

PREFACE

The creation of this Thesis has not been a linear process and it has involved several changes of scope. It has dwindled itself through many interesting turns and road choices. In all the crossings I have passed it has been hard to figure out what direction to take and surely it has not always been the right decisions that I have made. Time to time I have felt a great resignation, thinking that I will never finish what I have started and therefore it is with great relief to put the final hand at this workload.

At this point I would also like to express my gratitude towards my tutors Bertil I Nilsson at Lund Institute of Technology, Göran Dahl & Bengt Håkansson at Tetra Pak Research and Development. If they had not been so understanding and helpful, the creation of this Masters' Thesis would have been a veritable nightmare! I am also very grateful for all their cunning advises and interesting point of views which have helped me a lot in many difficult situations during the process.

It is my hope that you as a reader find something interesting in this report and that it will help you in your professional development!

Best regards,

Henrik Lindell

ABSTRACT

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Title: Improving Project Management Performance through
organisational learning – a case study at Tetra Pak R&D

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Summary: **Purpose:** The aim of this Master's Thesis is to create a
procedure for internal project audits. This involves the
creation of an instrument for measurement and a prescription
for how to transfer learnings to other projects. The end goal is
to enhance organisational learning and through that create
Total Quality in the management of projects.

Methodology: Deductive, qualitative case study with
literature review and collection of empirical findings through
in-depth interviews and a survey.

Main results: R&D have come far with its development into
a mature project organisation, but still have some weak areas.
The organisation is at level 2 and in order to reach level 3
R&D must carry through some improvement actions. The
most significant of these are insufficient usage of WBS,
lacking Quality Plans, no Earned Value analysis and an unclear
Risk Response Process. Using the audit instrument
continually, improvement efforts can be measured, analysed
and evaluated. The work methodology I have recommended
involves developing lessons-learned from the project. By
focusing on the specific areas that needs to be improved
(provided by the audit) and pulled together the lessons learned
from each project a common understanding of the problem is
gained. The result of such a meeting is proposed actions and
in the end results that can be analysed and evaluated. The
results from this evaluation can then be used to develop the
audit instrument further.

Keywords: Project Management, Project Management Maturity Model,
Organisational learning, Process Orientation

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1 WHAT'S THE PROBLEM?

In this chapter I will describe how this Masters' Thesis has been defined, planned and managed during the creation process. After reading this chapter you should have a clear picture of what I have wished to examine and you should have probably also realised why!

1.1 Problem description

Tetra Pak is rolling out an implementation of a global process-orientation, which should radically change the way of work in the whole company. At Tetra Pak R&D the core process is “Innovation”, that is “to create the business opportunities of tomorrow”. This process is fully defined and implemented throughout the whole Tetra Pak. Tetra Pak R&D (in this Thesis I will refer this as R&D) is organised in a matrix through a line-project organisation. The projects are managed through the process description for the Innovation process found on the intranet based “Tetra Pak Innovation Network”, TPIN. Here, all sub-processes are thoroughly described and defined. The idea is that all employees working at Tetra Pak should use these processes and by that work standardised world wide. The focus of this study lies within the sub-process for Product Development.

In all projects it is always an issue to minimise the amount of man-hours spent in the project and therefore all re-utilisation of knowledge saves both time and costs. It is of course acceptable to do mistakes but as always it's much better to be proactive and avoid the mistakes that others have done already. It could be very useful to have a system for the sharing of different experiences and learnings between the different ongoing projects, thus enhancing the process flow.

At R&D external performance assessments once a year and now there is a need to do internal audits in between. In order to identify the areas of improvement an audit instrument is needed. This instrument should be used as an evaluation of the overall project maturity. Here the Project Management Maturity Model (PMMM) provides an effective tool. Using this as a self-assessment tool for the organisation this procedure could serve as a reminder for the project manager where the potential improvements are to be found. Here an important issue is to be aware of what weaknesses that are to be found in the way of work. When an audit has been done it is important to communicate the results to all that can have interest in these. Communication is therefore an important part of the audit process.

1.2 Problem complexity

Questions that has been important on a comprehensive level in this study is presented below:

- How can you use mistakes as a ground for learning, thus create a mindset where mistakes are seen as an opportunity to learn? How should these be communicated (preferably without a load of documents)?
- What learnings have been done and who could benefit from these results? How should these learnings be transferred to other project, that is how can we learn from each other in a structured and effective way?
- Can a mindset of learning increase quality in the projects and in the organisation?
- Can enhanced learning stimulate to a better way of work – can it stimulate Tetra Pak's strive towards a process-based organisation?

These are questions that I intend to investigate in this study, but the core question is presented in the purpose bellow.

1.3 Purpose

The aim of this Master's Thesis is to create a procedure for internal project audits. This involves the creation of an instrument for measurement and a prescription for how to transfer learnings to other projects. The end goal is to enhance organisational learning and through that create Total Quality in the management of projects.

Figure 1 presents a visualisation of this quite theoretical purpose:

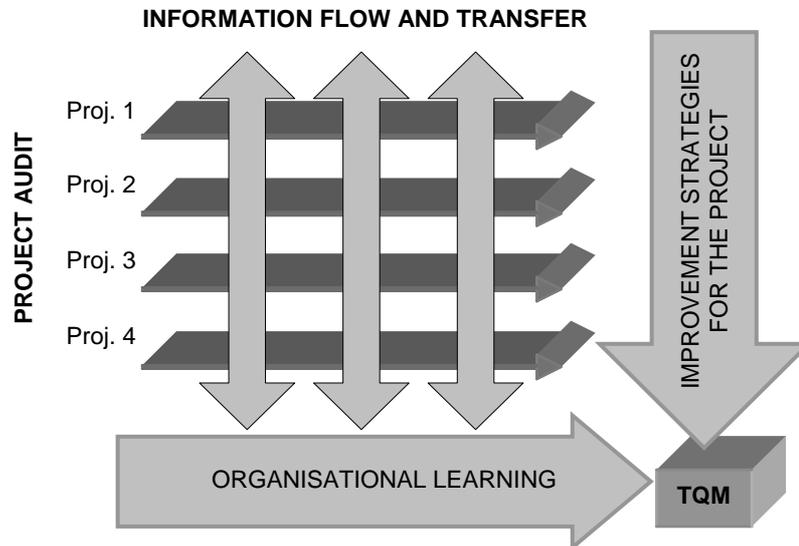


Figure 1: A description of the aim of the study.

1.4 Delimitation

With TQM I refer to a strive to continuously improve the quality of the Project Management Process. I have chosen the following definition of the end goal, TQM:

“Total Quality Management (TQM) is an integrative management philosophy aimed at continuously improving the quality of products and processes to meet or exceed customer expectations.”

(Ahire et al, 1995)

I do not intend to thoroughly investigate the theory and practise of TQM. It is not important for me that TQM in its true meaning is reached, to me it represent a stimulating end-goal.

You always have to choose to either work deep or broad. In this case I have chosen to prioritise the broadness on expense of the depth by looking on Project Managers only. To enhance the generality of the results external benchmarking could be used, but the scope of a Master’s Thesis do not allow this in consideration of the time available for the study.

The scope of this report is to find areas that can be improved, even though it must have a practical nerve, it does not contain the implementation of these improvements. The development of the audit instrument includes implementation so to say that I will test it and analyse the answers. I will however not be a part of the implementation of actions towards these improvement areas.

1.5 Target group

This study focus group are persons involved in projects at R&D. Others who can have an interest of my results are students and/or personal at Lund Institute of Technology (LTH), especially those interested in Project Management.

1.6 Abbreviations used in this report

Abbreviation	Complete
EVA	Earned Value Analysis
MAG	Market Advisory Group
MC	Market Company
MRT	Milestone Review Team
PD	Product Development
PMI	Project Management Institute
R&D	Tetra Pak Research and Development
TD	Technology Development
TPCA	Tetra Pak Carton Ambient
TPIN	Tetra Pak Innovation Network
WBS	Work Breakdown Structure

1.7 The creation process of this Thesis

In the following figure I will try to illustrate how this Thesis was created:

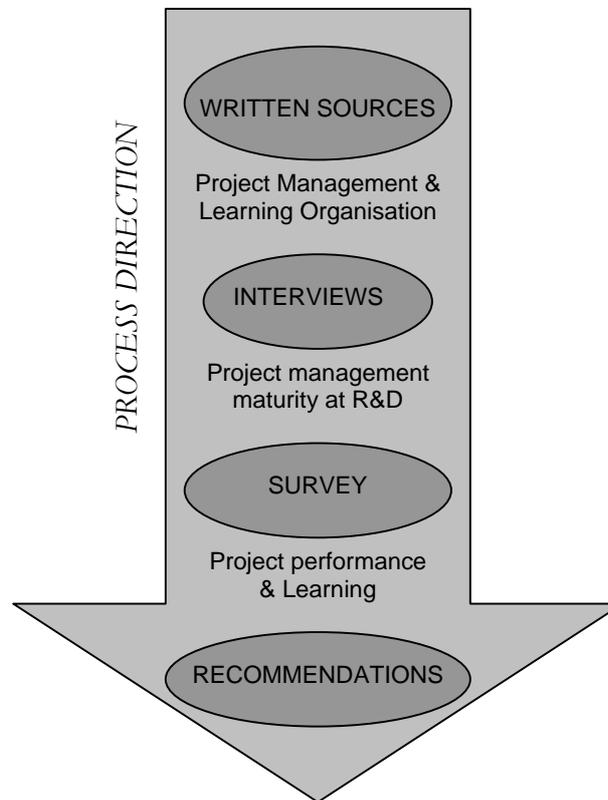


Figure 2: The creation process of the Master Thesis

I started to perform a vast theoretic study on the subject and compiled it into a literature review concerning mostly project management and organisational learning. After that I made interviews with Project Managers and Process owners which resulted in a description of R&D:s Project Management Maturity. Then I created the audit instrument and made a test run that included all project managers. This resulted in a greater understanding of project performance and project learning at R&D, which led to the recommendations I present in the conclusion chapter.

2 STRATEGIC RESEARCH METHODOLOGY, CHOICES AND METHODS

In this chapter I will explain how this study is composed, how it has been planned and carried out. I present the different kinds of research methods that was used and how they have affected the study and its results. The chapter also describes the attitude towards fact and data that has been the guiding-star during the development of this Masters' Thesis.

2.1 Starting point – research perspectives

Before starting a serious research study there are several strategic questions that you need to be able to answer. The first choice is to decide what to do and what not to do. The purpose of the study will decide what the answers of that questions will be. I have tried to solve a specific problem in a specific organisation and therefore done research on commission. This has affected the choices I have made.

I have chosen a qualitative approach since I'm mostly interested in specific questions in a specific environment. These questions and the issue of interest form a problem that encompasses a whole and therefore a holistic view is a necessity. In the best of worlds the ideal case would be to use both qualitative and quantitative methods (see the discussion about triangulation below). (Denscombe, 2000)

In a rough expression you can say that the difference between quantitative and qualitative methods are a combination of the number of variables and the number of respondents; the choice stands between either a broad or a deep investigation:

Qualitative methods use a small number of participants and investigate a great number of variables, while *Quantitative methods* use an extensive number of participating respondents and a smaller number of variables included. (Darmer & Freytag, 1995)

Formulating the purpose of the study goes hand in hand with the delimitation of the study – that is: “What have I chosen not to do?” The formulation of purpose determines what result the study is going to achieve (Darmer & Freytag, 1995). My mission is to create a general model, which sets clear limits of what I can and what I cannot do. I can't solve specific problems in specific work groups; what I can do is solving general problems by applying the model to different departments or the organisation as a whole.

The purpose with the model is to solve general organisational problems, but it should be able to apply it to specific departments.

Further it is important to decide what perspectives the study is going to derive from:

According to many researchers a deductive study is a safe road to discover “the reality” but do not lead to new knowledge. On the other hand an inductive study can permit new knowledge to be created, but the security in the generalisations are not guaranteed. See figure 3 below. Induction is a way to create generalisations stemming from observations, and then create new knowledge. The risk is that you state more than you can prove – the knowledge is principally insecure. Abduction is the middle road where the study is neither pure inductive or deductive. (Darmer & Freytag, 1995)

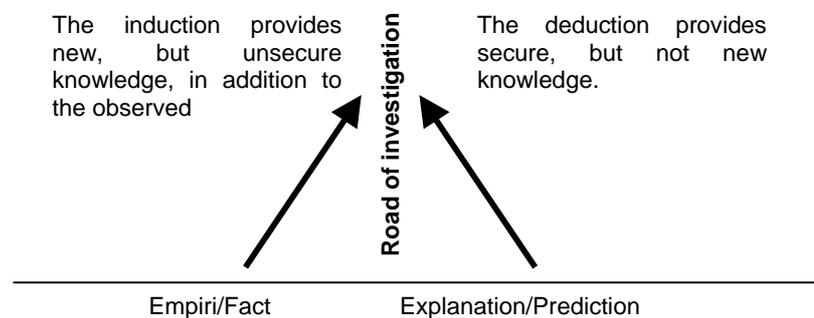


Figure 3: The hypothetic-deductive explanation (Darmer & Freytag p 99)

My study is mostly deductive since I take my stand from a theoretical point of view. On the other hand I apply my empirical finding to create the audit instrument which I then use to find more data, I could also say that it is partly abductive.

2.2 Why Case Study?

Significant for a case study is the following characteristics (Denscombe, 2000):

- Focused on one single investigation unit (one company, department etc.)
- A study that strives to investigate an issue in-depth
- Focus in processes and to understand how things are interconnected
- Examines something that already exists, studied in its natural environment

I have chosen to do a case study since this satisfies my purpose to deepen in a subject in order to create R&D specific solutions. Since case studies have both positive and negative effects on the study it's important to realise what those implications are (Denscombe, 2000):

- It's difficult to generalise results from a Case Study. Therefore the opportunity to generalise the result from this specific Case Study is dependent on the degree of similarity between the studied organisation and the comparison.

- Often several methods are used and therefore the method is coherent with method triangulation, which could be useful to audit data.
- More dedicated to processes and an adapted to a holistic view rather than small details.

2.3 Methods used in the study

2.3.1 Triangulation

By using several methods it's possible to identify the area of solutions, while the different methods can close in a common area (Denscombe, 2000). In my case I have used different methods to validate data. My base consists of the result from a theoretical study, but I have also used interviews and documentation so that I can secure the theoretical model to my specific case.

In a successful triangulation you should use both a quantitative and a qualitative method to be able to look from different perspectives. However, in a small research-project you don't have sufficient time and resources to be able to conduct such an extensive and thorough investigation. Therefore you have to choose method with that in mind and adapt your methods according to that choice. (Darmer & Freytag, 1995) In my case it has not been either possible or relevant to use a quantitative approach in this study.

2.3.2 Written sources

The purpose of the theoretical study is to be able to perform the empirical study and in the end to be able to ask the proper questions (Darmer & Freytag, 1995). In my case the quality of my theoretical platform will influence the quality of my end results. Much effort will be put to make the theoretical frame as solid as possible.

By investigating and discovering the research field it's possible to see the knowledge gaps. The aim of a theoretical study is to find the interesting questions to investigate. It's important to be able to validate the quality of the sources. In an academic point of view books written by distinguished researchers and articles published in well-reputed journals are the most trustworthy sources. (Denscombe, 2000) My sources are either well-reputed books that has been referred to in other studies or articles from scientific and renowned magazines.

2.3.3 Interviews

There are different aspects that need to be considered when performing interviews (Denscombe, 2000):

- It is always voluntary to participate.
- The material from the interview should be used as it is presented and not be distorted in any aspect.

- It's the researcher that leads the agenda and therefore guides the discussion.
- The ethical aspect.

There are different kinds of interviews and you use them in a way that suites your purpose. There are also different levels of structure while performing an interview. The level of structure is dependent on the kind of interview and the result that you are trying to achieve. In an early stage it can be handy to get some background information from the site where you are doing your research. The interview type associated with these kinds of investigations is called *explanatory interviews* and is used to get the basic data that you need. At this level it is handy to use a quite structured interview material, that is; you extensively use your prepared question formula. (Darmer & Freytag, 1995)

When you got the basics it's easier to deepen your investigation and to lift the analysis a level. To be able to do that you need a different kind of interview method called *depth interview*. While using the result from your pilot study and doing unstructured interviews you can discover deeper contents in your research field. An unstructured depth interview is more of a conversation than an interview, with the difference that it's the interviewer who leads the agenda. By using this procedure you can be able to get more specific information on topics that you're not so familiar with. (Darmer & Freytag, 1995)

In my case the pilot investigation has been performed during the summer in an area that is closely related to this research field. Therefore I was able to go directly to unstructured/semi-structured depth interviews. The interviews I performed for this study varied in structure from semi-structure in the beginning of the study to unstructured in the end.

2.3.4 Surveys

One part of my Masters Thesis is to create an audit instrument to measure Project Management performance. I have chosen to use the survey as a ground tool for the development of this instrument. The survey/audit instrument should have the following characteristics:

- Relatively brief answer (although there should be room for extra comments)
- Standardised data with quantifiable answer alternatives with an answer column
- It should be easy for the respondent to answer the questions

When developing the survey it is important to consider how it will appear for the respondent. A number of question needs consideration before distributing it (Denscombe, 2000):

- The questions should not be irritating or annoying for the respondent
- The questions should not be “leading”
- The formulation of the question should be easy to understand
- There should be enough answer alternatives to cover all opinions

2.4 Selection and verification of data

2.4.1 Written sources

It can be difficult to decide if a specific source is reliable from a research perspective. As criteria while validating following issues might be useful (Girden, 2001):

- Has the author explicitly presented the purpose of the study?
- Is there a description of how the research has been accomplished – that is; what methods have been used?
- What are the sources behind the results?
- Gut feeling while reading – is there a general feeling of quality and solidity in the research and the end product?

It's very important to create a good understanding of the source so that you can validate the quality and the reliability of the researcher's methods. You should not assume that it's a guaranty of quality that an article has been published by a well-known journal, but nevertheless it gives you some information. (Girden, 2001) Respected journals perform a scrutiny before publishing and therefore you should look for information that a scrutiny has been done. (Denscombe, 2000)

I have used a selection strategy that has begun in searching for articles and book reviews on different databases. I used search words such as:

“Organizational learning”, “Organisational Learning”, “The learning organisation”, “Project organisation”, Matrix organisation”, “TQM”, “Quality management”, “Project management”, “Project Management Maturity Model”, and “Process Improvement”

The reason to why I used these search-words where that they encompass the wider picture of Project Management and the specific environment that R&D is situated in. I used these in different combinations and could by that reduce the number of hits to a manageable amount. This incremental material has then been briefly studied to examine the relevance. A few of the book reviews have led to a couple of suggestions, a couple of articles has been judged as relevant and in some cases the reference tables has led to good suggestions and in some case pointed toward a common reference.

2.4.2 Selection of respondents

A big issue is the selection of respondents for the study. In a quantitative study it is very important to make the selection representative for the group that is supposed to be studied, but in a qualitative study the selection can be made more strategic. Very often it's specific persons with specific skills that you need to talk to and therefore the selection of respondents will affect the results strikingly. (Denscombe, 2000)

- Is the research objects (the respondents) representative for the aim of this study?
- Include the outliers (See: Miles & Huberman 1994). It's the exceptions that confirm the rule!
- Strategic selection – specific objects.

I have chosen to look at a wider picture in expense of the depth achieved when examining a single project thoroughly. By this I'm doing a strategic decision and include only project managers in the assessment study of Project Maturity. I do not look at any team members or core team members since it is not the scope of the maturity model to investigate single projects but rather how the projects are managed. By the assessment I'm going to be able to identify the key areas for improvement and also find out how to design the audit instrument. There is of course the risk that my respondents will chose to present their efforts in a favourable view. Therefore I am going to look at documentation to verify the data collected during interviews.

2.5 Three important catchwords:

In a serious research study it is important that you are aware of the weaknesses of the methods you're using. By scrutinising your own research you can avoid some traps:

2.5.1 Objectivity

How influenced am I of this corporation's culture? Can I still be able to see things with a critical eye? In my case I'm going to perform a thorough theoretical study before carrying through the empirical study which will affect my results.

2.5.2 Reliability

Would I get the same result if I tried to do the same study again? Is the research conducted in such a way that it is possible to replicate? These kinds of questions are always difficult to answer when you're doing qualitative research. The results are only guaranteed to be true in that specific context – the specific time, place and surrounding that is typical for the study. People tend to change opinion over time and therefore it is hard to talk about reliability in my study. (Darmer & Freytag, 1995) I would however like to say that there are some sort

of possibility to generalise, since the results from the interviews match the results of the survey to a great extent.

2.5.3 Validity

Am I studying right variables and am I investigating the right questions? Who and what are the most important persons/issues to study? Here the qualitative study has a major advantage since it's dedicated to the holistic view and processes. The methods are usually designed to find details and if you are sensitive when doing the study you got a good chance to find out what you are looking for. (Darmer & Freytag, 1995) The PMMM is a relatively new method, but it is based on the Project Management Institutes well-known PMBOK and the Carnegie Mellon University's Capability Model. It is of course difficult to make the assessment justifiable since it is based on subjectivity rather than science in the assessment process. I think that the validity of this study is quite good since I have used both interviews, documents and a survey.

