MAKING A DIFFERENCE
Project Result Improvement in Organizations

Martin Andersson

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To my parents Inga-Britt and Karl-Hugo;

and to Sofia – my inspiration

What is the pattern which connects all the living creatures?

(Gregory Bateson, Mind and Nature, 1979)

PREFACE

This report is the result of a research project carried out at the Department of Information Management at the Economic Research Institute (EFI) at the Stockholm School of Economics.

This volume is submitted as a doctoral dissertation at the Stockholm School of Economics. As usual at the Economic Research Institute, the author has been entirely free to conduct and present his research in his own ways as an expression of his own ideas.

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Stockholm, December 2004

Filip Wijkström

Associate Professor, Director of the Economic Research Institute at the Stockholm School of Economics

Mats Lundeberg

Professor, Head of the Department of Information Management

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Göran Nilsson has contributed very concretely as a colleague during the empirical work. His comments have, on many occasions, helped me to see things in a new light. I also want to thank Lars Bengtsson, Johnny Lind, Camilla Niss, Lars Frimanson, and Mandar Dabhilakar for interesting discussions in the MTO project.

The people at the company I call Alpha made this thesis possible by letting me into the organization to work with the TTM-project. My experiences from Alpha have provided invaluable inspiration for my analysis and writing. I particularly want to thank "John Svensson", "Mark Olsson", "Tom Sundin", "Lars Envall", and the participants in the design team for their help and insights.

My colleagues at the Department of Information Management at the Stockholm School of Economics have influenced this work in many ways. I want to thank Anders Mårtensson, Christofer Tolis, Björn Thodenius, Pär Mårtensson, Magnus Mähring, Bo Sundgren, Magnus Bratt, Niklas Källberg, Kristina Nilsson, Pablo Valiente, Frank Ulbrich, Lasse Lychnell, Susanne Ohlin-Kjellberg and Ragnvald Sannes. I am grateful for the ideas you have contributed with during seminars and hallway discussions. I have found your questions about how different parts of the thesis are connected, and your encouragements to more clearly explain my points, to be particularly helpful in developing my ideas and the manuscript.

I am also grateful to several people who have commented on different parts on the thesis. Gösta Steneskog has provided valuable input from a process management perspective. Hans-Erik Nissen helped by commenting on the philosophical parts of the thesis. His experience in using Bateson's material and knowledge of alternative sources has helped me to put my work in perspective. Gordon Davis, Allen S. Lee, and Steven Alter have also commented on sections of my thesis. Their insights have helped me to see that there sometimes are reasons to go with the flow, and sometimes reasons to go my own way.

I have been supported by several people throughout the work with preparing the manuscript. The administrative staff at SSE has helped me with many practical issues. Paul Schreiber has helped me to improve my English and to improve readability.

I also want to thank my family for supporting me throughout my work. My father, Karl-Hugo, has contributed with his long experience from industrial projects and management in numerous discussions. I cannot thank my mother, Inga-Britt, enough. Your support has always been important to me. I appreciate everything you have done. You personalize caring, trust and enthusiasm; and have given me energy to work on the thesis. My brothers, Rickard and Lars, have contributed with many experiences of project management both in hobby and business settings.

My final and most profound acknowledgement goes to my beloved wife Sofia. We have enjoyed this tour together. You, more than anyone, understand why writing this thesis has been important to me; and have supported me fully. I have appreciated the valuable time we have spent, and look forward to forming our own family.

This list of acknowledgements is by no means complete. The weakest link throughout my work has been my capacity to make use of all the inspiration you have provided. I am grateful for all the support you have given me. The responsibility for all the shortcomings in the text rests with the author.

Stockholm in December 2004

Martin Andersson

CHAPTER OVERVIEW

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PART I: INTRODUCTION

This research is intended to provide inspiration for people who are interested in making a difference in project results in an organization. How can project results in project-intensive organizations be improved? Part I of the thesis involves introducing the study and the method used in the research process. The thesis is written from an information management perspective, which emphasizes the relevance of considering people, operations and information systems as a whole in business development. In the introductory chapter this perspective, in combination with theory about project management, business process management and improvement work, is suggested as one possibility for understanding the phenomenon in focus: project-intensive organizations. The research question and purposes of the study are then presented. The main purpose of the thesis is to develop a framework for project result improvement in organizations. Further, an overview of the structure of the thesis is provided; including alternative paths for exploring the contents of the thesis. The research method used to develop the framework concludes the first part. In this methodological discussion, the empirical, theoretical and philosophical foundations used to develop the framework are introduced.

1. INTRODUCTION TO THE STUDY

Project-intensive organizations are an important part of the business environment in the contemporary economy. There are many possible paths for developing knowledge about them. In this introductory chapter I will present the path taken in this study. I start with the perspective and theories used to understand the phenomenon. The research question and purposes of the study are then presented. Finally, an overview of how the thesis is organized will be provided, in companion with reading suggestions.

1.1. Improving project results

In many organizations, the project form of work is central to operations. In product development, software development, business development, industrial construction, etc., projects have become the dominant structure for action. Such organizations, where a central part of the operative work is carried out in the project form, are here referred to as project-intensive organizations.

This thesis is about how people in project-intensive organizations can work to improve the *results* of the projects they carry out.

In order to develop an understanding of what is involved, different perspectives can be used. The perspectives selected here will influence how the phenomenon is framed and understood. I will discuss project-intensive organizations from a perspective which highlights the importance of people, business operations and information systems in business development. This perspective is often taken in the discipline of information management (cf. Earl, 1989; Lundeberg, 1993).

In Figure 1, the approach I have taken is illustrated. The phenomenon in focus, project-intensive organizations, is framed from an information management perspective. These information management "lenses" will influence how I understand the phenomenon. I emphasize understanding of how people, operations and information systems contribute to project result improvement in project-intensive organizations.

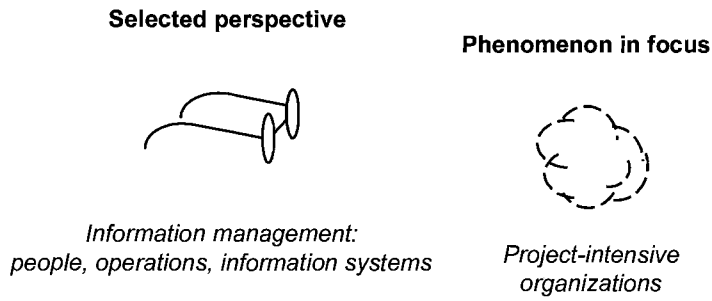

Figure 1. Selected perspective and described phenomenon in the study.

I will make use of theories from three areas: project management, business process management and improvement work. The intention behind selecting the three areas is to gather inspiration from partially different perspectives. Together these provide one combination that I find relevant for understanding project-intensive organizations.

The execution of individual projects influences project results. This is where "the rubber meets the road". Any particular situation in each project must be managed uniquely, which is demanding from a management point of view. Non-routine decisions are made in situations characterized by risk and uncertainty (cf. Gaddis, 1959).

If we take a step back from the individual projects, we can often find similarities, or recurring patterns, between projects in an organization. Not all activities seem to be "unique". General patterns in project work are often documented as project methods. This can for example be done in terms of phases such as initiation, implementation and termination (cf. Meredith & Mantel, 2000).

Management of recurring activities has specifically been studied in the business process management literature (cf. Steneskog, 1991; Davenport, 1993; Hammer & Champy, 1993). These theories can complement the traditional project management literature to further the understanding of project-intensive organizations. In this thesis, I will draw on streams of literature related to both project management and business process management.

An additional aspect highlighted in this thesis is improvement work. There is a rich literature available about organizational transformation and change management (cf. Greiner, 1967; Lundeberg, 1993). Improvement work is sometimes carried out in the project form (cf.

pirical data in development of knowledge can to a large extent also be directed towards the attempts to develop models for program and portfolio management, project based management, and capability maturity. There is a need for both fundamental theoretical structuring and empirical support for knowledge development related to project-intensive organizations.

Business process management literature is similar to the project management literature in that the initial literature was action-focused and directed towards practice. Several approaches were developed to support business process improvement and business process management initiatives (cf. Deming, 1986; Steneskog, 1991; Davenport 1993; Hammer & Champy, 1993; Rummler & Brache, 1995).

The spotlight in business process management was on cross-functional business processes. The recurring aspects of work processes were highlighted. Establishing the processes and the supporting information technology were important parts of the approach. The term "reengineering" emphasizes this focus on process and technology and the human aspects of process improvement were often forgotten (cf. Davenport & Stoddard, 1994).

Business process management is included here for its strength in focusing on recurring activities. It is also strong in its treatment of information technology as an enabler of improvement. Compared to the project management literature, it is, in my view, relatively stronger on recurring work and technology, but at least in its mainstream use relatively weaker on considering human aspects.

In the project management literature, ideas about critical success factors, project maturity and "excellence" similarly highlight the general patterns rather than the specifics of each project (cf. Belassi & Tukel, 1996; Turner, 1999; Westerveld, 2003). The standards provided by the Project Management Institute (PMI) and other similar organizations can also be described as emphasizing the general properties of projects rather than the unique. The idea of using general project methods is based on the assumption that general patterns in project execution can be found. This is similar to the way process descriptions are used within business process management. The description of an order process, for example, provides a general pattern, while the execution of the business process related to a specific order is unique.

The main focus in streams of research such as total quality management and business process reengineering has been on improvements rather than on the domain-specific properties of the operative work carried out in different types of processes (cf. Deming, 1986; Davenport, 1993). The business process management literature in general emphasized planned improvements (cf. Rummler & Brache, 1995). Other approaches to improvements downplay organized efforts. Instead, improvisational efforts are highlighted (cf. Orlikowski & Hofman, 1997).

The view I take on project-intensive organizations in this thesis is a combined view, where the unique aspects of projects are combined both with the general processes involved in the work as well as with the improvements that can influence the results in the projects.

1.3. Imagine the challenge

Let us now turn to an empirical sketch of some of the challenges involved in a project-intensive organization. The description is based on the organization "Alpha", from which the empirical material for this thesis is collected. The focus here is on the product development projects carried out in the organization. The methodological aspects of the research will be discussed in the next chapter. The full case description will be provided in chapter 3.

In Alpha, people are struggling to deliver flexible volumes of high quality components for mobile phones, a type of product where life-cycles are short. Each component is developed specifically for each new phone model.

In 1998, when this story begins, the growth of Alpha had been tremendous, going from an entrepreneurial spin-off within the "ComCorp group" in 1994, to a global player in its niche. Alpha supplied the largest and most successful mobile phone manufacturers with components. The largest customers valued the flexibility of the employees during the product development projects. The company was known for having high performance products, and high service levels in production. The entrepreneurial organization rendered large degrees of freedom. This also meant that a lot of responsibility was given to the employees.

However, from a perspective within the organization, there were several challenges.

The research question that has guided the writing of this thesis is:

- How can project results in project-intensive organizations be improved?

This has an important link to project management since the results depend on the way the specific projects are carried out. With the focus on project-intensive organizations I want to signal that the interest is not only on the individual projects but on how classes of similar projects are carried out.

The research question will be addressed within the thesis, but the specific purposes are narrower. In this thesis, the intention is to contribute with knowledge that is meaningful to both research and practice. One question is then how this can be achieved. What type of knowledge is purposeful to develop?

There are several theories available that can provide help to people interested in the research question, but the mapping of theories to practice is not straightforward. What theoretical help can we offer the people at Alpha and other similar organizations? An obvious answer is that there is an abundance of theory available. The selection provided in the introduction is only a tiny slice of possible sources of answers.

I have chosen to develop knowledge in the form of a "framework" for project result improvement. I will use the term framework to refer to a conceptual frame for making descriptions. This conceptual frame can be used when describing a phenomenon. My reason for choosing to develop a framework is that it provides enough substance to be helpful in practice, but does not prescribe specific solutions.

In my experience of change processes, one of the observations I have made is that structuring descriptions of phenomena often is problematic. Frameworks can help to structure the analysis (cf. Lundeberg, 1993; Alter, 1999). In the field of information management, the use of frameworks and modeling techniques has a long tradition as a means to support development work (cf. Nilsson, Tolis & Nellborn, 1999).

I will draw on several different theories, select constructs and relate them to each other in a focused way, particularly addressing improvements in project-intensive organizations. This has the advantage of combining different sources. It also makes it possible to communicate the results in a condensed way. A central challenge in this approach is to

consistently integrate concepts from different sources. This will be addressed by using a specific *theory structure* in the framework.

With this background, we can now present the main purpose of the study.

- The main purpose of this thesis is to develop a framework for project result improvement in organizations.

I call this the "PRIO framework", where PRIO is a short form for Project Result Improvement in Organizations. This conceptual structure is developed specifically to address the research question: how can project results in project-intensive organizations be improved?

In this thesis, I will show that the development of the framework can benefit from support from several foundations. Explicitly describing the foundations for the framework is important in order to establish rigor and transparency. Without explicit description of the foundations, the research results are difficult to evaluate.

In the following, I will introduce the three foundations that I will use to support the development of the framework: empirical foundations, theoretical foundations, and philosophical foundations. Each foundation contributes with partial insight into project result improvement.

I have organized the development of each foundation as a specific sub-purpose. Fulfilling the sub-purposes provides the foundations for the development of the framework, which in turn contributes to answering the research question.

Empirical foundations are important for several reasons. The empirical material provides a possibility to establish the practical relevance of the framework. The empirical material also contributes with concrete examples and descriptions of the phenomenon. Without reference to actual situations, a framework is just a complicated theoretical statement. In the empirical work, there is also a possibility to learn from the experiences of people who work in projects and try to improve results.

Theoretical foundations provide an opportunity to draw on earlier research. Prior studies can provide concepts and relationships. These can become a part of, or influence, the framework. Prior theories also provide a starting point for identifying areas where theoretical contributions are possible. Research findings are often influenced by the tradition in which the research has been conducted. By describing the

perspective from which the framework has been developed, it is possible to put the research contribution in its wider context and understand its background.

Philosophical foundations are important since they provide the assumptions underlying the study. Even with theoretically and empirically motivated results, there is still the question of how we can know that the framework is "true". What is the relationship between the framework and "reality"? In my view, philosophical foundations provide important assumptions which influence the theory development process. Describing these assumptions is then a way of increasing transparency.

By combining empirical foundations, theoretical foundations and philosophical foundations, support for the framework is gathered on three bases.

Developing the foundations form the three sub-purposes that I will work with in order to develop the framework. The three sub-purposes of the thesis are:

1. to describe project result improvement in an organization,
2. to explore theoretical sources of inspiration for project result improvement in organizations, and
3. to explicate fundamental assumptions about project result improvement in organizations

We can now summarize the research question and purposes (cf. Figure 3). The research question is: how can project results in project-intensive organizations be improved? In order to contribute to answering the research question, the primary purpose of the study is to develop a framework for project result improvement in organizations. In order to support the development of the framework, empirical, theoretical and philosophical foundations are developed. Specifically, the sub-purposes are 1) to describe project result improvement in an organization, 2) to explore theoretical sources of inspiration for project result improvement in organizations, and 3) to explicate fundamental assumptions about project result improvement in organizations.

Research question:
How can project results in project-intensive organizations be improved?

The main purpose...
is to develop a framework for project result improvement in organizations.

The sub-purposes are...

1. to describe project result improvement in an organization,
2. to explore theoretical sources of inspiration for project result improvement in organizations, and
3. to explicate fundamental assumptions about project result improvement in organizations.

Figure 3. Summary of research question and purposes.

The framework *contributes* to answering the research question rather than providing a complete answer. This relationship is intentional. The reason for not claiming to provide a complete answer to the question is that I believe that many perspectives can contribute to answering the question. I am only able to take a limited number of perspectives into account in this thesis.

The main contribution of the thesis lies in developing the framework based on the foundations which are developed within each sub-purpose. However, the sub-purposes are intended to provide partial contributions in themselves. Each sub-purpose provides a foundation that is relevant in the light of the research question. The empirical material investigated within sub-purpose 1 provides an example of an initiative aimed at project result improvement. The theories explored within sub-purpose 2 provide a background to understanding project result improvement. The fundamental assumptions explicated within sub-purpose 3 provide views for example related to knowledge, which is relevant in project result improvement.

1.5. Selected focus and delimitations

The selected focus of the thesis has been indicated in the introduction. In this section, I will briefly summarize the selected focus and discuss what alternatives I have excluded.

An initial focus is on *operative project results*. The results that are in focus are the results of the operative projects. This means that the financial results for the whole organization, for example, are not in focus. There are many ways to improve financial results without improving the ways in which projects are carried out. However, operative project results are likely to influence financial results in project-intensive organizations.

The method used to collect the empirical material for the study will be described in chapter 3. Since the data available for the analysis provides an important foundation, I will briefly characterize the empirical setting and point to some consequences for the study.

I have chosen to focus the empirical data in a setting in which *product development projects* are carried out. Product development is an important part of an organization since it is directed towards future revenue flows. The framework that is developed, is however, not limited to product development since the theoretical and philosophical foundations provide a wider scope. I view product development in Alpha as an example of project result improvement in a project-intensive organization. Nevertheless, this empirical delimitation should be considered when the use of the framework in different contexts is evaluated.

The study is focused on an empirical setting of *customized material component development*. The organization studied develops customized components for each customer. This can be contrasted with an organization acting as a systems integrator (cf. Shenhar, 2001). In such cases, the project work would probably be different, in the sense that a larger share of the work would involve integration of system components. Collaboration with suppliers is relevant in the studied case as well, but the developed components are relatively simple. If the products had been developed for a consumer mass-market, the process of selecting what projects to run would probably have been emphasized more. In the current case the customers initiated the projects. The described projects are similar to professional services projects in that the main resource used was people's time.

Since the phenomenon in focus is project-intensive organizations, I have included theory from other domains such as systems development when I have found it useful. The focus of the thesis is not on the operative work per se, but on improvements of operative work. This means that the most interesting parts of the case is related to change processes

rather than to the particular steps and activities carried out in the operative projects.

An important aspect in the work is that I have taken the perspective of the "improver". In the empirical case, I participated as a clinical researcher. This participation has influenced the empirical material I have collected regarding the project. Even though I have interviewed persons working in the process, there is a relatively stronger influence from the business development perspective.

The time period studied in the organization was a period of dynamic growth, interrupted by a downturn in the economy. The organization was entrepreneurial and the majority of the employees were young. These characteristics can be contrasted to organizations which work under more stable conditions and with a greater range in the ages of the employees.

1.6. Overview of thesis

There are many possible structures of the thesis that could be used to develop the framework. I have organized the text in four parts (cf. Figure 4): introduction, foundations, framework development and concluding remarks. In the following, I will introduce the chapters. I will then provide a brief comment about the contents of each chapter.

After the introduction and method (Part I, Introduction), the foundations for the development of the framework are presented (Part II, Foundations). I start with the concrete empirical foundations and continue with the theoretical and philosophical foundations. This chapter sequence is based on a structure which I have chosen based on readability. Following the foundations, the framework is developed (Part III, Framework development). Part IV, provides concluding remarks in the form of conclusions and an epilogue written in dialog form, based on the question *so what?*

Part I: **INTRODUCTION**	**Introduction to the study** (chapter 1)
	Research method (chapter 2)
Part II: **FOUNDATIONS**	**Empirical foundations** (chapter 3)
	Theoretical foundations (chapter 4)
	Philosophical foundations (chapter 5)
Part III: **FRAMEWORK DEVELOPMENT**	**Constructing the framework base** (chapter 6)
	Continued framework development (chapter 7)
	PRIO framework (chapter 8)
Part IV: **CONCLUDING REMARKS**	**Conclusions** (chapter 9)
	Epilogue – So what? (chapter 10)

Figure 4. Overview of thesis chapters.

Part I consists of the previous introduction and an overview of the area under study. The focus of chapter 2 will be on describing the selected research method and the main decisions made during the research process. This will involve describing how I have developed the foundations and how these have been used to develop the framework.

Part II provides the three foundations for the framework. These foundations are developed in chapters 3-5.

The empirical description developed from the Alpha case will be presented in chapter 3. The reason for starting with the empirical foundations is that it is the most concrete foundation for the development of the framework. Insights from the empirical material have also influenced the direction of the thesis.

The theoretical perspective taken in the study (information management) will be described in chapter 4, together with domain-specific

theories from project management, business process management and improvement work. After the presentation of the empirical material from chapter 3, the theoretical foundations provide a possibility to reflect on relationships between the selected theory and the empirical material. In chapter 4, I will, however, only sparingly comment on these relationships. The reason for waiting with my own comments is to try to preserve the three foundations for transparency. I will then add my integrating analysis after each foundation has been developed.

In chapter 5, the philosophical foundations will be developed. The philosophical foundations provide a possibility to reflect on the relationship between the empirical material, the selected theory and "reality". This involves discussing what is "real" and how can we know that a theory is "true". This chapter is a preparation for the analysis in that it describes a deeper level of assumptions that influence the understanding of both the empirical material and the theory. The specific theory structure that will be used in the development of the PRIO framework will also be described.

Part III explains the development of the framework for project result improvement in organizations. This involves three parts. The first is to construct the framework base. In chapter 6, I will draw on the foundations in selecting the constructs to use as the base. In chapter 7, the development of the framework continues, making use of the constructed base as well as drawing on each foundation.

In chapter 8, a summary of the PRIO-framework will be presented in a condensed form. For readers interested in the framework itself, this description provides a summary of the framework and a description of the key concepts. The chapter has been written in order to provide a text that can be read relatively separate from the rest of the thesis. Some main lines of thought are therefore summarized to provide a background to help interpret the framework.

A key principle in the development of the framework is to make use of the *zigzag theory structure* explicated in chapter 5 as the structure of the framework. This zigzag theory structure is mainly based on the work of Gregory Bateson (1972, 1979). The content of the framework is inspired by empirical material and domain-specific theory (chapters 3 and 4). The relationships between the selected concepts in the framework are based on the zigzag theory structure from the philosophical foundations. In

2. RESEARCH METHOD

In this chapter the focus is on the research method that is used to develop the PRIO framework. This framework is developed on three foundations: empirical, theoretical and philosophical. The foundations are briefly introduced in order to describe how they contribute to the development of the framework. The analytical method used in chapters 6-8 to develop the framework is also introduced.

2.1. Overview of research method

The main purpose of the thesis is to develop a framework for project result improvement in organizations. In the following, the method for achieving this end will be described and discussed.

2.1.1. Integrative research approach

In the philosophy of science, a general distinction is often made between positivist and interpretive positions, depending on the view taken towards knowledge and reality. Positivists often view reality as objectively given and believe it can be described in terms of properties that are independent of the observer. Interpretive traditions on the other hand often make the assumption that reality is socially constructed and only available to us via our interpretations (Lee, 1991).

From an interpretive perspective, questions about how it "actually is" become less relevant than in the positivist approach. Instead, understanding is highlighted. Interpretive approaches often use qualitative methods for collecting empirical material, whereas the positivist approaches often rely on quantitative approaches.

Lee (1991) argues that the differences between positivism and interpretivism are not irreconcilable. In this work I will balance between these approaches. My research approach can be described as integrative rather than positivist or interpretivist.

I believe that our reality is socially constructed (Berger & Luckmann, 1966). However, I also believe that there is a reality independent of the observer. If there are no observers, there are no social constructions, but reality itself still exists. My view is therefore not easily classified in terms of positivist or interpretive, but can be seen as combining parts from each view. I will develop my view on the relationship between knowledge and reality further in chapter 5.

2.1.2. Support from three foundations

The foundations for the PRIO framework have been developed over time in a calibrating fashion. The development can be described as abductive (cf. Bateson, 1979). This means that the theories I have used have influenced my understanding of the empirical material, and that the empirical material I encountered also has given rise to the use of new theories. This has also been the case in regards to the philosophical foundations. The development of the framework gave rise to questions that required philosophical support.

The importance of complementing the empirical and theoretical foundations with philosophical foundations is highlighted in the philosophy of science and research methodology. Often, the fundamental assumptions underlying science are not explicitly discussed. Research then runs the risk of being fundamentally irrational, failing to critique its ultimate foundations (Morgan, 1983). By describing these philosophical foundations I aim to make it possible to criticize the ultimate foundations of the framework.

A broad description of the research process is provided in Figure 5. I had a theoretical starting point in the information management field, and an interest in business process management when I started the research process. During the empirical work, I sought additional theoretical inspiration from project management and improvement work. I sought new theoretical inspiration to understand the same phenomenon, and then came to understand and appreciate other aspects of the phenomenon. This abductive relationship is indicated by arrow a) in Figure 5. In my analysis of the empirical data, I encountered questions that were philosophical in nature (cf. arrow b). Throughout my work, this type of abduction has been important. Further examples of abductive analytical processes are referred to in Table 1.

The framework development is built upon each foundation. The double-pointed arrows in the figure are intended to show that the relationships between the research focuses have been calibrated to each other. The development can also be seen in my publications during the research project (Andersson, 2000; 2002; 2003a; 2003b; 2004).

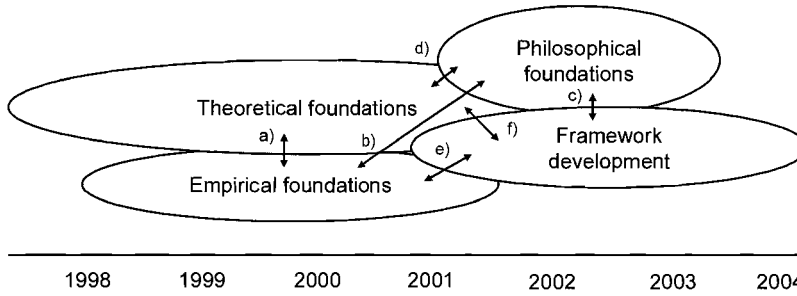

Figure 5. Overview of research focuses in the research process.

The reason I use the name abduction to refer to the relationships (arrows in Figure 5) is that each arrow represents a calibration of ideas in a wide sense. How can ideas from theoretical foundations and empirical foundations be connected? How can ideas from philosophical foundations and empirical foundations be connected? How can ideas from each foundation be connected in the PRIO framework? In framework development, I have built on each foundation, and described the patterns I have found. This type of reasoning has been very important during my work. In Table 1, I indicate areas in which abduction has influenced my work. The reference in the table is related to the arrows in Table 5.

Reference	Examples
a)	Findings in Alpha made me seek new theoretical inspiration (project management and improvement work). These new theories made me see the empirical material in a new light.
b)	I encountered empirical problems needing philosophical support. Philosophical insights gave me a new perspective on my empirical material (relationship between description and reality).
c)	Philosophical foundations were used in the development of the PRIO framework (theory structure and framework base).
d)	Philosophical foundations helped me to structure and relate theories to each other.
e)	Empirical foundations were an important anchor for developing the PRIO framework.
f)	Theoretical foundations provided inspiration and concepts to use in framework development.

Table 1. Examples of abductive processes in the research.

The overview of the research process describes my main focuses over time. From a methodological perspective it is also interesting to discuss the relationships between the foundations and the development of the PRIO framework.

In Figure 6 below, an overview of the foundations and the relationships to the framework development and PRIO framework is shown schematically. The final PRIO framework (shown at the top) is based on a process of framework development. The framework development is based on empirical and theoretical foundations, which in turn are based on philosophical foundations.

My view of the importance of the philosophical foundations has changed during the research process. In the beginning, my assumptions were implicit. When I worked with developing the framework, I realized that knowledge was likely to be a part of the framework in one way or another. This raises fundamental questions about knowledge. What is knowledge, and how does it influence action and results in the projects? I also started to consider change on a more fundamental level than I did initially. For me, this raised fundamental questions about what we *can* change, and ultimately about what exists.

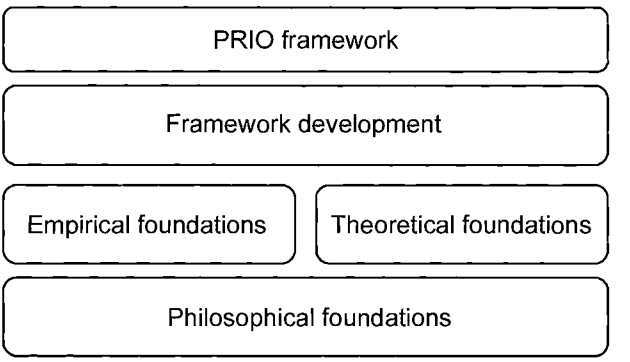

Figure 6. Schematic overview of the basis for the PRIO framework.

With Figure 6, I try to show that I view philosophical foundations as the base for both empirical description and theory, but that the relationship between empirical description and theory is not of the same type.

Explicit or implicit philosophical assumptions about reality are required in order to come to the conclusion that description and theory are at all possible. Once we have made these assumptions, what is seen as description and what is seen as theory, is in my view, relative. What is seen as "only" an empirical description by one researcher may include terms of high theoretical relevance for another researcher.

The theoretical foundations influence the empirical foundations and vice versa. What theories we bring forward influence how we understand the empirical material. What empirical material we have access to influence what theoretical foundations that are reasonable to use to understand the phenomenon. This will be further discussed in section 5.2.

The chapter sequence in this thesis (cf. Figure 4, p. 16) is chosen based on readability. In the presentation of the foundations for the framework, I start with the concrete empirical material and increase the level of abstraction gradually in the theoretical and philosophical foundations. The relationships in Figure 6 by contrast reflect a hierarchical structure in my reasoning (cf. Wilden, 1987). Even though the philosophical foundations sequentially are presented after the empirical and theoretical foundations, I see the philosophical foundations as an important base.

2.2. Foundations

I will start this section on foundations by presenting how I have collected the empirical material for the case study. The approach I have taken has been clinical (cf. Schein, 1987). In this approach a close collaboration with persons in the organization is emphasized. I have participated in an improvement project at an organization I call "Alpha". This improvement project was heavily influenced by a process improvement method called the Rummler-Brache method (RBG-method).

The experiences from my time at Alpha have influenced the direction of the thesis in important ways. The focus of my research question is one example.

The theoretical foundations will then be developed. This includes the information management perspective and the main theoretical areas I draw on. These are project management, business process management and improvement work. The process approach which influenced the change initiative in Alpha is complemented with further theory from project management and improvement work. One reason for this is that I do not think that business process management is sufficient to connect to the daily work in the projects. I also seek a broader understanding for improvements than offered in the process improvement methodology used.

I will then describe the lines of thought I have followed in the development of the philosophical foundations. The philosophical foundations have been developed over time with influences from both theory and empirical material. I will try to describe these interactions. Key parts of the philosophical foundations are related to knowledge, reality, action and theory structure. A central source of inspiration has been the work of Gregory Bateson (1972, 1979).

2.2.1. Empirical foundations

The empirical foundations in this thesis consist of a case description of an improvement project in one organization (Alpha). I have developed the case description based on active participation in an improvement project focusing on improving the results of the product development projects. The improvement project was facilitated by consultants who provided a process improvement method (Rummler-Brache) for the im-

provement work. The bulk of the empirical material was collected in the period of 1998-2001 with an additional follow-up in 2004.

Case study as a basis for empirical material

The purpose of the framework is to contribute to answering: how can project results in project-intensive organizations be improved? This focus makes it important to understand the processes involved. An understanding of the processes helps in interpreting the complexity of what is involved in project result improvement.

The reason for selecting qualitative case study material as the basis for the empirical foundations has been that it provides possibilities for developing a rich understanding of the phenomenon under study. The approach is often taken when social phenomena are studied (Morgan & Smircich, 1980; Yin, 1994). The interpretative approach is often associated with ethnography, hermeneutics, phenomenology and case studies (Lee, 1991).

I have chosen to conduct a single case study. The advantage with a single case study is that it is possible to gain deep insights in the case under study. On the other hand, there is no opportunity to make cross-case comparisons. Also, it is often argued that it is easier to generalize from several cases supporting the research. However, generalizing from one setting to another is based on assumptions that the theory will hold in the new situation. Increasing the number of cases studied does not guarantee that the results will hold in new settings (cf. Lee & Baskerville, 2003).

The choice I have made in this study is related to the advantage of gaining a deeper understanding for the case. It has been important for me to have access to detailed empirical material as a way of linking as closely as possible to the phenomenon studied. If I had studied several cases, the material gathered would have been less direct due to the restraint in available time.

Using a case study approach, I can select and integrate different theories in an abductive analytical process over time. This method supports an ongoing process of questioning theories and finding new theoretical inspiration. The new theoretical inspiration can then be tested in relation to the case. The selection of the areas of project management, business

process management and improvement work has been the result of such a process.

In the following, I will describe the approach I have taken in the development of the case description.

Selection of research site: Alpha

Alpha, a division within ComCorp, was chosen as the research site. In Alpha, I had the opportunity to participate in an improvement project in a project-intensive part of the organization: product development.

An advantage to selecting a case focused on product development is that this is an area where recurring projects are a part of the daily work. The improvement project was related to a project-intensive part of the organization. The focus of the project was on project result improvement. It was thus a good match compared to the research question and purposes of this thesis.

When the project started, I was working together with Göran Nilsson, a colleague from the Stockholm School of Economics, conducting a preliminary study of the production process for the production manager at Alpha. This gave us an entry point to an improvement project that was initiated within Alpha. We saw this as an interesting opportunity to understand the improvements from a perspective within the company. Göran Nilsson has published his findings from the study (Nilsson, G. 2003). In his work, he started from a management control perspective and focused on means of control for process orientation. Our different theoretical backgrounds complemented each other in our discussions about the case.

Our sponsor at the company during the improvement project and research project was the head of business development.

Active participation through clinical research

When developing a case description, there are different alternatives regarding how to collect the empirical material. Interviews, participant observation, ethnography and clinical research are some common alternatives.

I chose to participate actively in the improvements through a clinical research approach. This tradition is influenced by "action research" (cf.

Lewin, 1947). In clinical research, the researcher has an active and helping role in relation to the organization (Schein, 1987). With this relationship to persons in the organization, an understanding for the organization can be developed. The method is based on an assumption that:

> *...one cannot understand a human system without trying to change it.* The essential dynamics of the system are assumed to remain invisible to the *passive* observer. Only by becoming a member of the system and learning over a long period of time how it operates could the passive observer decipher it. (Schein, 1987, p. 29).

The research question addresses improvements. The clinical method is well suited for this type of situation. Other methods like participant observation or ethnography do not give the same type of knowledge. Of particular interest is the possibility to "test" ideas based on interactions with persons in the organization. Schein writes:

> In my own experience, it is the observed anomalies, blank looks in response to simple questions, defensive denials and counter-arguments, and various other kinds of emotional responses that occur in reaction to my own behavior that are the most valuable sources of insight into what is going on (Schein, 1987, p. 29).

However, Schein argues that the researcher should not be intentionally provocative since the purpose is to establish a helping relationship. The active interactions with persons in the organization are in the clinical perspective both a resource for theory development and a resource for testing the theory that is developed.

There is also another reason for my choice of a clinical approach, based on my own experience. When I started my research, and searched for an interesting subject, I conducted several brief studies in industrial organizations related to management control of business processes. The respondents I interviewed acted as a filter between my understanding and what "actually" happened in the organization. That is, I did not get a first-hand impression of the phenomenon. I found it difficult to separate between the statements made by the people I interviewed, and what actually went on in the organization. I found that this made it difficult to select theories from different areas. The description was already colored by the respondent's understanding. If I wanted to go "back to

the things themselves" and apply my own perspective, I needed to get behind the scenes.

The clinical method provides an opportunity in that the researcher can get an understanding and experience from an area that is difficult to get from passive observation.

A drawback of using a clinical method is that the involvement in the organization has a cost in terms of time. In my methodological decision, I chose to place a high value on the in-depth participation rather than on conducting several cases.

A further risk in clinical research arises if the researcher becomes too closely associated with the organization. In such relationships the ability of the researcher to critically reflect on the empirical material may be reduced. In this research, I have had time to reflect and partly distance myself from the case. My application of several theoretical areas is an indication of this reflection.

Involvement in the case

The characteristics of my participation have changed over time. Before the improvement project started, I studied problems and opportunities in the production process and product development process. During the first phase of the improvement project, I was a member of the design team. I participated in the implementation of the changes, and conducted an evaluation of the results.

As it turned out, at the end of the project there were many new people involved. Only a few of the people who contributed to the design of the process were still in the organization. The material I have collected is interesting in that it provides a continuity which few people in the organization had.

I had two roles during the project. A central part was to observe, document and analyze the change process. The other part was to actively contribute to the project work from my perspective.

When the project started, we reached an agreement with the head of Business Development who also was the project manager for the improvement project. The agreement was that we should particularly address two aspects during the project.

The first aspect was an assumption that it was important to view the product development and production processes as a whole rather than in isolation. This was partly a theoretical starting point, but also supported by our initial studies. A narrow focus on one process can lead to sub-optimizations. We believed that there would be an inclination to focus improvements within a function, or narrowly defined process, rather than attempting to solve the more difficult problems of integration between departments or processes.

The second aspect that I believed was important was to address people, operations and information systems in integration. I believed that it would be fruitful to work with the whole of these three parts rather than to focus on one or two. For example, a common problem in change work is to implement information systems without giving enough attention to the people who will work with the technology. New work processes often require new IT-support (Davenport, 1993). Explicit consideration of the links can increase the chances that the process and IT support work well together (Lundeberg, 1993).

In regard to the two aspects, it is probably fair to say that Göran Nilsson was the strongest advocate for the integration between functions whereas I had a relatively stronger emphasis on the importance of addressing people, operations and information systems.

In the case presentation, I have chosen to place myself in an observing position, rather than clearly describing the case from my perspective. In Van Maanen's terms, it is a "realist tale of the field" (Van Maanen, 1988). I have selected this type of case presentation since I think it is the most accepted type of presentation within the Information Management field.

The main parts of my involvement in the case are shown schematically in Figure 7.

In 1998, we conducted interviews with 27 persons from different parts of the organization in preliminary studies of production and product development. These processes were later called the Time-To-Customer (TTC) and Time-To-Market (TTM) processes.

The improvement project carried out at Alpha was initiated by the head of business development. He selected the consultancy Rummler-Brache Group (RBG) to assist in the improvements.

The product development process (TTM) in Alpha was selected as critical for the business. This process preceded the production process (TTC). The improvement project was called the TTM project.

