have required technical skills and suitable staff as its resources. When we come to project management risk analysis, having a good perspective of required skills and staff capabilities seems essential.

5.1. **Sources of Resource Risk**

Sources of project resource risks are categorized into three main groups: people, outsourcing and money. People risks mostly relate to people who work in the project. Outsourcing risks may come when accomplishing an urgently important project work located outside the project requires applying project staff or its services. Money risks are of a different nature in comparison with the other two groups. Although financing problems are usually not reported in its primary stages of the project but they are the root cause of many people and outsourcing risks and have meaningful role in most serious impacts during project planning and executing (Kendrick, 2003).

5.2. **People Risks**

Many different risks may be considered as people risks. Conflicts between a project team or between two or more projects which may happen at about the same time and have the same objective with much interference are considered as people risks. Low motivation with falling morals especially in long projects are the other kinds of people risks. Among people risks, risks associated with availability of people seem more significant than others. Leaving a project team member permanently or temporarily, joining a person in project team very late and also shortage of people with special expertise are some types of problems related to availability of people (Kendrick, 2003).

Resignation, reassignments to other work or project, leave of absence, illness, changes in organization and decreasing number of staff are some type of reasons which result in losing people in the middle of the project permanently or temporarily. Although finding and forewarning of these risks seems to be difficult, having a good record of previous similar events and analyzing tendencies can help to predict some of these risks (Kendrick, 2003).

In some cases needed project staff is not available when the project needs them and they join the project late. The reasons for this problem depend on the project situation but the most common situation occurs when some of the staff is still working on former project which has delay and at the same time a new project starts to run and this causes problems with availability of people (Kendrick, 2003).

In order to minimize project costs, projects mostly prefer to hire special experts temporarily. Since these experts work with many projects at the same time, sometimes they are not available when a project is ready for them. In this situation, the project is faced with a kind of people risk that relates to availability of people.

Providing a believable project schedule can help to forewarn of many crucial people risks. Comprehensive histogram analysis of required project resources can provide a good
perspective of different situations that the project may face regarding people. Project managers should adjust the capacity of the project team to project requirements continuously. Another powerful tool to uncover and estimate consequences of people risks in project is backward-looking analysis of a project especially in chronic problems (Kendrick, 2003).

5.3. **Outsourcing Risks**
Outsourcing risks have three subcategories: delays, late starts and revisions. Since outsourced problems occur somewhere outside of the project, determining the root cause of the problems may be impossible for project team.

The first subcategory of outsourcing risks, delays, may be related to supplier failures in providing the project requirements on time or may be result of people availability problems. In some cases, when some parameters in projects don’t meet essential standard specifications, it also leads to project delays (Kendrick, 2003).

Late start problems are also common among causes of outsourcing risks. Some time-consuming processes concerning contracts between project deliverables, complexities in relationships with people who are outside of the project and have no familiarity with the project team or some unusual project requirements that need to find a suitable supplier, can cause serious late start problems (Kendrick, 2003).

Revisions in the project specifications, in the project plan, in the relationship between different people engaged in the project or in staff trainings, also cause delay in the project.

If both the project team and outsourcing deliverables fully understood all the contract terms, finding and decreasing potential outsourcing risks are more reachable. These types of risks can also be detected by a precise analysis of project planning processes.

5.4. **Money Risks**
Although money risks are not very numerous at least during the primary stages of the project, meaningful limits on project finance can cause project delays and handicapped processes (Kendrick, 2003).
6. Questionnaires and Surveys

Gathering data by using risk questionnaires is one of the techniques for assessing project risk. There are many types of risk questionnaires and they can vary from a simple form to advanced computer-based questionnaires. There are some standard formats for risk questionnaire designed for use in different organizations or projects but it is important to adopt them for each specific project or organization. If the number of questions in questionnaires is kept to a minimum and each question has simple and limited responses then the performance of this survey approach becomes better. After finalizing the risk assessment questionnaire, it should be distributed between target persons who should be asked to respond to questionnaire (Kendrick, 2003).