3 HOW TO ENHANCE PROJECT CAPABILITY THROUGH ORGANISATIONAL LEARNING

In this chapter I give a brief presentation of the concept of business processes and then continue to develop theory concerning project management and organisational learning. The concept of Project Management Maturity is presented to create an understanding of how this can be used later in this study.

3.1 Business Processes – what is that?

“A Business Process is a chain of activities that in a repetitive flow creates value for the customer.” Two issues is fundamentally important in this definition: “repetitive flow” and “value for the customer”. To focus on Business Processes is to look on the company with the customers eyes – the repetitive flow is the instrument to do this effectively. If the process is resembled with a road between to cities the journey begins in the “Need village” and ends in the “Satisfaction village”. The road must also be designed in the best manner in order to do the transportation secure and swift. (Ljungberg & Larsson, 2001)

3.1.1 Process orientation

Michael Hammer, founder and master of the concept process-based enterprises, states that there are four major issues that need to be reflected in order to organise in accordance to the core processes instead of functions (Michael Hammer 1999):

- Focus on customers and teamwork.
- Negotiate and collaborate.
- Exert influence rather than authority.
- Coach and develop (rather than control) front-line employees.

Like in a project organisation conflict in authority is easily created due to the matrix structure with line managers and process owners. Therefore it is important that unit heads negotiate with the process owners to ensure that the process designs are sound, the process goals reasonable, and the resource allocations fair. The split in authority makes co-operation unavoidable. If they don't work together, they will fail. (Hammer 1999)

The idea of standardised processes is something that is emphasised as beneficial to the organisational effectiveness. This impact is due to lowered overhead costs since the process requires only one owner with one staff, only one set of documentation and training materials and only one information system. There is also another advantage that mainly concerns the image of the organisation and therefore are more difficult to quantify. A company with

standardised processes presents one face to its suppliers and customers, reducing transaction costs both for them and for itself. (Hammer 1999)

Due to the standardisation organisational flexibility can also be enhanced. If people in all business units are performing a process in the same way it is easy to reassign people from one business unit to another when demand are shifting, thus enhancing the plasticity in the organisation. As a rule of thumb you can say that a company should standardise its processes as much as possible without interfering with their ability to meet diverse customers' needs. Change demands and consumes resources and can, if handled badly, cause both harm and damage through confusion and encouragement of cynicism. It is therefore important for a process enterprise to examine its different change programs and pruning those that do not enhance process management. It is very important to keep the distractions to a minimum. (Hammer 1999)

3.1.2 What is Project Management?

In project management there are mainly three factors that are mentioned as important when inquiring what to measure project performance (Cleland & Ireland, 2002):

1. Technical project success according to agreed-on plans.
2. On-time performance.
3. On budget performance.

There are however more variables that also important for the success of project management in long-term perspectives: Are we responsive and flexible towards customer requirements and changes? Do the project have a strategic position of the project for future business? What abilities do we have to stretch beyond the planned goals? How can future project benefit from the organisational learning that this project leads to? (Cleland & Ireland, 2002)

3.1.3 Project versus process

There seems to be a great confusion in the distinction between projects and processes, but this is very important to be aware of. Applying project management to a process and vice versa is highly inefficient. The most important differences are presented in table 1:

Table 1: *Project vs. Business process*, (Martin & Tate, 2001) p. 1.

Project	Business process
Temporary – has a beginning and an end	Ongoing – the same process is repeated over and over again.
Produces a unique output or deliverable.	Produces the same output each time the process is run
Have no predefined work assignments.	Has predefined work assignments.

Some cases can be a process but not a business process – one example is new product development, which always is a project. The way of managing the project is described in a process, but since it is a project the process don't have predefined work assignments. When doing periodical improvement and redesign of processes project management is used. (Martin & Tate, 2001)

3.1.4 Managing a project

Senior management responsibility for building an organisational culture can be expressed in the following (Cleland & Ireland, 2002):

- Maintaining the balance of power between the project office and the line organisation.
- Providing facilitating services such as budget, administration etc.
- Developing a strategy for how to prioritise and conflict resolution.
- Providing performance standards both for project success and functional support.
- Establishing criteria for performance evaluation.
- Defining decision parameters within the matrix organisation
- Providing the project manager and the functional manager with strategic direction.

The question of strategic fit for the project could be answered through trying to answer the following questions: “Will there be a customer for the product?”, “Will the project results survive in the competition?”, “Is the project based on needs in organisational strategies?”, “Can the organisation handle risk and uncertainties associated with the project?”, “What is the probability that the project is completed within time, budget and technical performance?”, “Will the results provide value to a customer?”, “Will the project provide a satisfactory return on investment to the organisation?”, Will the product have a strategic fit in the future product portfolio?”. If the answer is yes there is probably enough business conditions in place in order to proceed with the upstart of the project. (Cleland & Ireland, 2002)

3.2 The Project Management Body of Knowledge

The world-wide Project Management Institute (PMI) was founded in 1969 and has today approximately over 100 000 project management professionals as members. During time the institute has developed its know-how in project management and collected this in a “bible” of best practise called “The Project Management Body of Knowledge” or “The PMBOK” as it is abbreviated. In order to have a comprehensive and explicit structure PMI have choose to work with the following model throughout the project cycle, see Figure 4:

The process begins with identifying the correct inputs that are needed in order to be able to deliver the proper outputs. To be able to deliver the proposed

features you need significant tools. The identification and usage of these are a critical success factor in project management. (PMI, 2000)

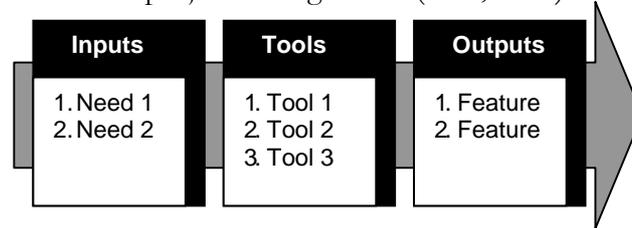


Figure 4: *The model for project processes according to the PMBOK.*

3.2.1 The Project Management Maturity Model

The Project Management Maturity Model (PMMM) is a method to describe project maturity – that is: to what degree a company has developed a best practise for how to run projects. The model is using the PMBOK’s nine project management areas as a base structure and the Software Engineering Capability Model as a starting point for the assessment of maturity level. By using the PMMM a company can get an idea of where to improve it’s project management practise. The levels of maturity have the following characteristics (Crawford, 2002):

Level 1 – Initial Process: The project process is managed in an Ad hoc manner. The project manager is aware of the weaknesses in the way of working but lack the competence and knowledge needed in order to change the culture.

Level 2 – Structured Process and Standards: An effort has been taken in order to structure the basic project management practise in a process manner. The processes are merely used on large highly visible projects and are not standard procedure for project management. The management supports and encourages the usage of the structured process. (Crawford, 2002) The development of accurate requirements is an essential part of the planning phase and this process involves a standardised way of extracting Work Breakdown Structures and cost estimates based on expert knowledge. (Fincher, 1997)

Level 3 – Organisational Standards and Institutionalised Process: The whole organisation applies the project management practise prescribed and the process is perceived as an organisational standard. Project Managers use the methodologies but adapt these to the specific project environment. (Crawford, 2002) There exist a sharing of best practise throughout the organisation. Risk management, cost estimating and scheduling is integrated through the use of WBS as decision base. (Fincher, 1997)

Level 4 – Managed Process: The project management processes are integrated with corporate processes. Solid analysis of project performance and adaptation of corrective actions is done throughout the entire project lifecycle. Management decisions and actions are based on data rather than assumptions. (Crawford, 2002) In a level 4 organisation project management is a part of each

person’s job and the project teams and the functional organisation works well together. There exists a support for the project management process and the projects support and links to the organisations strategic and tactical plan. (Fincher, 1997)

Level 5 – Optimising Process: There exists processes to measure project effectiveness and efficiency and these are used as a mean to improve project performance. The focus for the management is to support and encourage continuous improvement. (Crawford, 2002) The different project management methodologies is operated on a routine basis and as a consequence of this the people focus on systematic improvements. The organisation often take part in benchmarking studies as a way to generate ideas for improvements and to refine its metrics. (Fincher, 1997) To get a comprehensive of the PMMM-level of each Knowledge area, see appendix 1.

3.3 Project Integration Management

The importance for managing all the different aspects related to Project Management implies a need for a measurement system that contains all these different variables. This need is contained in the Project Management System (figure 5)



Figure 5: Project Management System (Cleland & Ireland 2002) p. 114.

The system is a planning tool for projects, but can also be used as a audit tool during the implementation process. *The facilitative subsystem* has a responsibility to provide the clarity needed about organisational structure, relationships within the matrix structure and the strategic context for the project. *The control subsystem* measures the performance by comparing actual progress with planned progress. The purpose is to propose modifying actions and to assure that projects are finished within time and within budget. For collection and distribution of timely information *the information subsystem* exists. It may be formal or informal. *Techniques and methodology* simply refers to the different methods used to evaluate risks and uncertainties during the process. *Cultural ambience* is how people in the project conceive the management style in the project – the feelings, emotions and perceptions found within the project organisation. *The human subsystem* deals with the problem how to work with people in order to obtain the project objectives and goals. The most important issue is how to motivate and stimulate, that is the leadership skills needed to be able to successfully carry out a project. *The planning subsystem* has the purpose to plan the implementation and provide the measurements needed to evaluate project success or failure. Important features are the work breakdown structure that defines project details, project budget and schedules. (Cleland & Ireland, 2002)

The most important aspect of Project Integration is successful planning. Considering the planning and execution of a major project Work Breakdown Structure (WBS) is an important tool to make the project manageable. Important questions that can be answered through the WBS (Cleland & Ireland, 2002):

- Are the goals clear?
- Are they specific?
- Are they time-based?
- Are they measurable?
- Can they be communicated easily to the project team?
- Can they be clearly assigned to the work package managers/professionals?

Once you have established your WBS it is important to do follow up so that you are aware of the actual quality of your structure. When comparing actual results with planned results the following questions are useful: “How is the project going?”, “If there are deviations from the project plan, what caused these deviations?” and “What should be done about these deviations?” (Cleland & Ireland, 2002)

3.3.1 Project Integration Management according to PMI

Project Integration Management is the way that different processes are coordinated in a project. In order to complete a project successfully the various processes needs to be integrated with the ongoing operations of the

organisation. This also means that project scope and product scope needs to be integrated. The processes that are part of this area are Project Plan Development, Project Plan Execution, and Integrated Change Control. (PMI 2000)

Project Plan Development: The purpose with the project plan is to guide the project through the execution. This aspect also contains to make and document the assumptions and decision alternatives chosen. The work breakdown structure provides an important tool for assessing the project scope. The project manager also has responsibility to facilitate communication between project stakeholders. In order to monitor progress and to maintain project control a baseline needs to be provided.

Project Plan Execution: This process can be described as how to carrying out the project plan. In a brief view it is the co-ordination of technical and organisational interfaces in the project. During this project there are continuous monitoring against the project baseline in order to take corrective actions based on a comparison between project plan vs. actual performance.

Integrated Change Control: It's important to influence the factors that create changes to ensure that changes are agreed upon. This also involves to detect changes and to manage changes that occur. It's important to maintain the original defined project scope and integrated performance baseline by continuously managing changes to the baseline. This can be done either by rejecting new changes or by incorporating them into a revised project baseline, that is: the performance measure baseline needs to have a high degree of integrity.

3.3.2 PMMM level 3 description for Project Integration

There should exist a fully documented process for the development of the project plan with consideration of all the PMBOK knowledge areas (scope, cost, time, quality, risk, HR, communications and procurement). The information in these areas should be on a level that permits visibility and control in the project schedule. The plan is regularly updated in order to reflect the approved changes from the change control process. Status and performance reports are produced and information on work results is integrated and analysed and reflected in summaries. There exists a well-defined change control process for scope, cost and schedule. (Crawford 2002)

3.4 Project Scope Management

Easily put Project Scope Management can be described as the desired outcome of the project: *what* is proposed to be created and when the results should be available. Another central item is the amount of money that can be spent to obtain the goals. Other aspects that are important, but more subjective and deal with how the work is going to be accomplished such as: attitudes, skills, behaviours and the expectations of the client. (Archibald, 1992)

3.4.1 Project Scope Management according to PMI

Project Scope Management is the techniques associated with the process of ensuring that the project includes all work needed to complete the project successfully. Here it is important to know what the term scope refers to: product scope are the features and functions that characterise a product or service, project scope are the work that needs to be done in order to deliver the product with the specified features and functions. (PMI 2000)

Initiation: This is the process where a new project is to be initiated or transitioned into a new phase. The reason for initiation can be due for example: a market demand, a business need, a customer request, a technological advance, a legal requirement or a social need. It is when some of these factors are seen as an opportunity that ground successful project management exists.

Scope planning: Here the different product requirements are to be defined in to a project description with various constraints and assumptions. The result (output) of this process are the scope statement (an agreement of project objectives and deliverables) and the scope management plan (how this is going to be achieved) supported with a sufficient level of details.

Scope definition: Scope definition is about dividing deliverables into more manageable parts in order to improve the accuracy in estimates (cost, time and resources needed), defining the baseline for performance measure and to facilitate clear responsibilities assignments.

Scope verification: This process is about how to obtain formal acceptance from the various project stakeholders. In short this is achieved through a review of the deliverables and work results obtain during execution.

Scope change control: Scope change control means to: influence the factors that create change in order to ensure that changes are agreed upon, determining that a scope change has occurred and to manage the actual changes when and if they occur.

3.4.2 PMMM level 3 description for Project Scope Management

All stakeholders are engaged in the process of developing the business requirements. There is a general agreement of the requirements, they are thoroughly documented, communicated and fully understood by all. The technical requirements are developed through a standard process for the producing of specification and with the proper level of details required. The identification and proper documentation of deliverables is an important issue and their ability to meet business or technical requirements. This should be managed through an integrated project team involvement and preferably with customer involvement in this process. All assumptions and constraints should be clearly documented in the project scope statement. The scope undergoes continued scrutiny throughout the entire project lifecycle. (Crawford, 2002)

3.5 Project Time Management

The amount of work conducted in a project reach its maximum in the middle of the process (figure 6). The different phases and inherent work packages can be seen in the graph below (Cleland & Ireland, 2002):

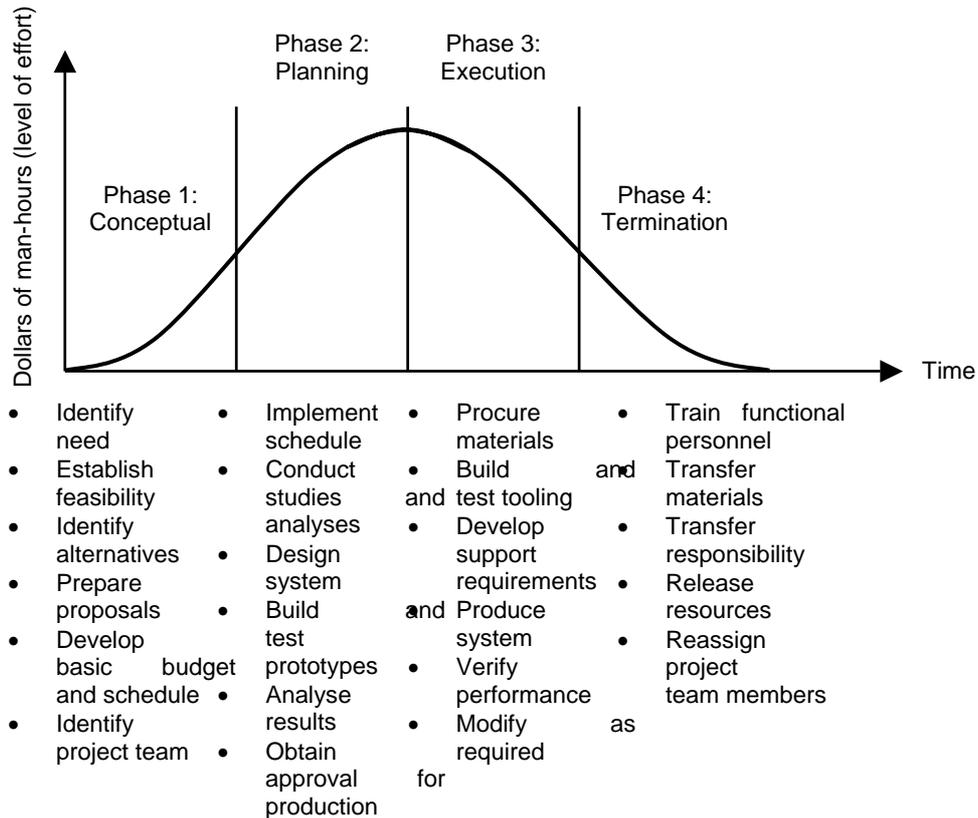


Figure 6: Project phases (Cleland & Ireland 2002) p. 292.

3.5.1 Project Time Management according to PMI

Project Time Management is the processes that need to be done in order to complete projects in a timely manner. (PMI 2000)

Activity definition: This involves the identification and documentation of the specific activities that needs to be performed to produce the deliverables identified in the Work Breakdown Structure. It can often be useful to use an activity list from previous projects as a template when creating an activity definition for a new project.

Activity sequencing: Activity sequencing involves the identifying and documentation of logical relationships. All activities needs to be accurately sequenced in order to support the development of a realistic and achievable schedule.

Activity duration: This is the process for how to transform information of project scope and resources into estimates of duration as input to schedules. The inputs is provided from the person or group who is most familiar with the nature of the specific activity. When presenting the updated activity list it is very important to assure that all assumptions has been documented.

Schedule Development: Schedule developments is how to determine the start and finish dates for the activities associated with the project. Once again it is important to set realistic goals, else there is a great risk that the project activities not are going to be finished as scheduled. This must be an iterative process and continuously provided with new inputs from other planning variables such as cost and duration estimates.

Schedule Control: Schedule control means to being conscious about the variables afflicting the schedule. One must try to influence factors that creates changes to the schedule in order to be sure that they are agreed upon, to determine that the schedule has been changed and to manage the changes as they occur. Schedule control needs to be thoroughly integrated with other control processes, such as change control.

3.5.2 PMMM level 3 description of Time Management

All assumptions and constraints should be visible in the project scope statement and this should be considered an organisational standard. The WBS is always the main enabler for determining project activities and the information is used as a refinement procedure for all activities. The project teams successfully use historical information for common activities and use templates for the activity definition. Metrics is always collected and the definition process is documented and repeatable. The project team performs earned value analyses and schedule changes are being identified, evaluated and managed. (Crawford, 2002)

3.6 Project Cost Management

As the headline implies this is how to control and measure spending according to the approved budget. Activities involved are: Setting budget for specific tasks, measuring expenditures and identifying variances against the budget, assuring that expenditures are proper and taking appropriate controlling actions where budget variances exists. In order to gain control over costs in large projects Earned Value Analysis is a powerful method. Simply put it measure how much value the project has earned by measuring the status on the various activities involved in the project. When an activity is completed its value has been earned and there are different rules how to measure the amount of completion. One important aspect in order to use the tool successfully is to have a large amount of tasks with relatively short duration. There are different philosophies how to measure, for example: 50 % earned in the start, 50 % at completion; 100 % at completion and percent complete supported with firm

guidelines. The measuring method is however not the most important aspect. (Archibald, 1992)

3.6.1 Project Cost Management according to PMI

Project Cost Management is all activities associated with the completion of projects within the approved budget. (PMI 2000)

Resource Planning: Resource planning involves the determination of what resources and what quantities that are needed to perform the project activities. The co-ordination with cost estimating is essential.

Cost estimating: This involves how to develop a approximation of the resources needed to complete the project activities. Here it is important to identify and consider various costing alternatives.

Cost budgeting: Cost budgeting is the techniques involved in the allocation of estimates into the work packages in order to create a cost baseline for the measurement of project performance. A cost baseline can for example be a spending plan or a cash-flow forecast.

Cost control: In accordance with change control, the purpose of cost control is to:

- Influence factors that create changes to the cost baseline with the aim to reach agreements of the changes.
- Determine that the cost baseline has changed.
- When the changes occur; manage them in line with the agreements previously decided.

In order to reach this there must be continuous monitoring of the cost performance in order to detect and understand variances from plan. It also includes to assign proper changes and to prevent incorrect changes from being included into the cost baseline.

3.6.2 PMMM level 3 description for Project Cost Management

The organisation has standards for the identification of resource requirements. There are several organisational specific standards for the development of cost estimates. All estimates are continuously compared with the actual costs, metrics is regularly collected and historical databases are used for comparison. The projects develop and document project baselines at the lowest reasonable level and the baselines are established in line with the project schedule. (Crawford, 2002)

3.7 Project Quality Management

How can a project be monitored and evaluated according to the standards defined during the conceptual phase? There are many important factors to take into consideration for the assessment of project results, where the most important issues are (Cleland & Ireland, 2002):

- Measurements should be kept to a minimum relevant to each work package in the project work breakdown structure.
- Measurement of work packages must be integrated into measurement of the project as a whole.
- Measurements should be developed that are applicable to both current project results and future projections to project completion.
- Measurements should be conducted around previously planned key result areas.