A cross-functional team with 13 members worked in designing the new process. About 40 persons were actively involved in the implementation of the process. One of the main tasks in the introduction of the new process was the implementation of a document management and product data management system. I participated in the team responsible for the information infrastructure and the development of a measurement system for the process.

We conducted an evaluation during the spring of 2001. We interviewed 19 persons working with the TTM-process and in the product development projects. The primary purpose of the evaluation was to see if the TTM goals had been reached.

In 2004, I conducted follow up-interviews with four of the people who continued to improve the process. The purpose was to describe the continued improvements of the process, and listen to reflections on the change initiative.

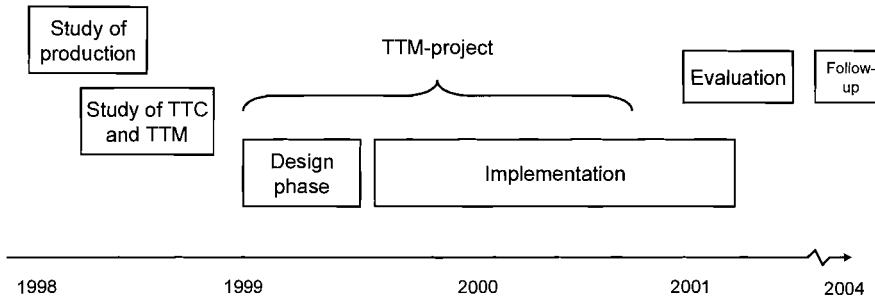

Figure 7. Collection of empirical material.

I have decided to present the case in chronological order, rather than in some pre-structured form. This is a matter of degree, since I have used my own perspective when interpreting the situation in Alpha. I have been inspired by many theories during the data collection. By presenting the case with little explicit theoretical structuring, I hope to be able to show how the framework that I develop during the analysis is related to the case description. If I added theoretical structure already to the

empirical data, the transparency of the analysis could be negatively affected.

Anonymous organization

I have chosen to keep the name of the organization anonymous. The reason for this is that I want to be able to describe the project as closely as possible to my understanding of it. When one is involved as a team member in a change project, many issues that normally would not be talked about surface.

When the project started, we agreed that the contact persons would have the right to review any material that was to be published if the name of the organization would be mentioned, but that I had the option to publish my own interpretations of it if the name was not mentioned.

I have presented the empirical description for the TTM-process owner in order to evaluate my description of the change initiative from the perspective of a person who participated in the project from the start and who worked with continuous improvements after the project was finished. His reaction was that it was described well in the case.

Sources of empirical material

I have used several different sources for empirical material and several different means of collecting the material.

I have conducted interviews with people from Alpha. The interviews have, for the most part, been carried out together with my research colleague. While collecting data, before and after the TTM project, the interviews were taped. We also made notes during the interviews.

The taped interviews were summarized in a 61 page document. This provided a summarized index that made it easier to find the empirical material on the tapes during the analysis. Sections in the document were color coded in order to highlight parts of the interviews that I found relevant to the thesis. These sections were then more closely studied.

In cases where I have used quotations in the empirical description, these have for the most part been translated from the tapes. In most cases I have simplified the quotes by removing pauses, words and sentences that I found made the quotes longer and more difficult to read without adding sufficient value to the meaning of the quote. A few quotations

have been provided from my meeting notes or from vivid memories of the scene in which it was said.

During the TTM project most of the data material was gathered in less controlled forms, such as in internal meetings, workshops and company conferences. During the design phase and implementation of the process, a lot of the work was carried out at conference facilities where informal discussions were a natural part of the work.

I have had access to written documentation, financial statements, quality documentation, customer surveys, employee surveys, etc. Press clippings have been used to get a perspective on how the company was portrayed in the media.

Further, an important source of information has been hallway discussions and informal meetings during my time in the organization. During these meetings, some of the most interesting, and provocative, statements were made. These informal meetings particularly provided insights into relationships between groups and persons in the organization.

In qualitative studies the idea of triangulation is often used as a means to improve the quality of the research (cf. Yin, 1994; Maxwell, 1996). Denzin (1989) distinguishes between four types of triangulation. These are data triangulation, investigator triangulation, theory triangulation and methodological triangulation.

Data triangulation is used here by collecting data through several means. Since I worked together with a research colleague, investigator triangulation was also achieved. Theory triangulation is used in the sense that theory from several areas is used. Methodological triangulation is used by combining empirical, theoretical and philosophical foundations as a basis for the framework. The analysis of the relationship between theory and empirical data is complemented with a philosophical analysis of the relationship between theory and reality.

Strengths and weaknesses of the empirical material

A strength of the case is that it provides insight into an organization that works with short product life-cycles in a dynamic market. More and more product development is likely to be done in this type of setting.

The Alpha case can provide insight into a type of situation that many organizations are likely to encounter.

The clinical method used for data collection provided many opportunities to discuss our interpretations with people in the organization. We also reported our findings to the production manager, manager of business development, and the TTM-process owner. Further, we made a presentation to the management team when the TTM project was evaluated. This provides strength from a methodological point of view in that the empirical material has been tested in different situations within the organization during the research process.

I also had the opportunity to discuss my interpretations of the situation in Alpha with my research colleague. This has been an advantage since it has given me variety in what theories to use. By becoming aware of different alternatives, I could more clearly see what theories I used without reflection. This has contributed to more varied interpretations than if I had conducted the work alone. Göran Nilsson could also provide valuable experience since he had previously worked in a similar organization.

A weakness with the case is that a project-intensive *part* of an organization is studied. The product development projects include a ramp-up in production, but do not include the operative production process. There may be differences between the case and an organization where the project results represent the final activities within the business firm. For example, a consulting firm that only works with development activities might be different from a company that includes production (or implementation). On the other hand, it can also be seen as a strength that it is possible to see not only results of the project, but also effects of the projects in the organization.

2.2.2. Theoretical foundations

Scientific inquiries can be guided by different perspectives. The choice of perspective is important since it influences what is highlighted and what is left in the background. By being open to new perspectives, we can see things in a new light. In my view this is an important part of knowledge development. New ideas and explanations can be the results when different perspectives guide our understanding of phenomena (cf. Bateson, 1979).

By being explicit about the perspective used, it is possible for the reader to see from what perspective the framework is developed. With explicit description of the perspective, it is easier to evaluate the value that is added by the selected perspective.

If a "project perspective" is used to understand the execution of a project, the difference between the perspective and the description of the phenomenon may be small. By viewing projects from a new perspective, alternative views of the same phenomenon are provided. In this thesis the information management perspective will guide the analysis. By taking this perspective the theory that is developed here takes on a somewhat new direction.

The relationship between perspective and phenomenon is relative and the choice is personal. In my view, there is no objective way of deciding on what is what. In the first section, I will try to explicate my basic perspective in order to make it easier to see where I have taken my starting point. I will then present selected theoretical areas which I believe can contribute to the understanding of project result improvement.

Perspective: information management

This thesis is written from an information management perspective. The information management discipline has traditionally had a strong focus on development work. The discipline can be described as a special type of business development, emphasizing persons, business operations and information systems (cf. Lundeberg & Sundgren, 1996).

The academic discipline of information management provides a perspective which is closer to business development than what is common in related disciplines such as information systems, management information systems, management of information systems and informatics.

The initial focus was on information systems as technical artifacts. This was later complemented with theory emphasizing analysis of information requirements and business operations (Lundeberg & Andersen, 1974; Lundeberg, Goldkuhl & Nilsson, 1978). Another theoretical development was related to further understanding the persons that used the systems to support the business operations (Lundeberg, 1993).

The information management perspective is the frame I use to describe reality on a high level. This has consequences for how I understand the phenomenon of project-intensive organizations.

Projects, processes and improvements

I have delimited the domain specific theories used in the analysis to a few areas which I have found especially central for improving results in project-intensive organizations. I use the names "project management", "business process management" and "improvement work" to refer to these areas. In this study, I will make use of theory from the information management perspective and combine it with theory related to project management, business process management and improvement work.

Project management theory has been selected since it is directly related to how the phenomenon is described. The projects carried out at Alpha were inspired by project management theory. I have chosen mainly to use theories from the general project management field rather than from product development. The reason for this is that I am interested in project-intensive organizations in a general sense. I use the case at Alpha as an empirical example.

Business process management is typically focused on general properties of processes rather than on the specifics of each execution. This provides a possibility to leave the single-project focus, which is often put forward in the project management theory. My use of business process management is supported by the fact that the people in Alpha were influenced by both project management and business process management theories.

Further, more general theories about improvement work will be put forward. These are relevant to understand the improvement processes involved.

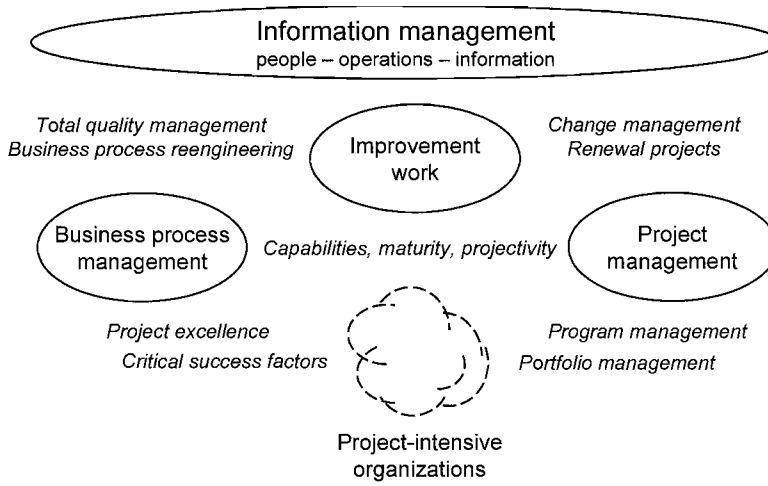

Figure 8. Examples of theory used in the thesis.

In Figure 8 above, the information management perspective and theories used are described as related to the phenomenon of project-intensive organizations. The intention with the figure is to show that the information management perspective is "above" the theoretical perspectives. That is, the information management perspective influences my interpretation of project management, process management and improvement work.

My interpretations of the theories influence my view of the phenomenon as a project-intensive organization. With other perspectives and theories, the same phenomenon could have been described in other terms.

In other words, the phenomenon "is" not a project-intensive organization, but project-intensive organization is the name I use to refer to the phenomenon I am interested in.

There are also several theoretical areas which I have found relevant, but that I do not use as primary theoretical foundations. I have added these theories to the figure between the theoretical areas I have already mentioned.

In the area between business process management and improvement work, we can highlight total quality management (Deming, 1986). The total quality management movement has its strongest tradition in operations management. This was one of the sources of inspiration for the

business process reengineering boom during the 90s. The focus is on the processes in an organization, and on how these processes can be improved (cf. Davenport, 1993; Hammer & Champy, 1993).

Improvement work can be related to project management for example in the areas of change management and renewal projects (cf. Lundeberg, 1993; Ekstedt, Lundin, Söderholm & Wirdenius, 1999). Improvement work is often described in terms of projects. This is one example of a link between improvement work and projects.

There are also theoretical areas which can be related to project management in project-intensive organizations. Examples are program management, portfolio management, multi-project management and resource allocation (Andersen & Jessen, 2003; Engwall & Jerbrant, 2003).

The relationship between process management and project-intensive organizations can be described in terms of best practices, critical success factors and project excellence (Turner, 1999; Belassi & Tukel, 1996; Westerveld, 2003). These areas are related to the general properties of projects rather than the execution of the individual projects.

In the center of Figure 8, I have used the terms "capabilities", "maturity" and "projectivity". These are concepts which can be related to projects, processes and improvements in organizations where projects are an important part of the operative business. Examples of theory in this area are capability maturity models (Andersen & Jessen, 2003) and frameworks for projectivity (cf. Wenell, 2001; Ljung, 2003). In building future theories for project management, this direction of inquiry has been suggested as relevant (Söderlund, 2004).

The distinction between perspective and phenomenon is selected and not given. What I want to signal is that the information management perspective has an influence on how I perceive reality, and that this is relatively stronger than project management, business process management or improvement work in this thesis.

I have chosen to use the three areas of project management, process management and improvement work for inspiration. I view the areas of capabilities, maturity and projectivity as important areas to gather inspiration from, but the research within these areas is still limited and under development. The main contribution of this thesis is directed towards understanding project result improvement in project-intensive organizations.

2.2.3. Philosophical foundations

When developing a framework for project result improvement, several philosophical questions are implicitly or explicitly touched on. I will here introduce the philosophical foundations that form the fundamental basis for the development of the framework.

For me, philosophical inquiries contribute to making my assumptions about fundamental questions explicit. Even though it can be argued that this increases the complexity of the discussion, it is important since it then can be openly criticized. Bateson (1979) makes this point in connection with epistemology, which deals with questions about how we can attain knowledge.

> What is important is that, right or wrong, the epistemology shall be *explicit*. Equally explicit criticism will then be possible. (Bateson, 1979, p. 20).

I have no basis for arguing that the view presented here is superior to any other. I believe that each mind must make its own way. I have developed what is written here in my own unique way, with lots of inspiration from others, and I do not expect other individuals to be different in this respect. I therefore write to inspire rather than to convince. What I think is important is that the philosophical foundations are explicit. If they are not, it is difficult to evaluate the results.

The selection of what is covered is mainly based on problems I have encountered during the development of the framework. However, I have been inspired by several authors. Reading philosophy has opened my eyes to questions I would not normally have reflected upon.

The areas I have covered are not "new". They have all been discussed at length in the philosophical literature. My intention is not to try to provide an overview of different philosophical schools, but to describe my current view. The philosophical foundations have been developed during my research process. In the following, I will describe my reasoning when selecting the areas of assumptions.

Knowledge and reality

At the outset of my research process, I started to look for foundations related to knowledge since I saw this as a traditional starting point in the philosophy of science. When new knowledge is developed, it is natural

to discuss the foundations for knowledge. This is often referred to as epistemology.

An early inspiration for me was provided by Langefors (1966) who emphasize that the frame of reference of a person making an interpretation influences what information will result. Since different persons have different frames of references, the same data can mean different things to different persons. As a starting point, I described my view of knowledge as "interpretive".

From this view, I did not really reflect on the relationship between knowledge and reality. Reality itself was inaccessible to direct perception, and discussing "reality" itself is then not very meaningful. This is rather close to the idealist perspective on knowledge in which reality in principle is "created" by us. The thought and the thing are one and the same. The world and the subject's experience of the world coincide (Harré, 2000).

From an idealist perspective, some facts of life are difficult to handle. Anthony Wilden puts this well when he writes that (real) reality is what trips you up when you do not pay attention to it (Wilden, 1987). During my work, I increasingly started to question my initial view. I felt a need to describe the *relationship* between knowledge and reality.

During the development of the PRIO framework, the question of what is real was awakened by the practical work. My participation in the Alpha case led me to ask what could be *changed* in order to improve the project results. This in turn led me to ask about what actually "exists". If we are going to make changes, it should preferably be changes of "things", in a broad sense, that exist in reality. If they do not exist, the whole idea of changing them is problematic.

I felt restricted by not being able to differentiate between interpretations and the boxes of scrap material in the production facilities. Trying to convince the production manager that the scrap material in production was only his interpretation would probably have been problematic. To him, what he referred to as "scrap" was real.

I had already implicitly made the fundamental assumption that knowledge was a part of reality, but also started to take other assumptions about reality seriously. This led me to an interest in ontology, the branch of philosophy that addresses the question of what exists.

An important step here was to acknowledge that I worked with assumptions about reality rather than reality itself. Thus I worked with assumptions both related to ontology and epistemology. I tried to find a set of assumptions that described both what "exists" and how we can "know" what exists. I found support for the relevance of the ontological question in Heidegger (1962).

Since I made the assumption that we cannot have direct knowledge of reality, the idea of "truth" related to reality becomes problematic. If we cannot relate knowledge to reality directly, what anchor can we find to evaluate knowledge in relation to?

The route I take here is that "theory" in a broad sense is not compared to reality itself, but compared to *descriptions* of reality, which in themselves are indirect in relationship to the reality that is described.

In order to understand reality we can compare different descriptions of reality. Bateson provided several examples of when "two descriptions are better than one". He called this "the method of double or multiple comparison" (Bateson, 1979, p. 71). It is central in this view that none of the descriptions are direct in relation to reality. We can compare different types of descriptions of reality with each other, for example theory and description of phenomena. We cannot compare theory or description of the phenomenon with the phenomenon itself.

This view means that evaluations of theory are partly self-fulfilling. The theory we use to understand a phenomenon in reality influences our interpretation and description of the phenomenon. The glasses that we wear influence what we see.

With the distinction between knowledge and reality, we can relate to the terms "subjects" and "objects", or to "mind" and "nature". However, introducing these terms is not unproblematic. The relationship between the mind and the world in a broad sense is a central and ancient philosophical problem. How is the mind connected with the world? Or are they separate from each other? Further, what is the relationship between mind, the world, and time? Has reality always been the way it is now? If we are going to discuss what "exists", we also have a problem of how reality has become the way it is.

I wanted to describe the assumptions I made about the larger context, in order to motivate an ontology. The distinction often made between the

"subject" and the "object" presupposes a larger context in which subjects and objects are possible.

I have been guided by one of Bateson's main contributions during my work. Bateson argued that "mind" and "nature" formed a unity that could not be separated. He also described a form of theory inspired by cybernetics where he used "forms" or "classifications" and "processes" as central types of concepts. He argued that theory could be developed by alternating between classification and process in a zigzag ladder (Bateson, 1972).

The epistemology and ontology I explicated was influenced by this zigzag pattern. On a high level, I used a zigzag ladder structure combined with an analytical (rather than real) distinction between mind and nature as a starting point (Bateson, 1972; 1979). I tried to distinguish between different forms and processes of mind in order to describe learning, which I saw as one critical link between mind and nature.

The empirical material led me onto a path in which I started to think about the relationship between the changes we made in the organization, and how these changes influenced the *actions* of the people in the organization. In what way did the changes lead to improved results? This type of question is also dealt with in sociology, psychology and management studies (cf. Berger & Luckmann, 1966; Kolb & Whishaw, 2003; Samuelson, 2000). The reason for including it in my philosophical foundations is that it is closely linked to my view on knowledge.

One central example was that there seemed to be a relationship between the documented routines for product development, and the actions of the employees – but what was it? In the case organization, there were examples of where routines were followed strictly. However, there were also cases in which they were totally ignored. This forced me to think more closely about the relationship between learning and acting. Processes of mind were related to learning, but also to projecting and carrying out courses of action.

Theory structure

When I worked with developing the framework, one of the questions I asked was what sort of structure I could use to link concepts in the framework. What types of constructs should I use? How should the constructs in the framework be related to each other? I found the idea of

"causality", which is often explicitly or implicitly used in models and frameworks, to be problematic; and so I sought a theory structure that was more in harmony with the social context I was studying.

We are now closing in on a core question that must be answered before the framework can be developed: what is the structure of a theory which can explain project results?

Markus & Robey (1988) discuss theory structure related to information technology and organizational change. They describe the structure of theory in terms of three dimensions: causal agency, logical structure and level of analysis (cf. Figure 9).

Causal agency	Logical structure	Level of analysis
Technological imperative	Variance theory	Macro
Organizational imperative	Process theory	Micro
Emergent perspective		

Figure 9. Dimensions of causal structure (Markus & Robey, 1988).

The technological imperative provides a perspective where technology as an exogenous force determines or strongly constrains the behavior of individuals and organizations. Markus & Robey describe the organizational imperative as offering almost unlimited choices of technological options and almost unlimited control of consequences. The emergent perspective, in contrast, holds that the uses and consequences of information technology emerge unpredictably from complex social interactions. With this view, behavior cannot be predicted *a priori*.

The logical structure is described in terms of variance theory and process theory. In variance theory, causes are necessary and sufficient for outcomes. With this view the outcome can be predicted. In process theory, causation consists of necessary conditions in sequence, but chance and random events may play a role. This means that outcomes cannot be predicted with certainty. Even if certain conditions are at hand, chance and random events may influence the process.

The level of analysis concerns what phenomenon that is studied, for example society, organizations or individuals. Researchers should be care-

ful with mixing the level of data and the level of conclusions. If key people in an organization state the goals of the organization, it is not certain that inference holds to the organization level. Markus & Robey (1988) suggest the levels macro and micro, or a mixed strategy for the level of analysis.

The zigzag theory structure I will use is strongly influenced by Bateson's recursive model of form and process (Bateson, 1979, pp. 205-219). It can be related to the emergent perspective of causal agency. The logical structure of the zigzag theory structure is similar to process theory. The level of analysis will in this study be mixed, considering individuals, groups in the organization and the organization as a whole.

I have selected this theory structure since it is in harmony with my view on the world of the living. A basic example is provided in the following: when you kick a dog, it is not the force in the kick that bites back. The structure of a theory that can describe this situation is not causal in a material sense. There seems to be choices involved. The dog's reaction can be described as the result of a process in mind. In psychology the result of this process is called the "fight-or-flight response" (cf. Atkinson, Atkinson, Smith, Bem & Hilgard, 1990). We cannot know for certain what the dog will do. This can be contrasted to falling apples. The falling apple has no choice.

The zigzag theory structure (shown to the left in Figure 10) is the most fundamental theory structure that I use to develop the framework. It is a frame for creating descriptions of reality. This zigzag structure is assumed to be inherent in the phenomenon under study in this thesis. That is, I cannot know the real structure of reality, but I act *as if* it is characterized by a zigzag structure. If this zigzag theory structure is inherent in the phenomenon under study, descriptions of the phenomenon can be mapped to a zigzag theory structure.

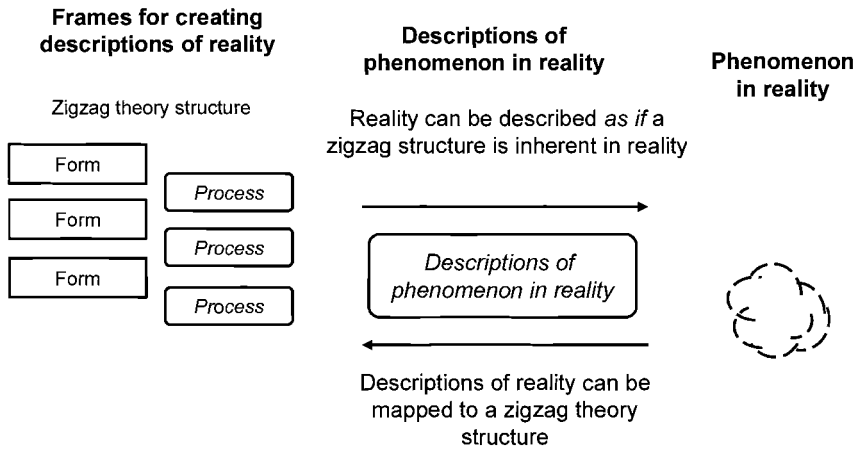

Figure 10. Framework structure and reality (inspired by Bateson, 1979).

I see this theory structure as a social construction (cf. Berger & Luckmann, 1966). It is a constructed pattern, and I cannot have any final proof whatsoever regarding the "actual" structure of reality. Ultimately this formal ontology is based on assumptions.

In my analysis, I will make use of the zigzag theory structure as a sorting mechanism. I will try to sort out combinations of forms and processes on several related levels. The framework can then be used in other situations, to map descriptions of phenomena.

The relationships between the framework, the description of the project-intensive organization and the assumed structure of reality are a matter of theoretical consistency. That the structure of the framework reflects the assumptions about the structure of reality is not absolutely necessary. The framework is a simplification, and we can simplify not only which constructs we shall include, but also the relationships between them. An alternative would be to describe the assumed structure of reality and then motivate the use of a more simple structure in the models used.

I have decided to use the zigzag theory structure since I am interested in providing a model which acknowledges the assumptions I make about reality on a basic level.

However, there is a cost in terms of complexity resulting from this choice. It would be easier to simplify so that the kick "causes" the bite. The kick happens before the bite, and we can describe this relationship

I have used two fundamental criteria for framework quality as a guide in the research design. The first criterion for framework quality is related to the internal consistency of the framework. The second criterion for framework quality is related to the way the framework can match the richness of reality. In operationalized terms, I use the design criteria to "avoid paradox" and "avoid reductionism" in the development of the framework.

The basis for these criteria is a distinction between two streams of philosophy: rationalism and empiricism. Does knowledge spring from pure categories, logic and mathematics, or does it spring from perception? In my view, knowledge springs from a combination. I therefore use criteria from both.

Avoiding paradox is a criterion for framework quality from an internal perspective. Introducing paradox already in the framework is likely to make its application problematic. A classical example when there is a risk of ending up in paradox is the use of the same name for a class and a member of the class (cf. Whitehead & Russell, 1910). For example, if the term "project" is used in the framework, there is a question of whether the term is used as a label for projects in general (as a class), or if it is used to refer to a specific project (member of the class). To increase clarity and avoid paradox it is beneficial to use different terms for projects in general and specific projects.

By using the zigzag theory structure my aim is to reduce the risk of introducing paradox in the framework. Bateson (1972, 1979) used the theory of logical types (cf. Whitehead & Russell, 1910) as one of the cornerstones in the zigzag theory structure for this reason.

If we aim to avoid paradox, we risk ending up in a theoretical "model world" which is nicely ordered, but bears little resemblance to the complex reality we live in. In other words, avoiding paradox can lead to a simplified and reductionist view of reality.

Are the design criteria of avoiding paradox and avoiding reductionism in opposition? In my view they can be reconciled. Avoiding paradox is related to the internal structure of the framework, while avoiding reductionism is related to the relationship between the framework and reality.

The framework itself should be consistent, but its application in relationship to reality should not lead to reductionism towards how *reality per se* is understood. To avoid reductionism, we need to acknowledge

that the framework provides a simplified view of reality. This simplified view does not mean that reality in itself is simple. I have tried to avoid reductionism by being explicit in describing how the framework is related to reality.

2.3.2. Communicative aspects

The practical relevance and value of a framework is partly dependent on how easy it is to communicate and use (cf. Benbasat & Zmud, 1999). I think that the communicative aspects of the framework are important.

Even though avoiding paradox in the framework should contribute to ease of communication, it is not certain. A stringent treatment of a phenomenon often leads to formalization when care is taken to define different terms and relationships. Increased precision in terms tends to complicate theory, which can be a drawback from a communication perspective. This can influence the costs involved in using the framework. If the framework is difficult to communicate, it is likely to be expensive to use, due to the time required for learning.

In this thesis, my main focus is on developing a framework based on the criteria of consistency and richness, and I have tried to consider the communicative aspects as much as possible. My argument for focusing on consistency and richness is that simplifying *too much* from a communication perspective risks reducing the rigor in the research contribution.

I have included an epilogue which presents the results of the research in a form which considers the communicative aspects. In writing the epilogue in a dialog form my intention has been to make it easier to read and consume.

2.3.3. Development process

I have tried to be open for new ideas during the development of the framework. The development process has been abductive rather than based on a predetermined sequence. My use of theory has been influenced by the unfolding case; my reflections during the collection of the material have also influenced the development.

To describe an abductive analysis process is a challenge. One of the reasons is that many of the roads taken end up being dead ends. Usually

only a few of the ideas considered will be found meaningful at the end of the abductive process. An important choice, when describing the analytical process, is to what extent the dead ends should be described. What is not selected may be as important as the issues that are selected.

In this thesis, I have chosen to be relatively restrictive when it comes to describing the thoughts that I found no good use for. The reason for this choice is that I think it will make the thesis easier to read. However, I will try to provide the arguments for my choices and describe why I have decided to develop the framework the way I have.

With the view I take, there is no strong dividing line between development and testing of theory. I agree with Bateson that the explanations, or the regularities that bind ideas together, are as close as we can get to ultimate truth (Bateson, 1979, p. 207). This means that it is not the theory, framework or model in itself that is "true".

Thus I can not claim that the PRIO-framework is true in any general sense. It can be used in different situations, and in each case, the "truth and reason" in the mapping can be evaluated relative to a description of the phenomenon. Using the framework might be more or less useful in different cases.

2.4. Summary of research method

The research question in this thesis is how project results in project-intensive organizations can be improved. In order to contribute to answering the research question, a framework for project result improvement in organizations will be developed.

In order to develop the framework, three sub-purposes are targeted. These are to describe project result improvement in an organization, to explore theoretical sources of inspiration for project result improvement in organizations, and to explicate fundamental assumptions about project result improvement in organizations. Empirical, theoretical, and philosophical foundations are developed in the thesis in order to fulfill the three sub-purposes.

Contributing to answering the research question involves an understanding for the processes of project result improvement. A clinical research approach is used to collect the empirical material in one

organization. The case is focused on improving results of the product development projects in Alpha.

The information management perspective provides an overarching framing for the study. The three areas of project management, business process management and improvement work are explored in order to find inspiration for project result improvement. The philosophical foundations provide assumptions about knowledge, reality, action and theory structure.

During the development of the framework, the foundations are used. The zigzag theory structure explicated in the philosophical foundations provides a fundamental assumption about the structure of reality. This theory structure is used in the development of the framework. The concepts used in the framework are influenced by the three foundations. The concepts are ordered in the framework with the purpose of explaining how project results can be improved.

PART II: FOUNDATIONS

The PRIO framework is grounded on empirical, theoretical and philosophical foundations. In Part II these foundations will be developed. The first chapter provides empirical material about the improvements at Alpha. In the next chapter the information management perspective as well as theories from project management, business process management and improvement work will be explored. Finally, the philosophical foundations are explicated. In part III these foundations will be used in constructing the framework base, and developing the PRIO framework.

3. EMPIRICAL FOUNDATIONS

In this chapter, improvement efforts carried out at Alpha will be described. A background to the organization is first presented, followed by a description of the planning and execution of an improvement project focused on product development within the organization. The final part of the description consists of an evaluation of the results of the project. I have participated in the improvement project as a clinical researcher.

3.1. Introduction

In this chapter the Alpha case will be presented. The case provides practical insight into the challenges involved when working with project result improvement.

The intention with starting with the empirical foundations is to provide a concrete illustration of the phenomenon in focus. With this description, the theoretical and philosophical discussions in the two coming chapters can contribute to put the phenomenon in perspective.

The empirical, theoretical and philosophical foundations will be used in the development of the framework in chapters 6-8. Theories and philosophical assumptions will be used as inspiration for selecting and sorting concepts in the framework. The concepts will be selected and sorted with the specific purpose of explaining how project results can be improved.

3.2. Alpha – background

This case is about Alpha, a business area within the ComCorp group. In the following sections, the ComCorp group and the business environment of Alpha will be introduced.

3.2.1. The ComCorp group

ComCorp was founded in Sweden during the 1940s with a focus on products for radio transmission. Since then the company has expanded and the technology content of the products has increased. During the 80s, a strategic decision was taken at ComCorp, focusing the business on the increasing market for components in telecommunication networks.

In 1998, the ComCorp Group consisted of two similarly sized business areas: Alpha and Beta. Alpha was focused on developing, manufacturing and marketing components for mobile phones. The company was founded in 1993 with only a few employees as a small subsidiary to ComCorp. The other business area, Beta, developed, manufactured and sold components for telecommunication networks.

The ComCorp headquarter, Alpha and Beta had separate offices and the business areas were run relatively separately from each other. In 1998, the company had a turnover of 1.7 billion SEK, and about 900 employees.

3.2.2. Being a part of building something

Alpha had a tremendous growth during the latter half of the nineties. It went from a small entrepreneurial company in 1994 to a global leader in its telecommunication components niche with more than 400 employees.

The people in the organization felt that they were a part of building something. Even while the research project was conducted, the changes could be felt very strongly. Parking at the small parking lot, and being welcomed informally in 1998 were quite different from the newly paved parking lot of the renovated, fenced and expanded building, where a professional receptionist entered guest names in the computer and printed a guest label in the decorated and secure lobby in 2002.

Some of the key people in the organization had worked in Alpha from its early days. They had a deep understanding of the business. For example, Mark Olsson, the Production Manager, and John Svensson, the vice President of Business Development, seemed to be involved wherever something big was going on.

3.2.3. Value chain requirements

The main part of Alpha's business was geographically centered in Stockholm, but there were also offices in Southeast Asia and USA.

The development of products was made based on contracts from mobile phone manufacturers. These mobile phone manufacturers sell the products to distributors, who in turn sell the products either to retailers or to the end consumers.

Product development was carried out in close cooperation with customers. The development activities consisted of two types of work; concept development and variant development. Concept development was intended as long-term in order to provide product platforms. Variants were developed in customer-initiated projects in order to satisfy the immediate needs of the customers. The production consisted mainly of the automated assembly of sub-components provided by suppliers, who in turn bought raw material from their suppliers.

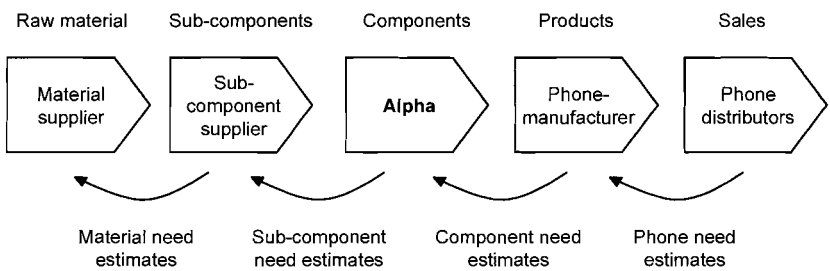

Figure 11. Summary of value chain.

The product life cycles are short in the mobile phone market. This presented Alpha with the challenge of developing new products quickly, but also the need for flexibility in production volumes.

During the introduction of a mobile phone, the demand is often high. This demand then generally diminishes over time. It is difficult to know beforehand what the demand will be. The components Alpha created had to be designed individually for each new phone model since the functionality of the component was dependent on the design of the phone chassis. This meant that it was difficult to purchase large stocks of components. If the demand was not as high as expected for a model, the company would get stuck with components that could not be used.

On the other hand, if the demand was higher than expected, it was crucial that the capacity was large enough to be able to deliver to the customers' production lines. It was not a pleasant experience to be the supplier who stopped a mobile phone production line due to lack of components. Production estimates were used in order to pass the estimated market demand back in the value chain.

3.2.4. Business network

The value chain was complex in the sense that there were many suppliers of raw material and sub-components, and many customer organizations for whom the components were to be developed and integrated. Rather than a straightforward value chain, the situation can be described in terms of a business network. As a part of the production process for some components, the sub-components were shipped to an organization for plastics processing. This was particularly critical since the capacity directly influenced the lead-time of the production. In the figure below, the business network is presented with Alpha as the focal company.

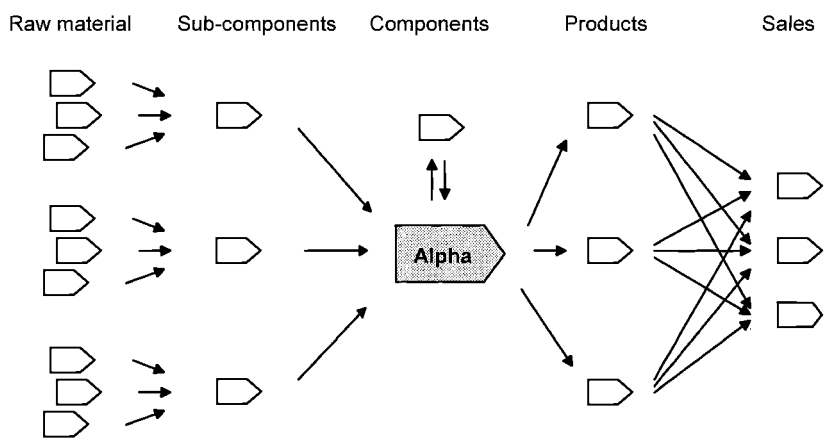

Figure 12. Business network

The network configuration made it necessary for Alpha to manage many relationships to sub-contractors, and many relationships to customers.

3.3. The situation at Alpha

After this background, the organization will be described and strengths, challenges and critical issues will be identified. The description is based on the situation in Alpha in 1998.

3.3.1. Organization

The organization was predominately functional with marketing & sales (M&S), research & development (R&D) and operations as the main departments. There were also bodies for quality, finance & control, business development and personnel.

Within the functional structure, there was also an important team-structure. Many employees were part of a customer team or production team. The teams are shown as ovals in Figure 13.

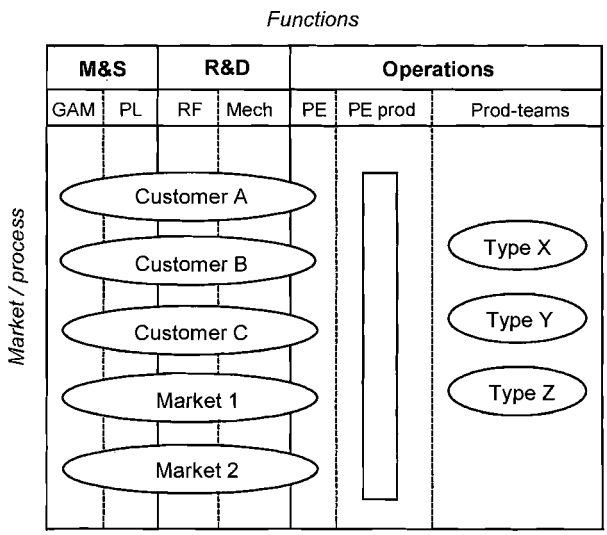

Figure 13. Functions and teams in Alpha.

The customer teams worked with sales and development of products for a large customer or a specific market. Normally, they consisted of a global account manager (GAM) and a project leader (PL) from the marketing & sales function, a radio- and a mechanical engineer (RF, Mech) from the research & development department, and a production engineer (PE) who formally belonged to operations.

The global account managers, could in principle, select which projects to start based on the resources in the team. There were five customer teams in 1998. Three teams were focused on the largest customers, and two teams were focused on several customers but within selected geographical markets.

The products were manufactured by production teams. The production teams were organized based on the type of product that was to be produced. This is shown schematically as teams working with product type X, Y and Z in Figure 13.