Data gathered by risk assessment questionnaires can be used in two ways. In the first approach, all the data is analyzed to provide a thorough assessment of risk. This approach is useful when two or more projects are compared by analyzers. In another approach to use these gathered data, responses are scanned one by one to uncover particular risks.

In this thesis work, it was designed a risk assessment questionnaire (appendix) with ten questions while each question has three suggested responses and since the target persons in this thesis work are project managers, the questionnaire was distributed between the heads of project management teams at Camfil Farr Company.
7. Statistical Analysis of Questionnaires Results Filled out by Camfil Farr Project Managers

Table 7-1: Histogram of total project length

<table>
<thead>
<tr>
<th>Total project length</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3 months</td>
<td>5</td>
</tr>
<tr>
<td>3–12 months</td>
<td>4</td>
</tr>
<tr>
<td>More than 12 months</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 7-2: Histogram of project manager experience

<table>
<thead>
<tr>
<th>Project manager experience</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished more than one comparable project successfully</td>
<td>6</td>
</tr>
<tr>
<td>Finished a project about the same size successfully</td>
<td>5</td>
</tr>
<tr>
<td>None, or has done only smaller or shorter projects</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 7-3: Histogram of Project sponsorship and management commitment to project objective (Scope, schedule, and resources)

<table>
<thead>
<tr>
<th>Project sponsorship and management commitment to project objective</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enthusiastic</td>
<td>6</td>
</tr>
<tr>
<td>Supportive</td>
<td>5</td>
</tr>
<tr>
<td>Neutral or none</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 7-4: Histogram of Project manager authority

Table 7-5: Histogram of Project manager focus

Table 7-6: Histogram of Team compatibility
Table 7-7: Histogram of lowest common manager for members of the core project team

Table 7-8: Histogram of Project communication

Table 7-9: Histogram of Project tracking
Table 7-9: Histogram of Project documentation

- **Accuracy and Availability**
  - **Accurate, current documents are online for project team**
  - **Current status and schedule are available to project team**
  - **Documents known only to project leader, or none**
8. Managing Activity Risks

Risks will be prioritized in risk assessment process. Preparation of this list is important, because it can show which troubles a project will deal with. The scope risks may show that project is impossible to do and also according to schedule and resources risk analysis can be determined which constraints are applied to each project. The risks will be prioritized the risks in the first step of risk management, after that the identified risks must be evaluated. Route cause analysis is very important for risk management strategy determination (Kendrick: 2003).

For finding the root causes, different methods can be used such as what-if and cause-and-effect. In this way, it is very effective to consult with expert contributors. Furthermore, in every step brainstorming is very suitable method in finding the risk sources.

In a cause-and-effect analysis fishbone diagrams can be used that were developed by Dr. Kaoru Ishikawa for display root causes visually. This approach can be followed for each significant risk.

![Fishbone Diagram](image)

Figure 8-1. Fishbone diagram

Managing project risks consist of different tactics such as prevention and recovery. Prevention are activities that reduce the probability of identified risks taking place and recovery are activities for after risk taking place. Generally, there are different categories of risks in projects, controllable known, uncontrollable known risks and unknown risks. All the identified risks are known risks that may be or may not be under control. A suitable response plan can be developed for a known risk but for unknown risks should be referred to previous experience. In some cases, reviewing the past projects may lead to a transformation of unknown risks to known risks (Kendrick: 2003).
Root cause analysis is suitable for either understanding the risks or managing each risk. According to causes that will be identified by root cause analysis, those can be controlled and if those are out of control can be developed a recovery plan. For known controllable risks, the project team management may be able to change the project scheme to eliminate or reducing those risk factors. For known uncontrollable risks, project the management team have no direct role on their causes and therefore the best way is recovery tactics after the risks occur (Kendrick: 2003).

It should be noted that in some cases dividing causes to controllable and uncontrollable is not easy. For responding to such risks with several controllable or uncontrollable causes preplanning and preparation for recovery activities will be needed.

![Diagram](Controllable Deal with Causes Known Risk Not Controllable Deal with Effects)

**Figure 8-2.**Risk management strategies

There are some management techniques like “five why” may leads to deeper understanding of risks causes especially about uncontrollable ones.