Projects should be monitored and evaluated during its entire life cycle. The evaluation should be considered as a process for assessing the capabilities of the project to support organisational strategy, that is: creating a useful product or service. Four types of evaluation can be considered: Pre-project evaluation, ongoing project evaluation, project completion evaluation and post-project evaluation. A useful method during project evaluations is to conduct audits to determine: what is going right and why, what is going wrong and why and what forces and factors prevent or have prevented achievement of cost, schedule and technical performance goals (Cleland & Ireland, 2002).

Another long-term success factor is continuous improvements, and here project management can provide a good ground for this. It has been proven correct that the following factors are important for the maintaining of innovation in companies (Cleland & Ireland, 2002):

- Focus on critical management problems.
- Develop and disseminate new learning tools and methods.
- Test tools and methods in practise.
- Provide cross-organisational learning.
- Use a cross-disciplinary approach.
- Provide co-operative education opportunities for students

Maintaining and developing quality within projects can be difficult in general, but in an R&D enterprise this task is even more challenging. However also R&D activities need quality system. An easy start to develop such a system would be to establish the following routines (Jayawarna, 2001):

- Quality responsibilities are documented and everybody receives a personal copy.
- All R&D processes have documented procedure.
- Quality programmes and plans for projects.
- Different tiers of documentation to express the work at different levels.

3.7.1 Project Quality Management according to PMI

Project Quality Management includes all the processes required to ensure that the project will satisfy all the needs for which it was undertaken. Important

issues are Customer satisfaction, prevention over inspection and management responsibility. (PMI 2000)

Quality planning: Quality planning is about determining which quality standards that are supposed to be met and they are to be satisfied. This process should result in a Quality Management Plan for the project that satisfies the important feature in modern Quality Management: *“Quality is planned in, not inspected in”* PMI (2000) p 97.

Quality assurance: Quality assurance refers to the systematic activities within the quality system that assures that all quality standards within the quality system are being met. These activities are to be conducted during the whole project and the aim is to create prerequisites for continuous improvement in the project/process.

Quality control: The purpose of Quality control is to monitor the project results against the quality standards previously assessed. It also involves finding ways to eliminate causes of unsatisfactory results and should be performed through out the entire project. (PMI 2000)

3.7.2 PMMM level 3 description of Quality Management

There are quality guidelines for the design of experiments, quality milestones and checklists to aid the project teams in their creation of quality plans. There should preferably exist people working with project quality assurance in the organisation. During the development of the product there are regular audit occasions where it is assured that the product meets the functional and market requirements. Performance standards are identified and are beginning to be established and measured against. (Crawford, 2002)

3.8 Project Human Resources

Successful project management is dependent on teams that are high performing. In order to create such teams there are important variables that are associated with such performances (Cleland & Ireland, 2002):

- Professionally interesting and stimulating work.
- Recognition of accomplishment.
- Experienced engineering management personnel.
- Proper technical direction and leadership.
- Qualified project team personnel.
- Professional growth potential.

In addition the strongest barriers to high team performance can be due to unclear project objectives and directions leading to confusion and apathy. Often the feeling that the project has insufficient resources leads to stress and bad productivity among the project work group. Power struggle and conflict is not unusual in a project organisation since this is usually arranged in a matrix type with different power balances between line and projects. If the company

has upper management who is uninvolved and disintegrated in their view of project management the benefits can be hard to obtain. One risk is of course also poor job security due to temporary project organisations. When management shifts there are also a major risk of constantly changing goals and priorities. (Cleland & Ireland, 2002)

It's often discussed how to alter culture in a company/project. This is naturally a very difficult task and there are no rules of thumb for how this is to be done. There is however a couple of questions that needs to be addressed (Cleland & Ireland, 2002):

Information: Inform the team members regularly on the status of the project and include both the good and the bad news. Inform about competitor threats.

Interaction: Promote sharing of ideas, problems and opportunities among the team members. Create a sense of belonging, especially for new members.

Socialise: To have social activities for the team on informal bases.

Support: The team leader must work to facilitate the teams work environment through work as mentor/coach.

Foster: Create a sense of urgency to the project. Try to have executives visit the project team and be briefed by the team members on the work they are doing.

3.8.1 Project Human Resources according to PMI

Project Human Resources are all processes required for making the best use of the people involved with the project. (PMI, 2000)

Organisational planning: This function has the purpose to identify and outline the processes for documentation, the assigning of project roles, responsibilities and reporting relationships. The organisational planning is often integrated with the communications planning, since the organisational chart within the project will have a great impact on the requirements on communications.

Staff acquisition: This is the process for the assessing of the right human resources needed for the project. It can often be difficult to get the "best" resources but it is nevertheless important that the resources that are available meet the project requirements.

Team development: The team's ability for development is critical for the possibility that the project will meet its objectives. Team development refers to techniques both for enhancing the ability of stakeholders to contribute as individuals as well as enhancing the ability of the team to function as a team. Various forms of teambuilding can be effective tools for this.

3.8.2 PMMM level 3 description of Project Human Resources

All potential interfaces (technical, organisational and interpersonal) is analysed and its effect on the project is understood. Descriptions of responsibilities for all project personnel are prevalent and thoroughly communicated. There exists

a development plan both for the team and for the team members as individuals. Peer evaluations may be performed and the results are used as an instrument to enhance team performance and team buy-in. The organisation has a defined project management process which project managers are expected to follow. The organisation should also have a developed career progression policy for personnel involved in project related roles. Effective metrics is in place in order to determine effectiveness among team members and organisation. The organisation provides courses at different levels for all project team members. (Crawford, 2002)

3.9 Project Communications Management

Timely and accurate information is an important mean to manage a project. Information can be both formal (meetings, protocol etc.) and informal (coffee break chats etc.); both equally important for the project manager. For the success of a project however information needs to be gathered and analysed in a systematic way. Therefore the use of a Project Management Information System (PMIS) are of great value for the project manager and the steer group. The system contains of an *information system* with cost management, schedules and performance review systems and a *control system* with policies, procedures and processes. The purpose with the information system is to monitor, evaluate and show important interrelationship among cost, schedule and technical information. Through this it can provide strategic information and identify important problems before they occur and thus being proactive. The strategic responsibility of higher management implies that they need to have thorough information about the project status. This can be achieved in different ways. An easy and informal method to do this is to move in the surroundings and simply “kicking the tires”. A more formal method is to have project evaluation and control meetings. To facilitate this some organisations have an information centre, or “war room”, for the gathering and analysing of information as well as for support, education and training of users and customers. (Cleland & Ireland, 2002)

The sharing of information is important for the evolving of an effective teamwork so that the team works in the same direction. The project manager need to ask the following questions in order to guarantee the quality and quality of information available (Cleland & Ireland, 2002):

- What information do I need to do my job as project manager?
- What information must I share with the project stakeholders to keep them informed on the status of the project?
- What information do I need about other projects in the organisation that interface with my project?
- What information do I require about the enterprise that provides me with insights into how the project fits into the overall strategy of the organisation?

- What information do I require co-ordinate my project's activities with other initiatives in the organisation?
- What is the cost of my not having adequate information about my project – and how that project interfaces with other projects in the overall organisational strategy of the enterprise?
- What information about the project *do I not need* to do my project management job? Remember, too, that I can be overloaded with untimely and irrelevant information.

It is important to be able to validate the information that is collected. The project planning function provides methodology for how to manage the available information resources (definition, structure and organisation of project information). You must be able to anticipate the information flow, review the information quality, control the use and source and through this determining suitable organisation policies. (Cleland & Ireland, 2002)

Information does have other functionality in a project organisation. It helps the teams to evaluate the performance against the proposed goals. Information must be comparable to project plans and standards. The information system also provides another great benefit by being a substitute for the manager being at all places at the same time where work is being carried out. However all information systems are not equally functional. An information system that does not reveal project problems immediately loses its value. (Cleland & Ireland, 2002)

3.9.1 Project Communications Management according to PMI

The issues presented below is the processes needed to ensure timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information. All project stakeholders' needs to be familiar with how to send and receive communications and also realise how their communications affect the project as a whole. (PMI 2000)

Communications Planning: This refers to the determination of who needs information, when they will need it, how it should be given them and by whom. It is very important to identify the stakeholders' informational need in order to reach project success. By a performance of a stakeholder analysis a thorough communications management plan can be developed.

Information Distribution: Here the communication management plan needs to be implemented in order to distribute the needed information timely to project stakeholders. It is also important to be able to respond to unexpected requests for information.

Performance Reporting: Performance reporting is about the collection and dissemination of performance information to provide project stakeholders

with information about how the project is progressing and how the resources are being used.

Administrative Closure: When a project has achieved its objectives or has been terminated for other reasons, it requires closure. The purpose of closure is to analyse and archive the results of the project, the effectiveness by which it was managed and the lessons that could be learned.

3.9.2 PMMM level 3 description of Communication Management

All projects are expected to have a communication strategy for the management of information responsibilities. There should be systems for information retrieval for all project stakeholders and standards for how to process information, present it and archive it for the future. (Crawford, 2002)

3.10 Project Risk Management

Risk Management is a key area in successful project management. While many areas of project management are reactive, that is dealing with the problems as they occur, risk management must be proactive. It involves various techniques that is used to discover potential problem areas before they strike the project and causes difficulties and expenditures. In order to handle Risk constructively a risk management process must be in place. The following figure 7 illustrates how such a process can look like (Thelin, 2002):

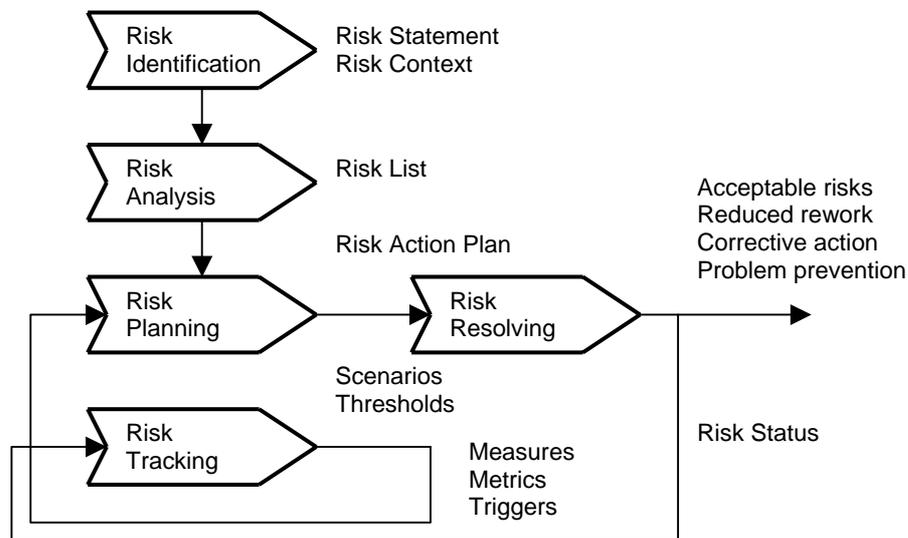


Figure 7: An overview of the Risk Management Process (Thelin, 2002) p. 2

3.10.1 Project Risk Management according to PMI

Risk management is a systematic process of identifying, analysing and responding to project risk. This is done in order to minimise the probability of undesired events to occur and to maximise the potentials of the project. The ability to identify risks is essential for the management of projects. (PMI 2000)

Risk Management Planning: The planning of risk management is a process that involves the decisions how to approach and plan for the handling of risk management activities for a project.

Risk Identification: The proper identification of which risks that might affect the project and the documentation of their characteristics is important. This is a process that is performed several times during the project in an iterative approach and by different groups. Usually it is easy to develop and implement simple and effective risk responses as soon as the risks are identified.

Qualitative Risk Analysis: This is the techniques and processes of assessing the impact and likelihood of the identified risks. An evaluation of the quality of the available information helps to modify the assessment of the risk.

Quantitative Risk Analysis: The purpose of this is to determine the probability of each risk and its consequences on project objectives by processing data numerically.

Risk Response Planning: This is focused on how to develop options and determining actions to enhance opportunities and reduce threats to the project objectives. It also includes identifying and assigning responsibilities for agreed risk responses. The planning needs to be in parity with the severity of the risk, the estimated cost effectiveness for treating the risk, timely, realistic within the project context, agreed upon by all parties and owned by a responsible person.

Risk Monitoring and Control: This refers to all practises involved in order to monitor that decided actions are executed and the continuous watch out for new risks. This also involves auditing the performance effectiveness of risk management plans and proposals for improvements.

3.10.2 PMMM level 3 description of Risk Management

There are risk identification processes that are considered an organisational standard and is used by nearly all projects. A risk management plan exists and is updated as risk events take place or changes occur. Teams contribute in the identification, which is later translated to total project risks and program risks. Management actively tries to develop lessons learned and a database for historical risk causes is developed. Management has a developed plan for the risk response and templates exist in order to simplify the development process. Project risks are actively and continuously tracked on a routine basis and corrective actions are taken in correspondence to the risk management plan. Metrics are collected throughout the entire project and decisions is based on results from analysis of metrics rather than assumptions. (Crawford, 2002)

1.8 The elusive Learning Organisation

3.10.3 A definition

One definition of organisational learning is:

The capacity or processes within an organisation to maintain or improve performance based on experience”.

Nevis et al (1995) p. 73.

A learning organisation is often described as an organisation where the focus is on acquiring, improving and transferring knowledge. In such an organisation it is also important to facilitate and to make use of individual learning and then modify behaviours and policies in order to reflect the learning. This is, however appealing the idea, not so easy to realise and therefore the learning organisation has been dimensioned into an elusive vision. (Miller, 1998)

1.8.1 The fifth element and the concept of organisational learning

Senge (1999) talks about a shift of paradigm as he describes the process of designing the learning organisation. The deceitful easy arguments that he proposes are, however easy to accept from an intellectual point of view, complicated to transform into direct actions. A shift of mind or paradigm does not in this case seem like an exaggeration. The learning organisation does not look in a specific way, it's not bound to a typical market or industry nor does it contain a specific type of co-workers. The learning organisation can only exist as cultural perspective; that is how we think and hence act. The framework for learning organisations consists of five basic components:

System thinking: It's much easier to learn something if you have a clear understanding of the whole picture. System thinking enable us to recognise events as a part of a whole and therefore the ability to take the correct actions. Many of us tend to put our efforts in isolated parts because it's much easier to solve problems if you first break them apart. When doing so it's very important not to loose the holistic view of a problem – to see the problems interconnected. This is a concern at all levels in the whole organisation.

Personal Mastery: A learning organisation is dependent on their workforce's ability to learn. Most people live *of* their work not *for* it, but nevertheless organisations that can attract the commitment of their workforce have a great advantage. A committed worker has a better opportunity to focus and deepen his skills to perfection and hence contribute to the success of his organisation. *“An organization's commitment to and capacity for learning can be no greater than that of its members”.* Personal mastery also involves a critical examination of your own

capability, your strong and weak parts. It's only when you have discovered your own weaknesses that you can truly learn.

Building a shared vision: In opposite to the many vision statements a *genuinely* shared vision contributes to people's ability to learn. A shared vision is the same as a common goal, something that all in the organisation is aware of and striving for. The difficulty of this lies in the translation of personal vision into a common and shared vision. There are two ways of reinforcing motivation in an organisation; either by fear or aspiration. To create fear of possible threats is a short-term solution, but to be able to have withstanding results the vision should set out an aspiration to fulfil the vision. One important discipline for leaders to master is the ability to present compelling and stimulating "*pictures of the future*" that foster truly committed staff.

Mental Models: We all have many "truths" that we take for granted and therefore consider impossible to change since it's affect our world view. This is called mental models and can be very hard to confront because of its tacit attributes. However if we have the ability to put our mental models under scrutiny and allow them to be questioned we might discover solutions to the "impossibilities". A big issue is to learn to make "learningful" conversations – that is: to expose the thoughts of individuals to the influence of others. This becomes extraordinary important when you want to obtain:

Team learning: Teams have a great ability to accomplish more than the individual members would accomplish by themselves. This ability is determined by the learning capacity of the group. Team learning is based on dialogue in contrast to discussion – the aim is to let the thoughts flow freely (without destructive criticism) in the group and by that discover new ideas. In the art of dialogue also lies how to avoid hindrance for learning. All too often defensiveness is such a variable and this can if unattained undermine learning. If the correct actions are taken it can on the other hand enhance learning. Such hindrance is important to handle because "*unless teams can't learn, the organisation cannot learn*". The ability to learn from your mistakes and transform the learnings into something fruitful is crucial.

These disciplines compose a body of theory and technique that need to be mastered and continuously maintained. The using of the disciplines enforces the decision to become a lifelong learner. They should be used as a platform from which it is allowed to experiment and by that advance towards the vision of the learning organisation. The five elements are to be used as a complete machinery that is dependent on all its parts to be able to function properly. It's system thinking – the holistic perspective – that is the uniting force – the fifth element. (Senge, 1999)

The comprehensive view – the ability to see the whole picture – is something that many authors are mentioning. Perhaps this is due to the theoretical view of the learning organisation as an imaginative illusion, something that affects only the surface of the organisation. However this picture is true or not, some authors have tried to transform theory into action.

In accordance with guidelines presented by Garvin a focus on an implementation strategy, has been used by Miller as action learning settings in real cases. His suggestion is to execute the implementation in three stages (Miller, 2003):

1. Cognitive stage: Encourage managers to think differently and to be exposed to and share new ideas and new knowledge. During this stage the managers took part on seminars with six key areas. Big effort was put in order to develop coaching abilities and behaviours that enhance motivation and confidence.
2. Behavioural change: The managers internalise their new knowledge and as a consequence change their behaviour. During weekly meetings the managers try to realise and develop new sets of behaviour.
3. Effective improvement: Usage of performance criteria in order improve the organisational performance. First a evaluation of the current situation is conducted with feedback from the focus group (consisting of both consultants and employees). After the actions have been taken towards a changed behaviour and in the end, organisational performance, a new evaluation is being done.

The result of this strategy has been proved to create withstanding changes in behaviour and performance throughout the organisation. The main issue is to create visible and measurable results and to use these to take the change program further. (Miller, 1998)

Change does however not appear by itself merely by presenting a change program. People can easily give you the answer that they are supposed to deliver, the so-called *espoused theory*. Whatever this is answer represent their actual way of dealing with an issue, their *theory-in-use*, is not always the case. Furthermore, the individual may or may not be aware of the incompatibility of the two theories. Another notion that is important in this context is organisational *images* and *maps*. Each member of an organisation constructs his or her own representation, or image, of the theory-in-use of the organisation. The official assembly of images is contained in organisational maps, such as organisational charts and other descriptive documents. (Argyris & Schön, 1978)

This leads to the formulation of the following axiom:

“Organisational learning occurs when individuals, acting from their images and maps, detect a match or mismatch of outcome to expectation which confirms or disconfirms organisational theory-in-use.”

(Argyris & Schön, 1978, p 19)

Organisational learning have two different functionality levels; double and single loop learning. In an organisation that can master single-loop learning organisational members respond to changes in the internal and external environments of the organisation by detecting errors which they then correct so as to maintain the central features of organisational theory-in-use. In other words this can be described as the organisations ability to remain stable in a changing context. Single-loop learning is sufficient when error correction can be done by changing the organisational strategies and assumptions within the specified organisational norms. (Argyris & Schön, 1978) Illustrated in a figure single-loop have the features showed in figure 8 below:

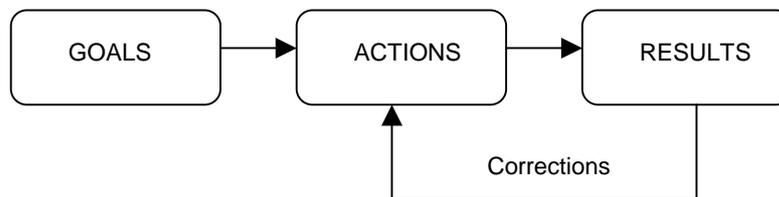


Figure 8: Single-loop learning. (Probst & Büchel, 1997) p. 33.

In some cases, however, error correction requires an organisational learning cycle in which the organisational norms themselves are modified. This criteria is satisfied by double-loop learning. The characteristics of double loop learning is that there are a double feedback loop which connects the detection of error not only to strategies and assumptions for effective performance but to the very norms which define effective performance. Double loop learning occurs when actions are put into change the root cause of problem, not merely its symptoms. Figure 9 illustrates how double-loop learning looks like:

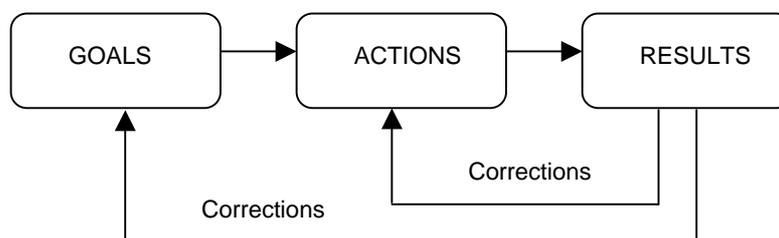


Figure 9: Double-loop learning. (Probst & Büchel, 1997) p. 34.