In 1998, there were about 100 different products that were manufactured, and the average product life was 18 months. In general, product development projects had lead-times of 9-15 months for concepts, and three months for variants.

The total time from the start of the product development to the delivery of the last component should not be calculated simply as the product development time plus the product life in production since a part of the volume in production was delivered before the actual product development project was finished. There was also a minor aftermarket which extended several years after the production was scaled down.

The customers required different product types in their different products, which meant that each customer team worked with several production teams, and that each production team worked with many customer teams. Even though there were production engineers in the customer teams, the integration was often handled by a specific production engineer department (PE prod) from operations.

3.3.2. Business activities

The variant development was initiated based on sales and negotiations with customers regarding functional specification, design, intended volumes, requirements on logistics, etc. During the variant development, existing product concepts were used. These concepts made it possible to design and manufacture products within specific limits. The concepts provided design guidelines, product models, basic machinery, tool models, material suggestions, and the specifications within which the products could be produced.

The concept development was intended to provide new platforms for developing product variants, but in practice, the existing concepts were highly influenced by the variants that had been developed earlier. The Product Council was the formal decision-making body regarding the introduction of new products, but the relative autonomous customer teams made it difficult to influence the product portfolio.

As a consequence of customer demands regarding speed and flexibility during product development, the projects were characterized by hectic work and swift decision-making. The expected production volumes and product specifications were often changed during the projects.

The products were tested in production runs before the components were approved for ramp-up in production. When the quality was approved, it was turned over to production for the daily operations.

Monthly sales estimates for the products were the basis for component orders. There were two main types of components. Some standard sub-components were kept in a small stock, but some components were specific for each product. These were ordered on a just-in-time basis. When customers ordered components, sub-component orders were placed and production capacity was scheduled. The products in the order were then delivered to the customer production line with the specific logistic requirements for the product. The order was finally invoiced.

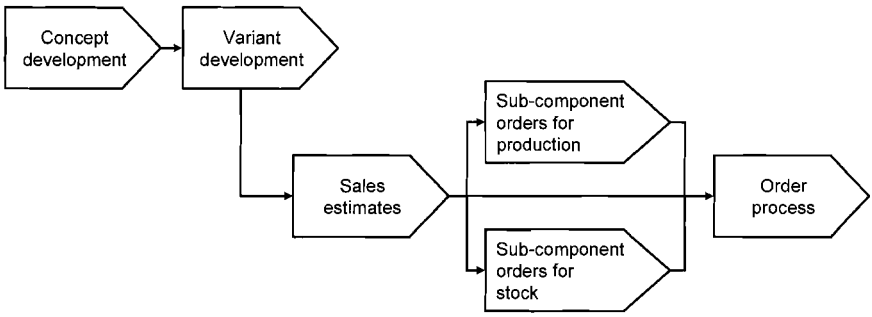

Figure 14. Main processes in Alpha.

The illustration in Figure 14 is based on empirical material collected by the researchers interviewing people from Alpha during the autumn of 1998.

The main focus in the first empirical studies was related to the order process. This process was sometimes referred to as the order process and sometimes as the production process. One of the key findings was that the variant development projects were very important for the results in production. We progressively moved from our initial focus on the production process towards studying product development. The management team had also started to consider carrying out a process improvement project covering the major processes in the organization. We reported our findings to Mark Olsson, the Production Manager.

3.3.3. Culture

The organization had an entrepreneurial culture which was widely acknowledged within the company. The work was, above all, customer and action oriented. According to a saying within the company, the employees had "screwdrivers in their pockets" and fixed the things that needed to be fixed in order to deliver to the customers.

> The company puts an enormous amount of responsibility in our hands and puts a lot of trust in the people on the customer teams. They perform magic and juggle and so on, and stumble up something which is reasonably good. (Global Account Manager)

The customer focus was strong both in the customer teams and in production. If quality was bad in an order, production employees stayed late and inspected each component manually, if necessary.

> The problem is that they [the customers] call us last; since they know we can fix it.... We might be at the top in terms of fixing things. (Production Engineer).

The level of ambition was high and the employees believed that they always could do more, according to the production engineer. In his view, this was a part of the company spirit.

> It is in the company spirit that we do not just come in and punch in our time.... We have a common goal, and make sure that the customers get what they want.... We do not have a suggestion box – if you get an idea we implement it together. (Production Engineer).

Even though many small improvements were made, they were mainly reactive. Continuous improvement of routines was not a high priority.

There were some documented routines, for example a paper-based handbook, or checklist, for product development. This was not used much, and a common joke was that no project had ever passed the requirements to go in serial production with the criteria in the manual (product review 3). In production, the work was somewhat more structured, with quality documentation and ISO-reviews.

The employees had a good deal of freedom in their work. In general, there were many possibilities to influence the situation, and the employees felt that they were trusted with many qualified assignments very early on. A team leader in production describes his experiences in working for the company:

> It has been incredibly fun.... New, technologically focused, and being a part of building something.... It was fun every time I came to work.... I traveled two hours every day.... The days went like this [snaps his fingers].... I got new assignments, and when new employees arrived, I got to grow and develop myself. (Team leader in production).

There were drawbacks to this flexibility. One project leader was hired from a position within the financial industry, and was given responsibilities for customer projects in Asia almost directly, even though he did not have any experience within product development or production. He tried to pick up ideas from the other teams, but a main source of learning was trial-and-error.

The business expanded quickly and many new employees were hired. The work force was young and many people had worked at Alpha for some years already, which led to a high turnover of personnel as the employees sought new challenges in the lucrative high-tech labor market. The large number of new employees in combination with a high turnover started to affect the company culture. The sense for the "whole picture" that was characteristic for the entrepreneurial phase was beginning to deteriorate.

3.3.4. Expanding facilities

In 1998, a project was under way to expand the offices at Alpha, which was required due to expansion. John Svensson was responsible for this project. He was the former quality manager, and had advanced to the executive team in Alpha, where he was vice president of business de-

velopment. He seemed to be involved in all major projects in the organization, and had an enormous work capacity. In the new office building he kept together work teams that dealt with the layout of the facilities, restaurant, archive, lobby, security, etc.

In John Svensson's view, it would have been better to reorganize the company in a process oriented fashion before the new office was ready. This was another main project he was responsible for. Given the necessity of new facilities, a goal in the new office was at least not to create restrictions for the process orientation. Much thought was put into creating a flexible infrastructure where office spaces could be easily rearranged.

> We are building possibilities into the building. I have worked with issues like process orientation, customer understanding and customer orientation. Plus, if you have a process perspective, you create good preconditions for working with continuous improvements. I have worked on this for a long time, with mixed results. There have been new players in the field, so I have had to start over. In my view, the business functions should be replaced with processes. The staff should be taken over by the process. (John Svensson, vice President of Business Development).

Even though the company had been in a growth phase since the start, improvements now started to take on new proportions. This was a time of unusually hectic work in the business development area.

3.3.5. IT Department

The IT Department was shared by the ComCorp business areas. Physically, the people at the IT Department were located at the ComCorp headquarters. The relationship between the people at Alpha and the central IT Department was somewhat strained. According to a mechanical engineer at Alpha, the IT Department sent "note-consultants", meaning that they had written instructions on how to install or modify a system in a computer, but had little knowledge of the business.

The IT-manager had drawn up a working relationship together with John Svensson. The IT Department was responsible for the global architecture, for example the enterprise resource planning system, and the business related questions would be taken care of in an IT Council with representatives from the IT Department and Alpha. In practice, the IT

Council did not fill its role as a link between business and IT. A person who visited two IT Council meetings reflected that it was not what he had expected. He thought that there would be persons with authority to make decisions in the IT Council, but the meetings resulted only in talk, and no decisions.

The people at Alpha focused on delivering products, and were generally not very interested in information systems. On the IT-side, the message was that the business people needed to improve their skills in specifying what the business needed; and on the business side the idea was that the "IT-muppets" needed to be closer to the business, so that they could understand its needs.

An example illustrating the relationship between business and IT was the measures used in production. The Production Manager noted:

> We do not really have the systems and tools for control.... We have tried to start measurements, but it often fails due to lack of IT-support. Now it works really poorly [due to an upgrade of the enterprise system where the prior modifications were lost]. We do not have enough support from the IT Department. (Mark Olsson, Production Manager).

At the same time, he noted that they also could have worked with the links to IT in other ways. He thought that the links to IT required more resources, and they tended to underestimate this need.

As a personal reflection during the autumn of 1998, I was surprised that I met so few people from the IT Department. I interviewed the IT manager, a consultant who had run the IT Department for the last two years. He showed me slides describing how the relationship between business and IT was supposed to be handled, but these good intentions did not seem to reach all the way to practice in the organization.

3.3.6. Strengths

In 1999, Alpha was a company with several strengths.

The market position was very good, as one of the world leaders in the niche. They supplied the largest and most successful phone manufacturers with components. The main competition that was felt was that the phone manufacturers would start to produce the components in-house, rather than purchasing from the outside.

The business was highly regarded by customers. A customer interview study performed by a consulting firm showed that the main customers valued the flexibility of the employees during the development work, and that the company was known for having high performance products and high service levels in production.

The company's financial position had been strong. Profitability had been high and the company had enjoyed strong growth for a number of years. Even though this growth was to a large extent a consequence of the industry expansion, the company had succeeded in capitalizing on the opportunities, and had been able to deliver.

The company spirit was strongly felt. The entrepreneurial organization rendered large degrees of freedom and made it possible for the employees to learn quickly and grow professionally.

Alpha was a very positive workplace in 1998. However, there were several challenges threatening to disturb the positive situation.

3.3.7. Challenges in product development

The employees had traditionally had a "sense of the whole" in the organization, but this became difficult to uphold as the business expanded. The division between different functions within the organization was increasingly visible. This was particularly evident between the customer teams and the production teams. The cross-functional teams from Marketing & Sales and Research & Development that worked with product development projects were well integrated, but the relationship to the production teams in operations started to deteriorate. The prior cooperation was increasingly replaced with a view of "we" and "them". When things went wrong, discussions regarding who was to be blamed for the problems were increasingly common.

A common view in production was that the customer teams were more focused on fancy technical design than on making it possible to produce the products. In development on the other hand, production personnel were increasingly viewed as complaining too much.

The decision-processes were seen as unclear, for example regarding what projects should be pursued; according to what development methods different projects should be conducted; how priorities between projects should be set; what the actual requirements for going into serial

production were and what resources that should be used for long-term development.

The methods for product development were not seen as adequate. The methods had not been adapted to the changes the company had gone through during the growth phase. The distinction made in the project handbook between concept development projects and variant development projects was not seen as helping in the projects. Rather, it was difficult to know what part of the handbook to use. This was one of the excuses often highlighted to explain why the existing project handbook was not used.

It was also problematic that the project management skills were not formally developed. Organizationally, they belonged to Marketing & Sales.

> The project leader does not have a project management guru to go to for advice or to discuss strategies, so the poor guy comes to me; but I am a salesman.... A different approach could be taken here.... Nobody has a responsibility for improving the project management function. This is interesting since project management is very important to us. (Global Account Manager).

The majority of the project leaders were young, and the lack of coordination of the project managers in the different customer groups made it difficult to learn and improve the project management skills, except through experience.

The industry went through a transition, where data- and telecom were increasingly integrated. This could potentially lead to changes in product and customer structures. A product strategy was not known within the organization, and few resources were used for long-term development.

There was an unclear product strategy. Special customer requirements often resulted in products that needed special machinery, which decreased the economies of scale in production. The product council did not play the intended role of harmonizing products to enable efficient production. The customer teams navigated in the development work with the good intentions of helping the customers in the best way possible, but this had consequences in internal efficiency.

The customer teams often had several projects going at the same time and the work was usually carried out with serious strain on resources. When the production of a component was initiated, the customer team had often already started other projects, and mentally had let go of the project. The new projects were then given high priority, and evaluations of finished projects were not conducted in a structured way. Sales data was monitored by the customer teams, but knowledge about quality costs, production lead-times, service levels and returned goods was not evident in the customer teams. The limited feedback from production made it difficult for the customer teams to learn from the projects. They acted on direct problem descriptions from the production teams, but only saw the top of the iceberg of the problems in production.

Sales estimates for products in production were given a relatively low priority by the customer teams. This sometimes made it difficult for production teams to order components and plan the use of machinery effectively.

Production was often started without formal acceptance from production, since deliveries to customers was a priority. Production was started with exceptions to the serial production requirements. The controls intended to secure a stable ramp-up in production were thus not always carried out. According to a purchaser in the customer team for the most important customer, the lead times in product development were often seen as more important than the costs of poor quality in production.

There was limited functional coordination between the customer teams. Account managers, project leaders and engineers worked mainly on their own customer team. There was limited time for knowledge exchange between teams, and development of the functional competencies.

The product development process, as it was carried out, resulted in limited long-term product development. The daily problems were the focus of attention, and coordinated improvement efforts were rare. One of the factors that probably contributed to this was that there had been a high turnover on the management level in Marketing & Sales as well as Research & Development.

3.3.8. Challenges in production

The product development process influenced production in many ways.

When production was started, the customer teams were already working on the next project, and production issues had been handed over to the production teams. Production specifications were seen as lacking in quality by the production teams, and the products were not always adapted for effective production, especially not with the existing equipment. According to a logistics coordinator in production, the customer teams started production before it was properly checked. In her view, the customer teams were in their own race, and did not consider the overall picture.

The supply of components to production was often problematic. The suppliers were not always contacted early enough in the product development process to be able to sort out all quality and logistics issues. The component supply was also influenced by sales estimates that were not always updated by the customer teams. This made it difficult to plan component demands and production capacity.

Limitations in the production specifications led to the production teams often working at fixing problems in production. Machinery and tools were adjusted rather than proactively evaluated and adapted. A senior production engineer said that the relationship between production engineering and development had gone sour. He did not like meetings where people were "throwing pies" at each other. He tried rather to do something about it, such as visiting a supplier to solve a problem. He described the work of the quality representatives as fire-fighting rather than proactive work.

The production manager believed that the company was entering a new phase, and he could see this clearly when the company reached about 300 employees. The chaotic work and decision making based on intuition that had characterized the growth phase was not the solution for the time ahead.

> We are on the way to, or in, phase two. We have been since a year back. We come from an expansion, where things were pretty wild, but we want to go to the next step. This is becoming a large company, more mature and stable. This can require other ways of organizing. We do not want to create a bureaucracy, but rather become more effective and secure. We need better control than today, and improved information for tactical and strategic decisions. (Production Manager).

There was limited control of the production process. Real control in terms of measurement was lacking, according to the production manager. It was difficult to get the data they wanted in a useful format. It was too much work to collect and organize the information. The good intentions to gather and summarize data manually tended to get low priority in the hectic organization.

The problems with component supplies led to production often scheduling based on the availability of components. The customer perception that Alpha was good at delivering, was to some extent, a view from the outside. Within Alpha, there was a constant struggle for quality.

The quality controls for the first two quarters of 1998 showed that the service levels (deliveries-on-time) were going down, and customer complaints were increasing. The complaints on suppliers were also increasing. Further, the trend for quality costs was increasing, and the main quality costs were traced internally to Alpha rather than its suppliers. Waste in production was the main source of quality costs, followed by product quality inspection.

Based on the problems in production specifications and the problems with component supplies, the people in the production teams felt that they had limited possibility to influence the results. This also led to a limiting of their interest in production measurements.

3.3.9. Critical issues

As described above, there were several challenges in Alpha. Below, some of the critical issues will be summarized. These are based on a report the researchers wrote after a study of the product development and production processes during the autumn of 1998. The report was based on interviews with 27 persons from Alpha.

Product strategy

Almost all product development was based directly on customer requirements. The strategic focus regarding markets, technical solutions and products was unclear, and to a great extent decided within the customer teams. Development was thus only loosely anchored in a product strategy. It was difficult to set priorities on long-term development work which was not carried out in practice. The lack of product strategy was

troublesome in itself, but perhaps particularly so in an industry where technology shifts were taking place.

Project management and work methods

It was not clear how different types of projects should be handled. The distinction between concepts and variants was not used in the actual work since many projects were based on existing concepts, but fell outside of the production specifications and thus could not be produced with existing equipment. The routines for product development were not perceived to be adequate. Project management was identified as one of the weaknesses in customer interviews.

Integration of product development and production

The increasing functional focus in the organization led to problems in the links between product development and production. The attitudes of the people in the organization, to an increasing degree, showed a functional separation within the company. The sense of the whole that had characterized the employees and work in the early days was starting to deteriorate. This was particularly evident in the relationship between the customer teams and the production teams.

Balancing structure and flexibility

There was a strong support for increasing the structure of the product development and production processes. The work methods that had served the company well during the entrepreneurial phase needed to be changed to support the organization in its new form. However, increasing structure could lead to reduced flexibility, which was one of the qualities the customers valued most in the work of Alpha. Finding a way to increase structure without reducing flexibility was thus an important challenge.

Learning from and between projects

Learning was a challenge in two aspects. First, learning from the consequences of product development for production was one important issue. This was about finding out what could be done differently already in development, in order to provide for efficient production. The other aspect was learning about work methods and product solutions be-

tween customer teams. The cross-functional design of the customer teams had increased the integration in the process dimension, but at the same time reduced the integration in the functional dimension.

Financial results

The costs of poor quality were high and the growth was slowing down. The financial results for ComCorp were not satisfactory to the investors and stock market. The company had formerly been seen as a high growth company, but ComCorp, and Alpha, were increasingly being questioned.

3.4. Addressing the problems

Within Alpha, voices were raised to promote changes in the way the organization operated in order to make the somewhat chaotic work processes more structured. The president of Alpha was replaced in 1998 with a person with long experience in the mobile phone industry.

3.4.1. Process focus

John Svensson, the head of Business Development, had for some time felt that something needed to be done about the product development and production processes. He was interested in the ideas presented within process management. He had read books, visited conferences, searched for information about process management on the Internet, etc. He believed that process improvements could be a solution for Alpha. He discussed this with his colleagues. One of them was Mark Olsson, the production manager, who also believed increased process orientation was required.

> We need to go towards a more prominent process perspective and a process organization, it is obvious. There should be clear responsibilities for the processes, rather than the functions and cost centers. The difficulty is that many people are stuck in traditional thinking. It is easy to fall back into the traditional functional division. The processes should be in control in the future, not the functions. The company was founded on a functional view. We need to get away from this. (Production Manager).

John Svensson invited different consultants to present their ideas for the management team in order to awake their interest for the ideas. After about a year, the management team decided that a business development project was to be initiated, with John as the team leader.

The general manager of Alpha commented that John had been working for this for a long time, and that it had been proactive when he presented the ideas. When they finally agreed to go on, it was instead a rather reactive project.

3.4.2. RBG method

A consulting firm, Rummler-Brache Group (RBG), was selected to provide the process improvement method for the change project. The method highlighted processes an organization and suggested process owners and process measurement systems to support process orientation. John Svensson selected RBG partly because of their ideas for process measurement. It was important to him to be able to measure the process as a basis for continuous improvements.

The background to the specific RBG-method was that the consultants Geary A. Rummler and Alan P. Brache published the book "Improving Performance – How to Manage the White Space on the Organization Chart" at the beginning of the process reengineering boom. The book contains few references, so it is difficult to trace the theoretical areas that have inspired them. It is, however, clear that the book was written from a process perspective, including ideas from Total Quality Management movement and the popular reengineering trend. With a process improvement initiative, organizations can bridge the functional "silos" and focus on processes.

In the following, a brief description of the framework they propose will be made as a background to understanding the improvement project.

Rummler & Brache (1995) provided a view of organizations from a systems perspective, in which the organization is open to its environment. The organization is seen as a processing system, which converts various resource inputs into products and services for a receiving system, or market. It also provides a financial value, in the form of equity and dividends, to its shareholders. The organization is guided by its own internal criteria and feedback, but is ultimately driven by the feedback from the market. The competition also draws on resources and provides

its products and services to the market. This is carried out within a social, economic and political environment.

In the view of Rummler & Brache (1995), an organization consists of subsystems which exist to convert the input into products or services. These internal functions, or departments, have the same systems characteristics as the total organization. Finally, the organization has a control mechanism in the form of management which interprets and reacts to the internal and external feedback, so that the organization keeps in balance with the external environment.

The three levels of performance within the organization together provide a basis for evaluating performance. On the organization level, the performance is related to the market. The second level of performance is what they call the process level. This is metaphorically described as what would be seen if the organizational "body" was x-rayed. The skeleton would then be the functions, or departments, in the organization, and the processes would be the musculature. This second level is the work flow, how the work gets done. Examples of processes are new product design, merchandising, production, sales, distribution and billing. The processes are in turn seen as performed and managed by individuals doing the various jobs.

The three levels together with performance-needs make up the nine performance variables, according to Rummler & Brache. The performance needs are goals, design and management. The goals are the standards to be evaluated against. The design is the structure that enables the goals to be met. Management refers to the management practices that ensure that goals are current and being achieved.

Rummler & Brache (1995) provide a definition of a business process. "A business process is a series of steps designed to produce a product or service". They note that most processes are cross-functional, spanning the "white space" between the boxes on the organization chart. They describe different processes in terms of primary processes, which have external customers, and support processes, which are invisible to the external customer. A third category is management processes. The processes should be improved continuously, and feedback is important to make this possible.

A method, or methodology, for process improvement is provided. The method separates the work in five phases (0-4).

In the first phase, the performance improvement effort is planned. This leads to a process improvement and management plan. Some processes are selected for improvement. In the project definition phase, the goals, roles and boundaries are set up for improvement. In the next phase, the process is analyzed and designed. A "should" implementation plan is then used in the next phase, the implementation. The improved process is then managed in the process management phase, in which continuous improvements are carried out. Some processes may be found to be unproblematic in the planning phase, in which case they go directly to the process management phase.

The book written by Rummler & Brache was not used in Alpha. The consultants provided summaries of the main points. The process improvement project was described in terms of four phases: planning, project design, process design and implementation (cf. Figure 15).

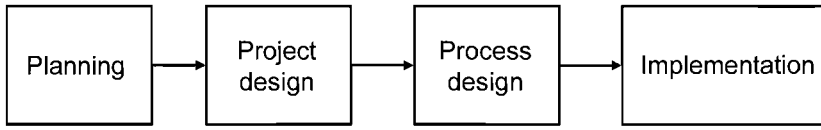

Figure 15. Process improvement, adapted from Rummler & Brache (1995).

This project was, in a sense, a landmark in the organization. It would be the largest improvement project carried out in terms of persons involved from different departments. The project was more firmly anchored in the management team than usual, had a larger budget, and was more "professionally" structured according to popular project management practices than what was common in previous improvement efforts. In a way, it was also a change in approach, since it left the screwdriver-in-the-pocket structure and addressed problems of growth with a planned process improvement project. It was a project in which many people had high expectations.

3.4.3. Planning

During the planning phase, which occurred in the autumn of 1998, an extended management team worked with the planning of the process improvement project, supported by the consultants. The CEO of Alpha argued that the organization needed to take on more complex product development assignments to avoid increasing competition in the com-

ponent market. The management team identified two main processes; the Time-To-Market (TTM) and the Time-To-Customer (TTC) processes. The TTM-process included several departments, but was mainly carried out in the customer teams. The TTC-process was performed in Operations, mainly within the production teams.

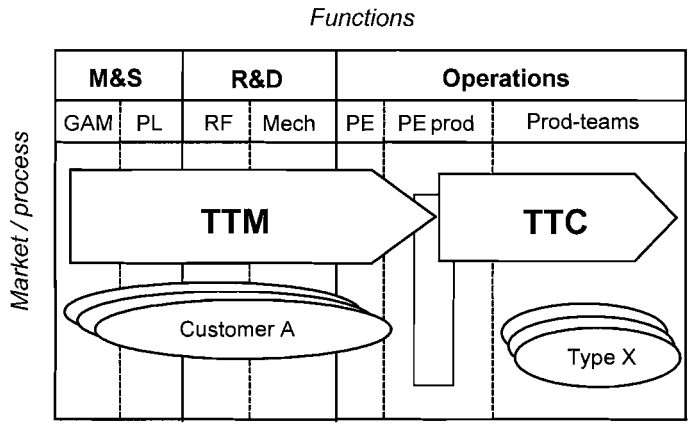

Figure 16. TTM- and TTC-processes.

The management team decided that TTM should be the focus of the process improvement project since it was perceived as the core business and was strategically important for Alpha.

Some of the key persons already had a demanding workload, and it seen as impossible to conduct two major improvement projects at the same time. Instead, the ambition was to carry out a separate improvement project for TTC after the TTM project.

The stated goals for the project were 1) to increase the net present value (NPV) of investments in product development, 2) decrease the TTM lead times for new product concepts to six months and for new product variants to one month, 3) increase customer- and employee satisfaction and 4) to get the first order for new products concepts within four months of sales start.

The "TTM project" was initiated at the end of 1998.

3.4.4. Project design

An important part of the project design was to appoint the people involved. The steering team for the TTM-project was defined. The participants were all members in the management team. Bengt Johansson, the president, took on the role as sponsor for the project. The initial members are shown in Table 2. The names of the people in the organization are changed in order to guard the anonymity of the individuals.

Name	Function
Bengt Johansson	President
Mark Olsson	Vice President Operations
Fredrik Elm	Vice President Marketing & Sales
Erik Berg	Vice President R&D (stand-in)

Table 2. Steering team.

The position of Vice President of R&D was filled temporarily. Erik Berg, who normally was manager of mechanical engineering acted in this position as stand-in.

The management team also appointed members for the process design phase. The appointed design team consisted of thirteen persons (cf. Table 3). The members were from the Customer Teams, Production Engineering, Quality, Product Management, Business Development, R&D, Purchasing and two researchers. John Svensson was appointed team leader. As in the previous table, the names of the people in the organization have been changed.

Name	Function
John Svensson	Vice President Business Development
Erik Berg	Manager Mechanical Engineering
Sten Fredriksson	Engineer
Tom Sundin	Production Engineer
Eva Lundin	Global Account Manager
Carl Eriksson	Project Manager
Peter Thordell	Production Process Manager
Karl Fors	Quality Engineer
Lars Envall	Product Manager
Olle Isaksson	Purchaser
Johnny Sand	Global Account Manager
Martin Andersson	Researcher
Göran Nilsson	Researcher

Table 3. Design team.

Nobody from the IT Department was included in the design team. The reason for this was that John Svensson and the management team felt that the process design should be made before any discussions about how it should be supported by IT. John Svensson clearly expressed that there should be no "IT-muppets" in the project. In prior projects, the IT Department had provided good reasons for not changing the systems. John Svensson wanted to have a specification that he could take to the IT Department in order to get what he needed.

A time plan was made for the design team meetings, which all were scheduled for 1-2 days at conference facilities in the Stockholm area. During the workshops the consultants would act as facilitators and provide workshop material, and document the results of the workshops.

3.4.5. Process design

The process design was the main part of the design team's work. The team described the "is-state" and the "should-state" in the TTM-process during the spring of 1999.

The consultants participated in the workshops. At the beginning of each workshop they described the work to be done during the day. At the first process design workshop, the consultants provided an overview of the RBG-method and the participants were given a folder with the mate-

rial that should be used. As an introductory analysis, the design team created a map which described relationships between different organizational units during product development projects.

The work continued by creating a description of the "is-state" of the process. The participants were divided in smaller teams to work on the assignment. The teams looked at different parts of the process, and then presented the findings to the larger group. The teams were rearranged in order to provide different perspectives on the parts of the process.

It was found that the different customer teams had different ways of working. It was clear that the projects carried out for customers in Asia often had a much shorter duration than the projects in Europe since the products developed were often minor modifications of existing concepts. In Europe, the work was conducted more closely together with the main customers. The development was, to greater extent, directed towards new product concepts.

The is-state description portrayed a compromise between the different work methods. The experiences from having different methods for variant and concept projects were felt to be negative by the design team. It was difficult to know which one to follow. In their view, it was important to have one common process for all projects. The description was made using a process graph on a detailed level.

When the process was described, the design team created a list of 49 problems in the process. Each member could then vote for three key problems. The top three key problems according to the votes were:

1. Unclear criteria for start of projects.
2. Too little focus on customer demands for quality, logistics and production issues early in the projects.
3. Strategic product development plan is missing.

A few hours were used to discuss root-causes for the problems. The discussions were related to lacking strategic management, a culture of fire-fighting, lacking routines, lack of understanding for each other's work and functional management focus.

The next step in the design work was to create the "should-process", that is, the design team's view on what the process should look like in the future. The design of the should-process was the most time-

consuming part of the work in the design team. The work started in January 1999, and ended in July 1999.

It was clear that an overview of the process was lacking in the team. The Global Account Managers and Project Leader were very active in discussions about the first steps in the process; the people from R&D focused on the development activities; and the people from Operations focused on the end of the process. During the discussions, the team participants became more familiar with the different aspects of the product development projects.

During the process design, the consultants had employees who took the paper sketches created by the design team and printed them on large paper. This was put on the wall as a reference in the "war room" at Alpha, where the work related to the project was carried out between the workshops. The process description on the wall was updated after every workshop. This was a way of informing the people at Alpha about the process during its design.

It was clear to the design team that the new TTM-process would require support by information systems. The links to information support were initially represented using lines from the activities to a "database". The design team did not have an overview of the systems that existed and what functionality they could provide. I presented an overview of potentially relevant systems and relationships for John Svensson based on interviews with persons in the organization. Some of the relevant systems are shown in Table 4 below. The abbreviations used were not the official names of the systems in the organization. I have added the abbreviations to make it easer to refer to each system.

Information system	Description
Project Planning (PP)	Used to create plans for individual projects.
Customer Relationship Management (CRM)	Customer contact information, e-mail history, documents.
CAD systems	Development of product models.
Product Data Management (PDM)	Supporting product structures, documents, version management, etc.
Document Folder (DOC)	Document folder structure on local area network.
Quality Documentation System (QDS)	System used to approve and distribute templates and routines.
Templates	Templates for documents, mainly used in TTC.
Time Reporting System (TRS)	Reports of worked time in the projects.
Enterprise Resource Planning (ERP)	Core system used for product structures, purchasing, orders, production estimates, etc.
Quality Control System (QCS)	Used for statistically measuring product quality.
Sales Estimate System (SES)	Extracted sales estimates from the ERP system.
Production Efficiency Measurement (PEM)	Measured cycle times and efficiency in automated production.
Customer Returns and Complaints (CRS)	System for tracking problems in deliveries to customers.

Table 4. Examples of information systems supporting the projects at Alpha.

Figure 17 below graphically shows some relevant information systems in Alpha, described from a TTM-perspective. The lines from the TTM- and TTC-processes indicate which systems were used in each process. The relationships between the systems indicate that information was shared, or could be shared between the systems. For example, templates were managed by the Quality Documentation System, and the resulting documents were stored in a network folder structure (DOC). Documents were also handled in the Customer Relationship Management system (CRM) and the Product Data Management system (PDM). The overview of the information systems supporting the process did not lead to a detailed understanding of the systems involved, but rather provided a map showing the complexity of the underlying IT infrastructure.

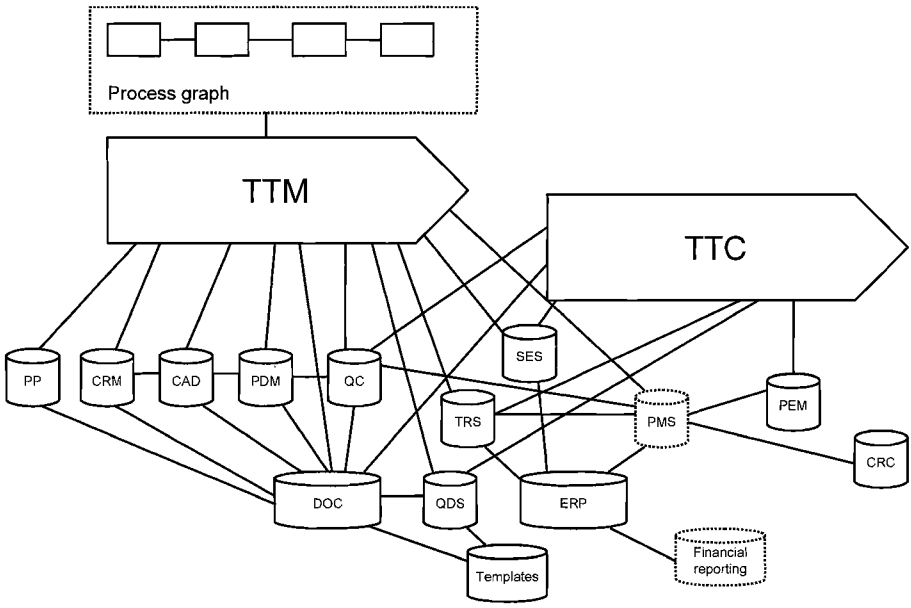

Figure 17. Examples of information systems supporting the TTM-process.

Three of the systems described in Figure 17 did not exist in 1999. These are shown with dotted lines in the figure. The process measurement system (PMS) was planned by the TTM-design team. There was also a system planned to support financial reporting. This was sponsored by the Chief Financial Officer. He was interested in developing a form of balanced scorecard for the organization, since the management team did not have a system for performance measurement. The TTM team specified that the users should have a process graph on the intranet as a starting point for their work. From this graph, the different support systems, templates, documents, etc, could be reached. This was seen as a major improvement compared to the situation at the time. The design team believed that data for the measurement system should be generated automatically from different systems. The links to the process measurement system show examples of data sources that were potentially relevant.

The design work progressed without major conflicts. The final should-process consisted of four macroblocks (cf. Figure 18). Each macroblock consisted of between 10 and 30 activities. In the Business Opportunity Evaluation (BOE), the fit between the suggested project and the tactical product plan should be evaluated, and the estimated profitability of the project should be calculated. The resources for the project execution

should also be selected. If the project contained new technology, a Feasibility Study (FS) should be made. The development work was made in the Product & Process Development and Verification block (PPDV). In this part of the process, the product, tools, machines and production process were defined and verified in close cooperation with the customer and suppliers. The product and process was then verified for ramp-up in the Serial Product & Process Verification macroblock (SPPV). Each macroblock contained one or several milestones, intended to support project planning.

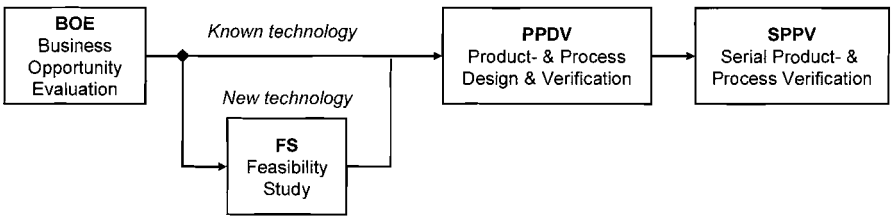

Figure 18. Macroblocks in the new TTM-process.

In each macroblock, roles were defined. Each activity was discussed and a role was identified as responsible for each activity. If it was not obvious what the activity was, a brief description of the activity was made.

The design team worked in different groups in developing a process measurement system. During the scheduled meetings, the measurement system was discussed by 2-5 people for about 15 hours. The purpose with the system was primarily to support the work of the process owner.

The Manager of Business Development argued that it was important that each project was managed individually. If one project failed, it was not the job of the process owner to solve the problems. The process owner should focus on improving the process in areas where many projects had problems.

Some people argued that it was important to separate the measurement systems for TTM and TTC, while others suggested that the result of a project only could be understood if one took the results in TTC into account. The argument for separating was that it would be too complex to develop a measurement system for both TTM and TTC. The argument

for including TTC was that the success of a project involved both TTM and TTC.

The measurement system was documented in a matrix with measures for the different macroblocks. Examples of measures were lead times, share of projects that pass production tests on the first trial, customer satisfaction, standard costs, budget, and the employees' perception of the usability of the process. One of the suggested measures was removed at a later stage. The measure was percentage of milestones finished in time. The reason for this was that the customer could change the time schedule. It was then difficult to know how the measure should be calculated, and there was a risk for low data quality.

The commitment to the measurement system on the part of the RBG consultants was obvious in a meeting at the end of the design phase. Some participants thought that the process measurement system should have a lower priority than other implementation issues. One of the consultants was strongly against this. She argued that many companies had failed in their process improvements because they did not have measurement systems. One of her arguments was that it is difficult to know if you are on the right track if you do not measure. The president of Alpha was also interested in the measurement system. One of the greatest risks he perceived in the project was if they could not develop good measurements for the process.

It was not clear who the process owner of the new process would be. The question became more apparent at the end of the design phase. Who would stand in front during the implementation and take care of the process? John, who was the project manager for the TTM project was appointed to be temporary process owner.

The design team formulated recommendations to the TTM project owners (extended management team). The recommendations were collected in nine groups. The recommendations were structured so that an implementation team could be created for each group of recommendations. Implementation groups were suggested for each macroblock. Other suggested groups were organizational changes, training, TTM and quality system integration, and IT. I suggested the term "information management" instead of IT in order to widen the scope to more clearly address the use of the information systems.

The recommendations included instructions for each group, process documentation, investment budget, and suggestions for team members in the implementation groups. The management team accepted the recommendations with minor changes and comments.

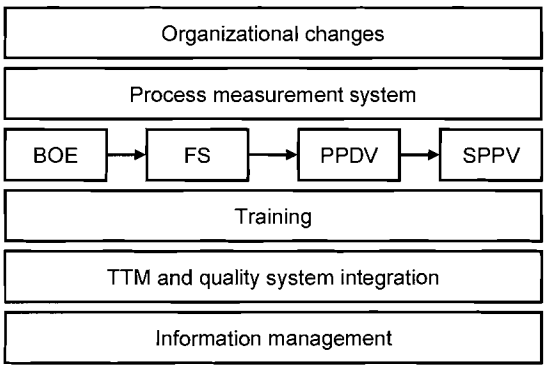

Figure 19. Implementation groups.

The work in the design team changed character near the end. Time pressure was more obvious, which led to work often being carried out by a few persons, rather than in teams. It was also more common that people were absent from the meetings near the end. Not all team members had an understanding of all the recommendations.

3.4.6. Implementation

The implementation of the process started in august 1999. About forty new participants were introduced to the improvement method and the recommendations created by the design team in a two-day conference at a hotel outside Stockholm.