Two approaches can consider for dealing with risks as a risk response plan, dealing with causes and effects. In consideration of causes, the risks factors may be avoided or mitigate the risks factors. In avoidance the project plan will be changed in a way that risks never take place but in mitigation, the probability or impact of the risk factors will be reduced (Kendrick: 2003).

There are two other different approaches to deal with risks, firstly in some financial risks can be transferred to other organization for example insurance company and secondly if the effect of risks be minor, those risks can be accepted in a project.

After risk analysis and categorizing, the project management team should determine suitable responses for every risk that may include avoidance, mitigation and transfer approaches. One or combination of these approaches can be chosen in base of cost-benefit analysis. In this way, the costs of every approach in accordance with their benefits can be analyzed.

In preventive approaches like avoidance and mitigation plan, after cost and benefit analysis, ideas must be applied to project plan and review it for new risks and consequences. There are different ways to determine suitable response to every categorized risk. The brainstorm technique or consult with experts in that specific relation can be used. Reviewing the past projects and use their lessons learned is very effective to determine the suitable response to identified risks (Kendrick: 2003).
Some generic idea for risk mitigation is:

- Good communication
- Use of specialists and generalists
- Strong sponsorship
- Continuing user involvement
- Clear decision priorities

One effective preventive action should be chosen about risks that the project will be deal with. This is the least expensive action that reduces the risk probabilities (Kendrick: 2003).

Furthermore, using specialists and generalists in projects may reduce the project risks. It should be noted that in the technical projects having specialist are very essential and they are faster than generalists. In some cases, generalists in projects are needed to fill the gaps and they are better in finding and solving interdisciplinary problems. Generalists can reduce the time for problem solving and also reduce schedule impacts (Kendrick: 2003).

One important factor for reducing the project is having strong sponsorship. The Project management should have a good relationship with the customer and sponsors of projects and should define their expectations and have an agreement on project goals and objectives. Strong sponsorship can reduce the timing impact and can also reduce the probabilities of many risk resources.

In a lengthy project the probability of risks will be increased because we cannot have a good contact with the final customer or users and their objectives. The project team should determine the end users’ acceptance and criteria and these criteria should be established measurably. The Determination of key persons in different sponsors and stakeholder that have a direct role in setting the criteria is important and it leads to a reduction of scope and schedule risks. Furthermore, setting decision priorities for the project can be a final strategy for reducing project risk. In preparation of these priorities, sponsors and stakeholders should be consulted and the project team management should satisfy their expectations. This priority list should be well known for the project team and its impact of failing to satisfy each priority should be established. This helps in managing scope risks and also in reducing schedule risks (Kendrick: 2003).

8.1. **Scope Technical Risk Mitigation Strategy**

Mitigation of scope risks are:

- Clear specifications of project scope and related deliverables and eliminating unclear points according to stakeholder needs
- Establishing the consistent change management processes
- Performing prototype, models and simulations
✓ Prototype validation by users and stakeholders
✓ Dealing with scope risks
✓ Translating project documents into relevant languages
✓ Reducing the external risks
✓ Considering the external factor
✓ Keeping all plans and documents current

The scope risks will be increased when the scope is incomplete or is too inclusive. In projects with inadequate specification the scope risks will be high. In technical projects, it is very difficult to have complete and exact project scopes but failure in projects goals and deliverables are more difficult. Incomplete and unclear project scope leads to incomplete work break down and unidentified activities that have a direct impact on project time, and costs. A continuum project scope may be expanded over time, using a project succession with low risks, is very effective for reducing the technical project risks (Kendrick: 2003).

A aggressive project scope is always a source of risk whereas the project scope should embrace all necessary and possible matters. The project team management should understand and divide “musts” and “wants” and they need to be ready to manage every change between these two aspects. “Musts” will be all absolute requirements and “wants” are desirable requirements and project management team should prepare the lists for each of them. In the next step, they should categorize these factors and specify which of them “are” in the project scope and which “are not”. The project scope risks can be minimized the project scope risks by managing all the change that will be take place in each scope. Every change should be made after a cost benefit analysis. Every change has a direct effect on projects resources and deadlines should therefore be confirmed by the project stakeholders and sponsors (Kendrick: 2003).