This demands the organisation to learn how to carry out single- and double loop learning. That sort of learning has been called deutero-learning or second-order learning. When an organisation turns its actions to deutero-learning, its

members learn and reflect about previous context for learning, or failure to learn. Out of this they invent new strategies for learning, they produce these strategies, and they evaluate and generalise what they have produced. The result of such sessions is new individual organisational images and maps which is reflected in a different organisational learning practise. (Argyris & Schön, 1978)

Important aspects that this type of process requires are a reflective mindset in the way of work. The process of learning how to learn has been described as the highest form of learning. This way of gaining insights into the learning itself is called process learning. (Probst & Büchel, 1997). This is illustrated in figure 10 below:

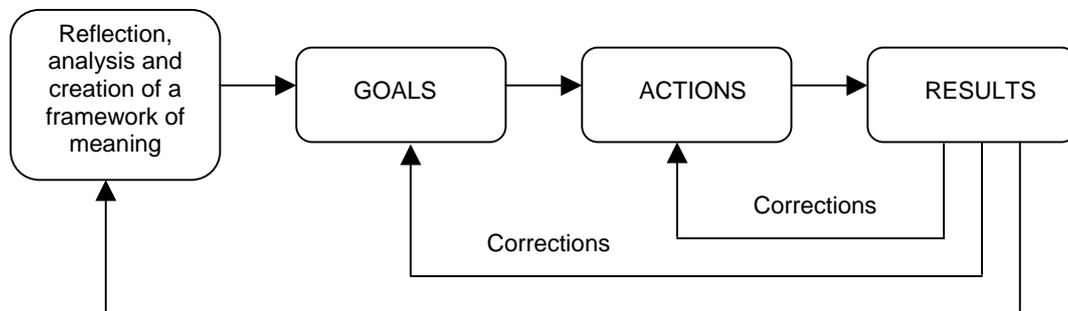


Figure 10: Process learning (Probst & Büchel, 1997) p. 36.

3.10.4 What does it take?

One important aspect of learning organisations is that there needs to be an alignment between work design, management practices and “skilling” strategies to be able to optimise the overall performance of the organisation and its ability to learn. The key areas that are highlighted are (Hill et al., 1998):

Vision/mission: The focus on quality products is more likely to be fulfilled if it is complemented with a statement that focuses on the development of the staff.

Quality: The organisation's reputation with community and customers has a significant effect on employee commitment to organisational goals and motivation to learn.

Empowerment to act is central to an organisations ability to learn: This means that people in the organisation has:

- Authority to act.
- The required information and technology that is needed.
- The proper work design for continuous work place learning.
- Support for learning with appropriate courses as required.

Case study: Developed strategies for learning are essential. Practical matters that comprise this are: multiskilling through cross-functional teams, learning laboratories, learning plans linked to pay and skill matrices.

Rewards: The pay system should be integrated with learning and professional development opportunities.

Organisational learning can be an important part of an organisational change strategy. Some say that the major benefit for organisational learning is that it enables organisations to manage change in a timely and effective manner. Change is something that most companies have to live with in order to survive competition. Therefore the organisation needs to learn at least as fast as the environment changes. If there is a great instability, that is a high degree of change, there also is a great need to move from traditional learning to organisational learning. As a consequence of this is the entire workforce should be involved in identifying the need for change and the implementation of it. In order to keep aligned with its environment this requires learning within the organisation. (Burnes et al., 2003)

A systematic approach to enhance organisational learning is to follow the sequence of the following actions (Burnes et al., 2003):

1. Knowledge acquisition.
2. Information distribution.
3. Information interpretation.
4. Organisational memory.

3.11 Learning within projects

Learning through experience is probably the easiest and most effective way to implement continuous improvements in a company. When it comes to innovative and creative product development, the learning comes from competent development projects. But organisational learning is not something that comes out of accident, nor is it a natural outcome of development projects. The fact is that it is far more usual to try to hide the mistakes done and to brag about the success parameters. Successful learning organisation finds opportunity to learn from both. Those who actively participate in the learning activities create an understanding of development and enhanced capability to better carry out such activities in the future. Further, sharing knowledge across people, jobs and organisational functions often result in an expansion of that knowledge in competitively relevant ways. An appreciation of cross-functional learning perspectives makes for sustained learning. (Sohmen, 1998)

This must be done with awareness of the appropriate method to apply. There are basically four different approaches to chose from when it comes to promoting learning (Probst & Büchel, 1997):

- Learning by developing a strategy.
- Learning by developing a structure.
- Learning by developing a culture.
- Learning by developing human resources.

3.12 A tool for change analysis and process improvement

One of the major benefits claimed for organisational learning is that it enables organisations to manage change in a timely and effective manner. (Burnes et al., 2003) When it comes to enabling change it is a major benefit to have a descriptive model to use as guidance.

In order to create high-performing project teams in Product Development the ability to learn is crucial in the change process. One important matter is to ensure that all working within the process/project knows how their (and other) contribute to the whole picture. This does not merely include those who work directly with the product development, but all in the supply-chain. Prasad (1999) In figure 11 the methodology is illustrated:

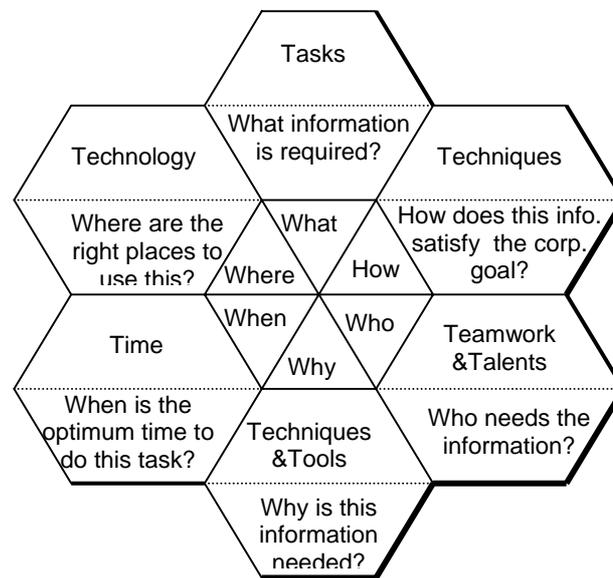


Figure 11: Change analysis and improvement. (Prasad, 1999) p. 180.

The methodology works with the following six steps:

1. What to change (Inputs, outputs and process steps (tasks) including measures and decision points.

2. How to change (Techniques, tools, process boundaries and process flow).
3. Whom to change (Talents, teamwork, customers and supply-chain).
4. Why to change (Techniques, processes, purpose, function and rationale for decision making).
5. When to change (Time, process order and structure).
6. Where to change (Technology gaps, process relationship and its context to the whole).

Learning is good and surely unavoidable if an organisation wants to survive in the competitive landscape of tomorrow. It is however important not to exaggerate the importance of organisational learning. I would like to borrow the following words:

“The learning organization is all the rage right now, and mostly for good reasons. But it is no panacea for anything. People have to learn, but they also have to get on with doing the regular work efficiently. (Horses wear blinders for good reasons.) There can be a time to learn and a time to exploit previous learning... So learning is wonderful, but there can be too much of any wonderful thing!”

(Mintzberg, 1998 p. 228)

4 A STUDY OF PROJECT MANAGEMENT AND LEARNING AT TETRA PAK R&D

This chapter contains the results from the investigations I have made on project management and organisational learning at Tetra Pak R&D. The results are displayed uncommented. Firstly in the chapter is an introduction of Process Orientation at Tetra Pak and the system called TPIN. This has implications for the Project Management part that comes after.

4.1 General description of Tetra Pak

Tetra Pak was, when the company started in the early 1950s, one of the first packaging companies for liquid milk. Since then, it has become one of the world's largest suppliers of packaging systems for milk, fruit juices and drinks, and many other products. In 1991 Tetra Pak expanded into liquid food processing equipment, plant engineering, and cheese manufacturing equipment. Today, it is the only international company in the world able to provide integrated processing, packaging, and distribution line and plant solutions for liquid foods manufacturing. The main advantage of this is that Tetra Pak's customers can get integrated solutions from a single supplier, thus reducing complexity. (Orbis, 2004-03-01)

Tetra Pak is a global organisation with 20 800 employees world-wide and activities in more than 165 countries covered by 62 market companies. The company delivered the astonishing amount of 105 billions of packages during 2003 and net sales for the year 2002 was 7543 Millions EUR. (Orbis, 2004-03-01)

4.1.1 Process Orientation

The work of transforming Tetra Pak into a process-oriented company is in progress. Eight Core Processes has been identified and the key measurement variables for each process. The process chart has the characteristics shown in figure 12.

The implementation of the Processes Model is to continue until 2006. Thereafter the processes are to be under continual improvement. The innovation process are partly implemented, see Tetra Pak Innovation Network below. (Orbis, 2003-10-20)

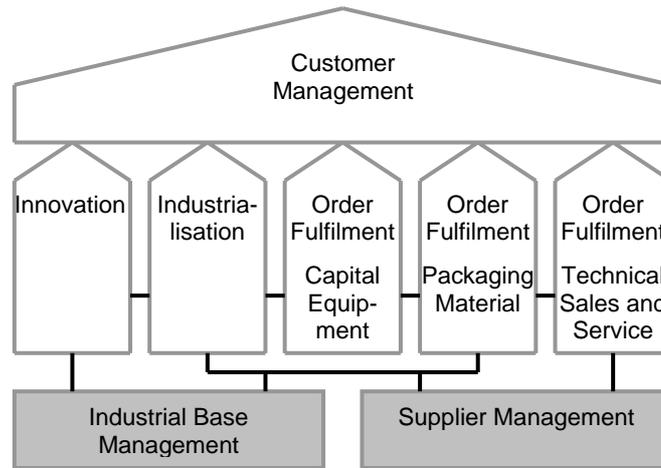


Figure 12: Tetra Pak Process Model – The eight Core Processes

4.1.2 Tetra Pak Innovation Network (TPIN)

TPIN is a web-based information system on the Tetra Pak Intranet (Orbis) available for all working within the Innovation Process. The purpose is to establish a forum for exchange and as an interactive handbook for Best Practise. The innovation process consists of all the activities in the development of ideas – from the identified customer need to the implementation of successful products and services. (Orbis, 2003-10-20)

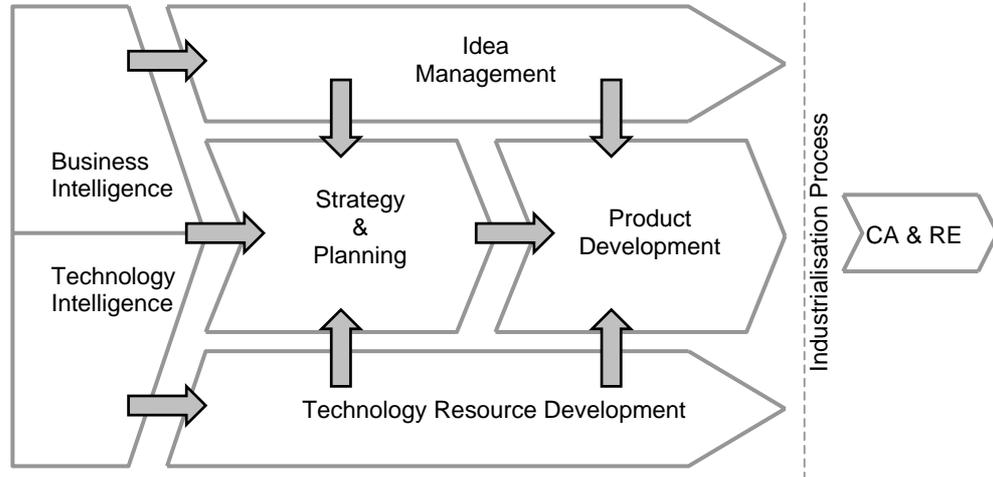


Figure 13: The Core process for Innovation.

The different sub-processes have the following characteristics:

Business Intelligence: Provides information about business opportunities and various customers’ desires.

Technology Intelligence: Provides information about new wall-breaking technology (an example is intelligent packaging). Together with Business Intelligence it provide the input called: “The Need”.

Idea Management: A process with tools for idea screening and evaluation. The purpose is to stimulate creativity throughout the company and thus creating an idea bank and possible future business opportunities.

Strategy & Planning: Contains the overall annual product and technology strategies. It also contains planning cycles and time line for deliveries and decision points.

Product Development: Consists of five phases with clearly defined goals and transition criterias. The process begins with the defining of a product and ends with the release of the product, evaluation and closure of the project.

Technology Resource Development: The purpose is to secure that all key technology is available when needed. This also involves the identification of key technologies that need to be available either in-house or through a supplier’s know-how.

Customer Alerts and Cause Eradication: A well-defined strategy for how to deal with problems in post industrialisation projects. This is a way of dealing with problems due to mistakes done during the project. (Orbis, 2003-10-20)

This is not merely a process chart, but a description of a standardised way to work with projects at Tetra Pak. The process is general and can therefore be modified in order to better suit the specific Tetra Pak company’s environment, which for example Tetra Pak Carton Ambient (TPCA) has done. (TPCA website, 2003-12-01).

At the department Package Development, the main focus is on the product development process. This has the following feature:

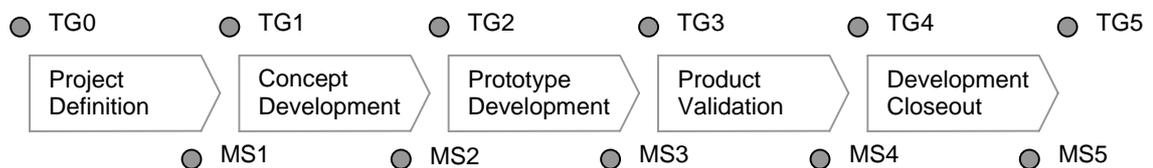


Figure 14: The Global Product Development process. (TPIN 2003-12-03).

Before each phase transition a Tollgate (TG) decision must be made. The tollgate is the go sign that state that the project has enough bearing and potential to continue development. When the phase has been completed a Milestone Review Team performs a quality assurance of the project. This team consists of well-merited technical expert that sees to that the project has delivered the technical performance that has been promised in the preceding tollgate.

4.1.3 Tetra Pak Research & Development

Tetra Pak regards R&D work on new processing, packaging, and distribution systems as an important method to retain its market leadership now and in the future

Tetra Pak R&D have its main activity in Lund but also has 20 so-called R&D centres globally. The company has 1,100 people engaged in numerous R&D projects in various parts of the world. R&D do research in areas such as for example: aseptic technology, sealing technology, filling technology and off-flavour analysis.

At the moment there are five product development projects and 11 technology development projects at R&D in Lund. Two of the product development projects are in the definition phase, one has just passed tollgate 1 and the last are in the preparation for field tests (TG 3 is to be passed).

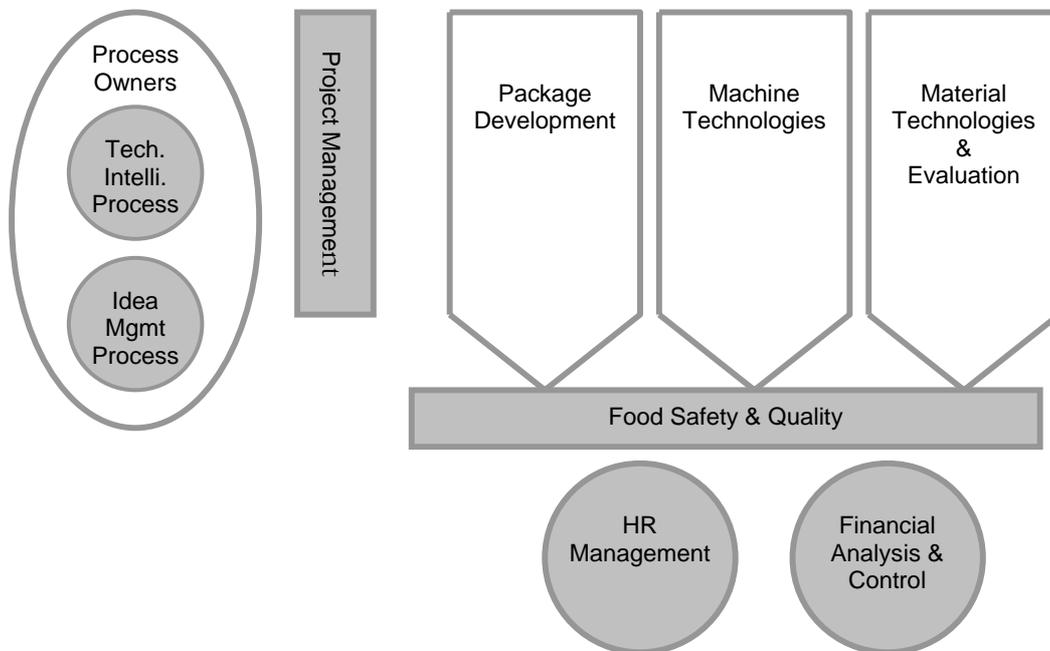


Figure 15: Organisational chart of Tetra Pak Research and Development

4.2 Project Management at Tetra Pak R&D

In order to better understand this chapter I advise the reader to have a look in Appendix 2 where the interview material is contained. I have structured the question material with the eight competence areas in mind.

4.2.1 Project Integration Management

The projects at R&D are usually a result from some sort of strategic gap in the Tetra Pak portfolio. Inquiries for new concepts come both from senior management as well as different Market companies or other expert groups

such as Category Leadership. In the pre-study phase theoretical analysis are derived to see whatever there is enough bearing to continue with the project. If it is stated that it, at least from a theoretical view, is possible to continue with the project, there is a formal start-up with a TGO-decision. Projects can also emerge out of concept development with for example wishes to use a certain machine platform on a new packaging concept. Another is a material development project that now is in the preparation of a kick-off and recently begun the project definition phase. This project has strategic importance with long-term consequences for Tetra Pak.

Today the purpose of most development projects at R&D are to protect Tetra Paks position from competitors or to take market shares on new market segments. One way to put this is that the company work more with “market pull” than “technology push”. Many of the projects are also driven in corporation with customers from the beginning. This enables, in greater extent than before that consumer needs are built into the packaging concept.

The way that projects are managed today varies a lot from how it use to be done in the past. Today there is more structure to follow and all projects are managed in the same way. The project managers are located together, which permits transparency and exchange to a much greater extent than before. Recently a new decision process has been established which have contributed with clarification in the way of work.

The outlining for a project plan develops out of specifications usually given from the project sponsor or market companies. The extent of these specifications is mostly not so impressive and is usually contained in a so-called project requirement document. This could mean details such as cost-requirements, volumes, and timeline for commercialisation etc. Since it is development projects, it also often contains a lot of assumptions and restraints. Out of this a business case or pre-study is developed to see whatever the requirements can be met. Usually the projects groups start working with many different options, each with an own project plan – a rough plan with time lines, to find the most attractive solution. In one of the new projects use an unusual working method with parallel projects within the project, each with it's own specification. Here the project managers role is more of a co-ordinator of the different specifications into one project plan, than of a detail planner.

The main measurement variables are time, cost and technical requirements. The tollgates are an important opportunity to measure the project effectiveness where the steer group considers a lot of different aspects (including time) and when decision for transition is to be made. A milestone review team sees to that the technical requirements have been met and they give the recommendation to the steer group to either make or not make the transition.

R&D have a balanced scorecard that contains many different measurements on organisational effectiveness.

TPIN is used as a co-ordinating tool since there is a need to speak the same language. This is due to the cross-organisation environment with co-operation with for example Carton Ambient and different market companies. When all organisations work with TPIN it's easier for the different organisations to co-operate, since there is a clear process to follow. R&D use TPIN as a framework and not as a detail-prescription for how to work. There are also continuous adjustments made during the process.

The project managers feel that they are able to affect the process, but there are details that need to be followed. For example they have to use the same structure as TPIN down to the second level. The purpose of TPIN is considered to be Tetra Pak's forum for Best Practise concerning Project Management. TPIN follows the PMBOK standard with defined input and output to each phase, which is considered as a good work structure among the project managers working at R&D.

4.2.2 Project Scope Management

Tetra Pak has a long tradition as a technology driven organisation. Consequently the projects in the past was dealing mostly with the problem to adapt to the customers needs. Due to this the organisation was very reactive and always a pace behind. Today the focus has changed towards being proactive and instead for responding to the customers' demands, trying to predict them. The whole company, not least R&D, has changed a lot towards being more market driven. A great change has also occurred in the number of projects that are managed, from many small projects to a concentration on bigger projects.