The main implementation work consisted of formulating descriptions of activities and templates for the work, training employees in the new routines, and developing and adapting the information systems that supported the new work procedures.

The budget for information systems changes was expected to be about a third of the total expected costs for the implementation. Document management was regarded as crucial in order to manage project information, exchange information between the different offices and to re-use earlier solutions. The implementation of a document management sys-

tem was started. Another important system involved a web-based process graph with links to the routines in the quality system which would give access to the process documentation, templates and measurements.

The management team decided that all new projects should follow the TTM-process from April 1, 2000. This was clearly communicated and it was obvious that the CEO of Alpha wanted the work to follow the process rather strictly in order to make sure that the benefits of the new process were harvested.

Organizational changes

Changes were made to the organization during the implementation of the TTM-process. A project office was established. This was done in order to support the project managers in their work.

Resources were centralized so that the customer teams no longer had independent personnel and budgets. The autonomy to select projects was decreased. The resources were instead allocated to the project office. This was meant to increase the flexibility between the teams. The account managers had previously been reluctant to let go of employees to other projects. As a consequence, people who previously had worked closely in a customer team on some projects came to work with people from several other customer teams.

The Project Office Manager created a template for TTM projects using a project planning tool. The template reflected the activities in the TTM-process. The purpose was to facilitate project planning. However, he noted that the relationship between the TTM-process description and project planning was not straightforward. The traditional work breakdown structure was not easily mapped to the activities in the process.

> We ended up with a work breakdown structure which really was the steps in the process. It is not certain that it is the activity level that should be used to plan and control the project.... It [the work breakdown structure] is not the same as having a project plan which describes all steps. (Project Office Manager.)

He saw the process owner role and the project management office as striving towards the same goals. However, he had a stronger focus on helping the project leaders, whereas the process owner was more focused on the general process.

Process measurement system

The process measurement team consisted of five people from Alpha and one researcher (myself). The people from Alpha were from Business Development, Marketing & Sales, Finance & Control, Production, and Quality.

The team used the specifications that were developed by the design team. Those who had worked with the IT Department in earlier projects said that it was important to have clear specifications before the IT Department was contacted. They would not allocate resources until the project was specified in detail. After an analysis of the time required with a traditional waterfall method, it was suggested that the team should contact the IT Department at an earlier stage in order to create a prototype.

The team used data models in order to specify the information that should be managed in the system. This was not an obvious choice since the team members were not familiar with the tools and they were not sure how meaningful it would be to learn.

The measurement team invited a person from the IT Department to comment on the project. He said that it was a great advantage from the perspective of the IT Department if the team could develop a data model for the system. He could also confirm that the solution the team defined was reasonable. I held a training session in data modeling with the process measurement team in order to support the creation of specifications.

Manual data entry was perceived as time consuming and boring, and there was an agreement in the group that it would be difficult to introduce such a system. The intention was to make the data input as automatic as possible, and a natural part of the work. For analysis purposes, the team agreed that the measures ideally should be broken down in different dimensions, such as product type, customer and whether or not the project contained new technology. The reason for this was that the measure of lead times would become imprecise if it was an average based on different types of products, with different degrees of new technology.

It was not obvious what systems would contain the data that should be used in the measurement system. Several information systems were to be implemented during the TTM-work. It was, however, clear that the

input would come from several systems. During discussion, it was recognized that data could be collected from the enterprise resource planning system, the document management system, the project planning tools, the time reporting system and the customer relationship management system. The team concluded that there were many ways to get the data that was needed, and that the preconditions for the measurements were to be established when the different systems were implemented or modified.

During meetings initiated by the Information Management Team, the data collection for the system was drawn into the process graphs. The result was a "data collection matrix" with information about what data was needed, in what process activity the data would be generated and in what system the data should be stored. The idea was that the data should be transferred to a small data warehouse which would contain all necessary data for the system. This data would then be transformed to multidimensional structures suitable for analysis using different end-user tools, such as web browsers, spreadsheet programs or standard tools for visualizing data in different forms. The basic structure that was suggested is shown in Figure 20.

The system specification was developed iteratively based on the data collection matrix, data model, multidimensional data model and user interface.

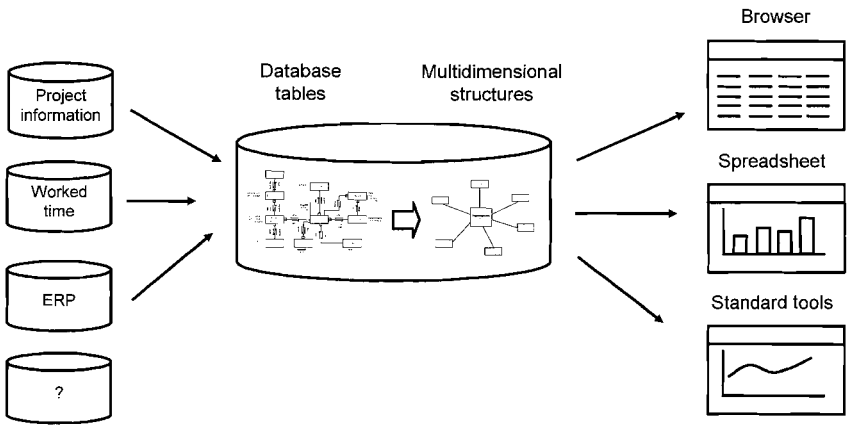

Figure 20. Structure of process measurement system.

The team developed a prototype in a spreadsheet program. The prototype showed the different tables and graphs that should be available, while the user could navigate in the system using dummy data.

The specification of the process measurement system consisted of the data collection matrix, the data model and the prototype made in a spreadsheet program.

Through contacts with the IT Department, the idea was that the development of the system should start when the specification was finished. The contact person was reluctant to start the project even though they had a specification. One of the reasons was that he was responsible for the year 2000 projects (Y2K) and did not want to disturb this work. The Information Management team also made the decision that the operative systems that were needed in the process, for example the document management system, were more important than the measurement system.

A lengthy discussion about definitions and terms in the process made it difficult to specify the information in the system. One example of this was that it was not clear whether or not a Business Opportunity Evaluation could result in several projects. If it was possible, it would be difficult to measure the lead time, since it was not certain that the subprojects would start at the same time. Other discussions were about the dimensions that could be used in analyzing the data. The team wanted to separate the lead times for projects that were based on known technology, from projects that had new technology. How this should be de-

fined was not clear. The team also wanted to view lead times for different product groups. This started a discussion about what product groups they actually had. None of the people in the team was satisfied with the existing product groups.

It was not clear in what system the categories should be entered. Should the product groups be entered in the document management system or in the enterprise system? The information was needed in both places, but it was not clear which alternative should be used. The discussions about definitions and terms had direct consequences for the measurement system. Each time there was a new decision, the team had to update the data model, the data collection matrix and the prototype, to reflect the underlying structure of the process.

John Svensson, who had been strongly interested in the measurement system, left the team because his normal duties became heavier than usual. The market representative left the team because his efforts were needed on the BOE-team. The project manager from the quality department was transferred within the organization, and his new manager did not want him to continue in the measurement team since it would disturb his normal work. The representative from Finance & Control took over the project manager role.

The salary negotiations did not take into consideration if the employees had worked on the TTM project. Most team members had their usual workload. If the work was neglected because of the TTM project, the consequence was that their salary was affected negatively. This contributed to the measurement team's eagerness to delimit the work. Even if the TTC-process was important, they did not consider it to be the measurement team's job to think about the relationship to the TTC measurement system.

Yet another person left the measurement team because his manager needed his efforts.

The definition of terms was not finished at the end of 1999. The document management system that would be one basis for the lead-time measurements would not be implemented in time for the pilot projects. It was also difficult to get resources from the IT Department.

The team decided to create a simple prototype to be used in a transition period. The team handed over the documentation to the IT Department. A programmer used the documentation and had a finished system in

about two weeks. The data model could be translated to the database that was the basis for the system. The system had a manual data entry interface on the intranet. The measures were presented as figures and graphs on an average level. It was not possible to view the data in different dimensions. The surveys sent to customers and employees were set up to be performed using a commercial web survey system. When a project manager tested the system, he thought that it was easy to use, but his comment was that it would be difficult to find time to enter the data.

Since the "real" process owner for the TTM-process was not appointed, the measurement team did not have a strong project sponsor, or system owner. This made it difficult to know if the prototype would actually be useful. A perceived risk was that the manual prototype system would become the final solution. The project leader for the measurement system team quit his job shortly after the manual system was finished.

Macroblock teams

The macroblock teams consisted of at least one member from the design team, and initially three to five additional members that could contribute to the specific macroblock. The teams met and discussed how the macroblock could best be implemented. The first meetings were focused on understanding the documentation. The work then continued with describing in more detail the different steps, and developing templates and checklists that could be used in the process. The teams focused on understanding the part of the process they were responsible for implementing. How the information in the process was to be stored was not addressed.

The work was carried out under resource strain. The macroblock teams were staffed with people who were not part in the initial design of the process. The commitment was not as high as in the design phase. Rather than setting time aside and leaving the premises to focus on the work, as in the design phase, the macroblock teams had to schedule the meetings in conflict with their operative work. The meetings were also carried out at Alpha, where the daily operations interrupted their activity. It was common that people arrived late to meetings and that phone calls disturbed the meeting processes.

Training

The training team had the assignment to develop training material and a course for the employees at Alpha. There was also an assignment to develop "marketing" material that could be used to inform customers and suppliers about the new work processes.

The written material created by the team was detailed, describing the different steps in the process. There was little information about the goals of the process in the material, and about the underlying thoughts the design team had when they designed the process. The training highlighted the steps in the new process rather than what difference it was intended to make.

Göran Nilsson was initially a part of this implementation team, but he left the team when he saw that the team would not work with the integration between TTM and TTC which was his research interest.

All employees received four hours introduction to the process, and the people who would work in the process directly also received general training in the document management system.

TTM and Quality System Integration

The ISO certification prescribed that the routines that were to be used should be documented and that there should be processes for changing the routines. An information system for quality routines was used to store the existing quality documents, and to send the documents for approval to different employees. The new TTM routines had to be transferred to this system and integrated with existing routines. The system would then be used continuously to update the templates and routines.

One concern was that the users of the TTM-process should be able to reach the documents from the intranet. The customer liaison from the IT Department could solve this problem. The quality system could export a web page with links to the documents grouped under different headings. The headings in the system were created so that they matched the macroblock names. Clicking on a macroblock in the TTM-process then showed a list of the documents that were used in the macroblock. With this setup, the users would click first on the macroblock, and then on the routine they wanted to use on the intranet.

The idea by the design team, that the user should be able to click on the activities directly in the process graph, was not fully implemented. On the other hand, it was seen as a sufficient solution and would be easier to keep updated when the process was continuously improved.

Information Management

The information management team consisted of six persons from Alpha and one researcher (myself). The team members were from Business Development, Purchasing, IT, R&D, Production and Product Management.

The first meetings were introductory. Nobody in the team had a complete picture of the current systems and what possibilities and limitations they had.

The team decided to start with meetings with the macroblock teams to describe information and information systems required in the process. During the meetings it was evident that the macroblock teams did not have a clear picture of the information and information support needed in the process. Their focus had been on understanding the process activities.

The meetings took longer than expected. There were many discussions about each activity in the process. Since the IT infrastructure was not clear, the idea was to describe what type of information was used, if it was not obvious which system should be used. In this way, the meetings could focus on the information needs, rather than deciding at an early stage the system that should be used. One example of this problem was that it was not clear how documents should be managed in the process.

When the four meetings were finished, the information management team made a summary of the systems that were needed. A number of systems seemed to be critical in order to be able to work in the process. One of the most important was a web-based process graph that could visualize the process. The graph should be connected to the quality system, where routines, checklists and templates could be found. The documents should then be stored in a system that made it possible to search for project documents and drawings. The purpose with this was to increase the possibility to reuse earlier solutions. The ERP-system was also perceived as critical since it was an important link to production and sales estimates. Other systems were the process measurement sys-

tem, a customer relationship management system, a competence-matrix with "driver licenses" for machine operators, simulation tools in development, CAD-systems and systems for quality measurement. Further systems supported project planning and time reporting.

All the information management team members perceived document management as most important. The work in the TTM-process was, to a great extent, work with documents. The information management team made document management the first priority in the implementation phase.

There were many alternative ways to solve the document management problem. At the time, a comprehensive folder structure was used on a local area network drive. In the Research & Development Department, the technical staff used a Product Data Management (PDM) system for product models and drawings. There was also a Customer Relationship Management (CRM) system that could support documents. The implementation of the CRM-system had taken a long time, and was not used by many people at the time. It was referred to as "the world's most expensive address book".

An evaluation was made if the PDM-system could be used to manage documents for the whole process. It seemed as if two aspects were important. One was if the system was easy enough to use for standard office documents. The system was introduced to manage product models and drawings, where version control is important. Would this "overhead" be perceived as unnecessary for the people who did not create drawings, for example global account managers? The other issue was how the work environment would be for the users if there were document templates and checklists on the intranet, but the documents then were stored in another system. The documents had to be uploaded to the PDM-system, where the user could classify it according to the principles in the system. The user should select what project the document belonged to, what project type it was referring to, what type of document it was, enter a description, etc. These fields were used in order to make the documents easily searchable.

The information management team decided to implement the PDM-system for document management in the whole process without further evaluation.

A long discussion concerned the time plan for the implementation. The employee who had worked with PDM in R&D believed that it take last at least a year to get it to work for the whole process. According to the supplier, there were companies that had done it in 1.5 months.

One issue was the level of ambition in the implementation. Should the system be used as a large "file explorer", or should the logic in the TTM-process be built into the system? In the first alternative, the folder structure could be transferred to the PDM-system, which would be possible to do relatively quickly. In the second alternative, there would be a need for programming and configuring the system to support the TTM-logic, for example by creating specific document types with different searchable fields.

The team chose to build the logic in the first macroblock into the system, while the other macroblocks only contained folder structures. The idea was to develop the other macroblocks when the process was in use. During the development, it was decided that the templates that were used should be imported from the quality management system to the PDM-system, so that the documents could be created from within the system. The users would right-click on the macroblock and select to create a new document. A list of the available templates was shown, and the user could enter the necessary meta-information before the document was saved in the database.

Together with the supplier of the document management system, four prototypes were created in about two months. One of the major issues in the prototyping was the structure in the system. Could one business opportunity evaluation lead to several feasibility studies? Could one product- and process design & verification lead to several products? Another issue was related to where data should be generated. Where was the list of customers? Was it in the ERP-system, the PDM-system or in the customer relationship management system? Where was the list of different product groups actually created? In order to search for information in the system, each project should be related to one, or perhaps several, product groups. The measurement system should use information from the document management system to read lead times for different product groups. The information was needed in several systems, but how should the links be created?

3.4.7. Pilot projects and initial use

The aim was to start two pilot projects in the middle of February 2000. One should be an internal project for a new type of product. This should be performed as a feasibility study. The other was a customer project that should be based on known technology. A project was selected, but the customer later backed out of the agreement. The internal project was run, but it was difficult to evaluate. The project team received little training, and did some of the documentation after the project was finished.

The TTM-process was increasingly being used, but the rate of adoption was slower than expected.

The work progressed with some negative feelings from people who wanted the work to be carried out according to the process, rather than by bypassing the important decision points.

One reason for the delay was that the people working in the TTM-process were reluctant to work according to the process since they felt that they lacked the document management system. The TTM-process owner noted that the implementation of the document management system required precise information specifications.

> A lot of the implementation work is done in connection with the document management system. This is when issues become really sharp. What information do we really need out of each activity. How should it be stored? What type of document do we need? This is really when we come to the final part of the implementation of the process. (TTM Process Owner, Product Manager).

The work with the document management system progressed during 2000. The document management support was really missed, according to the TTM-process owner. The documents were stored in different places. This made it difficult to find them and to monitor the progress in the projects. It was difficult to know how the templates were used. However, there were not enough resources or energy to define an interim solution for document management so the negative effects of the delay had to be accepted.

The work of adapting the document management system continued through the year, and an additional person was employed to work with the implementation of document management.

John Svensson leaves

During the spring of 2000, John Svensson had a very heavy workload. He was responsible for the TTM project but also had his normal duties as Vice President of Business Development. There were several other projects going on. In operations, a supply chain project had been started with a focus on TTC. This project was mainly run by a newly appointed logistics manager and was a complement to the TTM project. John Svensson had already left several of the implementation teams since he was under too much pressure. He also started to feel that he spent too little time with his family.

One day when I came to Alpha, I met John Svensson in the lobby where he had just finished hanging a new colorful painting. He was sitting in the sofa and looked tired. I said hello and started to talk about the implementation. He was usually enthusiastic about his work, but this day, he answered with short sentences and seemed distracted. I knew he was busy, so I continued to the meeting I was participating in.

John Svensson could not continue to work in the pace he did. He became ill and left Alpha. People in Alpha were reluctant to discuss the reasons, but it was clear in informal discussions that it was related to his workload.

TTM- process adjustments

Tom Sundin, now the Manager of Industrial Engineering, and Lars Envall, the Product Manager took over the responsibility for the TTM project. They had both participated in the design team and knew the history of the project. Tom Sundin thought it was an advantage to have two people with a shared responsibility. He noted that it probably had been lonely for John Svensson.

The manager of Alpha decided that all new projects should follow the TTM-process beginning September 30, 2000. This was made clear and was highlighted as one of the main goals in Alpha for the year. Projects that in September had more than three months before completion were to be converted to the TTM-process.

The requirements for information in the BOE phases were not easily met. If the decision to start the project was not made according to the criteria in the BOE phase, resources could not be allocated to the project. The customers wanted prototypes early on, particularly in Asia, before

the BOE could be finished. Customers would not commit to volumes unless they had prototypes and the people in Alpha could not provide prototypes unless they knew the expected volumes.

According to one global account manager, the process was difficult to follow. The first steps of the process were problematic.

> I came in after the TTM-process was implemented. With all the good intentions in the world, it was not possible to follow the TTM-process. This was very frustrating to me since it was meant as a support. (Global Account Manager).

In Marketing & Sales, there were many negative comments about the TTM-process. The prior resources the teams had were formally moved from the teams, and a structured process restrained their freedom. The global account managers were reluctant to use the process. This led to Lars Envall taking on the responsibility to run all BOE phases.

A "presales" phase was added to the TTM-process in order to address the problems. This made it possible to have flexible sales activities before the project started. A global account manager noted that the work with product development was less structured in the early phases than in the latter, and that the flexible presales process made it easier to work according to the process.

The cross-functional teams that worked in the product development projects tended to have meetings where all team members participated. This was seen as unnecessary since some of the members had specific competencies. A new role was established, called the IE Coordinator. This was a person from Industrial Engineering who took the responsibility for coordinating all the issues that could have production implications. With this approach the idea was to have a small core team and specialists who participated in more delimited ways.

Views on TTM-process use

The TTM-process was increasingly used during the autumn of 2000 and spring of 2001.

There were many opinions about how the TTM-process should be applied. Some people thought that it should be followed in detail. If an employee thought that the process did not correspond to a project, he or she should propose changes to the process. Another view was that the

method should be seen as a checklist, and that it was not necessary to follow it.

The message was clear from the general manager at Alpha. The Project Office Manager described the strong emphasis on following the process.

> We said that we should work according to TTM, and now we are damned to work after TTM whether it is possible or not. The goal was that all projects should follow TTM from the end of September, and then, people try to follow it. (Project Office Manager).

With a strict interpretation there was a risk of being bureaucratic. The project office manager gave the following example of a problem related to the cooperation with customers in the first phases of projects in the new TTM-process.

> I come to you [as a customer] and ask if you can give me a standard cost for this component. No, I am not allowed to do anything unless the BOE is approved. That is what it says. If it is not approved, we are not allowed to work, and in the meantime, we lose the project. (Project Office Manager).

This was based on a quote from an employee in Alpha. The project office manager said that he understood what they wanted, but he had doubts if the organization really could afford it. In his view, the TTM-process was a support, which should be used more as a checklist.

> You can choose between trying to follow every detail and then it will take a long time, or you can try to see what the spirit of the process is. This was not communicated.... We should have worked more with attitudes and the spirit of the process, and that this is an aid. There is a difference between a checklist and a law. Do you mean that these routines should be followed, or that these routines are a support for finishing the project as fast as possible? (Project Office Manager).

During interviews in the evaluation of the TTM project, we asked many questions related to how the project team decided on a course of action in the projects. Tom Sundin, the Manager of Industrial Engineering, who also was responsible for the TTM-process implementation together with the product manager after John Svensson became ill, described that both guidelines and improvisation was needed.

> It is like this.... that we can be very strict and tell people what to do, and ignore the fact that people have the competence to decide on these issues themselves. It is about finding a mix where we have relatively clear guidelines for what should be done, but still create room for, what shall we say, improvisation, for some parts. (Manager, Industrial Engineering).

A project leader for projects in Asia felt that the process had been introduced so that it encouraged following the process strictly. However, he argued that it was important to follow the work methods used by the customers.

> It is possible to follow the process. That is not the issue. The question is how many customers we would have if we followed it. As a supplier, we cannot say that this is how we do things, it is the best way. We need to follow the customer and their development process in almost 100% of the cases. (Project Leader, Asia).

After a while they realized that it was not reasonable to follow all activities, and the process became more of a guideline. On the question if it was more fun to work before the TTM-process was introduced, he answered:

> Then I would have to create a checklist myself. It is not possible to keep everything in your head. I think it is a support. (Project Leader, Asia).

Activities that were not carried out in the past were documented in the TTM-process, and this had several positive effects on the projects. For example:

> When projects have been executed with the new TTM-process, we get a better result in the end. These results are due to additional focus on the quality of the [production] process. One of the huge problems has been that we created specifications that could not be produced with high quality. We have an activity for that now. We have a whole new focus on logistical issues, where we also have defined activities. (Manager, Industrial Engineering).

Even though the focus on quality had improved, there were still the traditional problems with different views in development and production. The manager of industrial engineering described that the relationship

between the people in the TTM projects and Operations was characterized by lacking integration:

> There is a border between. It is not a border, it is a damn wall, you know; someone said that we [TTM] need to have some form of barbed wire between because we should not be involved in production. I think we should have three phases in the projects: sales, development and production. (Manager, industrial engineering).

By including production in the project definition, he believed integration could be supported. There were examples when the TTM-process activities were interpreted too literally and the whole chain of activities from TTM to TTC was not considered.

> People simply get mentally blocked...we get into situations where the project leader says that "they [production] will not accept my product". [We ask] "Yes, but is it finished?" [They answer] "Well, no, we have some things left to do but...date-wise they are supposed to take over".... Why do they reason in this way...what is most important with the project? (Manager, Industrial Engineering).

When the date set by the project leader for the handover to production appeared, he wanted to hand the project over, even if it was not verified for production.

The TTM-process owner comments on the literal interpretations.

> People have, to a rather large extent, interpreted the checklists for starting projects literally. When the information could not be collected, the BOE was not finished.... They misunderstood that it is OK to make your own judgments. This has been very difficult to get everybody to accept. (TTM-process owner, Product Manager).

The reasons for this might have been in training. It did not focus on the basic ideas in the process, but rather on the activities.

> I think that it was a flaw in the training. We did not succeed in communicating the purpose with this part of the process. People understood that it was important to make a business evaluation, but the instructions were followed literally, and it was not possible to finish. We have changed this so that it is now sufficient that a global account manager makes a qualified decision. (TTM Process Owner, Product Manager).

The Manager of Research & Development said that using rules like these is actually about common sense, but how could this be established?

> If I had a patent answer to that, we would probably have come through this process much easier than we did. (Manager, R&D).

How the TTM-process should be used continued to be a difficult question.

3.5. Evaluation

An evaluation was made by the researchers during the spring of 2001. The implementation activities had been going on for a year and a half, and the duration of the TTM project was two and a half years.

In the project teams, the general attitudes towards the TTM-process differed depending on their roles.

The global account managers were the main critics. Their previous autonomy in selecting projects was reduced and the teams needed to follow the criteria for project initiation. In their view, the process was too bureaucratic, and they felt that it was more important to follow the customer than to follow the process.

The project managers were more positive. The process description gave them an understanding for the whole process, and was a means of delegating activities according to project roles.

In the Research & Development department, the opinions differed. The younger engineers were positive since it clarified what their responsibilities were. The more experienced engineers felt that it was too bureaucratic, and were sometimes frustrated when long meetings were held regarding issues that were suggested in the process, but they could not see a need for in the specific project.

The quality engineers were very positive. Having routines was very natural to them, and it gave them the opportunity to check that the production quality was taken into account.

3.5.1. Positive aspects

The main positive aspects of the TTM project were related to the work structure and the document management system.

Work structure

One aspect that was commonly highlighted as positive was that there now was a structure available for the work.

> This is great! It is the first time we have a structure in what we do. The systems we have had earlier were impossible to follow. There were a number of routines, but it was not clear how they were connected. (Project Leader for a major customer).

It was seen as important to have the structure since there were many new employees. To become productive with the old manuals, a person needed to work for a few years to understand the routines. This became easier with the new process. The structured work was also seen as important in order to meet the demands of the customers.

According to the product manager, the projects were started in a more structured way than before. The planning of the projects was also better than before. The quotations to the customers had higher quality and the projects had a better link to the strategic plans. He also said that clearer responsibilities could lead to fewer issues being missed in the projects; but this was more of a feeling.

A senior mechanical engineer felt that the sense of the whole perhaps was better since the structure of the work was available when the project started.

The work structure was also a means to make it possible to control the work. The milestones were checkpoints where certain criteria in the project should be fulfilled.

> I think that it [the process graph] is a necessary support in order to control anything. We can understand where in the process a project is when there are issues of borrowing resources from other projects, or setting priority on one project before another. If we do not have a process model, it is difficult to understand the status in each project. (TTM Process Owner, Product Manager).

However, he emphasized that the process graphs were not used on a daily basis. The project managers learned the process rather quickly. The operative work was more related to the project plans, which were based on a template in a project planning tool where the TTM activities were included.

Document management

The product manager felt that the most important contribution was the document management system and the process.

The work structure provided by the TTM-process supported the people in the projects, but it was also a help in establishing the document management system.

> I think that the process graphs are very important. They are indispensable when we implement the document management system. (TTM Process Owner, Product Manager)

The document management system was seen as an important contribution from the TTM project both as a support for handling information in the operative work and for reusing earlier product ideas.

> The structure and order of the documents is an important success factor for reaching our goals. There are no doubts about what documents should be created, where they should go and what they should be used for; and we get the possibility to easily go back and find information about products we have developed earlier. (TTM Process Owner, Product Manager)

Another positive aspect was that the documentation had a common structure and layout.

> I think we would have had many different types of documents with different structures if we did not have the support systems. This is unfortunate in contacts with customers, and they would not tolerate it. It is very important to have these tools. (Senior Mechanical Engineer).

This comment was partly about providing a professional visual impression but also about recognizing the structure and layout in order to find the information easier.

Process improvements

The first phase of the process, the Business Opportunity Evaluation phase (BOE), was not documented before the TTM project started. The criteria and process for starting projects was unclear, and this had been seen as a weakness before. The new process was more strongly linked to a tactical plan which was not known before.

> I think one can say that the projects we have started now have a strong link to the strategic plan. (TTM Process Owner, Product Manager).

The process provided material for planning the project and estimating resources, which made the work with quotations easier.

It was also easier to plan company resources. The employees belonged to the central Project Management Office and the functions rather than the customer teams. It became easier to "borrow" resources.

3.5.2. Negative aspects

The principal critics of the new process were the global account managers from the Marketing & Sales department. The combination of the new TTM-process and the organization change, where resources were removed from the customer teams, led to a loss of flexibility and power. They were used to running their own show, and were not used to depending on others regarding resources and acceptance for their projects. Another negative aspect was the time it took to finalize the implementation.

Loss of autonomy

The organizational change carried out in parallel with the TTM project meant that the prior customer groups were formally split up and the resources moved to the line organization. This loss of autonomy affected the motivation in Marketing & Sales. The customer focus was reduced. Some employees chose to leave the organization, partly as a result.

Process design

The design team had been cross functional, but there were only three employees that represented the R&D perspective in the team. A senior mechanical engineer felt that it would have been better if there were more people from R&D when it was implemented. It was more focused on Operations and Marketing & Sales. This was partly because the first and last phases of the projects were problematic, and these phases were addressed by the design team. However, one of the consequences of this was that the development engineers were not as "visible" in the process as Marketing & Sales and Operations. They seemed to be responsible for few activities, even though they performed important parts of the work.

The design of the BOE phase was problematic since the assumption was that customers came to Alpha and asked if they could develop a component. When the process was implemented this was not the case. Many more resources needed to be put into marketing and sales activities. The process was not adapted to the market environment when it was implemented.

Delayed implementation

The process design was finished in June 1999. It took more than a year before the process was implemented, and an additional six months before the document management system was in place. This was seen as negative.

> It has taken significantly more time than most people hoped for. Reasons? It is really a gigantic project. We underestimated it. We underestimated the importance of the document management system and the complexity of implementing it. (TTM Process Owner, Product Manager).

A person from production engineering describe that the tools were important for the work and showed frustration about the delay.

> We took in a team to help in designing a work structure...and it has been talked about the importance of this with TTM, but then it was silent for more than a year. It was no go in the project... There is so incredibly much left to do with the different tools that should be used, they are not there...We say that we use the process, but the tools are not ready. This is what is the problem, that we have not had this before. (Production engineer).

The tools were both the practical routines used for example to evaluate the production capabilities of the product and the tools for storing the project information. The document management system was the part of the project that took the longest.

> It would have been good to have more IT-knowledge and resources in the project. It was a little thin in that area. It was many amateurs working with this. The consequence is that we are late with the document management...We did not realize how early we should have started with this and at that time we did not have

> the insight about how important it was, and that is easy to say now. (TTM Process Owner, Product Manager).

Another aspect that seemed to delay the implementation was that the marketing & sales department did not accept the new process.

> The sales people do not want to work with this, and they have given it a low priority. They probably think it is unnecessary paperwork and want to do real work instead, but if it does not come in, it will never come out [of the process]. (Project manager).

The R&D manager reflected on the negative comments about the TTM-process and said that "it costs to implement it". However, he saw this as a necessary step for the company. Even though there were heated debates during the implementation, the majority of the persons involved in the product development projects felt that the new process was a step in the right direction.

3.6. Case epilogue

The downturn in the economy influenced the telecom sector strongly. The management team at Alpha was forced to make personnel cutbacks during 2001 and Alpha was later merged with a competitor. After a turbulent time, the TTM-process became a part of the everyday business operations.

One of the reflections from Tom, the process owner was that the implementation work required management attention for a long time after the training and first uses of the process. The training sessions held during the TTM project were only the first step in the implementation.

The character of the improvement work shifted in 2001. The TTM project had ended, and a phase of continuous improvements started. The speed of improvements was felt to increase after 2001. Fewer resources were used but with a small and focused team they could make changes quickly.

One of the reasons for the focus on improvements was due to the external pressure to become more effective. According to a production engineer, the effectiveness had been important in everything that was done in the organization. With this pressure, they had to simplify and focus.

As a part of the continuous improvements, the process went through a simplification phase where the visual guidance was improved to make it easier to see the main flows in the process. The activities were also color-coded depending on what role that was responsible for the activity. Risk management was increasingly added to the process. This increased the focus on deviations from the plan rather than on following the process.

The approach on what to describe in the TTM-process was also somewhat changed. Instead of describing all activities, the focus was put on describing the activities where it was important that specific steps were taken. If there were many ways to accomplish a task, it was up to the team members to decide on how to perform the task, but if there was one "best way" it was important that it was carried out according to the process description.

The perspective on the method changed when it had been used for some time. At the outset, it was clear that the TTM-process should be followed strictly but after using the process, deviations became more accepted. It was not required to follow the process in detail.

> It is OK to make exceptions. The process is optimal from one perspective...but for different reasons we might need to take shortcuts...We did not have this knowledge when we first implemented the process. (Responsible for project management).

With the training and experience with using the TTM-process, the team members could increasingly be trusted to use their judgment. However, there was still a strong belief in structured work. The person responsible for project management described that the process represents a best way to carry out the projects.

> This is the best way to do it, so it is of course a rule. But we do not describe how people should go to the can. We only describe when there is one way to do it. It does not regulate everything. It is allowed to sidestep if you have motives. It contributes to clear responsibilities...There are clear descriptions. It is not up to you as an individual to decide. Because it [the process] is right. (Responsible for project management).

The employees stayed longer at Alpha than before. The problem with inexperienced newcomers almost disappeared. When the TTM project started, the new employees could not be trusted to have the required competence, but over time, they learned. The experience of the persons

was now much greater than when the TTM project was started. The engineers that had worked for several years did not need the detailed instructions in the process. The time spent on implementation also made it easier for the team members to understand the process, and they could more easily use it in a suitable way.

The macroblock owners in the process improvement team were replaced by owners based on competences such as project management, engineering and production. This was done to increase the focus on the whole process rather than on refining the individual macroblocks.

Even though the process was mainly developed for internal use it also became useful in collaborating with the customers. According to a global account manager, the customers felt that it was very good to be able to map the processes to each other.

The TTM- and TTC-processes were highlighted in the management system at Alpha. Management resources, such as a scorecard for the organization, the TTM- and TTC-process descriptions, routines for support functions, goals and measures were collected on a web site to simplify the use and to visualize the management system.

In the measures used, it was emphasized that the results rather than the process should be measured. What is delivered to the customers? How satisfied are the customers? Process efficiency was also measured as hours spent on the projects rather than lead time. For each project, a reference time budget was set, and the time spent on the project was compared. This was monitored in the project steering group meetings. The final measurement system included the results in TTC to a greater extent than the initially defined measurement system.

The new mother organization started to use the process also in other parts of the organization. After a time of uncertainty about the TTM-process, it finally settled in the organization. The quality reviews were very positive, and Alpha got visitors from other companies who were interested in the process and information systems.

The main parts of the new management system was the visible TTM-process and templates, the document management system, the time reporting system and the business information warehouse. The management system was made available via a web site.

They now had guidelines for their work, which in their view improved their abilities to achieve their targets and improve quality. It was also easier to work with several projects and make use of resources from other projects.

The person responsible for project management described the new TTM-process as being worth the efforts.

> Was it worth it, I would say yes, it was worth every investment... This is an implementation that I have not seen in any company before...Here quality is built in. The behavior is built in. Maybe it could have been done faster, but I am not sure. (Responsible for project management).

In his view, the TTM-process was so customized to Alpha that it could not be compared to the general project methods that are available. He emphasized that the TTM-process had grown out of their experiences, and that they had learned many lessons during the improvement work. As a reflection, he noted that taking the "easy" way by purchasing finished solutions probably would not provide the same benefits. They had even declined to sell their solution to visiting companies with the argument that the methods and tools need to be developed within the organization.

The time was a turbulent one for the organization. It is probably fair to say that the TTM project influenced the identity of the organization from an entrepreneurial organization, and introduced some "professional" structure, which was one of the main intentions behind John's work. The difficulties involved in the improvements were highlighted by that the changes carried both positive and negative consequences for both persons and work results.

4. THEORETICAL FOUNDATIONS

The theoretical foundations for this study starts within the information management discipline. Theories from project management, business process management and improvement work are provided as a basis for understanding project-intensive organizations. In the following, each area will be explored.

4.1. Perspective and domain theory

This thesis is written from an information management perspective and uses domain theory from project management, business process management and improvement work (cf. Figure 8 on p. 37). In the following, I will describe these theoretical foundations.

By combining knowledge from several theoretical areas, I aim to make use of strengths in each area as a support for developing the framework in chapters 6-8.

There are both similarities and differences between the theoretical areas discussed. In order to make use of knowledge from each area, I will conclude the chapter with a discussion and comparison of some key concepts which are central in each area.

4.2. Information management

This thesis contributes to developing information management theory related to a specific type of organization: project-intensive organizations.

Trying to describe the different parts of the field of information management is not possible within a single thesis. Therefore, I will describe two frameworks which together will provide an overview.

The first framework I will summarize is OIP, which relates Operations, Information and Persons (cf. Lundeberg, 1993; 2003a). The second framework is the Work Systems Framework (WSF) developed by Alter (cf. Alter, 1999; 2002a).

I present Lundeberg's model since it is structured according to the principles of form and process on different levels of abstraction (cf. Bateson, 1972, 1979). The framework builds on the theory structure I will use to develop the PRIO framework. Alter's model is presented since it is well known in the field and is used widely in university courses. It reflects some of the major components of the field in a condensed way.

4.2.1. People, operations and information systems

According to Lundeberg (2003a), describing business operations means working with descriptions related to different "logical levels" and comparing these. The levels persons, operations and information systems are, in his view, central when describing business operations (cf. Figure 21).

The development of the information management discipline has, according to Lundeberg (1993), grown from the bottom up. When working with information systems development, a main problem was to understand the operations to be supported. When knowledge about operations was accumulated, a new area required attention, related to persons in the business. The use of information systems to support operations is dependent on persons and their view of the usefulness and ease of use of the systems (cf. Davis, 1989).

Putting persons on the top level in this model can be seen as a statement regarding their importance. An alternative would be to state that "employees" are hired to conduct operations. In this view, people would be a support for the business activities, and the information systems would be supporting people. The argument put forward by Lundeberg is that persons have a choice regarding what activities they want to carry out (even though this possibility to choose is not always used).

Lundeberg has presented several frameworks related to the model. In this context, I will use the OIP model. The left column refers to constructed patterns, and the right column refers to descriptions of phenomenon. This distinction is related to form and process in Bateson's terms (cf. Bateson, 1972, 1979).

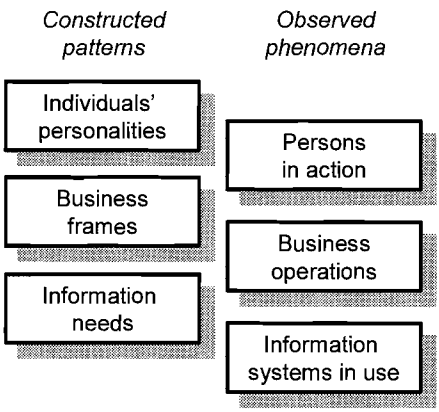

Figure 21. OIP model (Lundeberg, 2003a, p. 54).