Evaluations of Scope risks are very difficult in construction projects and these risks can be understood better at the planning step of every project, because in this step feasibility questions can be considered and studied. It leads to problems and defects identification early and before the construction phase.

More risky activities must be scheduled first although it is risky to separate difficult activities in the project later and it is impractical to begin with them. For doing these activities the simpler activities should be completed first.

One of important scope risk is a lack of skills and must be determined exactly which expertise will be needed. If the project team needs to have cooperation with outsource consultants must be planned to spend enough time, effort and also plan a budget to project budget. Generally all the activities should be planned and revised at every change as they occur because every project scope will change and if the scope and planning aren’t revised serious risks will be dealt with (Kendrick: 2003).
Another factor of increasing risks is due to misunderstanding of scope information in the project team. This risk factor should be decreased by having interpretation or follow up of project plan and have a discussion in the project team. Misunderstanding of scope information can lead to expensive and damaging failures.

The scope sometimes depends on service or production from suppliers, quality and timely delivery of goods are important. Project team can mitigate such risks by having other sources although this strategy may increase the costs of a project but having extra sources is cheaper than the cost of a delayed project (Kendrick: 2003).

Natural disasters and uncertain events may have a direct effect on the project scope and these scope risks should be studied. The project management team can mitigate this type of risks.

8.2. Schedule Risk Mitigation Strategy
Techniques for reducing schedule risks:

✓ Use “expected” estimates when worst cases are significant.
✓ Schedule highest-priority work early.
✓ Schedule proactive notifications.
✓ If you must use new technology, explore how you can use older methods.
✓ Use parallel, redundant development.
✓ Send shipments early.
✓ Be conservative in estimates for training and new hardware.
✓ Break down projects with many people into parallel efforts.
✓ Partition long projects into a sequence of shorter ones.
✓ Schedule project reviews.
✓ Reschedule work coincident with known holidays and other time conflicts.
✓ Track progress with rigor and discipline.

The high risk activities in the project have significant worst-case estimation. The most likely estimation is a cause that has low risky priority. These estimations should be applied to a project plan and schedule for providing reserve resources and decreasing the schedule risk impacts. When activities have been scheduled from high priority cases to low priority cases, the project risks can be reduced. Every activity requirements should be reviewed and specified that how they will be used (Kendrick: 2003).

It is better to have a lag between two activities that one activity’s production will be used to another activity. For activities that have unnecessary deliverables, they should be validated by the stakeholders and if they are not necessary remove them from project plan.
Many schedule risks are as a result of delays that can be avoided through good communications. If these communications need special equipments and services an activity in the schedule for considering and studying these factors must be put (Kendrick, 2003).

One of more important factor that increases the project risks are new technologies such as hardware, systems or software that are common source of delay. Alternatives for these sources of risks must be considered unless the new ones are as critical project requirement.

One alternative is low technical sources that can be a better choice for the project or can be a stand by options for using in the necessary situations. The project management team should consider these alternatives in a project schedule.

Another source of risk is due to shipping problems that are very important in many projects and it may be avoided simply by ordering or shipping earlier or faster. The project management team should consider this in the project schedule (Kendrick, 2003).

The project management team also should consider the time needed for installation, running and training new equipments and also new skills for the project. They must know how long it takes and to plan for this in the schedule. This is very important because the following activity depends on the previous activity and uses their deliverable as an input.

Large projects have a high risk that they can be reduced by dividing the projects into subprojects that are easier to manage and have a lower risk potential. Dividing projects may lead to other risks between the subprojects. For reducing these new risks, the project management team should define the subprojects interrelation (Kendrick: 2003).

Long projects have higher risks in comparison to short projects. We can define the project in different phases that every phase has a specific deliverable that will be considered and evaluated by the project management team. The project management team should break down the long projects into shorter ones, less than one year periods. If a lengthy project should be undertaken as a whole, every project’s phases should be defined in detail that reflects what have been learned in every phase. At the end of every phase, all the planning should be reviewed and changes should be applied to the next phase or the entire projects plan (Kendrick: 2003).