The development of project scope contains of two parts; firstly the development of a project charter. This is then communicated by an official announcement of the project containing:

- Who is Project Manager
- What are his/her responsibilities
- What is the scope of the project

Then a project requirement document is developed containing all necessary details needed to be able to initiate a project. This includes: outlining, content, purpose and delimitation for the project

Before TG0 decision it is usual to do a project scope and objective statement. These are quite basic with a conclusion of what type of material, market and technology the project is to be applied on. These kinds of statements are mostly based on experience from earlier development projects and know-how

from market companies. On steer-group meetings decisions are taken for the purpose and scope of the project. These meetings also serve as the baseline for the project. In some important, long-term projects ambitious pre-studies is performed in order to get a good hold of what that is possible to do, both from a technical and commercial view. Project scope is always a question of weighing up the balance of what that is wanted and what that in fact can be done.

Market expertise exists in the project core teams through persons from Carton Ambient and project specific Market Companies. The business requirements are developed in co-operation with the local Market Company and Category Leadership for respective Market. The starting point for projects is more often a result of markets requests than technical innovations. During the project there is a Market Advisory Group (MAG) that provide consultation and expertise in market questions. They are also involved in the development of the cost specification for the product.

Technical requirements are developed much out of experience and therefore many assumptions are made. Due to the many uncertainties in a development project (you are entering ground you do not know) and the very specific technologies that Tetra Pak works with (aseptic technology and sealing technology) these assumptions are hard to avoid. Technical standards exist, but mostly on for example filling machines and strength, more subjective issues such as aseptic level are more difficult to answer. On milestone review team meetings an expert advisory group scrutinise the project to see if the technical requirements (including the measurement methods) have been met and on the basis of that do recommendations to the Steer Group whatever transition to tollgate is possible. This serve both as a scope control instrument and quality assurance – if the project passes it is on the track.

When passing a tollgate new criteria are developed for the next tollgate. This can sometimes be hard since it is difficult to imagine all problems that can arise and it is therefore important to have the appropriate ambition level (not to hard and definitely not to easy, if so you end up with a lot of problems unsolved in the end). The different assumptions are documented as they arise, but they are not documented on a single place. There is a slight risk that people forget that an assumption is merely an assumption but this can only be a matter of bad communication. You need to be very clear on this. The latest update of the process description for product development that is recently developed a “lessons learned” document is included as a mandatory input for the new tollgate.

WBS is considered as a best practice and from the process owners point of view it should always be used as a planning tool for resource allocation, project planning and risk management. At R&D it is a common wish to use WBS in

the project core team, but it has been hard to do this thoroughly. When planning out of WBS it is difficult to predict all activities that need to be done in order to perform future activities. The project managers have usually begun with a “super-structure”, a declaration of what different phases they have to pass in the project during a period of about a year. It is usually quite difficult to co-ordinate the different departments specific WBS into the overall planning, since they can be on different phases in the project. One of the project managers says that they could definitely be better in planning, but due to many uncertainties this has been hard to manage. In the process owners view of project planning those who do not use WBS always fail to meet timeframes since many details pass unnoticed.

4.2.3 Project Time Management

It is difficult to measure effectiveness in development projects, what should be measured: time elapsed, money spent or maybe goal fulfilment? All these variables are dependent on the quality of the project plan. One effectiveness measure could be time to milestone contra planned time.

All changes in time frames needs to be supported by a decision from the steer group. The Project Manager can propose changes in the timeframe, or ask for more resources in order to reach the tollgate in time. The tollgate functions as a time-control system but TPIN also serve as a reminder of what activities that need to be performed, and in what phase. The steer group can also decide to postpone the milestone review and to allow a transition with condition to do it later. There do not exist a good measurement system for project effectiveness. At TPCA they work with time based measurement system that is; the time between the tollgates is standardised and shall be followed. This is not regarded as a good work method for R&D even though the company has a need to improve on this aspect. The projects at R&D are not as predictable as the projects at TPCA, and besides it is stated, that time elapsed does not say anything about efficiency.

Many of the projects at R&D work close with TPCA who has extensive technical knowledge in many of the Tetra Pak key technology areas. Many projects are cross-organisational with involvement from many different Tetra Pak companies both in Sweden and abroad. You can say that all projects are dependent on other projects at R&D since they all are competing for the same limited resources (both human and utilities such as laboratories).

Timelines can also be extracted from a risk analysis in some part of the projects. In some case (for example in one of the machine development projects) the risk identification process can lead to the creation of a well functioning time frame. Thus there are many methods used to create time plans, but the focus is not how this is done, only the quality of the time plan. Time is an important factor.

4.2.4 Project Cost Management

The project plan serves as a starting point in the cost estimate process. Together with the line management it's the project leaders responsibility to develop the estimate for the entire project. The cost estimates are developed for the new budget year when applying for funds from the R&D management. Estimates for the general budget are developed one time during the spring and one time during the autumn. The estimates are based on man-months, material costs and consultations. The estimate process is common for the entire R&D and is regarded as good and well functioning.

The estimates are usually created from an bottom up approach where the different part project leaders extract estimates based on their planned activities. A project budget is then created through a summation of these different estimates. Once a month the project manager gets an economical follow-up report from the economy department, that is how much money that has been spent.

R&D do not use “earned value” as a measurement of project effectiveness since they consider it as an uncertain method in a development project. From corporate Process owners point of view it is considered as a good working tool, but since it is not mandatory to use it, R&D has chosen not to work with it. A method could be to measure how much money that have been used in comparison with the size of the budget and the goal fulfilment, but it the Project Managers are sceptic towards what you would achieve by this.

Due to the difficulties in predicting all difficulties in a development project the correctness of the estimates may vary substantially from project to project. There are naturally opportunities for improvements and discussions are regularly held at R&D top management, but for the moment no such actions are at hand. In one of the projects the core team (material, machine and development) is assembled in a sort of project office fashion, which is a unique approach at R&D. The experiences from this cross-functional organisation have been very good since these groups traditionally are hard to bring together. On the other a hand, another project manager states, formation of such privileged groups also could lead to enhanced feeling of hierarchy and introversion within the project.

4.2.5 Project Quality Management

Quality is a highly priority matter for the project managers and this includes both quality in the products and high quality in the way of work. One of the project managers closely connects quality to risk management, thus stating that the quality work begins with the identification of the major project risks. In accordance to the identified risks a matrix is developed to find out what aspects influence what. This is regarded as a way to improve the quality on specifications and test procedures.

The line organisation does also a form of quality assurance on the project status by follow-up meetings with three months intervals. At these follow-ups the line managers have the opportunity to get information on the overall project status and contribute with advice and suggestions. This is also a way to avoid duplication of work. It is not merely the project manager who is responsible for the quality in the project; the line managers are equally accountable for the success of the projects as the project managers. This is an effect of the matrix structure at R&D and therefore such meetings are a prerequisite. On the other hand, quality is not seen as someone's specific responsibility – everybody is responsible for maintaining quality.

R&D are not certified and do not use quality plans in their work. There exists an old quality handbook, but this is neither used nor recently updated. One quality parameter that is important is to what extent the project plan is followed. This is also something that is very easy to measure and control. TPIN serves as informal quality assurance, but there do not exist a detailed quality plan or strategy in it. The product quality is much up to the different projects how they wish to work. Here the quality work is deeply embedded within the organisation, you could say that R&D has a strong history of development through trial and error and therefore a gut feeling for quality!

External audit is not widely used at R&D, simply put it has not been that culture. One of the newly appointed project managers says however that he is going to use external audit before every important tollgate. He says that this was one of his most important lessons learned during his former project. On request of the project manager a project revision can be held, but this is not commonly used. Sometimes there is a R&D audit that is performed but that consider both project and line and include a lot of different variables. Once a year a performance assessment is held that measures the project management effectiveness in using TPIN on different Tetra Pak companies.

A couple of times per year the project managers at R&D gathers to exchange experiences and to develop their best practise for project management. All the project managers regard this as a positive way for informal improvement. The feedback within the projects is more seldom held, but some of the project managers have occasions where the project group is gathered to reflect about what that is good and what that needs to be improved.

The local process owner for TPIN does for the moment drive an implementation of a decision structure for how projects are supposed to be initiated. This is merely a sort of best practise that includes measurement index for how well we work in accordance to the process. This structure should be well known among project managers and steer group members.

TPCA has developed a Quality Plan as an instrument for internal audit on management and organisation. The aim of the quality plan is to describe the organisation and the authorities and responsibilities within the project. It should contain a for the project relevant description of working methods that may be applied. A list of references to procedures and documents in the corporate quality system should also be included in order to enhance the ability to search for information. (Tetra Brik Packaging Systems Quality Procedure 1997).

4.2.6 Project Human Resources

The projects are organised approximately the same way as the R&D organisation chart. This consists of machine development, material development and package development. These different departments also serve the projects with team members in project core teams. The resource allocation to the projects are also managed from these line departments.

There is a corporate wish that Tetra Pak should develop its project management competence. There are several courses that Tetra Pak provide and there are many of those who work in the projects that have attended such courses. The project managers are also involved in the improvement of project management methodology and have regularly discussions with the process owner for TPIN. R&D have a local process owner who is responsible for the customisation to R&D conditions. The creation of a professional pride among project managers is something that is seen as important since the matrix structure at R&D is regarded as quite weak (thus, strong line).

The allocation of resources is always done from the line. The project manager can have wishes for suitable persons but it is the line manager who does the prioritisation and makes the end decision. This can be difficult for the project manager since corporate prioritisation can severely effect the accessibility to technical and human resources.

There are not so many formalised project roles within R&D; this is rather up to the different projects to decide. All projects has the same formalised structure with project manager, core-team and steer-group, but some projects has assigned more specified project roles. This could be for example project administrator or commercial manager with specified responsibilities. There are also great differences between the different projects to what degree authority and responsibilities are documented. R&D does not have a plan for conflict resolution, neither is it something that is missed. The policy are instead to deal with the conflicts that arise and not try to blunt them.

The extent of team-building activities in the project groups differs somewhat between the projects. One of the project core-groups is composed of persons stationed in different countries and therefore such activities are impossible.

Some of the projects have had several “get-together” activities while others have had none. Some projects have had project meetings on a place off-site, a sort of informal environment. The feeling of “being a team” also differs somewhat between the different projects. In most of the project core-teams there seems to be a strong project feeling, while other project members more seems to feel more belonging to the line organisation. One of the project managers state that it has been his conscious strive not to create too much team spirit since the project is to be handed over to another organisation.

The line organisation is responsible for competence development and the project managers do not interfere in this. In dialogue with the line manager a plan is developed how the individual should deepen its competence (what courses to attend etc.). Competence development is much up to each individual to plan and execute.

4.2.7 Project Communications Management

All project leaders state that communication always is an area for improvement. This can be due to the strong line tradition at R&D where it is hard to bring the different groups together. There can also arise cultural problems due to differences among organisations and/or countries. It is an established policy (part of TPIN) to work in accordance to a communication plan. This plan are supposed to be established in the early stage of the project and continuously revised during the process.

All projects have a communication plan, although they are made with different level of ambition. Some of the communication plans are merely two lines stating the project managers responsibility, others are more explicit in the definition. The communication plan is a mandatory input in TPIN.

The opinion differs greatly between the different project managers how to work with communication. Some state that the communication is good, but that there is a need to continuously work with the improvement of the internal communication. The communication within the core-team is mostly considered well-functioning, but the communication flow to lower levels are somewhat stemmed.

One project manager is very careful that no meetings are held just for the sake of the meeting. He states that the consequence of this is better work climate at the meetings since all knows that they get important information. It also has the positive effect that the meetings have good attendance.

Tetra Pak has formulated a Project Communication Guideline in order to support the project managers working within the Innovation Process with communication. Basically it consist of a methodology for how project

managers can develop their own communication strategy. This process begins with structured way to ask the questions:

*“...**why** are you informing and **who** are interested in **what** you have to say. Once clear on these points, you have a good basis for deciding **how** and **when** you’re going to do it.”*

(Maleus & Martin, 2001 TPIN).

In order to continuo improving communication skills one must always scrutinise the effort in order to recognise areas for improvements. Evaluation is therefore an important link in the communication process following the simple questions quoted above.

4.2.8 Project Risk Management

The risk management plan should be developed simultaneously as the project plan since these two aspects go hand in hand.

While performing risk analysis a bottom up approach are also made, so to speak that the sub-project managers first perform a risk analysis for their part. Then a general risk analysis for the project is performed with consideration of the overall risks. There exists several methods for this procedure, but there is no mandatory. The important issue is to extract the potential high risks, not how you do it. Something that could be useful is a good project risk software.

All risk analysis begins with a screening process where the most important risks are identified and highlighted. Among these the most important are identified and action plans are created. These action plans are then used in the planning process to identify Work Breakdown Structures. The corporate procedure for Risk Management include the following steps:

1. Preparation
2. Risk Identification
3. Risk Classification
4. Risk Assessment
5. Priority
6. Development of Risk Management Plan
7. Reassess risks
8. Continuing Risk Management

In addition to this the procedure of the management of risk is to develop thorough Risk Responses, preferably in a Risk Response Plan. This is however not a document that needs to be developed, the information is in fact more often contained in the Risk Management Plan. However the feeling when scrutinising projects are that most projects do not make such a vast Risk Management Assessment, and in those cases risk management could be described more like:

1. Identify risks
2. Reduce the risk to manageable level and
3. Eliminate them.

There is a need to use risk assessments both on a general project manager level and on the more specific line level. Risk management is something that all should be involved in to create conditions for good planning. The coordination of the different risk assessment into a general risk management plan needs to be done by the project manager, but the development of the plan must be done jointly. Risk is a highly important issue, but there seems to be difficulties in assessing all risk correctly. The prediction of risks in a development project is a very demanding task. The most important issue while dealing with risk is however to deal and communicate known risks instead of ignoring and constricting them.

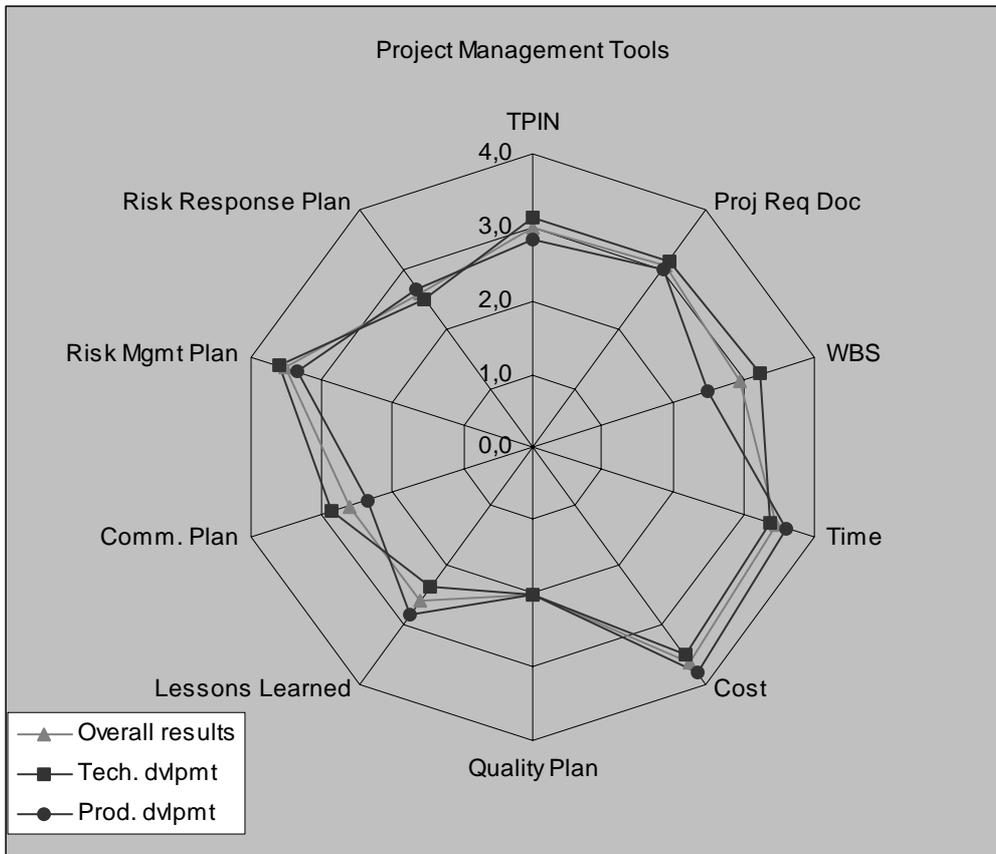
There do not exist a historical database for risk causes, but when lifting this question there seems to be point to established such a structure. The observed risks are documented and filed in the TPIN structure.

4.2.9 Summary and comparison

After performing the interviews and analysed the results a questionnaire was compiled. This had the same structure as above, but was approached in a new angle – the focus was on how the project managers work with learning and improvement within the above-described structure. In the following called Performance Assessment I intend to show the result from this study mainly in graphs and tables and some comments concerning these. In Appendix 3 you can find the questionnaire used for this study. The questions were graded from 1 to 4 where 1 denotes a negative answer and 4 denotes a very positive answer.

So far I have only looked at PD-projects, but since there are many TD projects that also is conducted at the company it is also interesting to do a comparison. In the graph 1 below the usage of a couple of common Project Management Tools is charted. The different tools correspond to the Project Management knowledge areas presented above.

As mentioned above TPIN is used in PD-projects as a forum for best practise and therefore the integrative aspect gets a bit less attendance. Most of the project managers however use the guidelines in TPIN and by that reducing the difference between the projects.



Graph 1: Usage of Project Management Tools at R&D

The graph use a grade system from 1 to 4, where four is the highest score and 1 is the lowest (for an better understanding of the variables see Appendix 3). Both TD and PD measure Time and Cost, but few have established a quality plan in order to assure that they use the correct metrics. As mentioned above Lessons learned is captured in some of the PD-projects, but this is less common in TD-projects. More Project Managers in TD-projects state that they have an up-dated communication plan than PD-projects. As good as all that has been asked say that they have an up-dated Risk Management Plan, however somewhat fewer have an up-dated Risk Response Plan

4.3 Organisational learning at R&D

In this study organisational learning is limited to concern Project Management only. The focus of the learning assessment should be to find rooms for improvement within the Project Management Methodology used at R&D. Below are some extract from interviews and further down the results of the assessment study done to identify organisational learning within the projects.

4.3.1 Learning within projects

One of the project managers has on a couple of occasions had a summary of lessons learned during the project. During these occasion the core team made an overview of the recent status compared to the planned status, what was good and what could be done in a better way. Then a gap analysis was performed and out of those action plans were developed in accordance to that. On the other hand, the project manager admits that they could be even better on this point, and says that you could actually ask your self every day were you need to improve!

One of the recently appointed project managers at R&D have experiences from a recently terminated project where a very ambitious “lessons learned” where performed. He states that he intend to use these “learnings” daily in his new project and he also wish to spread this as best practise at R&D. In order to enhance your own learning you must use “lessons learned” from day one in the project. He is also aware of the difficulties in implementing all learnings, due to the uniqueness of every project, but he will sincerely try. He have presented his experience of lessons learned for management at different companies and he thinks that the most important lesson is to show managers that there are nothing wrong about doing wrong as long as you learn from it!

The culture at Tetra Pak has earlier made such work difficult since most people don't find it amusing to admit that they have done something wrong. His presentations has also resulted in changes in project management training (a course that Tetra Pak provides for project managers) so that lessons learned is a part of the best practise methodology. It is also included in the course “Governing project for steering groups” so that all who work in contact with project management is aware of this. “Lessons learned” is also to be integrated into TPIN as a best practice for TD projects. In figure 16 an example of a lessons learned that was performed in a major development project that was terminated is described.

An example of how to use Lessons learned:

When it was decided to terminate all project activities it was also decided to continue with a thorough investigation of what that went wrong in a lessons learned.

This resulted in a structured report with analyses of both technical learning as well as organisational learning. All was done with the goal to share this information to other projects allowing them to take advantage from the learning, positive and negative ones.

The main learnings, being the root cause for the development of the project, was:

- Insufficient work in the project definition phase.
- Lack of quality assurance of provided date.
- Underestimation of the effect from the new packaging material into the total system.
- Mixing technical development in the product development phase.
- Organisational set up.