In Lundeberg's terms, the logic in the OIP Classic Model can be described as follows.

> Individuals' personalities influence their perceptions and actions, which are behind and influence the business frames, which in their turn influence the business operations. The business operations are behind information needs, which are fulfilled by information systems. (Lundeberg, 2003a, p. 54).

Within this thesis, I view the levels persons, operations and information systems as a minimum requirement for the framework that will be developed. In other words, this view holds a strong presupposition. Even though there is a possibility that the material from the case could signal that some of the levels could be left out, this is unlikely. There are at least two reasons for this. The first is that it is a part of my perspective, and thus has influenced my interpretations of the case. The other reason is that similar ideas have strong support within several fields such as socio-technical research and management information systems (cf. Emery & Trist, 1960; Laudon & Laudon, 1996).

4.2.2. Work system framework

Alter has proposed a view which focuses on a "work system". With this approach human participants and/or machines perform work practices using information, technology and other resources to produce products and/or services for internal or external customers (Alter, 1999).

He separates out work practices, participants, information, and technology as the four elements of the system performing the work. The work system provides an output (products and services) received and used by its customers. Alter's inclusion of products, services, and customers reflects a work system that exists to produce things customers want (Alter, 2002a). In previous versions he used the term "business processes" to refer to the work performed. I have decided to use the term *work practices*, from his later publications.

On the borders of the picture, *environment, strategy and infrastructure* are shown. Alter considers these to be key determinants of whether a work system can operate as intended and can accomplish its goals. The strategy does not necessarily have to be explicit, but as a concept it can be used to explain why the work system operates as it does.

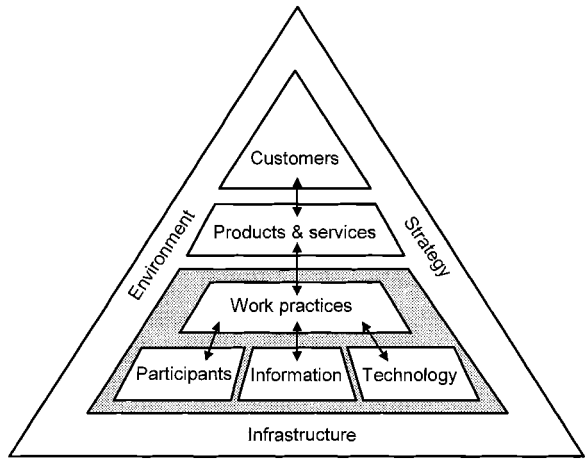

Figure 22. Work System Framework (Alter, 1999; 2002a).

An interesting point in Alter's work is his view on critical success factors. He argues that there may be critical success factors for general work systems, where the phenomenon of projects is a specific case. Some critical success factors may be common for all systems, but some may be specific for projects, and again for specific types of projects.

In relation to the work system framework, Alter has suggested a life-cycle model for work systems. In his model, the life-cycle can be described in terms of cycles of initiation, development, implementation, and operation/maintenance (Alter, 2002a).

4.2.3. Information systems

Information systems provide support in different ways and in different contexts. This has traditionally been a challenge within the information systems discipline. As a profession, systems developers are focused on systems development processes. Specifying and implementing systems are central. However, applying information systems development principles is done in the context of the specific work processes the system will support. For example, developing an information system supporting product development, requires an understanding for product development processes and the persons performing the product development work.

The challenge is to combine skills in information systems development with the domain in which the system will be used. Over time, different ways of describing types of information systems have been developed. Since technical development influences what systems that are available, these categorizations typically evolve over time.

Sundgren (1996) has provided a model of types of information systems in an organization based on a distinction between operative information systems and directive information systems (cf. Langefors, 1966).

Operative information systems are typically used to support relatively concrete and repetitive tasks. In principle it is possible to identify information requirements for such processes. Traditional examples include systems supporting production, accounting, inventory, and order handling.

Directive information systems on the other hand are used to support activities which are less repetitive in character, such as planning and control, decision-making and research and development. Typical examples are *decision support systems* and *executive information systems*.

For technical reasons it is often advantageous to separate data used for on line transaction processing (OLTP) from data used to support decision making, or on-line analytical processing (OLAP). Different forms of data warehouses can then be used to optimize response times and flexibility for analysis purposes.

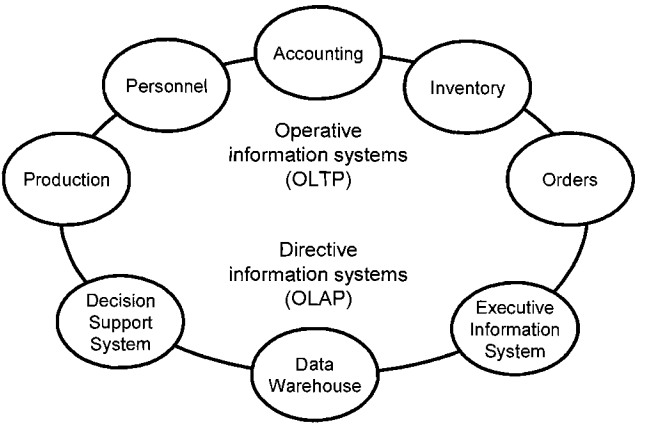

Figure 23. Operative and directive information systems (Sundgren, 1996).

The operative systems exemplified in Sundgren (1996) are related to departments in traditional industrial organizations. This way of providing categories is influenced by the historical development of organizations' use of information systems. With an increasing integration of different systems, the landscape is changing. The increasing use of standard application packages and systems for enterprise resource planning are two examples (Nilsson, 1991; Davenport, 2000). A large part of an organization's information processing needs are then provided in a single configurable standard application package. Other developments are related to component-based design and high-level programming tools.

Alter (2002b) similarly provides information system types and examples based on what business function they support. He also provides examples of technologies which can be used independently of the business function they support, such as office automation systems, communication systems and systems for enterprise resource planning (cf. Table 5).

System type	Examples
Product Design Systems	Computer aided design, product data management, product lifecycle management
Supply Chain Systems	Material requirement planning, supply chain management, electronic data interchange
Manufacturing Systems	Computer integrated manufacturing
Sales and Marketing Systems	Sales force automation, customer relationship management
Finance Systems	Accounting, electronic funds transfer
Office Automation Systems	Spreadsheet programs, text and image processing systems, presentation packages, personal databases
Communication Systems	E-mail, video conferencing, workflow, instant messaging, intranets, extranets, knowledge management systems, groupware, group support systems
Enterprise System	Integrated information infrastructure for several types of business processes

Table 5. Types of domain-specific information systems (adapted after Alter, 2002b).

Since technical development influences the nature of the information systems solutions in organizations, the categories provided here should be seen as potential categories. A specific information system in an organization often combines functionality from several types. For example, an accounting system can usually provide reports which can be viewed as a simple executive information system.

4.3. Theoretical inspiration

In the following sections, I will describe theory I have found relevant from project management, business process management and improvement work.

4.4. Project management

The project management field has grown considerably in recent years. The normative project management literature has been complemented with streams of research from several schools of thought (cf. Söderlund, 2004). I will here explore the project concept, different types of projects and theories related to project-intensive organizations. I will conclude with a discussion about project results, and information technology in the project management literature.

4.4.1. The project concept

Focus in the project management literature has traditionally been on projects as unique undertakings. Project management theory has its roots in the 60s, when major government and military institutions undertook extraordinary activities (Engwall, 1995). If a specific undertaking is not unique, it is normally not seen as a project, but rather as a natural part of the ongoing business operations.

Project is a term that is often used to refer to activities conducted by people in order to accomplish a task or goal within a limited time. PMI described a project as "a temporary endeavor undertaken to create a unique product or service" (PMBOK, 1996). This definition highlights that projects are temporary and that the purpose is to create something unique. It is often the case that there is a customer, or some sponsor behind the project.

According to Kerzner (2000), a project is "an endeavor that has a definable objective, consumes resources, and operates under time, cost and quality constraints. In addition, projects are generally regarded as activities that may be unique to the company".

Rather than presenting a short definition Meredith and Mantel (2000) describe a project as having several characteristics. First, it has a purpose. It is usually a one-time activity with a well-defined set of desired end results. It can be divided into subtasks that must be accomplished in order to achieve the project goals. The project is often divided into phases such as initiation, implementation and termination. Further, the project often interacts with other projects being carried out simultaneously. Interdependencies are thus common. Meredith and Mantel (2000) stress that projects are "unique". Every project has some elements that are unique. Since projects compete with departments and other projects for resources and personnel there are often conflicts in project work.

The larger part of the project management theory is based on normative principles developed by practitioners (Engwall, 1995). The popular project management literature has been criticized from several perspectives: for example that it too narrowly reflects military and government projects during the 60's, and that it does not take the context into consideration (Ekstedt, Lundin, Söderholm & Wirdenius, 1999; Engwall, 1995). There is also critique that the theory proposed by institutions such as PMI is culturally biased. Partly in opposition to this, a Scandinavian ap-

proach can be identified, where less focus is put on planning and structure, and the differences between projects are emphasized (Sahlin-Andersson & Söderholm, 2002).

Organizational environment has usually not been seen as problematic in this literature (Engwall, 1995). Projects are generally viewed from the "inside". There is a growing research literature about the wider project context in organizations, as researchers have taken a step back from single projects (Ekstedt, Lundin, Söderholm & Wirdenius, 1999; Mähring, 2002; Sahlin-Andersson & Söderholm, 2002; Ljung, 2003).

Examples of studies emphasizing the recurring characteristics in project work are project-based organizations (Lindkvist, 2001), project maturity (Andersen & Jessen 2003; Cooke-Davies & Arzymanow, 2003), multi-project management (Engwall & Jerbrant, 2003) and projectivity (Ljung, 2003).

Critical success factors and models for excellence in different types of projects have been developed (Belassi & Tukel, 1996; Kerzner, 2000; Turner, 1999; Westerveld, 2003). Literature on critical success factors is often directed towards project managers and project office managers.

The relationship between the organization in which the projects are carried out and the projects is often discussed in terms of different ways of organizing the project. One question is then how the interdependence between the organization and the project should be organized. The project manager can, for example, be given the resources to complete the project, or the line organization can have the control of resources (Martin, 1976, p. 66). Clark & Wheelwright (1992) have called teams that are relatively autonomous "heavyweight" project teams.

In recent years, academic interest in project management has increased, and the field can now be described as exhibiting a significant level of plurality (see Söderlund, 2000, pp. 293-317 for an overview). There has been an increasing interest in viewing projects in their organizational context. That is, the unique aspects of the projects have been complemented by a view that describes how they are embedded in an organization (cf. Mähring, 2002).

4.4.2. Types of projects

In mainstream project management theory, a series of phases in a project is often suggested, such as initiation, implementation and termination (Meredith & Mantel, 2000). Initiation is related to creating project proposals and deciding on the start of the project. During implementation, the actual project work is conducted and the work is controlled. In the termination phase, the project is evaluated and a project report is written.

From a contingency perspective it is interesting to differentiate between different types of situations. Different project management practices may be relevant in different situations.

One way of distinguishing between different situations is to differentiate based on project scope and technological uncertainty (cf. Shenhar, 2001). Examples of project scope are *assembly, system and array*. In assembly, a collection of components are combined to a single unit. This is for example the case in developing a power adapter. In a project with a system scope, a collection of sub-systems are integrated. Building construction is one example on this level. In projects with a scope on the array level, a large and widespread collection of systems are developed for a common purpose, such as in building a city. The degree of technological uncertainty can influence "decision-intensity".

There are project methods available for different purposes. For example, Andersen, Grude & Haug (1994) have provided one example of a project method (PSO) which is suitable in situations where people, systems and organizations are involved, while extreme programming (XP) provides methods for developing information systems rapidly. Within product development, Hayes, Wheelwright & Clark (1988) have provided a "funnel" approach. The most attractive project suggestions are selected based on criteria that fit the unit's technological strength as well as its strategic and financial needs (Hayes, Wheelwright & Clark, 1988).

4.4.3. Program and portfolio management

Early project management literature dealt with managing individual projects. Typical questions for project management literature are how the project can be planned in different stages, how the project can be organized, how conflicts can be resolved, how budgets can be set and controlled and how resources can be allocated (cf. Jessen, 1996). The idea of

programmes was introduced to refer to the situation when several projects were managed as a group. In recent years the term *multi-project organizations* has been used to refer to situations where multiple projects are carried out.

When several projects are considered, there are additional dimensions. Added complexity involves, for example, interrelated resources, that projects may depend on other projects, or technologies developed in other projects.

There is a growing normative literature on how project based organizations should act in order to be "excellent" in managing multiple projects, or how they score in terms of "maturity" depending on the sophistication of management principles. Such models typically make assumptions about what is perceived as "good".

In early construction and aerospace projects, a central project office often supported the project with staff and a "war room" where material related to the project could be managed (Kerzner, 2000). When mainframe computers became accessible to support project managers, it became obvious that it would be difficult to train all people in the use of the systems. The role of the project office changed from supporting one customer, to providing information support for several projects.

With increasing experience of supporting project managers, the role of the project office changed to a center for developing project management methodology, standards, training, mentorship, resource planning, etc (Kerzner, 2000).

The academic literature on information systems in project-intensive organizations is scarce. In the project management field, information is an important concept, but theory for identifying and describing information requirements is usually not considered. For example, Turner (1999) has proposed a model that describes information systems for program management. In his view, such a system consists of three parts: a time scheduler, capacity planner and people scheduler. The level of detail in this literature does not provide sufficient basis for developing or implementing information systems. In this area a closer integration between the information systems and project management disciplines could be fruitful.

4.4.4. Project management maturity and capabilities

Lindkvist (2001) has developed a model for managing project-based organizations. His model focuses on management in distributed knowledge systems. He argues that coordination should be made by "rules of the game" rather than by bureaucratic rules. In one case, he describes how competence networks are used in order to create a "network memory". The network memory is not a "black board" where all experiences are written. The network memory works rather by each person remembering specific parts of past experiences, and people know whom to ask about different aspects.

The term *project management maturity* is similar to the *capability maturity models* developed at the Carnegie Mellon Software Engineering Institute. Within the information systems field, capability maturity models (CMM) have been developed to support process development in software development (cf. Kulpa & Johnson, 2003; West, 2004). A base for capability maturity models is that an organization should move up a ladder of several steps (cf. Pennypacker & Grant, 2003).

	Description
5	Optimizing process
4	Managed process
3	Organizational standards and institutionalized process
2	Structured process and standards
1	Initial process

Table 6. Capability maturity model (based on CMM).

In the initial process, there are no established practices, and documentation is ad-hoc. On the second level, there are structured processes and standards, but they are different in different parts of the organization. On the third level, all project management processes are established as organizational standards. On level four, the processes are measured and managed based on efficiency and effectiveness. On level five, processes are in place and actively used to improve project management activities.

Andersen & Jessen (2002) have created a maturity ladder in order to understand project maturity and to investigate the level of project maturity in organizations. They propose a ladder which has tree steps: project management, program management and portfolio management.

On the project management level, project managers can concentrate on individual team efforts in order to achieve predefined project goals within predetermined constraints to time and resources. On the program management level, a collection of projects related to a common objective are managed. Andersen & Jessen (2002) describe program management as "the effective management of all the projects under the umbrella of the program". On the portfolio management levels, a number of projects and programs that do not necessarily share a common objective are managed. Only by relating the total effort to an overall strategy can this level be mastered professionally.

Related to the idea of maturity is the notion of "project management excellence". Westerveld (2003) propose the Project Excellence Model. The areas within the model are developed based on literature on critical success factors for projects. The areas considered in the model are shown in Figure 24 below.

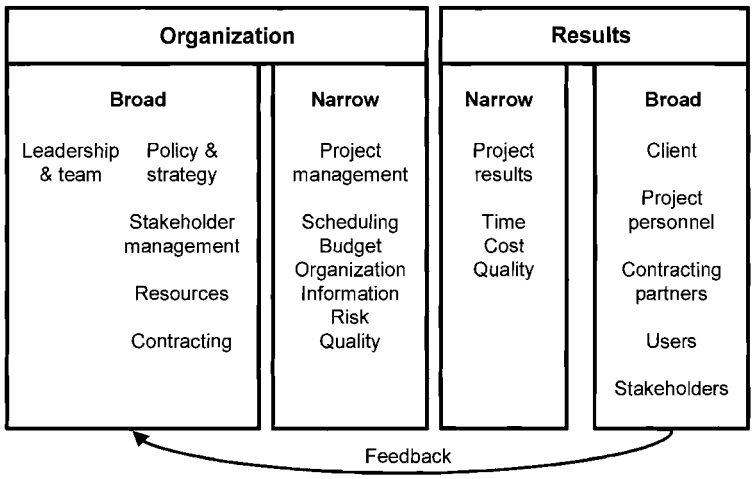

Figure 24. The Project Excellence Model (Westerveld, 2003, p. 415).

A distinction is made between five different types of projects with different properties: product orientation, tool orientation, system orientation, strategy orientation and total project management. One main difference between the types is that they increasingly consider the context.

In the product orientation case, a narrow view is taken. Project results are in focus, and coping with external parties is of limited importance.

An example given is when the maintenance department of a hospital replaces a sunscreen after the years of service. In the total project management type, several stakeholders are taken into consideration, such as project personnel, contractors, clients and users. An example given is the renovation of a city centre, where many parties cooperate. Westerveld (2003) emphasizes that a broader scope is not an end in itself. Excellence is, in his view, achieved by choosing the project type that suits the situation.

Van Der Merwe (2001) provides a framework in which he tries to integrate strategy, structure, processes and projects. In his view, project management is the natural departure when working with business development. Improvement work should be performed in the project form. Employees propose projects in order to improve the business processes. These improvement projects address the change in the strategic direction of the organization. One of his conclusions is that the project manager should consider both the business processes and the human behavioral processes when working with improvement projects.

4.4.5. Project results

A key term in the thesis is 'results', and *project results* in particular. There are several related words available. For example, in project management literature, terms like *performance, appraisal, control, deliverables, success* and *outcome* are used.

In this section, I will relate to different notions of results in order to provide a background for a discussion about project results in the analysis.

Result as an intransitive verb is defined "to proceed or arise as a consequence, effect, or conclusion". As a noun, it is defined as "something that results as a consequence, issue, or conclusion", and also as "beneficial or tangible effect" (Merriam-Webster, 2004).

In the noun form the term "something" is used, which is put together from "some" and "thing". This can be interpreted as something material, which is similar to the use of the term "output". However, not all consequences can be described as output. Learning has been presented as central in project work (Ekstedt, Lundin, Söderholm & Wirdenius, 1999; Berggren & Lindkvist, 2001). Using the term output to refer to learning is, in my view, problematic.

Within management accounting, Berry, Broadbent & Otley (1995 p. 6) write that the notions of purpose, effectiveness and efficiency lie at the heart of the task of control in an organization. Effectiveness is related to purpose, while efficiency is related to relationships between input and output.

Engwall (1995) uses the distinction between effectiveness and efficiency (or external and internal efficiency) and relates it to project management. He argues that project management literature is more interested in external efficiency than internal efficiency. The question is if the goals in terms of function, cost and time have been met, not whether this has been done in an efficient way.

The link to purpose in project management literature can be described in terms of the project goal. In the mainstream project management literature, the project process is seen as an execution. The client sets the goals. The project manager is then responsible for executing the project, and the result is evaluated by the client relative to the goal (Engwall, 2002). The main purpose with the project goals is to provide a start, not to predict final outcomes. Within this view, project execution can be described as a process of goal formation.

As already indicated, it is common to discuss project performance in terms of time, cost and function (or quality). This is particularly common in the normative project management literature (cf. Selin, 1998; Turner, 1999).

In some cases, the focus is narrower. For example, Adler, Mandelbaum, Nguyen & Schwerer (1995) have developed a framework for analyzing product development time. The selection of time as the variable to focus on is not really questioned, but rather accepted as an obvious variable for focus. Clark (1989) uses lead time and engineering productivity as measures of performance in product development. In Keller (1986), the performance of project groups in R&D is evaluated in terms of technical quality, budget and cost performance, meeting an assigned schedule, value to the company and overall group performance.

In a study of software development, Nidumolu (1996) divides performance into process and product performance. Process performance is based on learning, process control and quality interactions, while product performance is evaluated in terms of operational efficiency, responsiveness and flexibility. Nidumolu (1996) also uses "objective" measures

of performance such as cost overrun, schedule overrun and effort overrun in relationship to the original budget.

An alternative to predefining the result that is to be evaluated is asking people to make informed judgments regarding project performance. For example, in a study of external communication and project performance, Tushman & Katz (1980) asked managers to evaluate the overall technical performance of all projects with which they were technically familiar.

> Each manager interviewed was asked to make their informed judgments based on their knowledge of and experience with the various projects. If they could not make an informed judgment for a particular project, they were asked not to rate the project. Criteria the managers considered (but were not limited to) included: schedule, budget and cost performance; innovativeness; adaptability; and the ability to cooperate with other areas of the organization. (Tushman & Katz, 1980, p. 1077)

With this approach, a subjective evaluation was carried out and summarized in values on a scale from one to seven. Similar evaluations were also carried out by Lawrence & Lorsch (1967) and Katz & Allen (1985). One problem with this approach is that it is not clear what the value actually stands for. The criteria for the evaluation are not explicit.

Sivathanu Pillai, Joshi & Srinivasa Rao (2002) have developed a performance index for R&D projects in multi-project environments. In their index several variables are normalized: merit of project, risk, category bias, progress deviation, cost deviation, decision effectiveness, customer commitment, cost-effectiveness and production preparedness. The index was developed based on a division in project phases, and the identification of key factors in each phase.

Some insights can be gathered from a research review conducted by Brown & Eisenhardt (1995), in which product development is reviewed. The authors provide an overview of factors identified as affecting the success of product development projects. The success is evaluated in terms of lead time and productivity, which also affect profits, revenues and market share.

Silverman (1981) provides a more specific multidimensional project appraisal methodology (PAM), in which energy benefits, consumer savings and societal factors are evaluated. He argues that it is not possible to create a universal project evaluation scheme. It should instead be cus-

tomized to a given organization. In the example provided, it is customized to the Department of Energy, Division of Fossil Fuel Utilization.

Andersen, Grude & Haug (1994) discuss projects which influence how people work. In these cases, the project work is not only important in what is developed, or done in the project, but the effects in the organization. Within information systems literature there is often a distinction between the development of the system, and the use of the system in the organization. Lundeberg (2003b) describes this difference in terms of "delivery" and "effect".

When project results are in focus, there is also a question of how the particular project result is related to the results of the organization in general. Within project excellence, portfolio management, programme management, strategic project management etc, this question is highlighted. However also in general project management methods, the selection of projects is often related to corporate strategies and results.

We can also discuss the results in relationship to departments within the organization. A specific project can, for example, provide excellent technical functionality which is of importance in R&D, while at the same time be difficult to produce, which can lead to poor production results. We can find people in other groups such as teams and customers, who can have their own view on what constitutes good results. Westerveld (2003) makes this distinction in his broad definition of results (cf. Figure 24).

4.4.6. Projects and information technology

Specific treatment of information technology is sparse in the project management field. The management of information has been covered widely in project management journals (Themistocleous & Wearne, 2000). However, it is interesting that knowledge about how information systems can support this information is often neglected, or only briefly treated. When it comes to supporting project-intensive organizations in a wider sense with information support, the literature is relatively less developed. An example can be fetched from a standard textbook on project management (Meredith & Mantel, 2000). In a chapter on "monitoring and information systems" a view is presented of information that the authors believe is required for project control. The authors note that larger projects often need computerized information support. They use

the term computerized PMIS (computerized project management information systems) to refer to these information systems (Meredith & Mantel, 2000).

The criteria for choosing software are presented in terms of friendliness, availability of schedules, calendars, budgets, reports, graphics, charts and the possibility to migrate and consolidate data from different systems. In this, six steps are suggested. First, a comprehensive list of selection criteria is established. Priorities are then set for selection. Further, a preliminary evaluation of existing software packages is conducted. Based on this, the set of packages for consideration can be limited to three. These are then evaluated more thoroughly, and finally, price is negotiated regarding aspects such as product cost, support, training and maintenance. In the epilogue of their textbook, Meredith & Mantel (2000) write about the need for a universal information system which supports companies that have grown to the collaboration phase. Such a system should support retrieval of experiences, but the authors note that no one has been able to develop such a system to date.

The project management field has been inspired by *knowledge management* in recent years. There are many examples of studies with a combination of these. The empirical setting for knowledge management studies is often projects of different kinds. Concepts such as *tacit knowledge* are often highlighted in this literature, and *explicit*, or *codified knowledge* is used to refer to knowledge which is represented for example in documents (Davenport, De Long & Beers, 1998; Hansen, Nohria & Tierney, 1998; Zack, 1999).

In most cases, the discussion is held on a level where specific information systems or specifications for information systems are not involved. One of the reasons for this may be that this requires a more specific understanding for the particular type of project that the system should support. For example, Kovacs, Le Goff & McClatchey (1998) write about support for product data from design to production. In their view, product data management systems (PDM) should consider not only the design phase, but also provide support for the repeatable work processes in the production environment. In their work they provide partial data models and describe relationships between a workflow system and a PDM-system prototyped at CERN.

In summary it can be said that the project management literature provides an overview of information that is required for operative project work and control, but that perspectives on how information support can be established is limited to selection of standard application packages for a small portion of the project-intensive organization. Specifically, the focus is on tools for project planning and control of the project in relation to the project plan. This focus is increasingly shifting towards understanding the larger context.

4.5. Business process management

Within the process management literature, the focus has been on recurring activities. The business process concept will first be discussed.

4.5.1. Processes and business processes

Total quality management (TQM) and business process engineering (BPR) are two well known business concepts that involve a process perspective (cf. Deming, 1986; Davenport, 1993). This perspective is interesting within the context of project-intensive organizations since the activities carried out in the operative projects are likely to be similar to projects already carried out.

The basic word *process* itself has a long tradition and its meaning has been debated. According to Merriam-Webster's Collegiate Dictionary, the word process can have several meanings: 1) progress or advance, 2) something going on, 3) a natural phenomenon marked by gradual changes that lead toward a particular result, 4) a natural continuing activity or function, 5) a series of actions or operations conducing to an end. These definitions establish the term process as a very general concept.

In the business process reengineering literature, the word has a more specific meaning. Hammer & Champy (1993) define a business process:

> We define a business process as a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. (Hammer & Champy, 1993, p. 34)

The emphasis is on activities, with an input and output perspective. By introducing the customer into the definition, the scope of the term is delimited strongly. Only processes where value is created for the customer

can be called business processes in this view. The input and output perspective, together with the customer focus is also used in a definition provided by Davenport (1993):

> In definitional terms, a process is simply a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on *how* work is done within an organization, in contrast to a product focus's emphasis on *what*...A process is thus a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action. (Davenport, 1993, p. 5)

Davenport describes product development as a typical cross-functional process and emphasizes that it includes activities that draw on multiple functional skills. New product designs are generated by research and development, tested for market acceptance by marketing, and evaluated for manufacturability by engineering or manufacturing.

Keen (1997) argues that the input-output perspective risks leading to many important processes that do not have clear inputs and outputs are forgotten (for example management processes). Instead, he defines a process as any work that meets the criteria of being recurrent, affecting some aspect of organizational capabilities, can be accomplished in different ways that make a difference to the contribution it generates in terms of cost, value, service or quality, and involves coordination.

The role of process owner is often suggested for the person who is responsible for continuously improving the process (cf. Davenport, 1993; Hammer & Champy, 1993). The person responsible for the execution of a specific process, for example the fulfillment of a loan to a customer, is sometimes called the case manager.

Lundeberg has, together with Andersen and Sörsveen, developed a model that can be used to describe processes in organizations (cf. Andersen & Sörsveen, 2003). The model is called the X-model due to its graphical design, and has been developed along different paths. The main idea in the model formed by Lundeberg (1993) is that a process can be described in terms of preconditions and results. The description is divided on two interlinking levels. The person level describes the person preconditions and the person results. The process on this level is called behavior. On the lower level, task preconditions influence task

processes, leading to task results. Lundeberg stresses that each process involves persons and tasks as a whole.

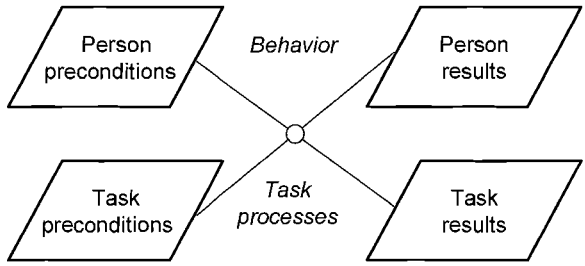

Figure 25. X-model in summary (Lundeberg, 1993).

The model can be used to describe different types of processes, such as a business process in an organization. However, it can also be used to describe change processes and other processes in a more general sense. For example, Westelius (1996) has used it to describe processes in *management accounting projects,* and Mårtensson (2001) has used it to describe *general management processes.*

X-models can be linked to describe a change process and the influence on the business process that is changed. The change process then establishes the preconditions for the business process. Linked X-models can be used to describe deliveries from one process, which then become preconditions for the next process, in which the effects of the deliveries can be evaluated (Lundeberg, 2003b).

4.5.2. Different types of business processes

Business processes can be characterized in different ways. Davenport (1993) has used terms such as *development processes, delivery processes, customer facing processes* and *management processes.* Distinctions can also be made between administrative, or support processes, and operative processes.

Gavin (1998) has provided a framework for processes in two dimensions: organizational processes and management processes (cf. Table 7). Organizational processes involve work processes, behavioral processes and change processes. Managerial processes involve direction-setting, negotiation and selling, as well as monitoring and control. One intention

with the questions in the framework is to help managers select what actions to take in an organization.

Managerial Processes	Organizational Processes		
	Work Processes	**Behavioral Processes**	**Change Processes**
Direction-Setting Processes	Are there clear goals for operational and strategic performance?	Are there well-specified approaches to communication, decision making, and learning?	Is there a clear rationale, direction, and path of change?
Negotiation and Selling Processes	Have we obtained the necessary agreements and resources from upstream and downstream departments?	Is there widespread acceptance of the desired approaches to communication, decision making, and learning?	Are others in the organization convinced that change is needed that the proposed changes are the right ones?
Monitoring and Control Processes	Do we know how well our performance matches plans?	Do we know how well our current behaviors match the desired approaches to communication, decision making, and learning?	Do we know whether critical milestones have been reached and planned changes have been implemented?

Table 7. Organizational and managerial processes (Gavin, 1998, p. 47).

With the different types of processes suggested by Gavin (1998), a large part of the activities in an organization can be described in terms of processes.

4.5.3. Process alignment

In many cases, business process reengineering has been seen as providing a technical perspective on change management. Hammer & Champy (1993) and Davenport (1993) described information technology as enabling process improvements and innovation. In contrast, Rummler & Brache (1995) do not see information technology as central to their improvement approach.

Earl, Sampler & Short (1995) have provided a framework with different perspectives which they consider relevant when studying business process reengineering strategies. The framework highlights strategy, information systems and processes. They view change management and control as central to aligning each perspective (cf. Figure 26).

Strategy in their framework involves an interest in external industry forces, inspired by industrial economics. It also builds on a resource based view of strategy. Strategy formulation and implementation is relevant in this perspective. Information systems in the framework are seen as enablers of new strategies and processes. For Earl, Sampler & Short (1995), business process reengineering implies organizational change, and initiatives may be directed towards strategic change.

Approaches vary from the radical to the incremental. In the first approach, the intention is to change behavior quickly through new optimal procedures. In the second approach, the focus on people is more elaborate, emphasizing team-building in order to increase commitment.

The framework also suggests that performance measurement and management controls can help motivate and reinforce desired process-oriented behaviors.

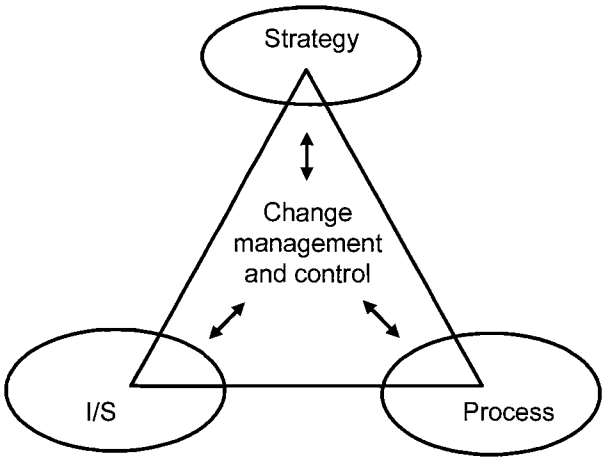

Figure 26. Framework for process alignment (Earl, Sampler & Short, 1995, p. 36).

In the view of Earl, Sampler & Short (1995), the framework can be seen as a process alignment model. They emphasize that the challenge is alignment between the perspectives in the model.

4.6. Improvement work

After the discussion about projects and processes, it is time to turn to improvement. This has been touched upon in the sense that the concepts and frameworks, to some extent, implicitly point to areas that are in fo-

cus for improvement. For example, if a project management office is to be established, the activities involved in this establishing are somewhat implied. In the following, types of improvement work will be discussed.

4.6.1. Patterns in organization change

Organization change has a rich research tradition. Greiner (1967) suggested patterns of organization change as a dynamic of several phases. Top management feel a pressure to take action, but this does not necessarily lead to corrective action (phase 1). Managers can be inclined to blame the problem on external factors. An intervention is sometimes made by an external newcomer, who may be successful in helping management reorient the attention to the problems (phase 2). A process of diagnosis and recognition can then be initiated (phase 3). When the problems are described, solutions to the problems can be devised. In this phase, establishing commitment to new courses of action is important (phase 4). A process of experimentation is then initiated and evidence for results is sought (phase 5). If the reinforcement is positive, the new practices become accepted, or institutionalized (phase 6).

Greiner points out that the use of shared power is more likely to lead to success than unilateral top-down implementation, or delegated authority where the responsibility for defining and acting on problems is turned over to the subordinates. He argues against the traditional view of a master blueprint designed to be executed in one swoop by a consultant or top manager. Change is the result of both planned and unplanned activities. Even in the more planned stages of involving lower-level people in the problem-solving process, there are unplanned events as subordinates begin to "talk back" and raise issues that top management probably did not anticipate. Rather than seeing the people "upstairs" changing the people "downstairs", Greiner provides a view where top management is a part of the problem. If they are not supporting change, it is doubtful if the lower levels will see the need for change. He proposes a middle-way of shared power in organization change.

Greiner has also proposed a model of phases in organizational development (Greiner, 1972). When an organization is young, growth is often achieved through creative operations. In Greiner's view this phase ends with a crisis of leadership. A new phase of growth is then enabled by direction. When the organization continues to grow, the development leads to a crisis of autonomy. This can be overcome through delegation.

When the organization grows through delegation a new crisis is reached, a crisis of control. A new period of growth can be initiated through coordination, but the coordination can lead to a crisis of red tape. The next phase of growth can then be enabled by collaboration. One of the points Greiner makes with this model is that time is important in understanding organizational development.

This model, with phases of growth, can be used relative to a specific organization in understanding the development path and challenges to come. The solutions to the problems in one phase may breed new problems in the next phase. With this view the model can be used to anticipate and plan for the challenges ahead.

4.6.2. Focuses in change processes – Y-model

One of the challenges involved in improvement work is that there is an enormous amount of interesting information available during the analysis of what direction to take. It might therefore be an advantage to have some way of sorting the available information.

The Y-model (Lundeberg, 1993) provides distinctions between different process focuses related to change processes. Information about a particular situation can be sorted, depending on if it is related to the current situation or the intended future situation. Using these distinctions, it may be easier to analyze the needs for change and different change alternatives that may be relevant in closing the gap. Further, plans for the actions to take can be described to specify concretely what will be involved in the change process.

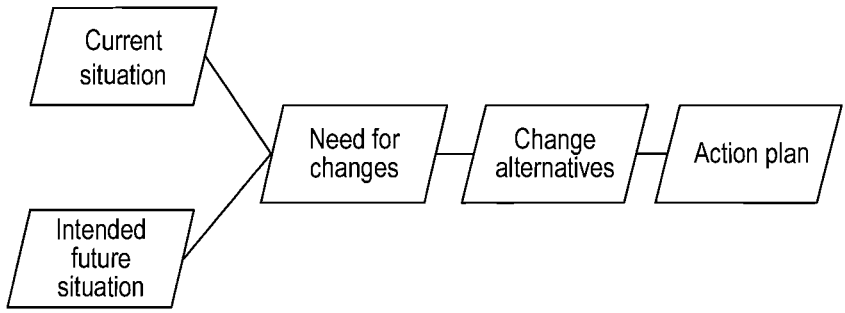

Figure 27. Y-model - describing process focuses in change processes (Lundeberg, 1993; 2003b).

Together the different process focuses provide an analysis tool that can be used iteratively. By envisioning possibilities in the future situation, ideas about problems in the current situation can be found. Thinking about different alternative ways to address the needs for changes may lead to ideas about the envisioned future situation. Rather than suggesting a specific sequence, the Y-model provides focuses that are relevant during the change process.

4.6.3. Delivery and effect

In working with business development, Lundeberg (2003b) provides a distinction between delivery and effect based on the X-model, which was described earlier in section 4.5.1. The distinction highlights that the first process leads to deliveries, and that the next process leads to effects. This is shown in Figure 28 with two linked X-models.

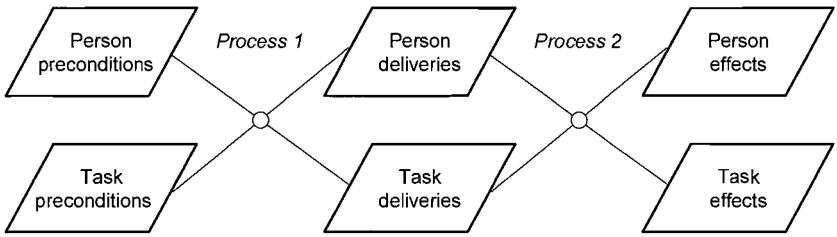

Figure 28. Deliveries and effects (Lundeberg, 2003b, p. 9).