Schedule risks may be take place because of time conflicts between the project plan and personal plans. For example milestones and project objectives should be coinciding with personal holidays or their discard. In global projects, information from different regions, their calendars and their cultural holidays, should be gathered and the project management should plan for elimination of conflicts between the project goals and these holidays (Kendrick, 2003).

Generally, the project management team should review risks, work flow, project estimations, project goals and other data.
8.3. Resource Risk Mitigation Strategy

Project resource risks:

✓ Avoid planned overtime.
✓ Build teamwork and trust on the project team.
✓ Use “expected” cost estimates where worst-case activity costs are high.
✓ Obtain firm commitment for funding and staff.
✓ Keep customers involved.
✓ Anticipate staffing gaps.
✓ Minimize safety and health issues.
✓ Encourage team members to plan for their own risks.
✓ Staff risky works with successful problem solvers.
✓ Rigorously manage outsourcing.
✓ Detect and address flaws in the project objective promptly.
✓ Rigorously track project resource use.

One resource important risks is overtime work. The project management team should review and revise the project plan and schedule that there is overtime probability. Overtime working will lead to a lower productivity of the project team because personnel should have a work/life balance. Furthermore, a project that involves overtime conditions is not motivating. Usually people don’t like to participate in such project and those who work in this situation do not work efficiently. Project team members in overtime conditions usually looking for somewhere else work opportunities (Kendrick: 2003).

Managing resource risks needs unplanned overtime for compensation of the project team in emergencies and unplanned risks conditions. The project management team can mitigate the resource risks by increasing the motivation of the project members. In a project where the motivation is high the resource risk is lower. Projects may be successful because the people working in them are successful. Project managers that have a good ability of team building and gathering the project team members to work in a project in good team spirit are more successful than project leaders who have contact through mail from a distance (Kendrick: 2003).

Financial resources are another type of project resource risks for activities in project that a worst-case cost is higher than the most likely prediction, the expected value will be calculated according to PERT formula.

For reducing the project resource risks all the project stakeholders should identified and sponsors and after that they should be prioritized according to their effects and influences on
the project goals and deliverables. It needs to know who has the highest impact and who can stop the project activities and who is responsible for tracking the project for the client, because must be had a good contact with client (Kendrick: 2003).

Customer and end user involvement in projects are important and should be defined, designed and tested. The project management should have regular meetings with their customers and stakeholders. Activities can be reviewed and proposed a mitigation plan for reducing the dangerous situations or the project plans can be modified to minimize the exposure.

All the activities that people do in every project are a source of risks and they are good persons to consult with them for preparation of mitigation plan or preventing actions. Expert opinion is a good way for mitigating the risks in a risky situation, because experts are more familiar with the execution of processes and activities and they know the risky points in every process. Therefore the project management should consult with experts in each area (Kendrick: 2003).

In every project some services will be supplied by outsourcing suppliers and it has a high potential risk in delivering on time and with desired quality. Having continuous and regular communication with suppliers, get status reports regularly and also quality control activities such as inspections or testing during and at the end of a process is a effective way in reducing these risks (Kendrick: 2003).
9. **Project Management Competency Development Program**

As a general mitigation plan in this section a project management competency development program will be developed and program will be written according to Project Manager Competency Development (PMCD) framework and will be explained in three major different sections that are Knowledge, performance and personal competencies (PMI: 2002).