Figure 16: An example of lessons learned activities. (Provoost, Jan, 2003)

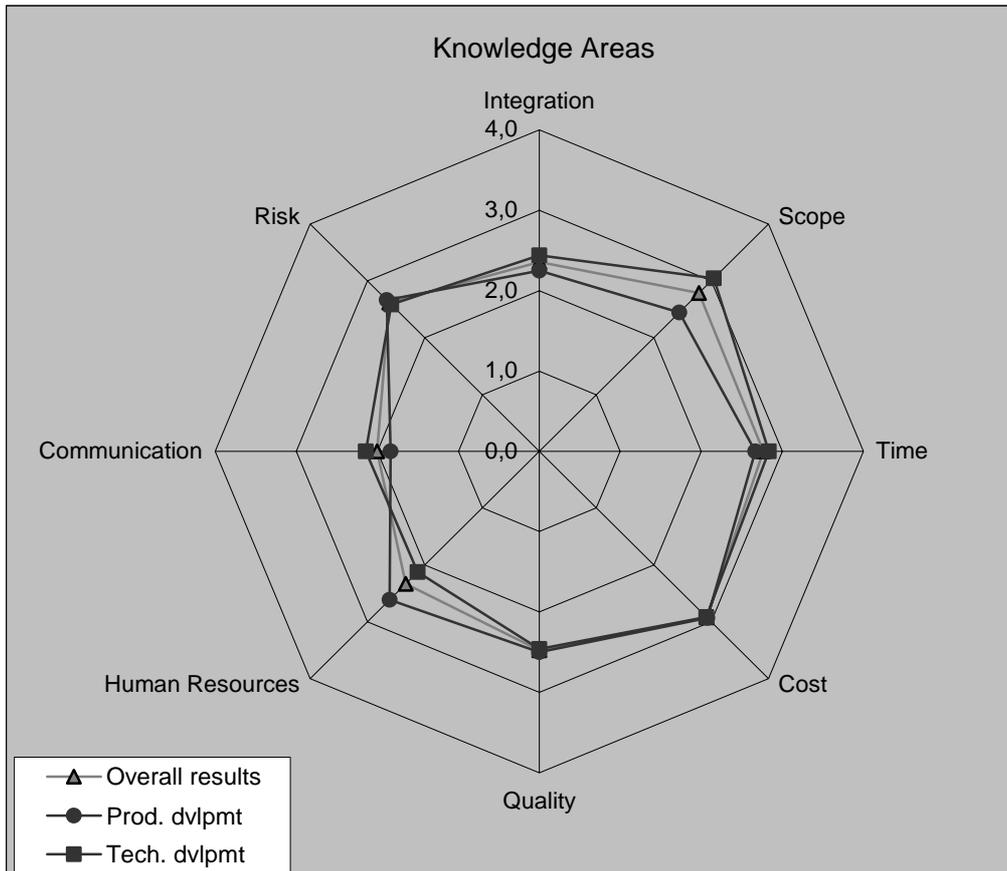
There are many people at R&D who has worked there a long time and this is of course an important source of knowledge, but sometimes it is difficult to know which persons that has competence and experience from different projects. This is due to that there is no skills database available at Tetra Pak. The documentation is also often insufficient and in those cases that it exists, it is not structured in the same way and therefore difficult to compare. Many times when you bring in persons with extensive experience there seems to be a lot of doubts whatever this new information is trustworthy. Often it is regarded as old, thus regarded as something that is not of present interest. You could say that there is a reluctance to take in diverging information.

4.3.2 An assessment study of organisational learning

The answers given are quite scattered, but a trend that is clearly visible is that the project managers in Technology Development (TD) projects give more positive answers than the project managers in Product Development (PD). Their mean results in each category is slightly lower in all areas except in Human Resources where TD give somewhat lower answers. In the areas for Cost, Quality and Risk both TD and PD ends up with the same results.

The knowledge area where PD projects managers consider themselves to be most weak in are Project Communication, where PD have a mean of 1,8 compared to 2,1 for TD-projects. One important aspect concerning an organisations ability to learn is the transfer of knowledge. There are however not many of the project managers who have worked in order to enhance the communication between projects. Neither do they have a plan for how to improve communication within the projects

TD project managers have more even results where their mean results for each category always is something between 2 and 3. In Graph 2 below you can see the mean results for each Project Management Knowledge Area:

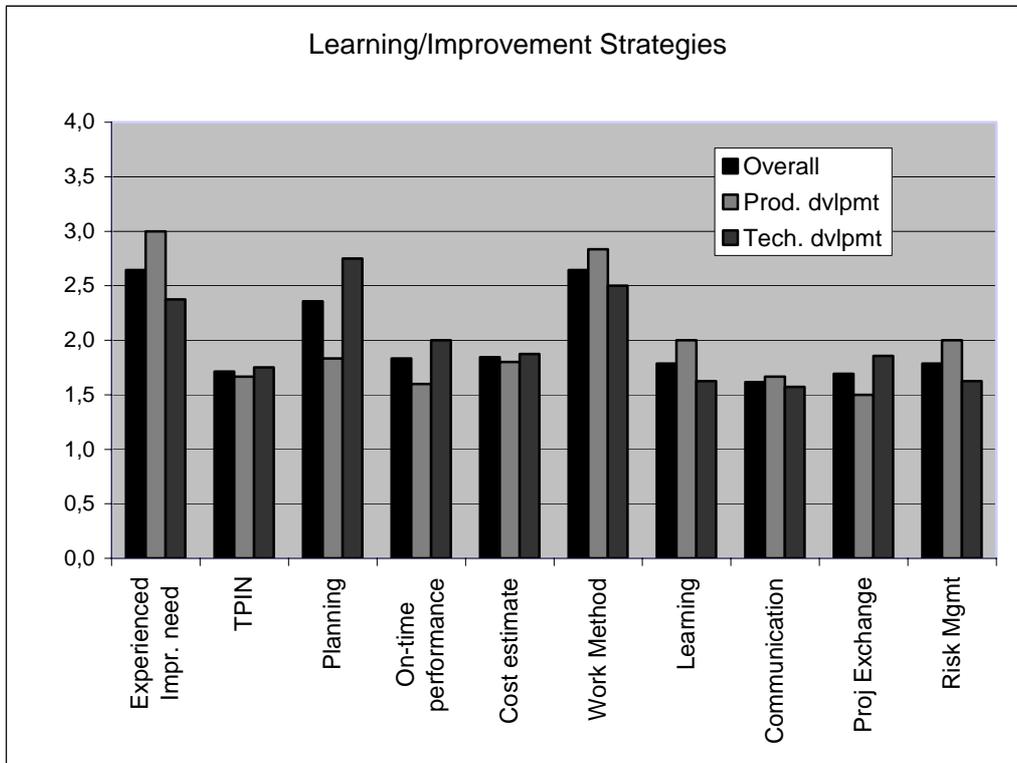


Graph 2: Mean results represented for each Project Management Knowledge Area

There are not particularly high scores in any of the areas. This is due to the low results in the questions regarding strategies for improvement (see graph 3). The best overall results are in the areas Cost and Time. Maybe this could be due to the high limits that I decided to use. In a future study the limits should be adjusted in order to reflect the variations more precisely.

As I have mentioned earlier the questions regarding strategies for improvement within the different Project Management knowledge areas where the questions that received the lowest ranks. This is a general trend overall the knowledge areas except the question that regarded the improvement of work methodology. Several of the project managers in PD-projects and a few of the TD-projects state that they have tried to enhance the quality of the way of

work. Several of the TD project managers have also implemented or tried to implement actions that improve of planning capabilities. Graph 3 illustrates the differences regarding trials to learn or improve:



Graph 3: Learning within projects and Improvement Strategies applied

The areas that received the lowest marks were improvement of learning, project exchange and improvement of TPIN usage. All the project managers in PD-projects and also many of the TD-projects have identified many or at least a few rooms for improvement. The discrepancy between the experienced need for improvement and the actual effort put in to improve is somewhat alarming.

5 ASSESSING THE PROJECT MANAGEMENT MATURITY MODEL ON R&D AND CONSEQUENCES FOR LEARNING ABILITIES WITHIN PROJECTS

This chapter deals with the problem how to use a theoretical model (like the PMMM) in a practical case. I have also used PMI:s structure to develop an own model which I have tried to use on an assessment of organisational learning in projects. The purpose of using the same structure is to create clarity in what purposes organisational learning could be used for.

5.1 Process orientation at Tetra Pak

The implementation of the process-oriented way of working is in progress. The organisation has been divided into eight core processes where I have only looked at the Innovation process. This is also one of the processes which have been fully implemented. In a R&D environment customers usually refers to internal customers such as market companies or TPCA to name a few.

The main advantage of organising R&D activities into processes is that it creates clarity when handing over projects to other organisations, since all work in the same standardised way (through the TPIN). It also adds clarity and efficiency in the Project Management methodology since all projects are managed in the same way, thus reducing complexity. In many projects there are people involved from outside R&D, which probably is easier in a process environment.

Whatever the culture has been altered at R&D due to process implementation is impossible to state, nor has it been the aim of this study. There seems though to be a very collaborative culture at R&D (it is of course very probable that this was the case even before the introduction of processes!). My impression is that the process owners add the clarity needed in order to help improving the process design, rather than creating conflicts in authority.

TPIN is used as a forum for best practise in project management and the various activities prescribed in TPIN are not mandatory. The project managers do only have responsibility to use it down to the second level, not the third detailed level. However, this enable great flexibility for the project managers, it is also a great risk that the best practise is not used. To give most effect of the cross-organisational usage of TPIN it should either be more mandatory or consist of fewer activities.

5.2 Project Management in Product Development projects

The presentation of Project Management at R&D given in the previous chapter combined with the description of PMMM in the theory gives the background for this PMMM assessment.

5.2.1 Project Integration Management

Through the TPIN all involved in projects have an illustrative description of the innovation process. Therefore the projects are clear and lucid to grasp and understand. The project plan is developed out of thorough information through a business case, but WBS is not used by all projects.

The TPIN contains all document that is relevant for the projects on a comprehensive level. The more detailed documentation is contained on the server. TPIN also serve as a forum for best practice at Tetra Pak, thus enabling development and continuous improvements. The process description also serves as an enabler so that all projects follow the same structure. All changes in project plan must be supported by a decision from the steering group. One of the three variables are on level 3, consequently Project Integration ends up on level 3.

Project Integration Management	Project Management Maturity level				
	1	2	3	4	5
Project Plan Development	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project Plan Execution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Change Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Transforming the R&D conditions into Cleland & Ireland's model of a Project Management System can be used to further identify blank spots, see figure 16:

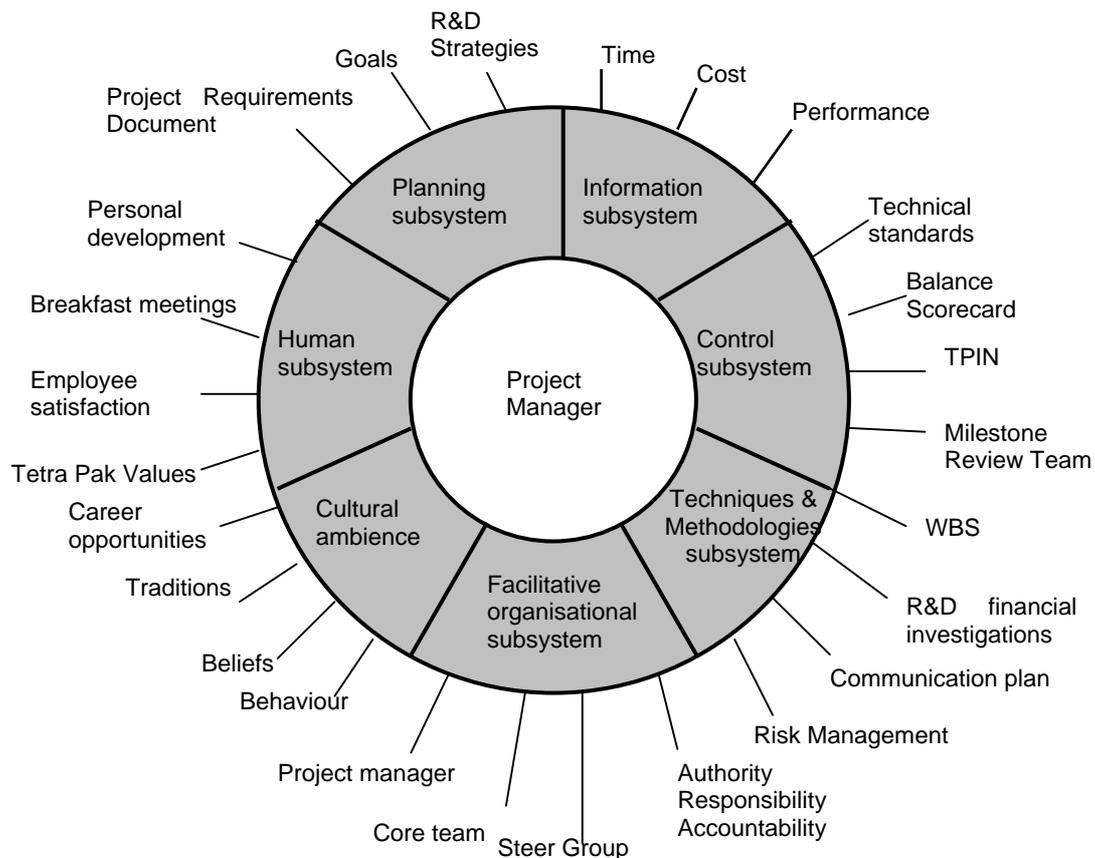


Figure 17: The Project Management System applied to Project Management at R&D

The right-hand side of the model contains factors that R&D manage well such as methods and performance measurements. The factors in the cultural ambience area are more hard to manage, such as traditions, beliefs and behaviour and there are no actual systems that cover these aspects. The idea is probably that the human subsystem should cover these issues, but from my point of view this is not the case. On the other hand the other areas are well covered and therefore R&D project integration is pretty good.

5.2.2 Project Scope Management

Today, in difference to the past, projects are based on business opportunities and not on technology. Market advisory groups (MAG) gives expertise in business knowledge and the business requirements are developed jointly by the Market Company, the project manager and the steering group.

The technical requirements are developed out of the conditions provided by the market investigation. There is no process for how to extract technical requirements since this is mostly done out of experience. Technical standards exist for the well-known technology areas.

Deliverables are identified in the project requirements document, which serve as the platform for the scope statement. The development of scope also involves the project charter and proper internal communication. In the scope statements all assumptions and demarcations known so far are documented. Changes in the project scope need to be supported by a steering group decision.

Work breakdown structures are not used in all projects. Many projects at R&D have problems to reach the deliverables in the project plan within time. Work breakdown structure is an invaluable tool for the planning process of projects and since it is not used by all Project Scope Management is at level 2.

Project Scope Management	Project Management Maturity level				
	1	2	3	4	5
Business requirements definition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Technical requirements definition	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deliverables identification	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scope definition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Work breakdown structure	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scope change control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The procedure of writing Project Requirements Document contains all specifications that Archibald considers important. However important the WBS is concerning planning, time and cost it does not have the same importance in the project scope statement. WBS does of course give a clarity among the issues that the project shall be dealing with. Further if WBS is developed on an early level it is easier to extend its extent further on in the project.

5.2.3 Project Time Management

Planning is mainly done out of experience and different methods are applied (no organisational planning standard). TPIN can help somewhat in the activity definition, but only on a generic project level. Planning and risk assessment is mostly done in a simultaneous fashion (in one case the risk assessment was the starting point for planning, which does not seem to be the most logical option). Schedules is created out of the joint process of planning and risk assessment. Since WBS is not used overall the ability to meet time lines in schedules is not as apt as it could be. Changes in schedules must be supported

by a steering group decision. R&D is at level 2 since two of the variables are on level 2.

Project Time Management	Project Management Maturity level				
	1	2	3	4	5
Activity definition	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Activity sequencing	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Schedule development	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Schedule control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Schedule integration	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

WBS is of course the most efficient tool in order to identify what activities that needs to be performed on a detailed level. On a more conceptual level TPIN serves as a good tool in order to secure that the right activities is carried out in the correct phase. In the following figure I have tried to assess R&D into a modified version of Cleland & Ireland’s project-phase model.

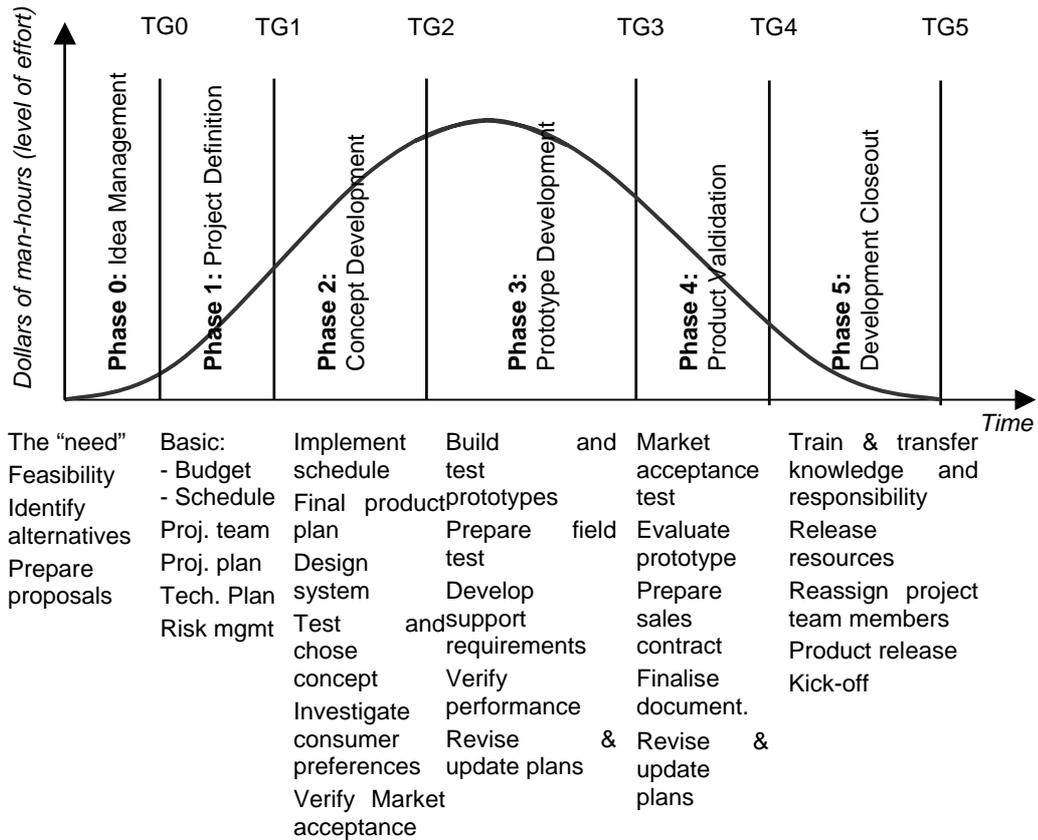


Figure 18: The project-phase model assessed to R&D’s conditions

Before a phase-transition a number of important inputs are provided and before leaving a phase a number of outputs should be delivered. This secures that the most important issues (the output of one phase is the input to the next) is done.

5.2.4 Project Cost Management

R&D:s budget is decided from Tetra Pak corporate level. Cost estimates for the budget are then developed in a bottom-up fashion with estimates from the line-departments and where the project manager has a co-ordinating role. Then it is up to R&D management to decide each project budget. The resource planning is connected with he ability to meet time line. Decisions to provide more resources to a project needs to be supported by a steering group decision. The project manager makes resource planning, no company specific process exists for this.

Since time also is money, the accuracy of time plans also effects the accuracy of the cost estimates. If the projects are delayed they will also be more expensive than planned and therefore the quality of the cost estimate cannot be better than the quality of the project planning. The project budgets are followed up once a month and compared with the original cost estimates. There are established cost baselines in line with the project schedule that the economy department measures from. Earned value analysis is not used as a performance measurement. Project Cost Management is at level 2.

Project Cost Management	Project Management Maturity level				
	1	2	3	4	5
Resource planning	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost estimating	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost budgeting	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Performance Measurement	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost control	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

There are several ways that R&D could use Earned Value Analysis to obtain better control over project funds. If the planning and WBS have enough accuracy and level of detail an EVA with 50% of the value obtained when an activity has been initiated and 50 % when it has been finished would suite R&D’s conditions best. This due to the rather lengthy time perspectives in development projects. In accordance to Archibald this would lead to a better overview of the projects’ financial performance.

5.2.5 Project Quality Management

The main quality assurance during project is the milestone reviews with clearly defined performance standards. Here a thorough investigation is made whatever the product delivers what it should deliver. There is no person at R&D who is responsible for quality assurance, but local process owners exist in order to improve process performance and implement change strategies.

R&D do not have a quality plan and it is not usual to perform project audits. Before phase transition there are however the Milestone Review Teams who scrutinise the project from a technical perspective. The MRT provide a recommendation to the Steer Group to proceed or not proceed (phase-transition or no phase-transition). The steer group is responsible that the products reach technical and commercial specifications. Before a phase transition the project defines the milestone requirements as an input to next phase. Two of the three variables are at level 3; thus Project Quality Management ends up at level 3.

Project Quality Management	Project Management Maturity level				
	1	2	3	4	5
Quality planning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality assurance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Quality control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The most forceful quality control instrument in use at R&D is the MRT which provide the Steer group with an impartial technical view of the problems in the project. An obvious limitation in R&D's quality assurance is the avoidance of project audits. Audits should be performed on a regular basis in all major projects in the organisation.