With this distinction, Lundeberg suggests that we think in terms of combinations of deliveries and effects which are relevant in a specific context.

4.6.4. Planning and improvisation

One dimension that is common in many theories that describe unfolding events is the degree of planning. To what extent should a change be planned, and to what extent should it evolve, or emerge? Orlikowski & Hofman (1997) describe an "improvisational" model for organizational change as a complement to the traditional view of anticipated, planned change. They argue that the traditional view of organizational change is suited to stable environments. Plans should in their view not be blueprints. Rather, they should guide the work, and deviations from it should be actively managed.

In the above, we can find a distinction between the extent an improvement initiative is "planned" and the extent it is an improvisation. Another phrase for improvisational change is *emergent change*. A basic difference between planned and emergent change is the extent new information is integrated in the work. With a view of the plan as a guide rather than a blueprint, new information can be considered.

In development work related to information systems, ideas about structured design and implementation have been dominant. However the backdraws with this approach has led to a greater interest in iterative systems development. Nilsson (A.G. 2003) describes lessons from change work in organizations related to information systems development, and emphasizes that user needs should be the starting point. Methods and models can be helpful during the work. He promotes prototyping and changes in manageable steps.

4.6.5. Magnitude and form of improvements

Another useful distinction that we can make is related to the magnitude of the improvements. This has traditionally been seen as one difference between business process reengineering and total quality management (De Cock & Hipkin, 1997). Reengineering initiatives were "large" and radical whereas total quality management instead consisted of many "smaller" improvements.

We can also discuss the form of improvements. In many cases improvement work is carried out in the project form. Van Der Merwe (2001) describes this as a natural approach. However, in total quality management the form of work was rather continuous improvements in teams. The duration of improvement projects within a business is usually shorter than the "life" of the organization. In contrast, continuous improvements are carried out as long as the business is in operation.

In the project management field, Ekstedt, Lundin, Söderholm & Wirdenius (1999) write about renewal projects. They present a model representing an ideal anatomy of renewal. Unique renewal projects are seen as initiated by top management, which influences knowledge and action embedded in structure, institutions, organization and individuals. This in turn influences the organization member actions.

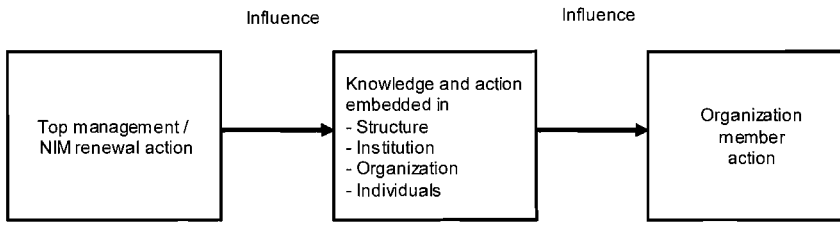

Figure 29. The anatomy of renewal (Ekstedt, Lundin, Söderholm & Wirdenius, 1999, p. 182)

The authors explain that renewal involves physical structure, institutions/rules, work organization and individuals. Of these, the physical and institutional spheres are seen as most powerful. However, physical renewal yields unpredictable outcomes and the institutional sphere is difficult to influence.

Goldkuhl (2003, p. 77) has provided a typology for organizational change. Organizational change is here divided in project-based change and change without a separate change organization. Project-based change can, in his view, be related to partial improvements or radical renewal. When a separate change organization is not used Goldkuhl uses the terms *running adaptation* and *recurrent refinement*.

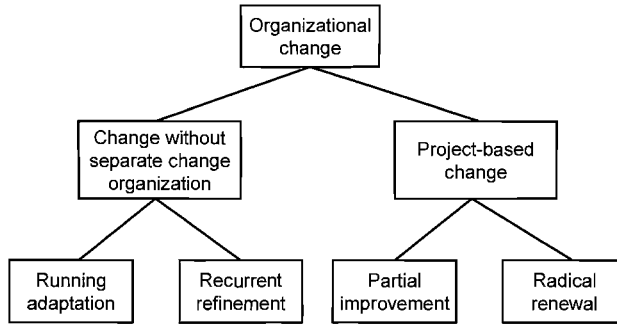

Figure 30. A typology of organizational change (Goldkuhl, 2003, p. 77).

Goldkuhl (2003) describes running adaptation as different from the other three types on the same level in that it is performed within normal business action and therefore only has an indirect orientation towards organizational change. This type of change is consequential rather than intentional.

4.6.6. Strategic direction

The relationship between strategy and improvement has been touched upon in the previous. Davenport (1993) describes process innovation as related both to business strategy and process vision. Greiner (1967) explains that "top management" initiates changes.

The term "strategy" has many meanings. The way I use it here is related to careful planning. Strategy involves goals and a plan for reaching those goals. The term "tactics" is often used to complement strategy. Wilden (1987) writes that a strategy without tactics is imaginary, and that tactics without strategy is impossible. *Tactics* then refers to the art of implementing a strategy. In many cases the term is used in a broad sense, including the process of setting the direction as well as the actions carried out for implementing the strategy.

The relationship between strategic and tactical planning is relative. Decisions that appear to be strategic to one person may appear to be tactical to another (Ackoff, 1970, p. 4). In a means-ends hierarchy, tactical planning is about selecting means to pursue goals. However, strategic planning is related to goals as well as means. It is therefore difficult to separate them.

A question related to strategy is, what the strategy is for. We can discuss strategy on the industry level where the strategy of an organization is related to competitors (cf. Porter, 1980). Another use of the term is related to the general strategy of the business or business unit in focus. We can also have more specific strategies such as IT strategies (Mårtensson, 2003).

In management control literature, the performance of an organization or unit is in focus. Different means of control can be used to influence the people in the organization to work towards the goals that are set up (cf. Samuelson, 2000). Management control is then related both to strategy and tactics. The balanced scorecard is one model that has been popular for connecting strategy and performance measures (cf. Kaplan & Norton, 1992; 1996).

4.7. Using inspiration from three areas

In the exploration of project management, business process management and improvement work, it has become clear that terms used in the

specific areas are used with different meanings, and that terms used in one area can be similar to another term in another area. This is not surprising since the theoretical areas have been partly linked together and partly isolated in their development over time.

The theoretical areas have been selected based on the idea that each area can contribute to a framework for project result improvement. The need to clarify concepts is then expected in order to make use of the theories in a new combination. In the theoretical discussions, I have found three central terms to be related: *process, project* and *method.*

4.7.1. Process, project, method

The Alpha case provides a situation in which the terms process, project and method were used.

When we worked with designing the TTM-process in Alpha, we said that we worked in the TTM project. This was considered a special, or unique project in Alpha since many prior improvements had been done with the "screwdriver-in-the-pocket" approach. However, this project was not a "unique" initiative from the perspective of the RBG consultants. It followed a rather strict pattern, the RBG-method. This method was one of the main reasons that John Svensson hired the consultants in the first place. The TTM project was not "unique" to them. In project language, the RBG-method could have been called a project method. It was a method for carrying out projects, such as the TTM project. However, in RBG-terms, it was a process improvement method.

With the RBG terminology, we used the *process improvement method* during the TTM project. The work in the TTM project aimed to improve the product development process (the TTM-process). The product development work was carried out in the project form. There was a project leader, working on behalf of the account manager.

The expression "the TTM-process" was frequently used during the TTM project, but it was used in two meanings. During the design work, the design team could point to the long process description and state "in this part of the TTM-process, we must have a clear handover to production". This statement referred to the TTM-process in general. In other cases, references were made to particular executions of the TTM-process. For example, "when Adam works in the TTM-process, he should use the template for Business Opportunity Evaluation".

In business process management literature, the project leaders in Alpha could be called "case managers" and the account managers could be viewed as internal customers, or initiators of the process. The person responsible for the continuous improvements of the TTM-process would be called the process owner. We could use the distinction between *business process* and *business process execution* from the process management literature to distinguish between the general process and the specific product development project.

Using terms from project management, the project manager would act on the behalf of the internal customer. The person responsible for the continuous improvements could be compared to the project office manager. We could use the distinction between *project method* and *project execution*, or *project process* from the project management literature to refer to the general pattern and the specific execution.

From improvement work, the project manager could be called sponsor, but in many cases this role is assumed to be held by top management. Terms such as *change method, change process, improvement method, improvement process, development method* and *development process* could be used to make the distinctions between the general and specific case.

4.7.2. Making use of each area

Making use of the knowledge represented in the areas of project management, business process management and improvement work is difficult when the terms are used in different ways. Clarifying how the concepts are related to the improvement of project results is then important.

How can this clarification be done? In the next chapter, the zigzag theory structure will be explicated. This theory structure can be used to sort concepts in order to avoid the type of problem encountered when comparing the terms *process, project* and *method* in the Alpha case.

The theoretical areas discussed above all have bearing on the phenomenon of project-intensive organizations.

Within project management theory, the scope has widened in recent years in order to consider the larger contexts in organizations. With this path, the project management literature, to an increasing extent, addresses project-intensive organizations. Program management, portfolio

management and project management maturity are examples of areas which are relevant. It is interesting that project management literature has a very limited discussion of different types of information systems solutions supporting the project work.

Business process management provides insights that can be used to describe execution of recurring projects. Compared to the project management literature, process management has had a strong focus on information system as enablers of business processes. This provides a potential for generating ideas about how project-intensive organizations can be supported by information systems.

Theory related to improvement work has provided categorizations of different types of improvements, such as *planned* and *emergent, project based change* and *change without a separate change organization.* Critical thinking on information systems vary significantly between different traditions. Generally, theory related to improvement work does not focus on specific solutions, such as what types of systems that can be used, but on change processes. Business process reengineering and total quality management provide links between business process management and improvement work.

There are few research-based frameworks designed specifically for project result improvement in organizations, but there are many ideas that can be used to develop a framework specifically for this purpose.

One of the observations I have made in the theory review is that the underlying assumptions about ontology and epistemology in the presented models and frameworks are almost always implicit.

5. PHILOSOPHICAL FOUNDATIONS

In this chapter, the philosophical foundations I will build on in the framework will be developed. What fundamental constructs and structures form the foundations for the framework? My view about what is real and how we can know what is real is presented. This also involves the theory structure of the framework. What types of constructs should be used? How are the constructs related to each other and to reality?

5.1. Overview of chapter

From the theory that has been referred to in the previous chapter, I will now take a few steps back to put the theory that I use in perspective. What fundamental assumptions can be used to support the development of the PRIO framework?

In the following, I will present my view on the relationship between reality and knowledge. There are two main reasons for this. The first is that it is important from a scientific perspective to describe the relationship between the PRIO framework and reality. The second reason is that knowledge as a concept will become a part of the PRIO framework. It is then important to clarify concepts in the framework. In other words, epistemology is relevant both from a methodological point of view, and as a part of the suggested framework.

In the discussion about knowledge, the question of what is real is raised. What assumptions are reasonable to make about reality? Explicating these assumptions is relevant for the development of the framework in two ways. First, there is a question of what categories are "real". This deals with what entities we want to assume exist. Behind this question there is a deeper level of assumptions of what *types* of concepts exist. What types of concepts and relationships, on a fundamental level, influence how we describe categories in reality? The terms to describe these two areas of assumptions are *formal ontology* and *material ontology*. The epistemological and ontological assumptions provide a set of assump-

tions which will guide the development of the domain specific PRIO framework in the three coming chapters.

5.2. Knowledge and reality

The questions about what is real and how we can gain knowledge about reality are fundamental to research. In the philosophy of science, two important areas of interest are assumptions about reality, and how one can gain knowledge about reality. The first area is often called ontology, after Parmenides poem (On Nature) about "Being". Being in Parmenides vocabulary refers to all that exists, all that there is, or everything that is in being (Kenny, 1998). Philosophy related to this fundamental existence is also referred to as metaphysics after Aristotle's work related to being, or the 'first philosophy', providing the principles for the special sciences (Kraye, 1988). The second area is epistemology, which deals with knowledge. Epistemology and ontology are tightly linked together (Bateson, 1972).

5.2.1. The starting point?

Trying to refer to a complex world which changes over time is a difficult task. Basically I agree with Bateson's view that "...we shall never be able to claim final knowledge of anything whatsoever" (Bateson, 1979, p. 27). However, I find it interesting to discuss the foundations that we implicitly use, or can use, for the theory we create regardless whether we can have final answers to the fundamental questions or not. If nothing else, it puts our contemporary theorizing in perspective. With this fundamental limitation in mind, I proceed in this discussion, trying to present a sensible set of *assumptions*.

One distinction that is often made is that of knowledge and reality. What is the relationship between knowledge and reality? Before we start to discuss this question, it should be noted that the categories represented in the taken-for-granted division between knowledge and reality are not self-evident. Why start with these concepts and this question? How can the question of what exists be approached?

In my view, the inquiry needs to be addressed from two sides at the same time. In order to provide a view of what is real, we also need to provide a view on how we can know that it is real. Heidegger has argued that by asking a question such as "What *is* 'Being'?", we can see

that we already have some understanding for the Being we are directing our inquiry towards; and by being able to inquire, the inquirer is an entity, and as such has its own character of Being (Heidegger, 1962, pp. 24-25). Heidegger criticized the idealistic epistemologies that were dominant at the time. He argued that we needed a fundamental ontology which guides the development of the regional ontologies dealing with particular realms of reality.

I have been inspired by Heidegger's question and think it provides a very appealing starting point. In my view, even the pure idealist makes an assumption that mind, or subjectivity, exists. There is a need for ontology even in this case. Bateson (1972) viewed ontology and epistemology as a whole that could not be separated the way it is sometimes treated in philosophy. By forming a fundamental ontology, we have the option to differentiate the fundamental assumptions in specific domains. What fundamental assumptions can we make that apply to all of reality?

The strength in Heidegger's question, in my view, is that even in simplifying the question by removing the presupposition of knowledge, the bare asking about reality implies that there is something like knowledge. The question of what is real exists in reality (cf. Figure 31).

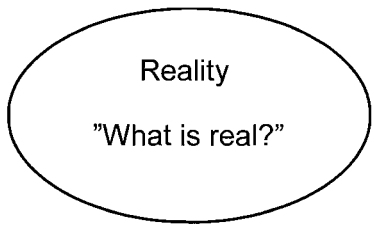

Figure 31. Ontology and epistemology are closely related.

The question of what is real is my starting point, and asking this question in my view invites to reflecting further on the question of the relationship between reality and knowledge. In the following, I will build on Bateson (1972, 1979) as the main source of inspiration.

5.2.2. Knowledge is a subset of reality

I have chosen to start the presentation of my view with a statement of a unity between knowledge and reality. When we look at a number of

trees, we can say that we believe that the trees exist in reality. However, the knowledge about the trees also exists in reality, since we who have the knowledge are a part of reality. Knowledge about reality is thus a subset of reality and therefore as real as reality itself (cf. Figure 32). Put differently, knowledge about reality is not a part of some other reality. With this view of knowledge, reality is a unity.

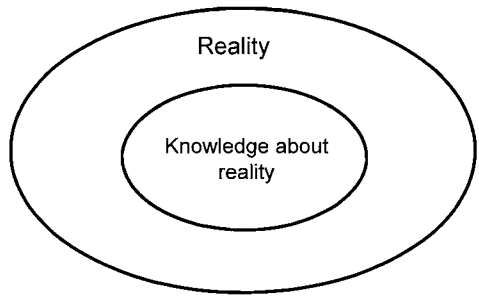

Figure 32. Knowledge about reality is a subset of reality (inspired by Bateson, 1979).

The term "knowledge" will initially be treated in broad sense. With this assumption about reality and knowledge about reality, we can continue to discuss the relationship between knowledge and reality.

5.2.3. Knowledge about reality is indirect

Kant was responsible for something of a Copernican revolution with regards to the relationship between knowledge and reality (Kenny, 1998). Rather than taking the objects as given, the knowledge we use to understand the objects was put in the foreground. Instead of asking how our knowledge can conform to its objects, Kant started from the supposition that objects must conform to our knowledge. He wrote that the objects must conform to the constitution of our faculty of intuition (Kant 1787/2003, p. 22). With this view, there is an important relationship of interdependence between objects and our knowledge of the objects. Kant wrote in *Critique of Pure Reason*:

> Without sensibility no object would be given to us, without understanding no object would be thought. Thoughts without content are empty, intuitions without concepts are blind...The understanding can intuit nothing, the senses can think nothing. Only through their union can knowledge arise. (Translation by Smith, 2003, p. 93)

It is an important point that "objects" seem to conform to our perspectives. There is thus, clearly, a relationship between thought and the objects of thought, or between knowledge and reality. The question is what characterizes this relationship.

I take the stance that it is not possible to perceive reality directly (Bateson, 1979). The thought about the object *is not* the object. There are many possible ways to express this idea. One simplified explanation can be provided by distinguishing between description and reality.

Korzybski (1941) used the statement "the map is not the territory", addressing the difference between reality and descriptions of reality. In the case of the map, it is clear that there is a distinction. We can hold the map in our hands, but it is much more difficult to hold the reality the map refers to in our hands in the same way.

Bateson (1979) expressed the idea in more general terms by saying that "the name is not the thing named".

> Thought can be about pigs or coconuts, but there are no pigs or coconuts in the brain; and in the mind, there are no neurons, only ideas of pigs and coconuts. There is, therefore, always a certain complementarity between the mind and the matter of its computation. The process of coding or representation that substitutes the idea of pig or coconut for the things is already a step, even a vast jump, in logical typing. The name is not the thing named, and the idea of pig is not the pig. (Bateson, 1979, p. 205)

There is a difference between the map and the territory, the name and the thing named, and the "actual coconut" and our idea of the coconut. It is important to note that our idea of the coconut does not consist of neurons. According to Bateson, the idea of the coconut does not exist in our brain. It exists in our *mind*. If we say that the coconut exists in reality, we are mixing the two levels of reality and names of reality. Something, a phenomenon, is assumed to exist in reality, and we have chosen the name "coconut" to refer to it. This something that exists in reality is impossible to access directly no matter how hard we try. The "actual coconut" cannot fit in our brain and even less so in the mind. This is shown in Figure 33.

The difference between the "coconut" and its environment, or the rest of reality, is not directly accessible either. The differences that I am aware of exist only in my mind as a transform of a perceived difference in real-

ity. The difference which exists in my mind is not the same thing as the "difference" in reality. The "actual difference" is not accessible to mind.

The "actual" coconut is drawn as a cloud, and the term "phenomenon in reality" is used to refer to it. The difference between the phenomenon in reality and the rest of reality is not self-evident. I try to show this in the figure by having openings in the cloud. It is, in my view, not possible to refer to separate "phenomena" that exist. The cloud can only point towards the part of reality I am trying to refer to.

Taken to the extreme, this point of view can lead to a position that is often called idealism, which in its strong form rejects the idea that we can have any knowledge about objects in reality. However, I do not agree with this extreme point of view. I believe that there are real processes of perception and interpretation in which reality can be indirectly understood by us. In other words, there is a relationship between reality and knowledge about reality, but it is always indirect. The dotted arrows in Figure 33 indicate that the relationship between phenomenon in reality and ideas in mind are indirect and that the relationship goes in both directions as a calibration. This indirect relationship will be further explored below.

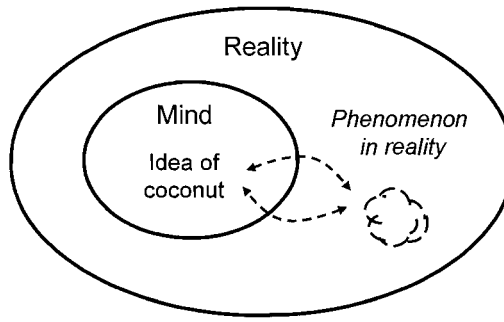

Figure 33. Knowledge about phenomenon in reality is indirect (inspired by Bateson, 1979).

The relationship between ideas in a wide sense and reality can be described in terms of the infological equation that was developed by Langefors (1966). In short, the equation states that information is the result of an interpretation process in which data is interpreted using the frame of reference of the person making the interpretation. The time available for the interpretation also influences what information that is

the result. The frame of reference consists of the total experiences and knowledge held by the person. The reasoning is described in terms of an equation as shown in Figure 34.

i=f(D, S, t)
i = information
D= data
S = frame of reference
t = time

Figure 34. The infological equation (Langefors, 1966).

Since different persons have different frames of references, the same data can have different meanings for different persons. There are thus multiple versions of information in a wide sense even related to the same phenomenon in reality. In the coconut example above, the data (phenomenon in reality) is indirectly understood in a process of interpretation, and the resulting indirect information in our mind depends on the frame of reference we use for our interpretation. The concept of coconut is required in our frame of reference in order to be able to interpret the phenomenon *as* a coconut.

According to Bateson (1979) and Watzlawick, Weakland & Fisch (1974), the perception and grouping of "things" (in the widest sense) is the most basic and necessary element of our perception and conception of reality. This ordering of the world into complexly intersecting and overlapping groups gives structure to what would otherwise appear as chaos (Watzlawick, Weakland & Fisch, 1974).

Our perceptions of reality are complex, and we can perceive several overlapping systems at the same time. For example, the trees referred to earlier can also be seen as a forest. The coconut can be seen as food, or perhaps even a weapon. We choose what we perceive as a system. A system can be described in terms of sub-systems, which in turn can be deconstructed to sub-sub systems. This is clear in the example with the forest and the trees.

With the indirect view on knowledge taken here, it is highly problematic to use the term "is" when referring to a phenomenon in reality. To me, it might be true that it *is* a coconut, but this truth exists in *my* mind. My mind has no direct knowledge of what it really is.

The tradition of using "is" rather than "as" is a long one. When parents point to an image of a cow in a picture book, and ask the question "what is that", the children happily conclude that "it is a cow". In line with what has been said above, the question should rather be "what do you think this represented information refers to", and the answer would be "the represented information reminds me of something that we usually call a cow". The distinction between reality and our knowledge about reality is particularly difficult since the processes of perception and image formation are unconscious.

> The *processes* of perception are inaccessible; only the products are conscious and, of course, it is the products that are necessary. The two general facts – first, that I am unconscious of the process of making the images which I consciously see and, second, that in these unconscious processes, I use a whole range of presuppositions which become built into the finished image – are, for me, the beginning of empirical epistemology. (Bateson 1979, p. 34)

In other words, it may very well seem to us as if the cow is real, since the formation of the image is unconscious. Linking back to the infological equation, we can say that the information we get from certain data depends on our frame of reference. If we do not know about the processes of perception and interpretation, we risk falling in the trap of mixing reality with our description of reality.

For economic reasons, the shortcuts we take in our use of language are understandable. What has been said here is thus not a practical argument against using the word "is". Concepts are necessary preconditions for our understanding of and communication about reality. Most of the time the shortcuts are purposeful. However, I think that it is important that we can make the distinction between something in reality and the name of this something when this distinction is called for. In theory development I think it is fundamental. In certain cases of using theoretical constructs such as methods, I also think it is important. A person's view of the relationship between method and reality is likely to influence how the method is used in practical work.

The view of knowledge and reality presented here is a unity in that knowledge cannot exist without reality. Reality is a unity. However, it is a duality in the sense that knowledge and reality are irreducible, or cannot be transformed to a simpler condition. Knowledge *about* reality is

different from the reality it is about. As soon as there is knowledge in reality, reality becomes a duality. It combines reality and knowledge about reality. However, in principle this duality is analytic rather than real in the sense that it is created, in this case by my distinction. I assume that there is an indirect relationship between knowledge about reality and reality itself, and I act *as if* knowledge about reality is different from the reality it is about.

5.2.4. Knowledge is gained through multiple comparison

If it is impossible to get direct information about reality, what can we do to improve our understanding of it? Since we cannot compare our description of reality with reality itself, we need to find some other anchor for our evaluation of information and knowledge. What can we compare our descriptions of reality with? Bateson has described a manner of search that can be conducted to increase our knowledge of the world. He calls it the principle of double or multiple comparison. The principle can be summarized in the simple statement that: "Two descriptions are better than one" (Bateson, 1979, p. 71).

He illustrates the idea with the added value of having two eyes rather than one. The leverage provided by the combination of information from both eyes can be used to perceive depth. The information provided from each single eye can be described as descriptions of reality. Depth information is achieved by comparing the two descriptions. In other words, by comparing descriptions with other descriptions we can get additional information.

Explanation is often an aim in theory development within the social sciences. The goal can be, for example, to explain why an information system is used or not used. In Bateson's words, explanation can be described as "the mapping of description onto tautology" (Bateson, 1979, p. 87).

In a pure description, all the "facts" or effective differences assumed to be immanent in the phenomenon are included, but connections among them are not shown. A film provides one description of what happened in front of a camera. However, this description will do little to connect the events shown on the screen, and does not by itself provide any explanation. Explanation, on the other hand, according to Bateson, can be total without being descriptive. "God made everything there is" is to-

tally explanatory but does not tell you anything about any of the things or their relations. In other words, tautology provides connections between propositions. The truth of the propositions is not claimed in relation to reality. If we agree on postulates and axioms, we can "prove" that Pythagoras' theorem is true, but this does not provide proof of anything in reality.

> Tautology contains no information whatsoever, and explanation (the mapping of description onto tautology) contains only the information that was present in the description. The "mapping" asserts implicitly that the links which hold the tautology together correspond to relations which obtain in the description. Description, on the other hand, contains information but no logic and no explanation. (Bateson, 1979, p. 87)

According to Bateson, we work with two different starting points, each of which has its own logic. Observations of phenomenon cannot be denied, and our existing knowledge needs to fit in.

We can describe this as if we approach the phenomenon by dialectically calibrating our explanation. Knowledge about reality is developed by comparing something relatively more abstract (such as tautology) with something that is relatively less abstract (such as description).

In the case of the two eyes, the comparison of two descriptions on the same level of abstraction could also provide value, but this added value is more information, rather than explanation.

Figure 35 below, shows an indirect explanation of a phenomenon in reality as dialectically connecting tautology and description. In my view, explanation is *a process of calibration*.

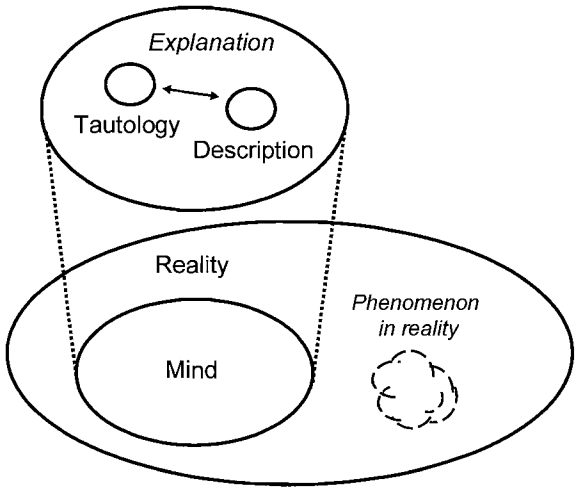

Figure 35. Explanation, the mapping of description onto tautology (inspired by Bateson, 1979).

A general model (tautology) contains no information whatsoever about the reality that is to be explained. It is just a general model. The process of explanation is about finding a general model, such as that when we compare our description of the phenomenon with the general model, the mapping becomes acceptable to us. To create an explanation, we thus seek a reasonable fit between our description and our general model. The influence goes in both directions. The general models we have to choose from influence what descriptions we can make, and the descriptions we have influence what general models we find reasonable.

The descriptions can be either quantitative or qualitative. In both cases, it is our description of reality that is compared with the general model, rather than reality itself. Lee writes that there is no way to induce, generalize or otherwise formulate theory from data or observations alone (Lee, 2003). The process of finding an explanation is thus abductive rather than purely inductive or deductive (Bateson, 1979). I use the term *general model* related to tautology rather than only *model*. The reason for this is that a model often is viewed as a representation of something in reality, which is closer to description in Bateson's terms.

5.2.5. Limitations of truth

Are there only different tautologies, or general models, and descriptions, or can some mappings be called "truth"? According to Bateson,

the closest we can come to truth are the regularities that bind ideas, in a wide sense, together. These ideas about regularities are a part of reality.

> What is crucial is the presupposition that ideas (in some very wide sense of that word) have a cogency and reality. They are what we can know, and we can know nothing else. The regularities or 'laws' that bind ideas together – these are the 'verities'. These are as close as we can get to ultimate truth. (Bateson, 1979, p. 207)

Since direct perception of reality is not possible, regularities between ideas in the wide sense of the word is as close as we can get to ultimate truth both in terms of knowledge *about* the world, and as a subset *of* reality.

The regularities are a matter of personal faith. An explanation becomes acceptable if we are willing and able to accept the links of the tautology. In exploration of a new field, it is the researcher that binds the ideas together. Bateson writes that "The point of the probe is always in the heart of the explorer" (Bateson, 1979, p. 93). What "is true" in the mind of a person is indicated with the arrow in Figure 35. It is true for a certain person that a particular general model can explain the description the person has made of a phenomenon. The general model contributes to explaining the described phenomenon in the mind of the person. Evaluating the truth of an explanation is a matter of personal faith. What is true for one person might not be true for another.

By remembering to supplement something that is more abstract with something that is relatively less abstract, and comparing the two, we can arrive at "truths" without falling in the trap of mistaking model and reality. However, avoiding the trap cannot be a property of the model itself. The key is in the perspective taken by the user of the theory, framework or model. In other words, reductionism happens in our *minds*, not in our models. It is a matter of how we *view* the relationship between the general model and reality, and this is an epistemological issue.

With this view, we can ask whether it is not in essence an idealist view of reality. Is truth just a matter of belief? Does it matter what we believe? Are there no ways to evaluate different truths? With the view taken here, stronger acceptance of a theory does not make it "right". We can only observe that several individuals state that they believe in a particu-

lar "truth". More empirical data, or general agreement does not make a theory true, but it may convince us.

Instead of making an argument based on force, I will use the criteria of consistency and richness for evaluating the quality of a theory. If we have several theories that explain the same phenomenon, I will prefer theories that are internally consistent and allow for a rich reality before theories that are internally inconsistent and are unclear with regards to the relationship to the complexity of reality.

Ockhams Razor is sometimes referred as a view where plurality is not encouraged. By selecting the simplest theory that will fit the facts, a certain compactness or minimalism is achieved (Kenny, 1998, p. 160). However, in my opinion there is one important part missing in this view. The "facts" that we have for our comparison with general models are *selected*. There is thus a great risk of reductionism if minimal models and a minimal set of models is the goal. This reductionism is in direct opposition to Bateson's view that "two descriptions are better than one".

I prefer a theory in which it is acknowledged that the facts are selected rather than a theory in which reality is assumed to be sampled *as it is* in the description. This highlights the assumptions in the ontology of the theory, since ontology deals with assumptions about reality directly. In other words, the general models that we develop say nothing about reality itself. The only "direct" models we can have of reality itself are created by us in our ontological assumptions about reality.

5.2.6. Benefits of separating description and reality

It may be time to pause in this discussion. It seems reasonable to ask the question "so what?" Let us say "the term project refers to..." rather than "a project is...". In what way is that an improvement? Why not skip this abstract reasoning and go directly to the development of the theory? Why should we be careful to make the distinction between description, or information, and reality?

My answer to the so-what question is that it depends on what we want to do when we develop theory or go about our daily business. It probably does not matter much if we accept to live our lives according to the norms that have been set up for us, and accept the world as it is laid out by others. We can then take it for granted that some things *are* projects, and other things *are not* projects, and trust authorities to decide on what

is what. However, if we want to change, or improve things, we need to be able to free ourselves from the boundaries created by language and institutions.

In Berger & Luckmann's terms, we can accept the objectivated social constructions that are more or less intersubjectively available in society, but at the extreme, we will be prisoners of the institutions and roles set up, accepting that "this is how these things are done". Bandler & Grinder (1982) have asked the question "Who is running your brain?" and we can ask the same question about our lives. The more we take for granted about "how these things are done" the less freedom of action we have (cf. Lundeberg, 1993).

A strength in separating between reality and descriptions of reality is clear in the processes of reframing. Problems can sometimes be solved by seeing things in a new light, rather than changing the things themselves. For example, Bandler & Grinder (1982) refer to a situation in which a housewife becomes angry when family members step on the soft carpet in the living-room so that there are footprint marks. By reframing the footsteps from being marks disturbing the cleanliness of the home, to being signs of that the family members she loves are around her – she could overcome the stress she felt.

Reframing, or seeing the same thing from a fresh perspective, is not a change in the actual thing. It is a change of our understanding of it. This change is a mental process within us. The argument is thus: that making the distinction between reality and description of reality gives us greater degrees of freedom, and increased flexibility compared to a situation where "things are as they are". Framing from different perspectives provides alternative explanations.

In the extension of this line of reasoning, we can connect to Ashby's law of requisite variety, that only variety can destroy variety (cf. Ashby, 1956, p. 207). In this context, by increasing the variety in how we frame things, we increase our possibilities to control them. This is what the woman in the example did. By being aware of the different ways of framing the situation, she could control her stress.

We can also connect to the theory of descent with modification through natural selection presented by Darwin (1859). With an increase in the variety of the gene pool of a species, the possibilities for the species to survive are increased in a changing environment. In analogy, species

having the possibility to make distinctions between reality and descriptions of reality have greater adaptive capacity in relationship to the environment than species having only one accepted way of understanding reality, and consequently only one way of "how these things are done". For example, rebellion might not be an alternative for persons who believe they *are* slaves, but a possible alternative for those who believe they are *described as* slaves.

To more clearly see the extension of the theory from evolution to learning, which is in focus when we talk about understanding reality – we can refer to the processes of learning and evolution. Bateson's view was that the two processes together provide great flexibility. The relative stability provided by gradual evolution, necessary for balanced embryological growth, is complemented by a formidable capacity to learn, and thus adapt behavior at a speed that is almost infinite in light of the classical Darwinian theory. The vast changes in society in modern time have almost nothing to do with evolution. They have to do with learning. This puts even more emphasis on the principle in the analogy to Darwin's argument. Learning *about* reality increases our adaptive capacity.

We started by examining the added value of separating between reality and description, the name and the thing named and the map and the territory. By extension the answer is about running our own brains, increased degrees of freedom, control and survival.

5.2.7. Levels of "knowledge"

In the previous treatment of "knowledge", the term has been used in a wide sense. I have done this to provide a starting point. We have increasingly used more precise terms such as tautology and description. Increasingly we have also started to describe processes of knowledge creation, and mental processes, such as explaining. In the following, additional concepts that can be used to differentiate the discussion will be provided.

I have chosen to use words that I think people within the management field, and people in practice, can relate to. Since I take an information management perspective, I have preferred terms from the information management field. Philosophical terms often have very specific meaning and have been developed in specific contexts. These discourses are often so complex that there is a risk that I will misinterpret the philosophical

meaning. I have chosen to describe how I use the terms, rather than claiming that my interpretations of the concepts match the original contributors.

Furthermore, I have been guided by the zigzag theory structure in developing the epistemology. Since this specific theory structure has not been explicitly used by the authors I cite, a challenge has been to develop the concepts in such a way that the final epistemological model adheres to the zigzag theory structure. This has made it necessary for me to fit the concepts in relation to each other in terms of forms and processes on different levels of abstraction. I have not found this to be entirely straightforward in any of the cases I will present.

Let us first repeat some of the concepts already used. Langefors provided a distinction between data and information in the infological equation. The frame of reference of a person making an interpretation was used, influencing what information that became the result. From Bateson, the concepts of tautology, description and explanation have been gathered. Bandler & Grinder (1982) have discussed the importance of framing for how we understand a situation.

Ackoff (1989) has provided a categorization in data, information, knowledge, understanding and wisdom. In his view, wisdom requires the mental function of judgment.

Engquist (1996) has used levels of abstraction to describe three levels of abstraction related to learning. On the first level, a person learns elements. This refers to the concrete world, like cars and house furnishings. The level above the element level is called *meta-level*. This level refers to patterns, categories, rules, points of view, etc. On a higher level, the *meta-meta-level*, we find a personal synthesis of categories on the meta-level.

Checkland & Holwell (1998, p. 90) provided distinctions between data, capta, information and knowledge. They use the word 'data' to refer to the great mass of facts available to us. The term is based on the Latin *dare*, which means 'to give'. They use the term 'capta' to refer specifically to that data which we have decided is relevant and which we therefore know we want to collect. This is based on the Latin term *capere*, meaning 'to take' (Checkland & Holwell, 1998, p. 89). The capta we have is enriched – we relate it to other things and put it in context. After such meaning attribution, capta becomes 'information'. The word

'knowledge' can be used to refer to structures of information that are expected to have greater longevity than many items of information. In Figure 36, the relationships are schematically described.

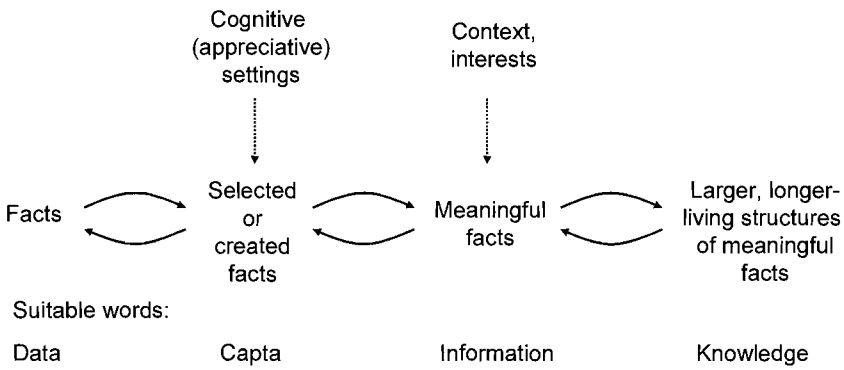

Figure 36. Links between data, capta, information and knowledge (Checkland & Holwell, 1998, p. 90).

From the different concepts described, we can also connect to learning. In Checkland & Holwell (1998), the "facts" available to us are in some way structured in patterns of longer-living structures of meaningful facts.

5.2.8. Relationship to acting

Learning is interesting in its own right, but in the context of project result improvement, the relationship to acting is also interesting.