9.1. **Project Management Knowledge/Performance Competencies**

<table>
<thead>
<tr>
<th>Unit of Competence</th>
<th>1. Project Integration Management</th>
<th>2. Project Scope Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMPETENCY CLUSTER</strong></td>
<td></td>
<td>Elements</td>
</tr>
<tr>
<td>Initiating</td>
<td>Preliminary study of project</td>
<td>Project charter development</td>
</tr>
<tr>
<td>Planning</td>
<td>Plan development</td>
<td>Scope development</td>
</tr>
<tr>
<td>Executing</td>
<td>Execution development</td>
<td>Scope execution</td>
</tr>
<tr>
<td>Controlling</td>
<td>Integrated change control</td>
<td>Scope control</td>
</tr>
<tr>
<td>Closing</td>
<td>integrated project closure</td>
<td>Project Scope closure</td>
</tr>
</tbody>
</table>

*Table 9-1: Units of competence (Project Integration Management, Project Scope Management)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMPETENCY CLUSTER</strong></td>
<td></td>
<td>Elements</td>
</tr>
<tr>
<td>Initiating</td>
<td>Initial planning</td>
<td>Budget development</td>
</tr>
<tr>
<td>Planning</td>
<td>Work definition and timing</td>
<td>Cost estimate and budget</td>
</tr>
<tr>
<td>Executing</td>
<td>Project schedule implementation</td>
<td>cost base line development</td>
</tr>
<tr>
<td>Controlling</td>
<td>Schedule monitor and control</td>
<td>Cost control implementation</td>
</tr>
<tr>
<td>Closing</td>
<td>Project Time closure</td>
<td>Project cost control closure</td>
</tr>
</tbody>
</table>

*Table 9-2: Units of competence (Project Time Management, Project Cost Management)*
### 5. Project Quality Management

<table>
<thead>
<tr>
<th>COMPETENCY CLUSTER</th>
<th>Elements</th>
<th>6. Project Human Resources Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiating</td>
<td>Quality requirements identification</td>
<td>Organization definition</td>
</tr>
<tr>
<td>Planning</td>
<td>Quality plan development</td>
<td>Organization planning</td>
</tr>
<tr>
<td>Executing</td>
<td>Quality assurance implementation</td>
<td>Team making</td>
</tr>
<tr>
<td>Controlling</td>
<td>Quality control implementation</td>
<td>Human resource monitor and control</td>
</tr>
<tr>
<td>Closing</td>
<td>Project quality control closure</td>
<td>Project human resource closure</td>
</tr>
</tbody>
</table>

Table 9-3: Units of competence (Project Quality Management, Project Human Resources Management)

### 7. Project Communications Management

<table>
<thead>
<tr>
<th>COMPETENCY CLUSTER</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiating</td>
<td>preliminary Communication planning</td>
</tr>
<tr>
<td>Planning</td>
<td>Communication final planning</td>
</tr>
<tr>
<td>Executing</td>
<td>Communication plan implementation</td>
</tr>
<tr>
<td>Controlling</td>
<td>Project performance monitor and control</td>
</tr>
<tr>
<td>Closing</td>
<td>Project communication closure</td>
</tr>
</tbody>
</table>

Table 9-4: Units of competence (Project Communications Management, Project Risk Management)
### Table 9-5: Unit of competence (Project Procurement Management)

<table>
<thead>
<tr>
<th>COMPETENCY CLUSTER</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiating</td>
<td>Preliminary procurement plan</td>
</tr>
<tr>
<td>Planning</td>
<td>Procurement final plan development</td>
</tr>
<tr>
<td>Executing</td>
<td>Procurement plan implementation</td>
</tr>
<tr>
<td>Controlling</td>
<td>Contract controlling</td>
</tr>
<tr>
<td>Closing</td>
<td>Contract closure</td>
</tr>
</tbody>
</table>

### 9.2. Personal Competencies

There are many personal competency factors that will be mentioned in four units,
- Influence
- Management
- Personal effectiveness
- Achievement and action

### Table 9-6: Unit of Personal Competence (Achievement and Action)

<table>
<thead>
<tr>
<th>COMPETENCY CLUSTER</th>
<th>Elements</th>
</tr>
</thead>
</table>
| quality and accuracy | - Project management in accurate way  
                        - Accuracy in providing information |
| Initiative         | - Accountable for project  
                        - Looking for new opportunities |
<p>| Information Seeking| - Project management information is complete and accurate |</p>
<table>
<thead>
<tr>
<th>Unit of Competence</th>
<th>Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMPETENCY CLUSTER</strong></td>
<td>Elements</td>
</tr>
</tbody>
</table>
| **Influence** | • Take positive action to influence other works  
• Have positive influence on project activities  
• Understand of other project team member and whole project and organization |