R&D measure the most common project capabilities: cost, time and technical performance. Even though the number of measurements (in accordance to Cleland & Ireland) should be kept to a minimum, there is a need to have a more structured system for measuring project performance. The requirements on the measurements are:

- Generic: Should be able to use during the entire development process and in all projects, both present and future.
- The project must establish a number of key areas on which measurements can be conducted.
- Integrated: Applied to the project the measurements should give a comprehensive view of how the project is going both compared to other projects and compared to historical data.

Further these measurements should be implemented into the day to day work in the project. The responsibilities for who that should use these measurements should be documented and distributed. This should be thoroughly documented in a quality plan. As the quotation at page 30 says: “Quality must be planned in!

5.2.6 Project Human Resources

Responsibilities and authorities are clearly defined and communicated throughout the organisation. The project organisation is clear and well functioning. The R&D mode of organisation with a rather weak matrix structure makes it well prepared to meet variations in workload as projects evolve over time. The line managers do all staffing to the projects.

Project management is a core competence area for Tetra Pak and much resource is spent trying to build up a corporate expertise in the area. There are several courses and a clearly defined competence career plan for how to develop in different project roles. There are however no development plan for the various project groups since all competence development are made from the line organisation. Teambuilding exist in various forms throughout the projects. Project Human Resources is at level 3 since three out of four of the variables are at level 3.

Project Human Resource Management	Project Management Maturity level				
	1	2	3	4	5
Organisational planning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Staff acquisition	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Team development	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Professional development	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

R&D is a very project focused company (even though a weak matrix in organisation) and there are great possibilities for those interested in project management as well as for technical specialists. In an organisation there can never be too much recognition of accomplishment and this is mainly a management responsibility. This is not something that I can measure in this study, but my main impression is that there is a very professional attitude towards these issues.

If there is something that R&D has a lot of it is experienced personnel; it is not unusual with staff that has worked 20 years or more in the company. Due to the specific technology at Tetra Pak (for example aseptic) there are core-competence that hardly is prevalent in any other company. There are also a lot of resources available in order to accomplish interesting projects. The five

headlines that are relevant in this context (according to Cleland & Ireland) applied to R&D could look like the following:

Information: On a regular basis project members are informed about general issues regarding the project on the so-called follow-up meetings for each project. Once a month there are breakfast meetings for the entire R&D, aiming at distributing important information that concerns all regarding projects or other general news.

Interaction: Since R&D is organised in a rather weak matrix there are in most cases a stronger feeling of belonging towards the line organisation than towards the projects. The project managers do sometimes have informal meetings where they discuss project management matters in general and R&D in particular. Something alike in the other parts of the project would be suiting.

Socialise: In most projects there have been various team-building activities. It is however important that such activities involve not merely core-team members but the projects as a whole. This can be difficult in the largest projects, but I think all project should strive in that direction.

Support: The supportive and facilitative functions are managed from the line. There are for example the personal development discussions and all responsibility for competence development is in the line. Maybe there are not time enough for the project manager to deal with such issues, but a good thing would be to have persons in the project who worked in a facilitative and supportive role.

Foster: In many cases the projects have been delayed (especially towards the original baseline) and the official explanation is that this is due to the uncertainties in the development process. This could of course also be due to that there are to low sense of urgency, perhaps nobody consider the baseline as an important issue.

5.2.7 Project Communication Management

Communication within the projects is formalised through the communication plans. In this it is included to do a project charter and stakeholder analysis in order to identify critical partners. Other official communication channels are the R&D website, the Breakfast meetings and TPIN. Internal communication within projects is managed through meetings and the TPIN. Other project material is contained at the server.

Once a while the project managers at R&D is gathered to informally discuss how to improve and to learn from each other. The project reports to the steering group. One of the variables are at level 4 and the rest is at level 3, thus Project Communication Management ends up at level 3.

	Project Management Maturity level				
	1	2	3	4	5
Project Communications Management					
Planning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information distribution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Performance reporting	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Issues tracking and Management	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Communication is considered as the weakest area among the project managers at R&D. This could be due to that there are no control system for communication, that is – you can never be sure that you have communicated effectively enough. A systematic approach to deal with this problem is to establish a Project Management Information System. In this the Communication Plan should have its place and also guidelines for updating and improvements. This system should also serve as a reminder that all information is available in order to make proper evaluation of cost, schedule and technical performance. This also simplifies other aspects such as:

- What information that is needed in order to manage the project.
- What policies that are needed in order to control and anticipate the information flow.
- How to evaluate gathered information.

5.2.8 Project Risk Management

The identification process for risks is an organisational standard, but the various projects do still use somewhat different approaches. Usually a bottom up approach is used where the project core team develops the risk analysis jointly. Out of this a risk management plan is developed and a risk response plan prepared.

Lessons learned is used in some projects, but it is more hard to tell whatever the result is used to improve risk management. Historical risk causes is not documented or used. Corporate guidelines for how to work with risk management exist as a best practice and templates also exist to simplify the process. Four of the variables is at level 3, but due to insufficient documentation Project Risk Management still is at level 2.

Project Risk Management	Project Management Maturity level				
	1	2	3	4	5
Risk identification	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risk qualification	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risk response development	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risk control	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risk documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In my assessment risk management got quite high figures while risk response got significantly lower. Risk response should preferably be a part of risk management and perhaps this is the case. By separating the two issues you can easily create confusion, but on the other hand it is also possible to shift the focus towards the risk responses, which is the most important issue. Applying Thelins’ model for a Risk Management Process on R&D conditions could look like in figure 18 below:

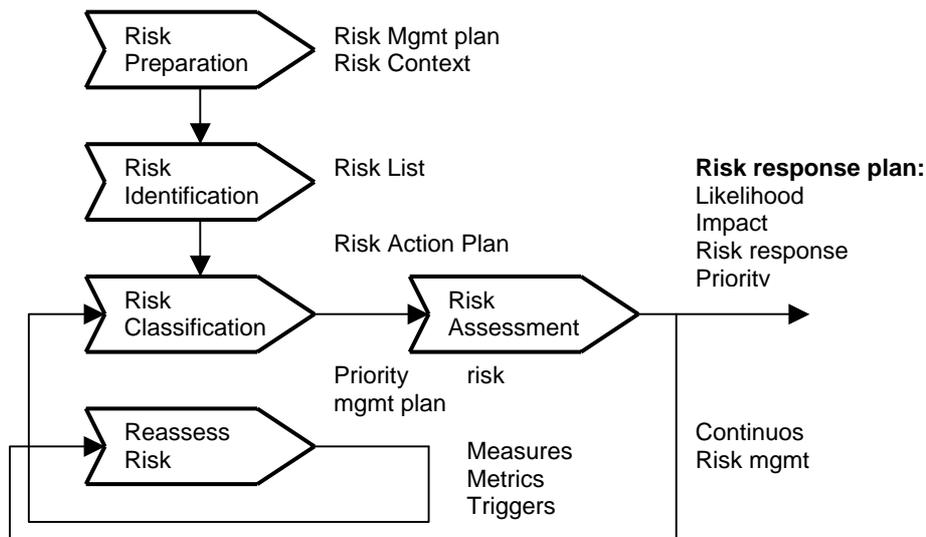


Figure 19: Applying a Risk Management process at R&D

It is obvious when applying R&D to Thelins’ model that the processes are equal even though they do have the same name for the various activities. When applied to the model, the Tetra Pak process receives some extra clarity. The most central parts in the risk assessment process are to identify the likelihood and impact of a potential risk. Then the risk should be prioritised and proper risk responses should be developed. These central aspects are contained in the risk response plan.

To summarise, the PMMM assessment end up R&D at level 2, since four out of the eight areas are at level 2. The other four are at level 3 and in chapter 6 I will reflect upon what R&D needs to do in order to reach this level.

5.3 Organisational learning and Project Management

Learning requires reflection. This involves both that kind of personal mastery that Senge describes and the organisations' ability for double-loop learning (Argyris & Schön, Probst & Büchel). Without reflection only single-loop learning exists, thus making it harder for change to occur.

Lessons-learned sessions are great opportunities for reflection and learning. Such a session enable for the participants not only to share their experiences in various knowledge areas, but also to reflect about their own behaviour. Sohmen states that organisational learning requires awareness and ambition to change in order to succeed. It is just as important (if not even more important) to lift up the mistakes done in a project as well as highlighting the successful parts. Both parts should have equally place on a lessons-learned session.

The purpose of having learning sessions is to improve performance. It is of outmost importance that the results of such a session is secured and transformed into concrete actions. If the lessons-learned session is merely seen as a waist of time, then it is doing more harm than good. What perspective or approach to apply (Probst & Büchel) does not have the same importance, the most important thing is to be aware of what difference it does and to make a deliberate choice. At R&D the focus could be either on either one of the four different approaches.

- The change towards being a process-oriented organisation requires a change of culture. This does of course require learning. Such a change can be helped by next approach:
- Developing a structure through developing TPIN to fit the organisational needs and to promote usage of this function also serve as a learning opportunity.
- The development of a well-defined strategy for how to improve Project Management both requires and results in learning. Senge highlights the importance of having a shared vision for how this could function in the future. In this case all must agree in how learning should be used to enhance the quality of Project Management.
- Developing human resources in Project Management both strengthen the organisations overall competence but do also ensure that all work with same methodology.

A change strategy can involve all above-mentioned approaches, but in order to succeed a clear focus of the goal must be highlighted. There seems to be an agreed sense of need for improvement among the Project Managers at R&D,

but there are however not so many that has initiated improvement strategies in order to fulfil this need. There are no strategies for any of the Project Management knowledge areas except for the category called “Work methodology”. Probably they refer to their feeling of security in the role as Project Manager and how they are dealing with different management issues. Having thought about it I can see no other option than to consider Work methodology as referring to the usage of the various project management tools. Thus if no improvement strategies are in place in those areas, no improvement strategy can exist on the work methodology, which therefore is a contradiction in answers. This kind of answers are however a most human behaviour. Perhaps this sort of question should be obliged with a qualitative answer – “what have you done?” Likewise almost all grades their work methodology as a 3, certainly an effect of that nobody wants to degrade themselves neither brag about their competence.

The statistics also provide some interesting analogies in the answer frequencies. TD project managers state that they have tried to improve quality and it is also they who are most successfully use WBS in their planning. A consequence of this should be that TD had better on-time performance than PD, but this has not been proven in this study. Controversially PD has slightly better accuracy in both time and cost.

Particularly weak results are the results in the areas risk and communication. Almost all do have a Risk Management Plan, but controversially fewer have developed Risk Response Plans in accordance to the identified risks. From an improvement point-of-view it is alarming that there are no strategies for how to learn to better do risk assessments in future projects. In addition to this, poor risk assessment contributes to less accurate time-schedules and cost-estimates and severely damaging the project credibility. A risk management plan without proper risk responses is like driving a car without wearing a seat belt.

6 CREATING TOTAL QUALITY IN PROJECT MANAGEMENT BY ORGANISATIONAL LEARNING

In this chapter I will do a backward loop towards the purpose stated in the beginning of this thesis. I intend to show what R&D needs to do in order to obtain Total Quality in Project Management. With Total Quality I refer to the definition of TQM given in the purpose statement. Further I use both the Project Management Model and the term of Organisational learning to propose potential improvement areas. Finally I present my recommendations to R&D in accordance to the previously discussed conclusions.

6.1 How to improve in Project Management Maturity

Improvement of Project Management Maturity level is not a goal in itself, it's merely the means for the actions that needs to be implemented. The purpose of improving maturity level is to make the project organisation more apt to anticipate and control larger development projects. A mature organisation deals with problems on a similar and effective way all over the organisation. Thus similarity is a keyword, as is effective work methods. I intend to present what work methods that is needed in order to reach a higher maturity level. The focus for R&D should however be what results that can be obtained by using these work methods.

One issue that I think need to be stressed (and that is visible among all project management knowledge area) is to even more develop the project managers. What I mean by this is not that they do not act professional, merely that the sense of pro-activity could be raised. This is to foresee potential problems and to deal with these through action plan even before they arises. Today this is done to some degree in some of the knowledge areas, but if R&D should develop its project management into an institutional process it is the organisational standards that must be established. This is the focus of this chapter (6.1).

Project Integration

The TPIN is a very good integrating tool for project managers all over Tetra Pak since it present a clear process for how to work in development/innovation projects. It does also serve as a forum for best practise in practically all project management knowledge areas and serve as a reminder for what activities that is needed in different phases in projects. In addition TPIN creates similarity in project structure which makes them easier to govern.

On the other hand it also contains a whole lot of things that probably is all the rage right but never is used at R&D. My opinion is that R&D should adapt a

version of TPIN to better suit the conditions at the company. An adapted version has several advantages:

- Enhanced clarity: It is easier to see what needs to be done since all activities are required.
- Enhance usage: Since all know that the activities are required they will also use them.
- Enhanced manageability: If all projects are similar in their information structure they will also be easier to monitor and compare.

In order to get better project integration the aim must be to join the projects more closely towards the organisational systems. The project plans should be integrated with the organisational strategic plan. The financial systems should be integrated, thus enabling the project plan to provide information to the corporate system.

The usage of WBS is a central aspect in many project management knowledge areas. By using WBS in the development of the project plan the process is made much easier. The performance measurements should be integrated with cost and times schedule and on an early stage provide information about deviations according to baselines. Something that surely is the corporate organisations' responsibility, but even though needs attention when building the project is what Cleland & Ireland calls cultural ambience. What this means is that the project should consider and be able to manage variables such as attitudes, traditions, beliefs and behaviours within the organisation. These are variables that exist "in the walls" and can be very difficult to alter, but probably the most important thing is awareness of this issue.

Project Scope

WBS is not used on a detailed level in all projects, which makes the development of project Scope more difficult. The usage of WBS enables the project manager to get a good overview of the project already on a very generic stage in the development process. The WBS should be developed jointly with the identification process of deliverables when constructing the project plan.

Constraints, assumptions and dependencies in activities concerning project scope should be documented in a way that makes them easy to monitor and manage throughout the project. At R&D assumptions are documented in the project scope, but I do not know to what degree these are monitored during the development process.

The project scope is important, not only as formalised start document, but as a roadmap to where the project should be going. Therefore the scope should be monitored on a regular basis and deviations should be carefully documented.

Such deviations should be used to develop and improve the standard templates for scoping.

Project Time

WBS should be used as the basis for scheduling when determining all project activities. When using WBS as the main tool for planning it is possible to predict what activities that need to be performed with a much better accuracy than an ad hoc method. Thus, with a better planning process the accuracy of time schedules is leveraged a great deal and therefore it saves money. With proper WBS technique it is also possible to define more detailed schedules and detailed activity definitions.

The process for activity definition should be formalised and properly documented so that is entirely repeatable. Activity templates should be integrated into the standard scheduling software system and by that reducing complexity and enhancing transparency. There should also exist templates for the creation of networks diagram, thus enabling to discover interrelated activities.

R&D should more actively collect and evaluate performance metrics to measure and analyse deviations according to the time schedule. If historical information should be deliberately summoned and analysed a ground for continuous improvements have been built. The historical data can provide important input to analyse and estimate project duration for similar activities. The project schedule should be developed in line with the project scope and in the same level of detail as the WBS. If schedule and cost were integrated in the same project management software, project performance would be easier to control and problems could more easily be anticipated.

Project Cost

In order to get full visibility of project cost, integrated solutions is always preferable. If the cost report system is integrated with other project management software and automatically uploading information many synergies is obtained within accuracy, visibility and cost awareness. Cost awareness should not be underestimated as a way of gaining understanding for various project decisions, thus worth the effort! In addition templates and organisational cost standards could enhance such parameters, as well as the efficiency in handling cost estimates.

Metrics for cost units is essential in order to be able to measure effectiveness and to propose changes. Correctly assessed, metrics can be used to find rooms for improvement and organisational difficulties.

Cost analysis for alternatives is developed and presented on a detailed and thoroughly documented level. If a historical database with comparable project

activities is developed there should be a possibility to compare and analyse cost alternatives.

Earned value analysis is an excellent tool to gain control over cost spending during the entire development process. The method for how to perform the EVA should be documented in and repeatable through a process description. An effective EVA requires a thoroughly developed project schedule with precisely defined project activities. If EVA is used on a large development project (that goes over several years) without all activities being properly identified, the proposed use of EVA will give totally misleading data and results.

Project Quality

Project quality concerns how the project organisation measure and analyse project quality capabilities. The first and most important is to establish metrics that give comparable results (thus measurable, past vs. future). Further the organisation must be able to handle these metrics correctly and therefore a quality plan should be established for the project. The quality plan should be a structured system that describes how project performance shall be measured within the project. It should have the following characteristics:

- **Generic:** In order to simplify the development R&D should have a template for the quality plan in order to preserve the same overall structure.
- **Identify key areas:** The project should identify the key areas in which they should perform quality assurance.
- **Integrated:** The quality plan should contain all measurements within all project management knowledge areas. By looking in the quality plan one should get a good grip the overall project.

Quality planning should be a standardised corporate process to ensure that it is done on a similar fashions overall the whole company. Within R&D a quality office should be established that co-ordinate and support the projects in their quality planning. One of their major responsibilities should be to secure that all quality procedures is thoroughly documented and implemented at R&D.

Project Human Resources

An action plan should be developed to manage all organisational, technical and interpersonal interfaces in the organisation. This also involves the aspects contained in figure 16: such as attitudes, traditions, motivation and behaviour. All potential reasons for conflicts should be mapped and conflict resolution plans should be developed in accordance to them.

Another aspect that is weak at R&D (at least with the Project Management Maturity Model in mind) is the staffing policy. Due to the weak matrix structure at the company the project has virtual no saying in what resources it will get (since staffing is managed from the line). A staffing plan where all potential requirements on the project resources is analysed and listed should be developed. After that is very important to secure that there is commitment by all project stakeholders (including line management) to the staffing plan.

Further a skills inventory database should be organised. This could then function as a resource pool that would help in the prioritisation process when project teams is selected and appointed. In accordance to this follow-up is essential and this could be done in resource variance reports where potential mismatches and competence gaps can be identified.

Further I believe that stress needs to be put on the team development process. Today all competence development is managed from the line, but this could be complemented with commitment from project management. From a project perspective the responsibilities lies more on team performance than on individuals, but all weaknesses should be known and managed. The project manager has responsibility that team member training needs are identified and communicated to the line organisation. The Project Manager should, on a regular basis, do performance evaluation of the individual contributor.

Project Communication

A project Communication Plan is the most central tool in order to structure and clarify how communication is to be performed within the project. In many of the projects at R&D there are Communication Plans in use, but they differ somewhat in level of ambition. There should exist a best practise methodology for how updating and refinement of communication plans should be conducted. In order to enhance communication within the projects opportunities for both formal and informal meetings should be encouraged.

Performance measurement (for example earned value) should be captured both formally and informally in order to better understand and analyse project performance. This could be done both within the project as well as on an organisational level. Trend analysis should be conducted on a regular basis in order to gain better control of changes over time.

Project Risk

When quantifying risk the accuracy could be enhanced by simultaneously approaching multiple criteria. The process of risk assessment should be fully documented and repeatable over time in the development process. The Risk Management plan should be up-dated on a regular basis to ensure that the project has thorough preparation in case of dire straits.

The process of obtaining proper Risk Responses should be documented and established as a best practise. I do not think that Risk Response should be separated from the Risk Management Process, but it is important to put a stress on the development of Risk Response, which is the most important factor in the assessment of risk. Thus the risk response development process would receive somewhat more importance if it was properly mapped and documented. Further, Risk responses should be directly linked and integrated with cost and time management since actions in accordance to risks certainly affect the schedule.

In order to reach better ability to predict risk causes common risk items should be collected into a historical risk database. It is important not to overdo such a database. The main problem that needs to be solved is how risk causes should be labelled in order to be searchable. It is also important to be able to deal with risk not merely within projects but also between projects and within organisation. This must be an organisational responsibility. Out of the organisational, technical and interpersonal interfaces that were identified under Project Human Resources a Risk Management Plan for these aspects should be constructed.

All these actions that have been presented above are all important and would need to be addressed with proper precautions. As in most cases however this identification is only the beginning. In order to establish what actions that is to be taken and how they are to be implemented something is missing. I believe that the construction element that is missing is the usage of organisational learning through lessons learned sessions.

6.2 Project Management and Organisational Learning

Using Senge's five elements as a cornerstone in the development of strategy for learning seems reasonable for me. These are aspects that can be regarded as sheer common sense, but used in a context they actually bring the framework together. In order to continually improve its Project Management Maturity level R&D should develop this framework in a fashion that suits their requirements. The solution I have chosen is composed in the manner that is described below.

One of Senge's five elements is team learning. An essential part is therefore to arrange opportunities for meetings within in the team. It is perhaps too much to call a mere collection of project managers as a team (that is just bringing people together is not enough), but effort should be put to intensify the sharing between them. The informal meetings that are held sometimes should be formalised with a specified interval, length and agenda. Each of these meetings should have a specific purpose or focus. Such could be each of the issues that have been detected in the knowledge areas discussed in the previous

chapter. When the purpose of the meeting has been established (and all has been briefed about it some time before the meeting) the aim should be at discovering actions to be set. In the context of the team it is essential to create a creative and collaborative meeting climate.