In order to describe learning and acting, I have found a view presented by Schütz (1953) to be valuable. He describes human action in terms of action, project and motive. There is an interesting pattern related to time:

> All projecting consists in anticipation of future conduct by way of phantasying, yet it is not the ongoing process of action but the phantasied act as having been accomplished which is the starting point of all projecting. I have to visualize the state of affairs to be brought about by my future action before I can draft the single steps of such future acting from which this state of affairs will result. Metaphorically speaking, I have to have some idea of the structure to be erected before I can draft the blueprints. Thus I

> have to place myself in my phantasy at a future time when this action *will* already *have been* accomplished. Only then may I reconstruct in phantasy the single steps which *will have* brought forth this future act. In the terminology suggested, it is not the future action but the future act that is anticipated in the project, and it is anticipated in the Future Perfect Tense, *modo future exacti*. (Schütz, 1953, p. 15)

There are two related aspects that I find interesting in Schütz's claim. The first is related to what the person knows, and the second is related to what the person projects. They are related in that what the person projects builds on existing knowledge. All projections of forthcoming acts are based on knowledge at hand at the time of projecting. At the same time, the projection becomes a part of the knowledge of the person once it is made.

Kahneman & Tversky (1979) have shown the importance of framing for decision-making. People that have access to the same information about a problem make different decisions depending on their framing.

Ackoff (1970, p. 122) has written "to plan is to make decisions". He emphasize that control is a process. In order to evaluate decisions, information about actual performance is collected and compared with the predicted performance. Corrective action is then taken when necessary.

Judgment is also related to actions of persons. Gadamer (1975) has defined judgment in terms of being able to subsume correctly what one has learned and knows. Without judgment it is difficult to apply knowledge.

> The difference between a fool and a sensible man is that the former lacks judgment, i.e. he is not able to subsume correctly and hence cannot apply correctly what he has learned and knows. (Gadamer, 1975, p. 29).

He continues to describe the work of judgment as subsuming a *particular* under a *universal* and recognizing something as an example of a rule. He emphasizes that judgment is not something which one can learn in general. Conceptual understanding cannot guide the application of rules.

> In fact the work of judgment, subsuming a particular under a universal, recognizing something as an example of a rule, cannot be logically demonstrated. Thus judgment requires a principle to

> guide its application. In order to follow this principle it would need another faculty of judgment, as Kant shrewdly noted. So it cannot be taught in general, but only practiced from case to case, and is therefore more a faculty like the senses. It is something that cannot be learned, because no demonstration from concepts is able to guide the application of rules. (Gadamer, 1975, p. 30)

The concepts presented here are related to the link between learning and acting. This is of importance for project result improvement since knowledge is not sufficient to improve results. The question is what links learning to "reasonable action".

5.3. Formal and material ontology

In this section I will provide concepts related to formal and material ontology. I use the term *formal ontology* to refer to types of concepts that are used to develop knowledge about reality. *Material ontology* is then the materialization of reality in terms of the formal constructs. It seems reasonable to select formal constructs which are suitable in describing reality. Assumptions about reality then influence what formal ontology we use (cf. Figure 10 on page 45).

5.3.1. Form of theory

When we refer to theory development, an important question is what types of concepts to use. What sorts of concepts should be used in the theory? How are they interrelated? I have been inspired by Husserl (1900), who placed great value on the formal essence of concepts and laws, and argued that we should go back to the essence of theory in its pure form, which regulates all specialization of the idea of theory in its possible kinds.

> It is impossible to overestimate the importance of this first group of problems; it is doubtful whether they do not in fact involve the greatest difficulties in the whole discipline. (Husserl, 1900, p. 238)

He distinguished between formal ontology and material ontology, which provides the concrete categories of formal ontology. Formal ontology provides the theory of those ontological structures such as part/whole and universal/particular, which apply to all domains what-

soever. The formal ontology provides types of categories for all material existence.

It should be noted that there are several examples of formal ontologies presented in philosophy. Some examples of authors who have provided other categories are Aristotle, Bolzano, Brentano, Kant and Husserl. What will be used in the following is an example of a simple formal ontology in terms of philosophy.

I have chosen explicitly to use the zigzag theory structure since it provides a foundation for theory development that has been found useful in biological and social contexts (cf. Bateson, 1972, 1979). However, it is possible to extend formal ontology for more advanced and detailed analysis in future work. In this thesis I thus use the zigzag theory structure as formal ontology.

The formal essence of the constructs used has great influence on theory development. It is difficult to overestimate the importance of the basic assumptions we make. These assumptions are, in a way, multiplied into the theory that we create. The formal concepts are thus of particular importance when theory is *developed*. This first problem is usually not in focus in our everyday lives. The essence of concepts is often taken for granted, and types of relationships between the concepts are usually not reflected upon in the course of our daily lives. We can again quote Husserl:

> All these are seemingly trivial, preparatory tasks. To a large extent they are necessarily clothed in the form of discussions of terminology, and readily seem to the layman to be barren, pettifogging word-exercises. But as long as concepts are not distinguished and made clear to ideational intuition, by going back to their essence, further effort is hopeless. (Husserl, 1900, p. 238)

An obvious reason for not reflecting on these issues is pragmatic; we simply do not have time, and in general, we can conduct our lives with the understanding we have, even though our formal ontology might be a little fuzzy. The first argument for including a discussion of formal ontology in a thesis is that it makes it possible to criticize the fundaments on which the theory is built. Such critique is fundamental for research quality. In analogy, it is like criticizing the foundation of a building, or more precisely, like criticizing the principles used to create the drawing for constructing the foundation of the building.

At the same time, this criticism is difficult since it involves fundamental assumptions, and proof of assumptions is a difficult matter. The basis for criticizing formal ontology is by definition a philosophical one.

> The wider question will however be: What are the universal, law-governed conditions of this possibility of theory in general? *What therefore constitutes the ideal essence of theory as such?* What are the primitive 'possibilities' out of which the possibility of theory is constituted, or, what is the same, what are the *primitive essential concepts* out of which the concept of theory, itself an essential concept, is constituted? And further: what are the pure laws which, rooted in these concepts, impart unity to all theory as such, laws which pertain to the form of theory as such and which determine, in *a priori* fashion, the possible (essential) modification or species of theory? (Husserl, 1900, p. 235)

The possibility of theory in general is a fundamental question that has consequences for the specific theory we develop. The type of discussion Husserl refers to is generally held within the philosophy of science, even though it is sparingly held at the fundamental level indicated by Husserl. An important consequence of the view is that the assumptions made about the form of theory determine the possible modification of theory in specific areas. This highlights the relationship between the assumptions made about theory, and the reality we are trying to understand in a specific field. In other words, linking back to formal ontology is a way of providing a chain of thinking, rather than providing a few links at the end of the chain which are specific to a particular phenomenon.

5.3.2. Cybernetics and systems theory

In this section I will provide a background description of theoretical areas which I think can provide insight into the development of the zigzag theory structure. An important part of this background can be found in systems theory in general and cybernetics in particular. These theories have been used in several domain-specific areas.

Some of the core aspects of the zigzag theory grew out of a very productive period after World War II, when new perspectives were combined from several areas such as systems theory, information theory, communication theory, biology and anthropology. This new area was interdis-

ciplinary, where one common interest was control. The name cybernetics was given to the theoretical area.

The cybernetics movement as a general field of inquiry is focused on self-regulating systems, where feedback is central as a control mechanism. With this view, influence can be described over time in terms of restraints that govern a process. This emphasizes dialectic interplay rather than causality. Cybernetics in its general form does not provide domain-specific knowledge, but rather seeks to describe principles which have wide application. Wiener defined cybernetics as "the science of control and communication in the animal and the machine" (Wiener, 1948).

Many researchers have used systems theory and cybernetics without reference to these principles, so providing a background to the area is difficult. In the following, I will mention some of the researchers that explicitly use systems theory or cybernetics, or have been referenced to as related to this field. This should be understood as a background to my selection of the zigzag principle as a basis for theory structuring.

Wiener was one who advocated a cybernetic approach after the Second World War, emphasizing similarities of control principles in animals and machines (Wiener, 1948). Cannon (1963) described intricate and partly unexplainable body functions. He clarified the use of the term homeostasis, self regulation in biological systems. Ashby made early contributions and wrote a well known introduction to cybernetics intended as course literature in the growing field (Ashby, 1954; 1956). Emery & Trist (1960) coined the term "socio-technical research" to represent a systems approach with systematic interactions between human beings and technology in the context of organizational work. Von Bertalanffy (1968) was also an early contributor to general systems theory. Within the information field, Shannon & Weaver (1949) proposed early models for communication and information flows. Today these theories may seem limited in perspective but they provided important contributions at the time. Churchman provided early contributions to systems theory and inquiry drawing on several streams of philosophy (cf. Churchman, 1971). Galbraith (1973) provided information related theories for organizational design. A systems approach was also described by Langefors (1966) and Lundeberg & Andersen (1974) in the area of information systems analysis and design.

Bateson can be described as a systems theorist who was interested in cybernetics within *creatura*, or the world of the living. He was one of the early contributors to cybernetics and participated as a member in the core group in the Macy Conferences, which began in 1943 as an effort to bring psychologists, anthropologists and engineers together to develop the field of signal processing, computation and communication.

Gregory Bateson was a generalist in the sense that he made contributions to several different scientific fields. He worked mainly within biology, ecology, anthropology, psychology and philosophy. In philosophy, he was particularly interested in epistemology. The rich contributions by Bateson are relevant here partly because of his broad perspective. Bateson worked with some of the great questions of science. His interest was focused on why the world is like it is, and why it has developed the way it has. He asks: "what is the pattern which connects all the living creatures?" (Bateson, 1979, p. 8). These are of course questions much wider than the questions dealt with in this thesis. What is said here will therefore only be an interpretation and application of the ideas in a particular area.

In Bateson's view, cybernetics represented a new model for theory, and he believed that this new model would lead to advances in many fields, such as ethics, education, and evolutionary theory (Bateson, 1979, p. 211). He developed his own form of cybernetics inspired by the theory of logical types (cf. Whitehead & Russell, 1910), adapted to describe biological systems.

Argyris (1977) developed his view of first and second order learning in organizations based on cybernetic principles. The concepts were inspired by Bateson's distinction between levels of learning (Argyris & Schön, 1978).

Checkland (1999) provided a stream of research leading to the "soft systems methodology". In this view, a problem in an organization is not only seen as a given problem to solve, but as a problem situation in which models are used to understand the problem in a wider context.

In the management control field, Berry, Broadbent & Otley (1995) have written that systems thinking and cybernetics have had a strong influence on management control. They do not provide a complete theory, but in their view, these requires careful consideration since they are the nearest to a method for developing theory that we currently have.

Beer (1979, 1981) used an analogy to the brain in a neurocybernetic model of organizations as a viable system. In one central model, he proposes five systems of control, each of which considers a larger system. Nissen (2003) has proposed to include the organization in a total environment, an addition he sees as in harmony with second order cybernetics, to include the observer in the domain of observation.

Within sociology, internalization and externalization as used by Berger & Luckmann (1966) also follow a dialectic pattern. Giddens (1984) has proposed a structuration theory which builds on a dualism of structure, in which the rules and resources drawn upon in the production and reproduction of social action are at the same time the means of system reproduction (Giddens, 1984). These are not framed as cybernetic models but the theory structure is based on dialectics which is similar to the theory structure in cybernetics.

Wilden (1987) suggests that theories related to systems and cybernetics can be described as context theory. In his view, the scientific revolution of the last centuries has been a revolt against the all-too-simple. The mechanistic views of the past are not rich enough when we consider phenomena like communication processes. In his view, we need to include dialectical relationships in our understanding of reality. He comments that previous mechanistic views do not have much place for the dialectical both/and-logic of processes, levels and change. What Wilden offers is an alternative that does not throw out old knowledge. It is not in opposition. It is an addition. Context theory is a leap to a higher level of context forming patterns than provided by the mechanistic view.

Wilden describes traditional positions as inward-viewing. In this tradition, systems are described in terms of material-energy, causality, forces, symmetry and simplicity. These perspectives often include a more or less deterministic view. With the perspective of context theory, it is acknowledged that some parts of reality can be described in reasonable ways in these terms, but that we need to add descriptions that are information-oriented and include relationships, goal-seeking, restrictions, communication- and control levels as well as variation and openness. Context theory builds on ecosystems, cybernetic, semiotic and information theories as well as prior theory from the natural sciences.

Senge (1990) has developed a view which includes feedback loops related to learning organizations and leadership. The disciplines of build-

ing shared visions, mental models, team learning and personal mastery are complemented with a systems approach to integrate the disciplines. In diagrams showing circles of influence, Senge expresses the cybernetic idea of feedback and control.

Lundeberg (1993) uses a systems approach to handling change processes. He uses the theory of levels as introduced by Whitehead & Russell (1910), but is also inspired by Bateson. In later works, Lundeberg has developed information management frameworks based on Bateson's theory (Lundeberg, 2000). This has been my main inspiration for using Bateson's ideas.

5.3.3. Using the zigzag theory structure

The researchers who have been briefly mentioned above can in different ways be related to the zigzag structure that I will explicate and use. A comparison of the views held by the different authors is an extensive and complex task.

I have chosen to focus on the ideas provide by Bateson within this thesis. I have chosen to work with Bateson's ideas since I think he succeeds in focusing, or narrowing down, a very complex problem to a structure that is comprehensible and still succeeds to keep a perspective on reality in its full complexity.

I have made my own interpretation of Bateson's texts. I have also added other references, and tried to create a view that is consistent for me.

In this thesis, I will use the zigzag theory structure presented by Bateson (1979) as the core of my formal ontology. Bateson describes the cores of this theory in different ways. Some examples are logical levels, from classification to process, zigzag ladder of dialectics, and calibration and feedback. I use the name *zigzag theory structure* to refer to the principle that I will describe.

Bateson supported the principle of avoiding paradox in theory, and used ideas from the theory of logical types, provided by Whitehead & Russell (1910), as one important cornerstone. However, in applying the theory of logical types to 'reality', he found that classification in different logical types was not sufficient. The division in classes was not rich enough to describe mental and biological systems. He argued that these were characterized by a dialectic zigzag ladder between what he calls

form and process. It is this basic zigzag theory structure that I will use. In my interpretation of this idea, dialectic hierarchical control, or cybernetic calibration, is central.

I was introduced to this theory by Mats Lundeberg, who has great experience in working with it. The principles of what I will present draw heavily on what I have learned from Lundeberg. The contribution I perhaps can bring is to summarize and show how the somewhat abstract ideas can be used within a specific area.

To use the theory is not entirely straightforward, due to the "distance" between the abstract principles in the theory and the empirical data. This is also pointed out by Berry, Broadbent & Otley (1995) within the management control field. In their view, the ideas of systems theory and cybernetics are relevant and powerful, but applying them is difficult. I think that many of the ideas developed within cybernetics and systems theory still provide interesting insights, even if using them today perhaps is not in vogue. I hope to be able to contribute by using knowledge from earlier periods, and apply them in a way that matches the needs of people in organizations today.

5.3.4. Levels of description of reality

In the following, I will describe the concept of levels. This provides a first part of the formal ontology. In the next section, the levels will be expanded to show the distinction between form and process on different levels. These types of concepts will be used in the development of the PRIO framework.

If we agree to accept the assumptions about reality (there is a reality) and knowledge (we can have no direct information of reality), we can go on and ask questions about descriptions in a wider sense, including information, knowledge and perspective. Are all descriptions of the same sort? What happens when we compare or integrate different descriptions? Whitehead & Russell (1910) wrote in their theory of logical types about the paradoxes that can be the result of confusing classes and members. What involves all of a collection should not be included in the collection. For example, mankind is the class of all individuals, but mankind itself is not an individual. Dealing with one in terms of the other confuses reasoning. In the same tradition Bateson (1979) writes that:

> ...there is a deep gulf between statements about an identified individual and statements about a class. Such statements are of *different logical type,* and prediction from one to the other is always unsure. (Bateson, 1979, p. 43)

By analogy, when conducting a survey, it is risky to make statements about the specific answer of an individual based on information only about the distribution of the respondents' answers; or to make statements about the population surveyed based only on the answer of a particular respondent.

It should be noted that the formally strict theory of logical types as described by Whitehead & Russell is not used directly here. My use of the theory should be seen as an analogy rather than application. The current work is more inspired by Bateson's use of Whitehead's and Russell's theory than the theory from *Principia Mathematica.* When we work with descriptions of reality, I take it from the theory of logical types that we should be careful to separate our descriptions on different levels. With this way of making descriptions, the likelihood of arriving at paradoxes can be decreased, compared to a situation in which different levels are mixed.

In the theory of logical types, classes are separated since they encompass different logics. A higher logical level, or a meta-level, is about and classifies the next lower logical level. Bateson (1972, 1979) uses the example of the relationship between position in space and motion. Motion is a change of position. Still one level higher, a change of motion is called acceleration or deceleration. Acceleration is about change in motion, and change in motion is about change in position. Without the idea of position, motion cannot be thought of. It is a step out of the theoretical framework of position. According to the theory, we must be careful when we transfer logic between classes and members, but also when we transfer logic from one class to another.

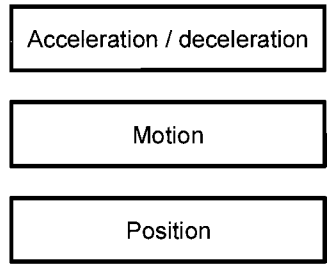

Figure 37. Examples of levels (based on Bateson, 1972).

Another example of a change related to levels is the distinctions between rote learning, proto learning and deutero learning (Bateson, 1972). Rote learning refers to continuous learning in a learning process. Proto learning can be represented as the slope of a learning curve. When learning, one can also increase the ability to learn. The curve can be steeper and steeper. This is the idea of deutero learning.

Argyris (1977) built on these concepts when he developed the ideas of single-loop learning and double-loop learning. Single-loop learning refers to learning within a given system. Double-loop learning refers to situations in which the system is questioned. This can involve challenging underlying assumptions, norms, and objectives.

5.3.5. Zigzag ladder of classification and process

We have treated explanation as a dialectical calibration between a general model and a description of what is to be explained, and noted that the description is not the same thing as reality. One of the difficulties with reality is that, presumably, phenomena in reality are different at different points in time. We thus need some idea about how to treat a reality that exists in time. Bateson did this by using the concept of processes, in addition to classification.

It should be noted that "process" in Bateson's terms is much wider than the concept of "business process" from the process management literature discussed in chapter 4. In applying the theory of logical types to 'reality', he found that classification in different logical types was not sufficient. Bateson thought that the division in classes, for example coconuts, was not enough to describe mental and biological systems. He argued that these were characterized by a dialectic zigzag ladder between what he calls form and process. Bateson writes:

> ...when we take the notion of logical typing out of the field of abstract logic and start to map real biological events onto the hierarchies of this paradigm, we shall immediately encounter the fact that in the world of mental and biological systems, the hierarchy is not only a list of classes, classes of classes and classes of classes of classes but has also become a *zigzag ladder of dialectic between form and process*. (Bateson, 1979, p. 211)

The perspective with form and process is expressed indirectly by Bateson in a metalog, where a father talks to his daughter about the question "why do things have outlines". Bateson defines a metalog as a dialog where the structure of what is being discussed is relevant for the discussion. Towards the end of the metalog, we find the following lines:

> ...Daughter: What did you mean by a conversation having an outline? Has this conversation had an outline? Father: Oh, surely yes. But we cannot see it yet because the conversation isn't finished. You cannot ever see it while you're in the middle of it. Because if you could see it, you would be predictable – like the machine. And I would be predictable – and the two of us together would be predictable.... (Bateson, 1972, p. 32)

We can use the metalog to show the distinction between form, process and reality. What really happens in this situation is not possible to know. What we see is not reality in itself. It is our interpretation of reality and therefore indirect description of reality rather than reality itself. The process that we can describe based on our frame of reference is dynamic. We can perceive changes in the flow of the process. After a few sentences we can classify it as a dialog since it involves verbal communication between two persons. When the dialog is finished, we can classify it as a metalog, since the structure of the dialog was relevant for the issue being discussed. This classification cannot be made directly based on observations of the dialog between the two persons. The classification is created based on a pattern that is identified in the finished dialog.

However, if beforehand we choose to classify the dialog in a specific way, it can influence our behavior in the process (and our understanding of it) so that it in the extreme case becomes machine-like.

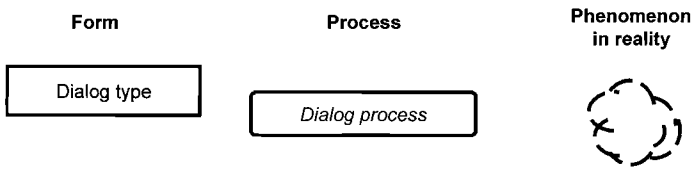

Figure 38. Phenomenon in reality, description of dialog process and classification of process in dialog type.

This is similar to the view presented by Giddens (1984) as the duality of structure, in which the rules and resources drawn upon in the production and reproduction of social action are at the same time the means of system reproduction. The metalog is thus both drawn upon and reproduced in the dialog process.

5.3.6. Relationships between levels

If we sort descriptions on different levels, we can start to think about relationships between these levels. What does it mean to have a zigzag *ladder* of dialectics? In the following I will provide some examples.

Bateson writes that he first worked with cybernetic principles when he was conducting an anthropological study of the Iatmul people of New Guinea (Bateson, 1979, pp. 209-210). He described actions of individuals, and mapped those descriptions to a typology of different temperaments (a typology of sexes). He then continued to study the processes of interactions between people that were summarized in the typology (interactions determining typology). Further on, he created a typology of processes (types of themes of interaction). These types of themes of interaction were again related to processes (interactions between themes). The resulting ladder provided a model in which the wider context increasingly was studied.

Bateson also uses the division of form and process on different levels in an example based on a cybernetic model. He describes a system consisting of a room, a person and a thermostat that is regulating the temperature in the room. Bateson is here inspired by Mittelstaedt (1960) who uses the words calibration and feedback, which according to Bateson are expressions of the same idea as form and process.

The oscillating temperature in the room (feedback) is influenced by a thermostat so that the average temperature oscillates around a specific

temperature. By changing the setting of the thermostat (calibration), the temperature can be raised for the whole system. The setting is influenced in a process in which the sense-organs of the person sense the temperature (feedback), and the person chooses to change the setting based on a personal threshold (calibration). This can in turn be influenced by experiences (feedback) of a warm or cold climate. These experiences can in turn be influenced by the person's status, such as a monk or soldier (calibration).

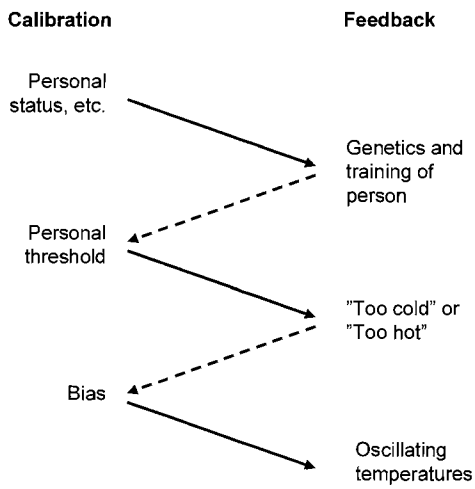

Figure 39. Levels of control of house temperature (Bateson, 1979, p. 214).

A more concrete example can be used to clarify. If a fisherman in the Nordic sea changes status (calibration) and becomes a fisherman in the Pacific Ocean, by moving his business to the tropics, his training in being in the warm weather (feedback) influences his personal threshold (calibration) for which the fisherman feels that the temperature is too hot or too cold (feedback). This in turn can make the fisherman raise the thermostat in his home (calibration) so that the oscillating temperature in the room (feedback) better resembles the outdoor temperatures he has gotten used to.

The different levels are separate levels of control, but it is the combination of the levels that makes a difference in temperature.

Bateson (1979, p. 109) gives another example when he says that you can take a horse to the water, but you cannot make him drink. The drinking

is his business. But then if your horse is thirsty, he cannot drink unless you take him. The taking is your business.

Watzlawick, Weakland & Fisch (1974) describe different types of changes based on levels. They use the term *first order changes* to refer to changes within a class. When a step is taken up in the hierarchy of levels, the changes are called *second order changes*. Second order changes can sometimes feel like paradoxes since they are seen as something else than the problem in focus. If *more of the same* of a solution is not effective, we must try *something else*.

We have touched upon this earlier in terms of reframing. To view a phenomenon in a new way is not a change in the phenomenon itself, but a change in our interpretation of it.

An example inspired by a proverb can contribute. If a person is hungry, one type of solution is that the person is given a fish for the day. This is a temporary solution. This can be called a first order change since it is made within the system. The fundamental situation for the person is the same the next day. Another type of change would be to give the person a fishing rod. This is a type of change that can be described as a second order change, which alters the preconditions for the person. To get a fishing rod still has some limitations. On an ever higher level, the person could be helped to develop the fishing methods by testing different types of bait in different situations.

Form and process, or calibration and feedback can be described on several different, but related levels in a hierarchy of orders of recursiveness. Bateson writes:

> From this paradigm, it appears that the idea of 'logical typing', when transplanted from the abstract realms inhabited by mathematicological philosophers to the hurly-burly of organisms, takes on a very different appearance. Instead of a hierarchy of classes, we face a hierarchy of *orders of recursiveness*. (Bateson, 1979, p. 218)

The message in the examples about form/process and calibration/feedback is that feedback and calibration can be described on several different, but related levels. With each completed zigzag alternation, the sphere of relevance that we are analyzing has increased.

In the discussions of relationships between levels above, we can see that there are different descriptions of relationships between levels. One is

the traditional notion of classes and classes of classes. Another is the model of form and process on different levels. We also have the ideas of learning on different levels, and learning both in the single act and in classes of actions. Finally, we have the idea of different orders of change. These types of relationships between levels could potentially be valuable in developing the framework.

One advantage with the distinction between form and process is that it explicitly includes time in the description. Processes evolve over time. When describing processes, we describe our interpretation of reality based on a certain period in time. For example, in the case of the fisherman, the calibration from changing status to a Pacific Ocean fisherman happen "before" the calibration of the sensitivity to temperature, which in turn happened "before" the actual changing of the thermostat in the house. At a closer look, the being in the room, turning the thermostat, also influences the threshold of the fisherman, probably in the opposite direction since the outside temperature probably is higher than the temperature in the house. If he stays too long inside turning the thermostat, he may eventually change status to an "office clerk" rather than a fisherman from the Pacific Ocean.

In a dialectical description it is highly difficult to speak of the direction of influence. Nevertheless, it may be possible to describe the direction of the line of reasoning over time when using a framework based on form and process on different levels.

5.3.7. Mind and nature

We have distinguished between reality and knowledge about reality, stating that knowledge about reality is indirect in relation to the reality it is about. The map is not the territory and the name is not the thing named. However, we have also stated that knowledge is a subset of reality. In terms of ontological assumptions about reality, there are at least two "sorts" of reality. A critical line between them is whether the reality we refer to is fundamentally about knowledge or not. Knowledge can only exist if there are minds.

> Mind is empty; it is no-thing. It exists only in its ideas, and these again are no-things. Only the ideas are immanent, embodied in their examples. And the examples are, again, no-things. (Bateson, 1979, p. 11)

Bateson stressed that the relationship between mind and nature is a necessary unity. He strongly criticized the separation of mind and body that has influenced much of the theory in modern times (Bateson & Bateson, 1987). In the philosophy of mind, the separation of mind from the brain-body is often attributed to Descartes (cf. Bateson & Bateson, 1987; Devlin, 1997).

Bateson used different means to highlight a fundamental dividing line between *creatura* and *pleroma*:

> Both questions concerned the underlying notion of a dividing line between the world of the living (where *distinctions* are drawn and *difference* can be a cause) and the world of the nonliving billiard balls and galaxies (where forces and impacts are the "causes" of events). These are the two worlds that Jung (following the Gnostics) calls *creatura* (the living) and *pleroma* (the nonliving). (Bateson, 1979, p. 7)

In Bateson's view the distinction between ontology and epistemology is difficult to make since they cannot be separated in practice. He decided to use the term epistemology to include ontology (Bateson, 1972).

Bateson created a set of criteria for mental processes. (Bateson, 1979, pp. 97-137). In his view, mind consists of interacting parts, which have the possibility to identify and be triggered by differences. In order to operate, he argued, that mind requires collateral energy. In his view, the modes of mental process must involve circular determination, or more complex patterns of interaction. The differences treated by mind are coded versions rather than the differences in themselves. Finally, he argued that mind must be capable of distinguishing between logical types, for example between message and meta-message.

The important point is not that this list of criteria for mental process and mind is in any way final. The message is rather that it is an assumption that the logics of the workings of the mind are partly different from the logics of the workings of the rest of reality, and that criteria for differentiating between them are important. For example, mind is qualitatively different from brain, and we should not mix the two.

Bateson was mostly interested in the world of the living, *creatura*. The part of reality referred to as *pleroma* was not directly considered. He was not interested in pleroma per se. However, he made use of ideas about pleroma in his inquiry into mind and nature. In my view this lends

some support to the view in Figure 40. The figure shows my interpretation of Bateson's use of creatura, pleroma and mind and nature.

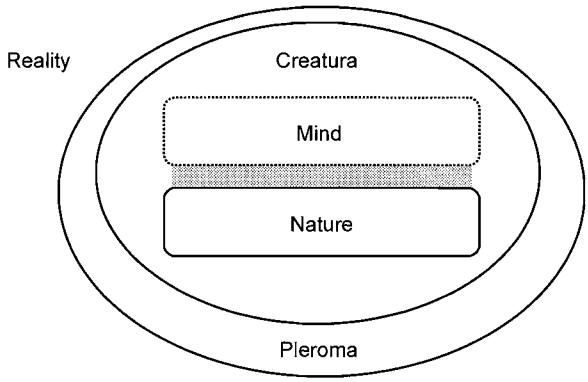

Figure 40. Mind and nature – a necessary unity in creatura (interpreted based on Bateson, 1979).

The relationship between mind and nature is here seen as one of hierarchical dependence. Mind builds on, and interacts with nature. However, mind cannot exist without nature. For Bateson, mind and nature was a necessary unity in the world of the living (Bateson, 1979, p. 7). The unity of mind and nature forms the world of the living, creatura, but reality (the big circle in Figure 40) also includes pleroma.

The sort of structure provided in these distinctions is similar to the view presented by Wilden (1987), who distinguishes between inorganic nature, organic nature, society and culture. According to Wilden, these orders of complexity form a dependent hierarchy. It is called "dependent" since each lower order of complexity as an open system is dependent on (and therefore limited by) the orders above.

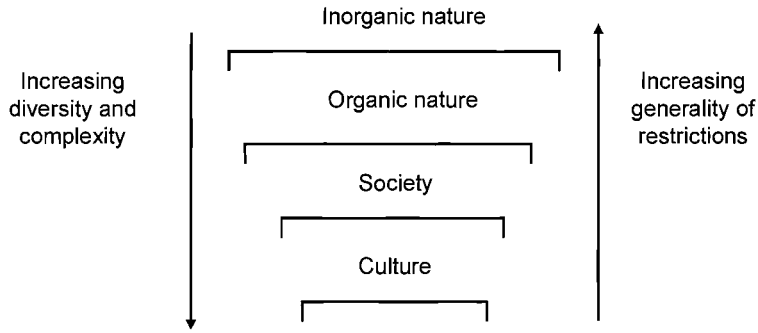

Figure 41. Orders of complexity (Wilden, 1987, p. 74).

(Note that Wilden turns the hierarchy around but that the type of relationship is hierarchical dependence between levels.) He uses an "extinction rule" to see where a certain level in the hierarchy should be placed. Inorganic nature cannot be removed without consequences for lower levels, since it would destroy the systems based on which organic nature builds. However, human culture and society are not necessary for inorganic nature.

> In contrast, if human society becomes extinct, nature simply takes over where we left off. Nature therefore belongs at the top of this dependent hierarchy, and its position there is the result of necessity, not of theory. (Wilden, 1987, p. 74)

This is also in line with Bateson's view that mind, and by extension, society requires collateral energy from nature. It should be noted that Bateson provided a very broad concept of mind (cf. Bateson & Bateson, 1987).

Bateson asked the question "is there a biological species of entropy?" With a statistical interpretation of the second law of thermodynamics, the disorder, or entropy, in an isolated system tends to increase. The hot pan cools down when energy is dispersed. If there is a different species of order, another type of entropy, we would have a very interesting distinction. The idea is that the type of change of order in the cooling pan seems to be different when compared to the type of change of order in a growing embryo.

Pirsig (1991) has developed a metaphysical structure, extending the ideas that he introduced in the cult book *Zen and the Art of Motorcycle Maintenance* (Pirsig, 1974). He describes the world in terms of four levels that can be static or dynamic. The four levels are the inorganic, biological, social and intellectual. He describes their relationships as dialectic interplay. Higher levels strive to dominate the lower, which partly act as resistance.

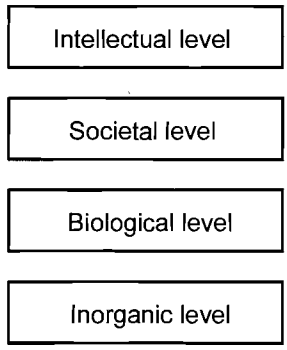

Figure 42. Metaphysical levels (Pirsig, 1991).

The biological levels strive to dominate the inorganic. Over time, evolution has contributed to the fact that organisms today can build cars and airplanes of inorganic material. At the same time, the organisms are based on the inorganic level, which limits the biological level. The biological level is the basis for the social level. The social level strives to dominate the biological level, which is the basis for the social level. Social conventions in society limit the behavior that is acceptable on the biological level. The social level is the basis for the intellectual level, which strives to dominate the social level. Ideas about justice have, for example, historically contributed to change social patterns.

5.3.8. Learning and evolution

In Bateson's view, the world of the living evolves in two great stochastic processes; evolution and learning.

> We face, then, two great stochastic systems that are partly in interaction and partly isolated from each other. One system is within the individual and is called *learning*; the other is immanent in heredity and in populations and is called *evolution*. One is a

> matter of the single lifetime; the other is a matter of multiple generations of many individuals. (Bateson, 1979, p. 161)

The combination of these stochastic processes influenced the development in the world of the living. What is seen in evolution was, in his view, that some species survived longer than others. However, both learning on the individual level and the reshuffling of genes between generations influence what species survives. This view can be used to provide a broad answer to the question of how the world of the living evolves.

I have included the link to evolution since I think it is important to provide a background to a material ontology. When discussing what material forms and processes there "are" today, there also is a question of whether it always has been the way it is today. If not, how has the reality we live in today become the way it is? What is behind the possibility of our knowledge about reality? The answer can obviously have fundamental consequences for the theory that is developed. Is there a God? In that case, what morality is given? What causes are "good"? I am currently not religious myself, and this perspective has influenced my assumption on this level.

5.4. Model of philosophical foundations

In the previous discussion the issues of formal ontology, material ontology and epistemology have been touched upon. These will, in the next chapter, be used to form a set of assumptions for the development of the domain specific framework for project result improvement in organizations.

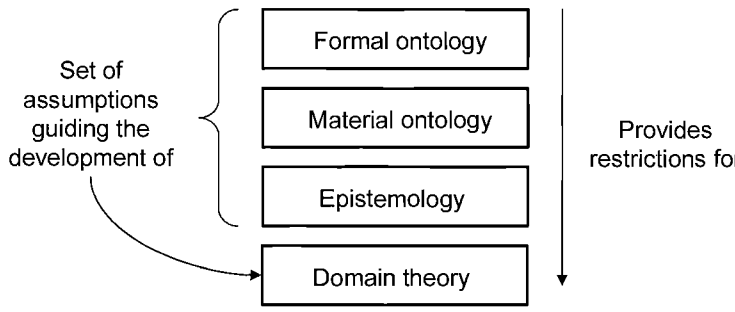

Figure 43. Three levels of assumptions relevant for the development of domain specific theory in the thesis.

The formal ontology provides the fundamental types of concepts that are assumed to exist *a priori,* prior to any sense experience. What are the types of concepts we believe are required to be able to describe reality? These concepts provide the form based on which all subsequent theory is developed. In this thesis, the formal categories are based on the zigzag principle provided by Bateson (1979). Selecting other formal categories would have consequences for what is said in the thesis.

The formal ontology is materialized in the material ontology. The material ontology provides forms, processes and relationships of what is assumed to exist in a broad sense in reality. The material ontology is restricted by the concepts used in the formal ontology.

When we are working with assumptions abut the material ontology, we at the same time have a question of how we can get knowledge about reality. What we believe exists in our material ontology provides restrictions for epistemology. If we believe that knowledge exist in reality (ontologically), the epistemological assumption is related to how we can know anything about this knowledge, or about reality in general.

Formal and material ontology is generally implicit in management studies. Restrictions guiding the development of domain-specific theory are then made on the basis of epistemology. For example, it is often stated that an interpretive epistemology is used without making explicit whether interpretations exist in reality.

By explicating the ontological assumptions, the set of assumptions as a whole can be evaluated and questioned. This provides a basis for developing not only the domain-specific theory, but the basis on which the theory is developed. The effect of changing the assumptions can be that new, alternative theories are developed. Existing theories may be restricted by the assumptions we implicitly have made.

In the next chapter, the assumptions made as a basis for the framework will be developed.

PART III: FRAMEWORK DEVELOPMENT

In Part III, the PRIO framework will be developed. Chapter 6 will primarily build on concepts from the philosophical foundations to construct the framework base. The background to the construction of the framework base is closely associated with insights from the empirical material in Alpha. In chapter 7, the development of the framework continues. In chapter 8, a condensed presentation of the PRIO framework will be provided, summarizing the parts of the framework. In the condensed presentation, some main lines of thought are repeated to make it possible to read the chapter relatively separate from the rest of the thesis. The development of the PRIO framework fulfills the main purpose of the thesis.

6. CONSTRUCTING THE FRAMEWORK BASE

In the following, the PRIO framework base will be constructed. The philosophical foundations will provide one important starting point for this fundamental analysis. I will also refer to the empirical material, since challenges encountered in Alpha have been important motivators for grounding the framework philosophically.