Table 9-7: Unit of Personal Competence (Influence)

<table>
<thead>
<tr>
<th>Unit of Competence</th>
<th>Managerial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMPETENCY CLUSTER</strong></td>
<td>Elements</td>
</tr>
</tbody>
</table>
| **Teamwork** | • Team oriented project  
• Having tight relation with project stakeholder  
• Following the project activities in teams |
| **Leadership** | • Leadership ability of project |

Table 9-8: Unit of Personal Competence (Managerial)

<table>
<thead>
<tr>
<th>Unit of Competence</th>
<th>Personal Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMPETENCY CLUSTER</strong></td>
<td>Elements</td>
</tr>
<tr>
<td><strong>Self-Control</strong></td>
<td>• Self control</td>
</tr>
<tr>
<td><strong>Self-Confidence</strong></td>
<td>• Self confidence and accepting the project failure positively</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>• Accept the changes to meet the project needs</td>
</tr>
</tbody>
</table>

Table 9-9: Unit of competence (Personal Effectiveness)
10. Conclusion

In this paper the project management risk factors have been studied and finally a competency development program has been developed as a mitigation plan.

First of all a definition of project and project management concepts have been given according to PMBOK 2004 and have been explained its specifications and characteristics. Then project life cycles and project phases have been defined. Project managers usually split the projects into different phases to control and monitor better.

There are a wide variety of risks types around project management subject but since on main risks should been focused, our study have been limited on those main risks and provided a risk questionnaire that contained ten questions to survey the risky situations related to project management at Camfil Farr. Then analyze the result have been started that was gained from the company and with the help of tools such as histogram was tried to find a suitable way to deal with these risks and based on this study our mitigation plan have been built.

After the project risk identification, the root causes have been analyzed by different methods such as a fishbone diagram and some mitigation strategies have been mentioned in relation with scope, schedule, and resource of project. Finally, project management competency development program have been developed as a general mitigation plan. It should be noted that, all analysis have been done according to the company risk questionnaire that was filled out by project managers of the company.
References

Appendix

Risk Questionnaire

For each question below, choose the response that best describes your project. If the best response seems to lie between two choices, check the one of the pair further to the right.

1. Total project length
   □ Less than 3 months  ☒ 3–12 months  □ More than 12 months

2. Project manager experience
   □ Finished more than one comparable project successfully  ☒ Finished a project about the same size successfully  □ None, or has done only smaller or shorter projects

3. Project sponsorship and management commitment to project objective (Scope, schedule, and resources)
   □ Enthusiastic  ☒ Supportive  □ Neutral or none

4. Project manager authority
   □ Most project decisions made by PM  ☒ Limited decision making and budget control  □ None; all decisions escalated to others

5. Project manager focus
   □ Full-time on this project  □ More than half time spent managing this project  ☒ Less than half time spent managing this project

6. Team compatibility
   ☒ Most of team has worked together successfully  □ Some of team has worked together before  □ New team

7. Lowest common manager for members of the core project team
   □ Project leader  ☒ Up to two levels in same organization  □ More than two levels up, or none

8. Project communication
   ☒ Frequent (weekly) face-to-face status gathering and written reporting  □ Sporadic, informal, or long-distance status and reporting  □ Ad hoc or none

9. Project tracking
   ☒ Frequent (weekly) reporting of actual progress vs. plan  □ Project leader tracks and deals with plan exceptions reactively  □ Informal or none

10. Project documentation
    ☒ Accurate, current documents are on-line for project team  □ Current status and schedule are available to project team  □ Documents known only to project leader, or none

Name and Date:

[Signature]

Date:

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Risk Questionnaire

For each question below, choose the response that best describes your project. If the best response seems to lie between two choices, check the one of the pair further to the right.

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Name and Date:

Jasper. Owey . 958
2009-04-27

32
Risk Questionnaire

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Name and Date: [Signature] 20/04/09
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