Such awareness comes out of the sort of approach that Senge calls Mental Models. That is to scrutinise all “truths” that is taken for granted and realise what is really needed. In this context the point of “learningful” conversations gets more clarity. At the improvement meetings it is essential to influence learning on each other through consistent adhered “lessons learned”. All team members should previous to the meeting have done an own lessons learned on their own project (within the subject of the meeting).

In order to make the concept of learning sessions work it is important that all is there of the same reasons, that they have a shared vision of what they want to accomplish. An example of such a vision could be to reach the fifth level in Project Management Maturity. If that seems to theoretic and distant more direct visions such as 100% on-time performances or 100% correlation with project cost estimate could be an alternative. Such a direct vision does also require many of the features that are contained in the concept of project management maturity.

Another aspect that is needed in order to succeed with the lessons-learned sessions is to secure Personal Mastery within the team. In other words it is important to make sure that the meetings creates withstanding improvements within the projects. This also involves discussion of actions that have not worked and a thorough analysis of why it did not work and what actions that are needed in order to succeed. Perhaps such discussions also can lead to better self-insight for the project managers, what they can do and what they can not. When such clarity is reached it is also easier to discover what resources/competence that is needed in the project in order to perform such activities.

System thinking is not something that is unique for organisational learning, it is a well known discipline used in many other research areas. The reason why Senge involves system thinking in this context is true learning require comprehension of the context. This is also something that is extremely important in Project Management since it involves so many different areas. The system thinking in this specific situation is learning how to improve the overall project maturity. With help of Prasads’ model I will try to figure out how, see figure 19 below:

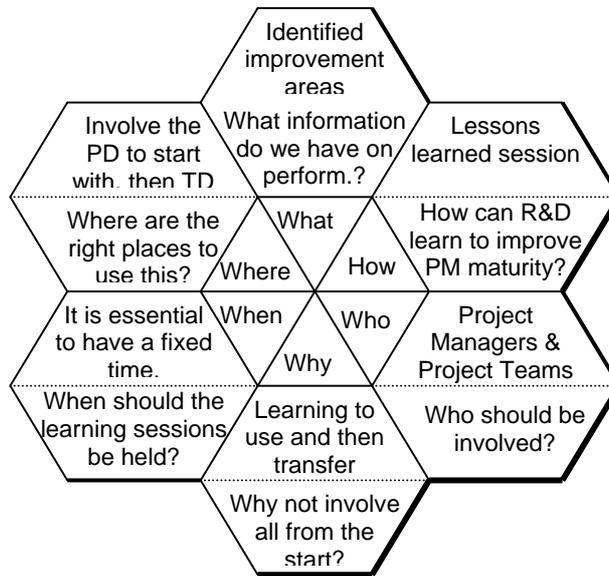


Figure 19: Applying Prasads’ model to Project Management Maturity improvement

What the figure tells us is (starting from the top going clock-wise direction) is that the start for actions always must be the identified need. This need must be supported by thorough information describing the problem. Then it lessons learned is collected from each of the projects by the project managers. These are then discussed and extracted to a shared declaration that can be transferred back to the projects.

The process can not stop by involving the project managers in lessons learned sessions, it is merely a starting point for improvement actions within the project. When it has been an established work method at Project Management level, then it is easy to spread within the projects.

The usage of measurements should not be limited to areas such as defects etc, it should be spread to encompass also issues such as how effective the improvement/change strategy have been. In order to do that it is important to identify measurable variables for the effectiveness of the change. For example extended usage of WBS:

In the end one measurable result should be better on-time performance and schedule coherence. Meanwhile other measurements could be for example number of projects using WBS down to the third level or number of activities registered in the project schedule.

Are there then any risks that this procedure only attacks the symptoms and not the problem itself? Of course this could be the case. When establishing a work procedure with improvement through learning some sort of double loop

procedure is preferable. My model for how to improve Project Management through Organisational Learning is presented in the following figure 20:

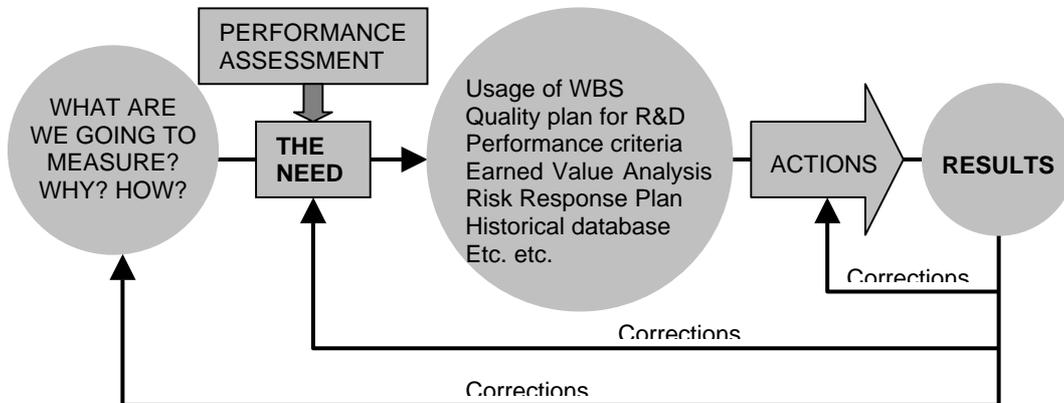


Figure 20: Using process learning to improve Project Performance.

My intention is that R&D should use the project performance instrument (see Appendix 2) that I have developed and used in this Masters' Thesis. Since it only has been used one time it needs correction on a detail level as well as on a comprehensive level. One of the more specific changes that is required is to change the limits on cost and time duration that I put too high (next time I recommend weeks as the unit instead of months). It is probable that R&D needs to change other more comprehensive issues such as structural questions and perhaps some of the content, this due to the fact that my performance Instrument have been designed in order to fit the purpose of this thesis.

Once the improvement areas have been identified lessons learned meetings should be held with discussions what that should be done. Then actions are been taken and the results are analysed. Finally corrective actions should be taken, both on single loop level as well as on double and process level. This involves questioning basically all aspects contained in the Performance Instrument.

6.3 Recommendations

I propose that R&D should take the following actions in order to obtain total quality in project management. If R&D wish to reach a higher level in project management maturity it need to implement actions in those areas that has been outlined in the analysis and the conclusions earlier described. Reaching a higher level in maturity is not the goal in itself, there are some of the actions that are more needed than other. But the problem is not what to do it is how it should be done. I recommend a method using formalised meetings (with specified duration: better few short meetings, than many long) where discussion is based on the project managers' results from their lessons learned efforts. The lessons

learned should be based on the identified need. The most important needs that I have discovered in this Thesis are:

- Work Breakdown Structure (WBS), which has effect on both project time, cost, scope and risk needs to be more widely used.
- TPIN should be adapted to the conditions prevalent at R&D. This could lead to enhanced usage as well as better manageability.
- Quality plans should be developed both at R&D as a whole and in the projects within the organisation.
- Enhanced monitoring of Project Scope.
- Introduce usage of Earned Value Analysis.
- A historical database for project time, cost, quality and risk.
- More specific process for measuring performance. Essential performance measurements should be identified and the usage should be standardised.
- Development of a skill inventory database that should enable to search for specific competence or experience from various projects or technology.
- Performance evaluation of the individual contributor.
- More specific template for the development of the communication plan.
- A more formalised way of obtaining risk responses should be developed.

When these actions have been implemented I recommend R&D to thoroughly analyse the results. Following these results corrective actions should be developed both on a detailed and on comprehensive level. When the project managers are sure of what the need in their project is the action and involvement in lessons-learned sessions needs to be spread down in the project organisation. Total quality is not a one-time effort occasion, it involves the continuous improvement held in a true learning organisation. It is therefore my recommendation to regularly measure and analyse project performance and to apply corrective actions in those areas.

The audit instrument that I have developed could serve as a start for this work. My recommendation is that R&D should use this to measure performance once every sixth-months period. Over time the content in the audit instrument could be changed in order to suite changing circumstances. The changes I propose are:

- Change the label from months to weeks on project cost and time deviation.
- Change the question concerning TPIN to be more general (it is quite specific denoting only the guidelines contained at TPIN).

Of course there could be more questions that are unsatisfactory from a content point of view, but this I hand over to R&D to decide and hence change if wished for!

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APPENDIX 1 - An overview of Project Management Maturity

Levels of Project Management Maturity	Level 1	Level 2	Level 3	Level 4	Level 5
	<i>Initial Process</i>	<i>Structured Process and Standards</i>	<i>Organisational Standards and Institutionalised Process</i>	<i>Managed Process</i>	<i>Optimised Process</i>
Project Integration Management	No established practices, standards, or Project Office. Work performed in ad hoc fashion.	Basic documented processes for project planning and reporting. Management only involved on high visible projects.	Project integration effort institutionalised with procedures and standards. Project Office beginning to integrate project data.	Process-standards are utilised by all projects and integrated with other corporate processes/systems. Decisions based on performance metrics.	Project Integration improvement procedures utilised. Lessons learned regularly examined and used to improve documented progresses.
Project Scope Management	General statement of business requirements. Little/no scope management or documentation. Management aware of key milestones only.	Basic scope management process in place. Scope management techniques regularly applied on larger, more visible projects.	Full project management process documented and utilised by most projects. Stakeholders actively participating in scope decisions.	Project management processes used on all projects. Project managed and evaluated in light of other projects.	Effectiveness and efficiency metrics drives project scope decisions by appropriate levels of management. Focus on high utilisation value.
Project Time Management	No established planning or scheduling standards. Lack of documentation makes it difficult to achieve repeatable project success.	Basic processes exists but not required for planning and scheduling. Standard scheduling approaches utilised for large visible projects.	Time management processes documented and utilised by most projects. Organisation wide integration includes inter-project dependencies.	Time management utilises historical data forecast future performance. Management decisions based on efficiency and effectiveness metrics.	Improvement procedures utilised for time management processes. Lessons learned are examined and used to improve documented processes.
Project Cost Management	No established practices or standards. Costs process documentation is ad hoc and individual project teams follow informal practices.	Processes exist for cost estimating, reporting, and performance measurement. Cost management processes are used for large visible projects.	Cost Processes are organisational standard and utilised by most projects. Costs are fully integrated into Project Office resource library.	Cost planning and tracking integrated with Project Office, financial, and human resources systems. Standards tied to corporate processes.	Lessons learned improve documents processes. Management actively uses efficiency and effectiveness metrics for decision-making.
Project Quality Management	No established project quality practices or standards. Management is	Basic organisational project quality policy has been adopted.	Quality process is well documented and an organisational standard.	All projects required to use quality planning standard processes. The	The quality process includes guidelines for feeding improvements back into the process.

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	considering how they should define “quality”.	Management encourages quality policy application on large, visible projects.	Management involved in quality oversight for most projects.	Project Office coordinates quality standards and assurance.	Metrics are key to product quality decisions.
Project Human Resource Management	No repeatable process applied to planning and staffing projects. Project teams are ad hoc. Human resource time and cost is not measured.	Repeatable process in place that defines how to plan and manage the human resources. Resource tracking for highly visible projects only.	Most projects follow established resource management process. Professional development program establishes project management career path.	Resource forecasts used for project planning and prioritisation. Project team performance measured and integrated with career development.	Process engages teams to document project lessons learned. Improvements are incorporated into human resources management process.
Project Communications Management	There is an ad hoc communications process in place whereby projects are expected to provide informal status to management.	Basic process is established. Large, highly visible projects follow the process and provide progress and provide progress reporting for triple constraints.	Active involvement by management for project performance reviews. Most projects are executing a formal project communication plan.	Communications management plan is required for all projects. Communications plans are integrated into corporate communications structure.	An improvement process is in place to continuously improve project communications management. Lessons learned are captured and incorporated.
Project Risk Management	No established practices or standards in place. Documentation is minimal and results are not shared. Risk response is reactive.	Processes are documented and utilised for large projects. Management consistently involved with risks on large, visible projects.	Risk management processes are utilised for most projects. Metrics is used to support risk decisions at the project and at the program levels.	Management is actively engaged in organisation-wide risk management. Risk systems are fully integrated with time, cost, and resource systems.	Improvement processes are utilised to ensure projects are continually measured against value-based performance metrics.

Source: Ingvaldson et al, 2003

APPENDIX 2: Question sheet for the PMMM- assessment

Project Integration Management

1. Hur uppstod ditt projekt? Vad var utgångspunkten (teknisk idé, marknad, strategi etc.)? Fanns det en kund redan från början eller när kom kunden in i bilden? Vilka anpassningar har gjorts för att tillfredsställa kundens krav?
2. På vilket sätt kommer projektet in som en del i R&D:s strategier?
3. Hur utarbetas projektspecifikationen? Vem gör det?
4. Vilka mätmetoder används för att säkerställa att projekten utförs enligt projektspecifikationen? Hur genomförs de? Vad används resultaten till?
5. Hur tar ni tillvara på misstag ni gör, det vill säga hur lär ni er att inte göra samma fel två gånger?
6. Har ni möjlighet att påverka din arbetsprocess, eller måste du följa TPIN?
7. På vilket sätt hjälper TPIN dig i ditt arbete? Hur underlättar det för övriga projektmedlemmar?

Project Scope Management

8. Hur bestämdes project scope för ditt projekt?
9. Finns det en tydlig baseline för projektet?
10. Finns det en TGO report?
11. Vem/vilka undersöker de marknadsmässiga förutsättningarna för projektet? (PL?) Finns det en färdig processbeskrivning av hur detta ska gå till?
12. Hur går det till när de tekniska kraven sätts? Finns det en standardprocess för detta? Finns det tekniska standarder på R&D som en utgångspunkt? TP standarder?
13. Hur säkras det att dessa uppnås? Vilka ”deliverables” finns? Hur identifieras dessa? Hur integreras nya deliverables (som upptäcks under projektets gång) i projektplanen?
14. Hur dokumenteras de antaganden och begränsningar som görs? Finns dessa samlade på ett ställe?
15. Hur går det till när projektets ”scope” (omfattning) sätts/bestäms? Förändras detta under projektets gång?
16. Hur går det till att göra WBS? Händer det ofta att det blir förändringar i tid och kostnad på grund av förändringar i WBS? Hur förankras sådana förändringar?
17. Har ni något system för att mäta effektiviteten i projekten, finns det något sådant i TPIN?

Project Time Management

18. Vilka kontrollsystem finns för att tidsramarna hålls?
19. Används WBS alltid för att bestämma projektaktiviteter? Hur definieras/beskrivs aktiviteter i projektspecifikation och tidsplan?

20. Finns det en process för hur detta går till och för hur det ska dokumenteras? Finns det historiska data att tillgå (för jämförelse i aktiviteter)?
21. Finns det andra projekt som ditt projekt är beroende av och projekt som är beroende av er? Hur hanteras denna koordinering och hur påverkar det era aktiviteter (sekvensering, beroenden etc.)?
22. På vilket sätt drar ni nytta av erfarenheter från försök etc gjorda av er i projektgruppen och av andra projekt i organisationen?
23. Finns det en plan för hur fördelar ska kunna uppnås och hur man ska mäta om de uppnåtts?
24. Görs det någon utomstående projektrevision?

Project Cost Management

25. Hur görs kostnadsestimaten, vad inkluderas? Hur ofta revideras dessa? Finns det ett standardtillvägagångssätt i organisationen? Finns det en strategi för hur estimaten ska kunna förbättras?
26. Finns det ett project office? Vilken funktion har detta?
27. Vilka system för kostnadsstyrning finns det? Hur redovisas kostnader (utbetalt, fakturerat, åtagande)?

Project Quality Management

28. Finns det en kvalitetsplan?
29. Hur arbetar ni för att uppnå bra kvalitet i projektet?
30. Finns det en Tetra Pak standard för kvalitetsstyrning av projekten? Finns det en kvalitetsplan? Finns det några andra standarder? Jag har hittat en kvalitetsstandard som TPCA använder, känner du till den eller något liknande?
31. Finns det några kvalitetskriterier i form av milestones?
32. PD gör konsument och tekniska test på förpackningar, men görs det någon annan kvalitetskontroll?
33. Hur tas det tillvara på feedback? Har ni några uppföljningsmöten för utvärdering etc? Hur ofta har ni utvärdering/återkopplingstillfällen?

Project Human Resources

34. Hur går rekryteringen till projekten till?
35. Finns det några specifika definierade projektroller (förutom för projektledaren)? Finns det en rekryteringsstrategi för hur vakanser fylls? Är dessa tydligt kommunicerade?
36. Är ansvar och befogenheter tydligt definierade för medlemmarna i teamet?
37. Finns det någon plan/process på Tetra Pak för hur konflikthantering ska skötas?
38. Finns det någon plan för kompetensutveckling inom projektteamet?
39. Har ni haft några team-building aktiviteter inom projektet? Hur upplevde du gensvaret på dessa?

40. Hur tycker du att team-känslan är inom gruppen? Känner medlemmarna större tillhörighet till linjen än till projektet?

Project Communications Management

41. Hur upplever du kommunikationen inom projektet?
42. Finns det en kommunikationsplan? Har denna reviderats/uppdaterats?
43. Följer du de guidelines som finns på TPIN?
44. Är kommunikation en återkommande punkt på dagordningen?
45. Hur kommuniceras resultaten? Görs det en analys av nuläge/börläge?
46. Hur kan kommunikationen bli bättre inom projektet?

Project Risk Management

47. Hur gör ni riskanalys? Vilka metoder används för att identifiera risker?
Finns det TP standarder?
48. Finns det en historisk databas för riskorsaker?
49. Hur mycket input är möjligt att få från andra projekt/TP-bolag?
50. Dokumenteras riskorsaker?
51. Vilka strategier finns för att hantera risksituationer som uppkommer?
52. Finns det en strategi för förbättring av riskanalys?

APPENDIX 3 – Performance assessment

Project Integration/TPIN	1	2	3	4
<i>Do you use the guidelines in TPIN as a help when working with projects?</i>				
1: No 2: To some extent 3: Mostly 4: Always				
<i>Do you have a plan for how to do this better?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
Project Scope	1	2	3	4
<i>Do you use a Project Requirements Document to define your project?</i>				
1: No 2: To some extent 3: Mostly 4: Always				
<i>Do you use a Work Breakdown Structure while planning?</i>				
1: No 2: To some extent 3: Mostly 4: Always				
<i>Have you evaluated how planning could be improved in the project?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Comments:</i>				
Project Time	1	2	3	4
<i>How much does your project deviate from the latest agreed baseline?</i>				
1: 12 months- 2: 6-12 months 3: 3-6 months 4: Less than 3 months				
<i>How much does your project deviate from the original timeplan?</i>				
1: 12 months- 2: 6-12 months 3: 3-6 months 4: Less than 3 months				
<i>Do you have a strategy for how to improve on-time performance?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Comments:</i>				
Project Cost	1	2	3	4
<i>How much does your cost estimate deviate from the latest agreed baseline?</i>				
1: 100%- 2: 50-100% 3: 10%-50% 4: Less than 10 %				
<i>How much does your project deviate from the original cost estimate?</i>				
1: 100%- 2: 50-100% 3: 10%-50% 4: Less than 10 %				
<i>Do you have a strategy for how to improve the accuracy of your cost estimates?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Comments:</i>				

Project Quality	1	2	3	4
<i>How do you perceive the quality of your work methodology?</i>				
1: Not so good 2: Quite good 3: Good 4: Very good				
<i>Have you evaluated how you could enhance the quality of the way of work?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Do you have a quality plan for your project?</i>				
1: No 2: No, but it could be useful 3: Tried to implement 4: Fully implemented				
<i>Comments:</i>				
Project Human Resources	1	2	3	4
<i>Have you used "lessons learned" as a work tool during the project?</i>				
1: No 2: Only before tollgate 3: I've tried to 4: Yes, continually				
<i>Have you evaluated how learning within the project could be improved?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Have you identified any rooms for improvements in your current project?</i>				
1: No 2: Some unpredicted 3: Many 3: A few				
<i>Comments:</i>				
Project Communication	1	2	3	4
<i>Have you communicated and documented these learnings?</i>				
1: No 2: To some extent 3: Mostly 4: Fully				
<i>Have you updated your communication plan?</i>				
1: I don't have a com. plan 2: No 3: I plan to do it 4: Recently updated				
<i>Do you have a plan for how communication can be improved in future projects?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Do you have a plan for how communication could be improved between projects?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Comments:</i>				
Project risk	1	2	3	4
<i>Have you updated your risk management plan?</i>				
1: I don't have a risk mgmt plan 2: No 3: I plan to do it 4: Recently updated				
<i>Have you updated your risk response plan?</i>				
1: I don't have a risk response plan 2: No 3: I plan to do it 4: Recently updated				
<i>Have you evaluated how risk management could be improved in future projects?</i>				
1: No 2: Yes, but not implemented 3: Tried to implement 4: Fully implemented				
<i>Comments:</i>				