6.1. Selecting the starting point

In the previous chapter we touched upon some fundamental questions and noted that in order to develop domain-specific theory, we implicitly or explicitly make fundamental assumptions. It is not obvious with what types of concepts we should start, or what types of "things" (in a broad sense) we want to say exist in reality. So, the question becomes where to start. Where should we put down a foot in order to start the development of the framework?

Since the assumptions involved are fundamental in character, I have found that the philosophical foundations provide the most support in this area. However, my experiences of the world I know, for example the Alpha case, also influence my assumptions as well as theoretical ideas. The way to develop philosophical foundations has not been a straight line, but an abductive journey.

The result of the combinations of concepts forms a set of assumptions which should be as consistent as possible. These assumptions can then be used in the continued development of the framework in the next chapter.

I had my high school specialization within the natural sciences, and find this perspective to be central in that it involves both what we call the living and the inorganic. I have in many instances of research and practice, come across situations in which lines have been drawn between the social sciences and the engineering sciences. Within the social sciences,

engineers are often seen as reductionists, whereas engineers often see social scientists as providing "fuzzy" knowledge of unclear relevance. From a perspective of natural science, both social and physical phenomena are relevant, and I have sought an integration of these views rather than trying to argue for either of the perspectives. I have found Bateson's perspective very appealing in this respect.

6.2. Zigzag theory structure

The idea of form and process provides two central formal constructs. The metaphor of a zigzag ladder also provides a basis for describing relationships between forms and processes. If we remove form, process or relationship from the formal ontology, we remove a necessary precondition for developing domain-specific theory.

This zigzag principle is seen as a pattern which connects all parts of reality. What are the fundamental *a priori* constructs that are necessary for development of theory in general? The zigzag pattern is my most condensed answer to that question. If we remove the meta-categories of form, process or relationship from the formal ontology, we in my view remove a necessary precondition for describing fundamental qualities of reality.

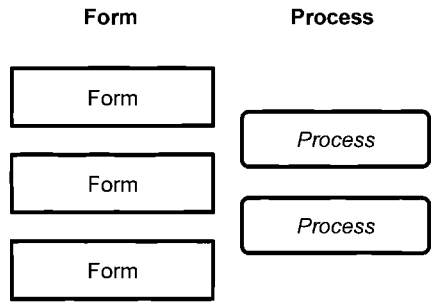

Figure 44. Formal ontology – the zigzag theory structure (inspired by Bateson, 1979).

In my interpretation, Bateson, Wilden and Pirsig use hierarchical models as formal ontology. Bateson and Pirsig include dynamic processes in their basic assumption about reality (cf. Bateson, 1979; Wilden, 1987; Pirsig, 1991).

This selection of theory structure is not a necessary starting point. My assumptions about reality underpin the choice. Writing with this starting point provides one interesting starting point. *What if* reality is characterized by a zigzag pattern, *what then* would a theory for project result improvement look like?

A central difference between form and process is that process as a construct includes dynamic time, whereas forms do not include dynamic time, but rather a time-stamp. That the zigzag ladder is described as dialectic is important since it opens up for a type of relationship that involves mutual influence between forms and processes over time. The term dialectic is here used to refer to tension which can have influence in both directions of a relationship. It is thus possible that an influence goes in one direction, but also that it goes in both directions.

Control is a central concept in this view. Control or influence is seen as dialectic or circular rather than causal. Importantly, several related levels of control can be described. *Dialectic hierarchical control* is one way to summarize the systems approach that I take here. That feedback is inherent in the system is also a central concept. I include this notion in the dialectic idea. Another word that can be used to describe systems of parts that are dialectically related in processes of feedback is *calibration*. I use the term *cybernetic calibration* to refer to dialectic calibration between levels of control. Higher levels govern lower levels in dialectic processes of calibration, where lower levels limit the possibilities of control.

6.3. Forms and processes of reality

Material ontology provides the concrete categories which are based on the principles from formal ontology. Reality is assumed to consist of related forms and processes in accordance with the zigzag principle.

These categorizations are of course difficult and should not be taken too far. My starting point is an assumption that organic nature and inorganic nature are qualitatively different. The laws of thermodynamics do not apply directly to questions of "difference", beauty, or the growing embryo. The sort of order resulting in my image of a dog requires energy, but the energy does only indirectly influence the particular image that is the result in my mind. If a burglar kicks a dog, it is not the energy in the kick that bites back. The kicking and the "cause" of the biting are on different logical levels. Beauty is only distantly related to the amount

of metabolic energy required for interpretation. This view is similar to and inspired by the ideas presented by Wilden and Pirsig.

Based on the work of Bateson, I take it that there are two main sorts of reality that we can analytically distinguish: something that we can call mind and something that we can call nature (Bateson, 1979).

The distinction between *creatura* and *pleroma* is in my interpretation analytic. When describing creatura and pleroma, our descriptions tend to be different in character. In order to guard the consistency of the theory that is developed, it is important to treat things that are different differently. Otherwise paradox can easily arise. Since our descriptions are different in character, they lend some support to the belief that reality in fact is different on the two levels. Since we cannot have direct knowledge about reality it is impossible to know for a fact whether or not they are different.

6.3.1. Learning and evolution

I will use the basic idea of mind and nature from Bateson, and also include the idea of process in the material ontology. Bateson did not formally present the model as shown below. In my use of this theory, nature can be divided into organic and inorganic (cf. Wilden, 1987; Pirsig, 1991). Organic nature is here defined as the parts of nature in which life is possible, and inorganic nature is defined as the non-living material part of nature.

I use the terms *evolution* and *learning* to refer to the processes that bridge the inorganic with the organic, and the organic with mind. The gray area linking mind and organic nature is meant to indicate that mind and organic nature are inseparable. That is, organic nature cannot be developed without pattern, and pattern is related to difference. Mind is described in a dotted box since it is not material in a normal sense, and is not limited by the skin. Differences perceived and interpreted by mind can exist externally.

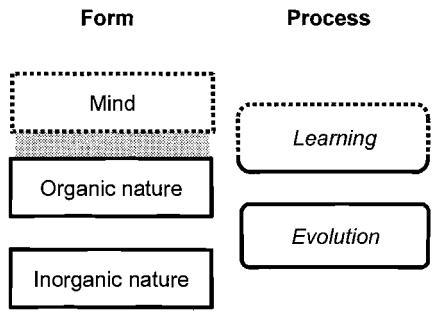

Figure 45. Material ontology – assumed forms and processes of reality.

In essence, what I assume exists is the *principle* that reality is organized in a zigzag structure, and I use the names *mind, organic nature* and *inorganic nature* to refer to forms of reality, and the names *learning* and *evolution* for the processes in which the forms are changed over time.

An important difference between evolution and learning is that learning is a matter of a single lifetime, whereas evolution is a matter of multiple generations of many individuals. Alterations between the described processes influence the totality of the system. What is learned by individuals will, over time, influence the survival of the species.

The relationship between higher and lower levels is one of hierarchical dependence. Higher levels are dependent on lower levels for their existence. However, there is also another type of dependence which goes in the other direction. Higher levels can influence lower levels in partly stochastic processes, such as when learning influences which individuals survive.

6.3.2. Mind and learning

We can now go on and focus the discussion on different levels and processes of mind. In organizations these levels and processes are vital. My view in this matter is influenced by my empirical material from Alpha. What happened in the minds of the people at Alpha when the TTM-process was introduced?

A challenge here is to relate terms such as data, capta, information and knowledge to the material ontology presented earlier. The model in Figure 36 presented on page 157 does not differentiate between levels of reality. The processes involved are implicit. In the following, I will use

the zigzag theory structure and material ontology as a basis for describing one view of the relationship between mind, learning and reality.

The view I take here is developed based on Langefors (1966), Bateson (1979), Bandler & Grinder (1982) & Lundeberg (1993). These authors have addressed processes of mind on several levels of form and process related to learning. There are overlaps in the views of the authors, so the argument I present could be presented differently and the names I have chosen could have been chosen differently. Langefors in his infological equation presents ideas about the relationship between data and information. Bateson provides ideas about the relationship between information and knowledge. Bandler & Grinder (1982) present ideas about reframing, which is about seeing situations from different points of view. Lundeberg (1993) has stressed the importance of different perspectives.

There are several possible terms to use for the level that has been called tautology, general model or knowledge and we have several candidates in terms of theory, framework, pattern etc. I settle for knowledge as a term for the level of mind that is related to general explanatory patterns, tautologies, models, frameworks and theory.

In the view presented here, there is a calibration between what can be perceived (data), our perception processes, the capta we gather from our perceptions and the processes of interpretation in which this capta is transformed to information. This reasoning is inspired by the infological equation (Langefors, 1966). It can also be compared with Checkland & Holwell (1998), even though my use of the term capta differs from theirs. In my view, the results of what is captured by our sensory organs are not meaningful until it has been interpreted.

Data is here defined as what can be perceived, and capta is defined as what is captured from that which is perceived. The information we have can be used in processes of explanation, making use of the knowledge we have at the time (adapted after Bateson, 1979).

The knowledge to use is influenced by our perspective in processes of framing (inspired by Bandler & Grinder, 1982; Lundeberg, 1993). This can be connected with context and interest in the model provided by Checkland & Holwell (1998, p. 90).

It should be noted that I use the term knowledge in a somewhat restrictive sense. Knowledge can only exist in mind. Another central require-

ment for knowledge is that it is related to a class of phenomena, or the general, rather than a specific situation. If it is related to the specific, I call it information. In the previous text the terms information, description and knowledge have been used without specific differentiation. Generalizations that do not contribute to explanation are not seen as knowledge here. A pattern is just a pattern if it does not support explanation.

Subsequently, *truth in mind* is the result of a successful mapping of *information* onto *knowledge* in a process of *explanation*, framed from a specific *perspective*.

We can now provide increased detail to Figure 35 presented earlier on page 151. Descriptions in mind are now named *information*, and tautologies are named *knowledge*.

One reason for introducing the levels framing, knowledge and explanation is that the infological equation needs to be expanded to take into account, and make explicit, the freedom we have to frame and explain in different ways. This is also supported by Kahneman & Tversky (1979), who emphasize the importance of framing for decision processes. This is relevant in this context since framing is not only interesting in relation to knowledge, but also in relation to how it influences decisions.

It should be noted that the processes of perception and interpretation are unconscious. Learning is here defined as changes between the levels. That is, learning can be the result of processes of interpreting, explaining and framing. These processes can be triggered by perception, but also by new combinations of existing perspectives, knowledge and information in processes of reflection.

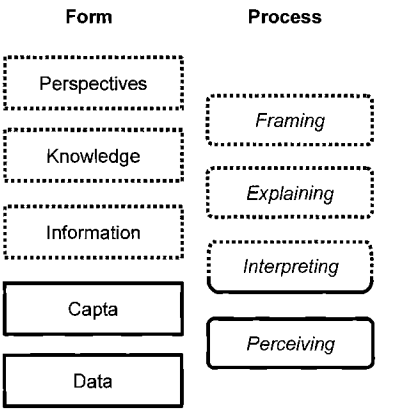

Figure 46. Differentiation of mind and learning.

It is an epistemological assumption that learning involves calibration between form and process on several levels. In other words, the process of learning can be expressed with the zigzag principle. This type of use of the zigzag theory of form and process related to perception and learning was also more or less foreseen by Bateson (1979, p. 211). What has been said here is one possible way of using form and process in relation to learning.

All levels of form and process are required over a lifetime in order to stop the mind from "runaway" or "standstill". This can be described with the cybernetic idea that perspective and processes of framing are required in order to moderate and control all the information that is built up, and be a basis for selecting what knowledge to use in our explanations. Without moderation, information overflow will be the result. At the other end, perception and data are required in order to initiate processes of perception and interpretation. With this view, the mind can be described as having the potential to do otherwise, or having a weak form of free will (cf. Walter, 2001). The awareness of different framings is important in this respect since it provides a possibility to choose from what perspective a situation is to be understood, rather than taking a certain perspective for granted without reflection.

Having presented the model above as epistemological, we must also acknowledge that what has been said is assumed to be a part of reality. Therefore, it could as well be described as ontological assumptions about the workings of the mind with regards to learning. However,

since these processes are processes of learning, I refer the descriptions of mind and learning to the epistemological part of the presented view.

6.3.3. Learning and acting

The focus on learning described above has been motivated by the understanding that learning is important in organizations. However, it is also important to see in what ways learning is translated to action. In Alpha, learning "too much" seen as was negative when it led to bureaucratic use of patterns in the TTM-process. In the following, the model of learning will be discussed and developed related to acting.

Even though the levels of mind, organic nature and inorganic nature can be used, I have chosen to differentiate the general material ontology from categories more suited to describing individuals and artifacts. The reason for this choice is that the categories then are closer to our everyday language in regard to projects. The differentiation involves going from a general level of species to the particular individual on the levels organic nature, evolution and inorganic nature. I am thus more interested in the body and actions of an individual than organic nature and evolution in general, and more interested in the interplay with artifacts than interplay between organic and inorganic nature in general.

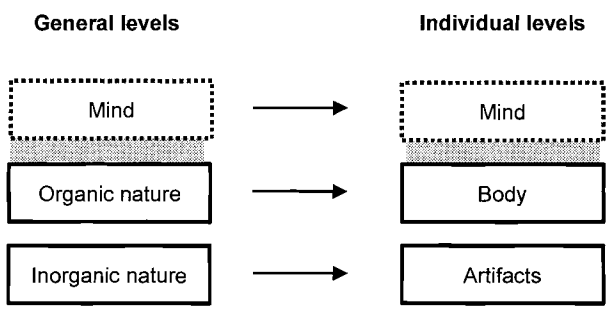

Figure 47. Differentiating the ontology to individuals.

The relationship between mind and body is of course a close one, and in the spirit of Bateson, a person is here seen as a unity of mind and body. There is no mind *separate* from body (Bateson & Bateson, 1987). The distinction is analytical. I try to show this unity with the gray area connecting the two boxes in Figure 47.

Bateson provided a very general definition of mind, which could include phenomena such as thought, evolution, ecology, life and learning. In my study the concept can be used both on the general and individual levels. The focus in the continued text will be on mind on the individual level, if not otherwise is explicitly noted.

The processes of learning have been seen as bridging mind and organic nature. In a differentiated ontology we can describe learning by individual persons in terms of a process connecting mind and body. However, learning is closely associated with processes of acting. The actions of a person involve both mind and body as a whole. In the following, relationships between learning and acting will be discussed.

Let us look at an example from Alpha to discuss the relationship between learning and acting related to the TTM-process. In the Alpha case, there was a situation of conflict when customers wanted prototypes before it was "allowed" to deliver prototypes according to the process description. The information that "the customer wants a prototype" is understood in a context of how general projects are carried out, and this knowledge of how general projects are carried out is selected based on the perspectives taken by the person. The perspective understanding held by a person influences the degrees of freedom the person has in projecting courses of actions. If a person has framed project work from a perspective emphasizing that projects should be "carried out by the book", or that the TTM-process provides a "best way", the use of knowledge about how to carry out projects is influenced by this selection. In an extreme case, following the project method strictly may be seen as the only available alternative.

We can here quote Howard, who based on game theory states that "if a person comes to 'know' a theory about his behavior, he is no longer bound by it but becomes free to disobey it" (in Watzlawick, Weakland & Fisch, 1974, p. 101). In my view, awareness of different perspectives, or perspective understanding, makes it possible to consciously choose a perspective and apply knowledge from this perspective in an informed way, rather than being bound by a specific theory through an implicit and unconscious framing.

I have previously separated between knowledge and information, emphasizing that knowledge pertains to the general, and information to the particular. In this case, information about the project process as it has

been conducted would be classified as information. If we identify a general pattern that the project is an example of, this would be an item of knowledge. In this case, the project method used in the product development projects would be such an example. In projecting future actions in the project, information about the project process and the project method could be used. Explanation would here correspond to the process in which the method is linked to the information about the project process. Where in the project are we? What is the next step according to the general project method?

Perspectives, in my view, make judgment possible. Acts of judgment require perspective understanding, which is on a higher level than the knowledge used. Applying a method in a reasonable way is related to judgment. This in turn requires perspectives. The perspective understanding of a person is used in framing knowledge for application. However, perspective understanding is not sufficient for judgment.

There are two critical levels in this discussion. One is related to framing, and one is related to explanation.

The perspective understanding of a person provides a basis for a process of framing, in which knowledge is selected. The process of framing thus depends both on the perspective understanding and the knowledge held by the person. The second level deals with how knowledge is used in relation to information in processes of explanation. The process of judgment can only be practiced in particular cases, and is thus also related to the senses. What information is used for explanation depends on processes of interpretation and perception.

We have earlier quoted Gadamer (1975, p. 30) in that judgment cannot be taught in general. We must have a practical situation to relate to. Judging is then related to selecting perspectives from which knowledge is used to provide arguments in deciding on a mental projection of a course of action. The process of judging is then of a higher order relative to the process of deciding. If we are only aware of a single perspective, the process of judging has limited flexibility. It is *obvious* that a particular decision should be made. The selected arguments are then not preceded by a conscious process of framing.

I stress the importance of decision-making in the planning process (cf. Ackoff, 1970). Based on arguments, decisions are made about a projected state and course of action. However, the decisions are made with

some background, depending on the perspectives which influence the decision process. The projection thus depends both on the decision processes and on processes of judging in which the arguments are selected.

The point here is that perspective understanding, as an enabler of judgment, provides an important part of the puzzle about the relationship between knowledge and action. The arguments put forward as a basis for deciding on a course of action are moderated by a process of judging, which is limited by the perspective understanding of the individual. This is also in harmony with Schütz's view on the paradox of rationality in action:

> To be sure, the more standardized the prevailing action pattern is, the more anonymous it is, the greater is the subjective chance of conformity, and, therewith, of the success of intersubjective behavior. Yet – and this is the paradox of rationality on the common-sense level – the more standardized the pattern is, the less the underlying elements become analyzable for common-sense thought in terms of rational insight. Schütz (1953, p. 26)

That is, the more standardized the process is, the less visible the process of judging becomes. If we *view* a process as standardized, it is natural that we downplay the requirement of judging in carrying out the course of action. This was the case in Alpha. The TTM-process was *seen as* providing a "best way".

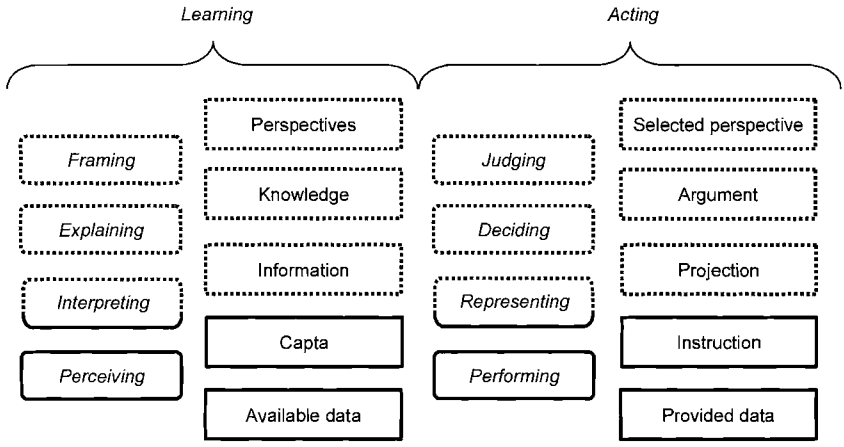

Figure 48. Differentiation of learning and acting.

In the previous analysis, learning and acting have been analytically separated almost as if there was a sequence, or well thought-out process. On the contrary, I view the interplay in terms of *multiple calibrations on multiple levels*, where calibrations in many cases are unconscious.

Figure 48 above is intended to describe learning and acting. The bottom levels provide a schematic interface between body and mind (shown by dotted/solid borders). The two left hand columns have been vertically mirrored compared to the model presented earlier (cf. Figure 46). I have done this to describe the close relationship that is assumed between learning and acting. The model is based on the idea of cybernetic calibration so that higher levels generally control lower levels, which also can influence higher levels.

The main line of argument when explaining the model goes from the bottom left side of the model, up to perspectives and then down to action on the right side.

However by reframing on the left side, and selecting a new perspective, new arguments can be found on the right side. By projecting a course of action, difficulties can be foreseen, forcing the line of argument back to the left side to find new frames for inspiration. Also, new interpretations of capta can result in the line of argument not holding in the specific case. The explanation from the selected perspective may not be sufficiently valid in the light of new data.

The model of learning and acting provides a frame for describing specific situations. In many cases the processes involved are unconscious. For example, in many processes of acting, the arguments behind the action are constructed after the action has been carried out. Arguments are constructed to be in harmony with what we already have done to guard consistency between what we have learned and what we have done. Festinger's concept of cognitive dissonance is close to this idea (cf. Atkinson, Atkinson, Smith, Bem & Hilgard, 1990, p. 707). In other words, the model does not imply rationality.

When a person imagines that reality is a certain way, this could be sorted on the information level. The capta used to develop the interpretation is then based on memory rather than perception. The imagined information about reality is then guided by the perspectives and knowledge used by the person. By framing from new perspectives, creative

ideas about reality can be imagined and formed to innovative projections.

An attitude could, in the model, be described as a general belief about some type of phenomenon based on a specific and unquestionable perspective. The person can believe that a certain method or model is good. The perspective from which it is evaluated as "good" might not be identified. In this case the particular attitude is placed on the knowledge level without being sorted under a perspective. It influences decision processes without acknowledging from what perspective the decision is called for. The "general way" suggested by the attitude is not consciously understood from a specific perspective. When asked why a person prefers a specific method, the answer might be that "it is the best one", without being able to qualify from what perspective it is "best".

The model can be used to describe my own mental processes, or it can be used to describe mental processes I believe other people have gone through. What perspective seemed to be behind John Svensson's decision to initiate improvements? What arguments did he seem to use?

It is important to note that the model does not explain all mental processes. It is developed with the specific purpose of describing the relationship between learning and acting in a context of work. The background to this selection has been an interest in improving project results, and specifically the challenges identified in Alpha.

6.4. Personal work process model

In the following, the structure from the X-model will be used to provide a frame for describing specific processes (Lundeberg, 1993). In its most summarized form, the X-model distinguishes between the person and task levels in a process (cf. Figure 25).

In the following, I base the description of the project process on the X-model and the material ontology developed earlier. The three main levels (mind, body and artifact) are bridged by two processes (learning/acting and performing tasks). Since the model provides a frame that involves time, the results on the three levels differ from the preconditions of the process.

Schütz distinguished between common-sense and scientific interpretation of human action. He defines "action" as human conduct devised by

the actor in advance, based upon a preconceived project (in a broad sense). The term "act" is used to designate the outcome of this ongoing process, that is, the accomplished action (Schütz, 1953, p. 15). Schütz tells us that action requires and involves learning. I summarize these two processes in *learning / acting*, which can be described as interplay between mind and body. Tasks carried out can be described in terms of interplay between artifacts and body. We can then describe the process of learning and acting in terms of how people perform specific mental processes, and the process of performing tasks in terms of people's actions in relationship to artifacts. The results could then be described in terms of mind results, body results and artifact results. Automated processes conducted by artifacts such as automated assembly are not shown in the figure. Automated processes can be seen as an additional process level below artifacts.

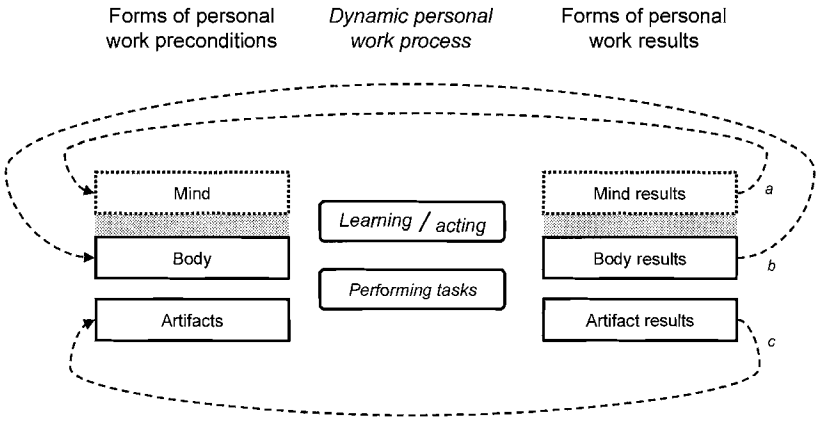

Figure 49. Personal work process model.

This modified X-model provides a personal work process model. The process named learning / acting in Figure 49 has been described in more detail in Figure 48. The process levels *interpreting* and *representing* from Figure 48 provide the link between mind and body in Figure 49.

The results of one personal work process can become preconditions for the next execution of the personal work process. This feedback is indicated by the arrows (a, b and c) in Figure 49. Knowledge gained from one process can be used in the next (a), physiological stress can influence actions (b), earlier products or solutions can be reused (c). The lines are dotted since it is not certain that the results influence future proc-

esses. For example, the person can forget lessons learned, medication can be used and artifacts may not be accessible.

The personal work process model is grounded in formal ontology (zig-zag theory structure), material ontology, epistemology and empirical material from Alpha. An earlier version of the personal work process model has been presented in Andersson (2004). With this base, we can now continue with developing the PRIO framework.

7. CONTINUED FRAMEWORK DEVELOPMENT

In the following analysis, the PRIO framework is developed based on the empirical, theoretical and philosophical foundations. The zigzag theory structure is used in the analysis, providing principles for connecting concepts in the framework. A basic framework is first developed, and then differentiated. With this gradual differentiation I aim to show how I have reasoned in the development of the framework.

7.1. Introduction

In this chapter, the empirical data from chapter 3 and theory from chapter 4 will be analyzed using the zigzag theory structure of form and process. The theory structure has been described in chapter 5 and exemplified in chapter 6. The guide for this analysis is the research question and specific purposes for the thesis (cf. Figure 3). Since the research question deals with how project results in project-intensive organizations can be improved, the discussion and selection of forms and processes will be based on how they describe the links to project results.

Assumptions that arise out of the philosophical foundations provide some of the basic concepts that will be linked to during the analysis. The reason for addressing assumptions about reality is that these are relevant also in project result improvement. I want to start working with what I assume exists. By doing this, the ontological and epistemological starting points can be used in the analysis, rather than their just providing a general background. What has been said about levels, mind, body, artifact, learning and acting, and the relationships between them, thus provides important categories for the analysis.

I want to provide a "theory chain". The first parts of this theory chain have been provided in chapter 5, leading to the material ontology (assumptions about categories that exist in reality) and the personal work process model in section 6.4. The challenge now is to continue this

chain, and increasingly describe how the framework for project result improvement is developed.

The first part of the analysis will provide a hierarchical structure of operations, improvements and strategy based on levels. These three levels of work are then condensed to a basic model of orders of change, before the zigzag theory structure is used to provide levels of form and process in the framework. The forms used first are classifications of processes, focused on the type of work method used on each level. This is then generalized to types of preconditions for the levels. Results are then discussed in relation to the PRIO framework.

The analysis provided here will, in the next chapter, be condensed to a description of the PRIO framework.

7.2. Levels of work

During my analysis, I have used different levels to try to understand how project results can be improved. This work has been characterized by much iteration, calibration and parallel development of the different models of the PRIO framework. I have analyzed the empirical material in the Alpha case and used concepts from theoretical and philosophical foundations during this work.

In the analysis, I have emphasized the TTM-project since it was an important part of the empirical data. What links were there between the TTM-project and the results of the product development projects? The work carried out in the TTM-project can be described in several ways. It can be seen as a tactical project, an organizational development project, a change process, a change project, a business process development project, a transformation project, a renewal project, etc. (cf. Greiner, 67; Davenport, 1993; Lundeberg, 1993; Ekstedt, Lundin, Söderholm & Wirdenius, 1999).

I have found that the project label is not suitable for the level of work exemplified by the TTM-project, since the work performed could have taken another form. For example, there is continuous improvement (cf. Deming, 1986). The work related to creating process descriptions could have been done continuously by a team similar to a quality circle. In my view, the term to use for the TTM-project level should therefore not be limited to "project work".

The work carried out in the TTM-project could for example be called tactical work, operations transformation, operations development or operative changes. One problem here is that operations are transformed, developed, and changed during their own execution. When a new project has been carried out, operations will not be exactly the way they were before. People have learned, new documents have been created, etc. The term used on the TTM-project level should distinguish between the transformation, development and change resulting from the day-to-day business in the operative product development projects and the work on the TTM-project level.

One of the main problems in this discussion is that the same term can be used on several levels. There is an important difference between the TTM-project and the product development projects in Alpha. Both levels involved change, governance, control, transformation and development. We can describe governance and control of the TTM-project as well as governance and control of the product development projects. To clearly distinguish between the levels the names for the levels should be different.

The way I have decided to handle this is to distinguish between work that is carried out with the specific *intention to improve* the results of the operative projects *in general*. This type of work is not related to the single operative project process, but to a class of projects. An improvement process can then be compared to work within an operative project process. The execution of an operative project in product development in Alpha was primarily aimed at developing products for a specific customer. The improvement process was not aimed at satisfying a specific customer, but aimed at improving the project processes in general. An alternative term would be *operations development process*.

Mårtensson (2001) has suggested a similar distinction for management processes. He used the term *execution level* for the operative management work, and *development level* to refer to development of the execution level.

I have used the term *strategy* to refer to the level of work exemplified by the management team in deciding on what improvements to carry out.

In the following, I will use a distinction between operations, improvements and strategy as a first aid to structure the analysis. The principle for the relationships between the levels is that improvement work is

about operative work and strategy work is *about* improvement work. This structure has provided a way for me to sort descriptions of the Alpha case. The structure of the three levels will be further differentiated and discussed in the development to the framework. There is literature that can be connected with each level in this first classification.

Within the strategy area, there are streams of literature that regard to industry strategies and corporate strategies (Mintzberg, 1978; Porter, 1980). From an information systems perspective there is also an area related to *information systems strategy* (Earl, 1989).

Within process management, the focus is on work that is carried out in order to improve some process (Davenport, 1993). The distinction between operations and improvements is also in line with the work system framework presented by Alter (2002). He separates between the "work system" and development of the work system in terms of a lifecycle of adaptation (Alter, 2002).

There are several domain-specific theories for different types of operations, such as product development, production and marketing (Clark & Wheelwright, 1992; Slack, Chambers & Johnston, 2001; Kotler, 2000). In the context of project-intensive organizations, we can relate to theories focused on operations carried out in the project form, such as product development and systems development.

7.2.1. Strategy, improvements and operations

In the Alpha case, the management team decided on the strategic focus of becoming more proactive and business-driven in product development and striving upwards in the value chain. The TTM project was carried out as an improvement effort, intending to improve the product development projects, which were a part of the operations in Alpha.

We can use the simplified theory of logical types to specify the distinction between operations, improvements and strategy.

Classes are separated on different levels of abstraction since they encompass different logics. A higher logical level, or a meta-level, is about and classifies the next lower logical level.

To refresh our minds, we can recapitulate and relate to one of Bateson's (1979) examples. Motion refers to a change of position. In a similar way, improvement work refers to changes of the operative work. If we do not

have the idea of position, motion cannot be thought of. In a similar way, the term "improvement" lacks meaning if we do not have any reference to what will be improved. Moving from position to the next level is a step out of the theoretical framework of position. In terms of the theory discussed here, it is a step from theory about product development to theory about improvement work.

According to the theory of logical types, we must be careful when we transfer logic from one class to another, or between classes and members. In other words, we cannot be sure that product development theory can be used to understand improvement work. This is an argument for separating the two levels analytically. Improvement *of* daily activities is different from the daily activities themselves. In the Alpha case, we can describe the improvement of the product development process within the TTM project as a specific example. The daily activities or the product development level can be exemplified with the development of product 2515, one of the components developed and sold by Alpha.

The three levels of work provide a classification (form). This classification scheme can be used to classify descriptions of work in a specific organization. The description of the work in the specific organization is different from the phenomenon in reality (cf. Figure 35, p. 151).

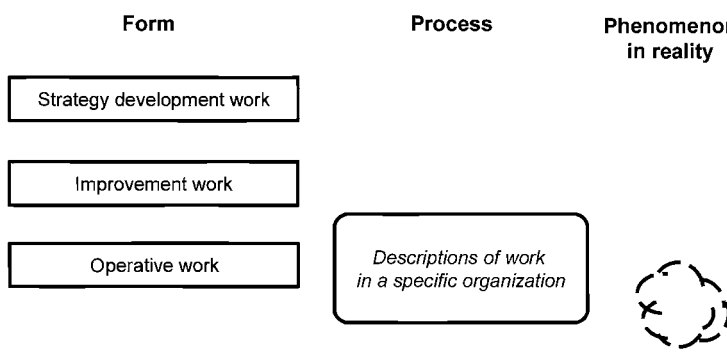

Figure 50. Sorting descriptions of phenomenon in reality on three levels of work.

The term *strategy development work* is used rather than only *strategy work* since I want to direct attention to the work carried out in developing the strategy rather than to the work of implementing the strategy. It is the intended strategy that is developed. The realized strategy is shown in the operative work (cf. Mintzberg, 1978).

By making the distinctions between strategy development work, improvement work and operative work, we become more sensitive to potential differences in logic. In the view taken here, strategy development work is *about* improvement work, which in turn is *about* operative work.

The differences between the work on the strategy development, improvement and operative levels can be seen in the theory, or rather "best practice" that inspired the people in the management team, design team and the customer teams in Alpha. It may be the case that the ideas used were important mainly in the sense that they were "modern", examples of "best practice", or simply accessible. Therefore, the following is a description of what theories that seemed to be included in the work rather than an argument for their fruitfulness.

The work of the management team during the strategy development process was influenced by the model of identifying critical business issues. This specific model was provided by the Rummler-Brache Group. The management team emphasized that they wanted to implement visions, strategies and common goals in the organization, which indicates that they could have used other sources for inspiration (cf. Kaplan & Norton, 1992; 1996). One part of the strategy the management team wanted to pursue was to climb higher in the value chain in order to avoid the competition on the component market. The management team here seemed to be influenced by general strategy models (cf. Porter, 1980).

Examples of theoretical areas addressing the strategy development level are *competitive strategy, corporate strategy* and *management control.* Areas that are addressed cover the relationships with the environment and competitors, how the corporate strategy can be developed and how control of the strategy can be achieved (cf. Porter, 1980; Argyris, 1985; Kaplan & Norton, 1992).

One clear influence for improvements came from the method provided by the consulting organization. The RBG-method was presented as providing knowledge from prior changes about how improvement processes can effectively be conducted. The ideas were documented in the book written by Rummler & Brache (1995), in the manuals used by the consultants, and in the workshop materials used during the project. The two consultants from the RBG group also communicated their interpre-

tation of the theory during the workshops. Other examples of ideas for improvement are provided by Steneskog (1991) and Davenport (1993).

The ideas provided in the RBG-method were not directly related to product development. According to the method, one of the main activities during the design phase was to create a process description. The method only indicated the general properties of the process description. Even if the consultants, and in more general terms their organization, had ideas about best business practice for product development, they did not provide specific information about this during the actual design of the process.

It was clear in their approach that the consultants acted as catalysts for improvement rather than as experts in the product development area. They had knowledge about improvement work and improvement projects rather than the specifics of the operative business that was to be improved. The "best practice" provided by the consulting organization can thus rather clearly be mapped within the improvement level in the classification.

Examples of theory related to the improvement level from a process perspective are organizational transformation, process management and projectivity (Greiner, 1967; Davenport, 1993; Ljung, 2003).

Ideas from the product development area seemed to influence the design team indirectly. The design of the TTM-process evolved to become something like a stage model similar to the ones provided in normative project management and product development literature (Kerzner, 2000; Turner, 1999; Clark & Wheelwright, 1992). Another example is that the Business Opportunity Evaluation macroblock suggested evaluating the project in relation to the tactical plans for product development. This was done to monitor whether the suggested project was in line with the tactical plan. There were also calculations for volume and prices to evaluate if the project were to be profitable. Further, a check was made to see whether the organization had the technical know-how and production technology to succeed with the project. This is similar to the product development funnel discussed by Hayes, Wheelwright & Clark (1988).

The reference to product development literature was seldom explicit during the work in the design team. The people in the design team had knowledge of "best practice", both through training and practical ex-

perience. It is difficult to evaluate to what extent the process was "deductive" based on theory, and to what extent it was a result of the people's experience. On a general level, the best-practice influence on the TTM-process description can be described as an abductive combination of information from past projects and deductions from best practice (knowledge).

The design also seemed to be influenced by the PROPS-method that was used by one of the customers. Even though the final TTM-process included the term "milestones", the word "tollgates" from the PROPS terminology was sometimes used to refer to these during the design of the process.

The classifications made between strategy development work, improvement work and operative work are also relevant for projects. The TTM project can be described mainly as an improvement project, and the product development work can be said to be carried out as operative product development projects. The strategy development level was only sparingly addressed in the RBG-method. The work was implicitly guided into a specific type of improvement work.

Combining strategy development and improvement work to one project, guided by one method, can be an advantage since it probably is easy to use. On the other hand, we might ask what alternatives that were implicitly disregarded when the same method was used for both levels. In the ideal case the persons in the organization should have the option to select theories for the improvement level that are suited to the specific problems and opportunities in the organization. It is not certain that the general solution is relevant in the particular case.

However, it should be noted that in practice it may be rational from an action-perspective to integrate the methods. If there are too many decision-points with several alternatives, there might be a risk that the project is not finalized. Considering multiple alternatives can evoke uncertainty, which can reduce motivation and commitment to the change (cf. Brunsson, 1985).

There is a difference between the terms "work" and "projects" in the sense that we can think of other forms of work, which are not carried out in the project form. When we switch from talking about improvement work to talking about improvement projects, alternative forms of improvement work are left out. In the same manner, when we talk

about the operative business in terms of operative projects, alternative types of operations are excluded. The term *work* is on a higher level of abstraction than the term *project*. Projects are here seen as examples of the more general category of work.

This is contrary to the view held by Van Der Merwe (2001), who presents the idea that projects are the only departure for business development. It rather seems as if Van Der Merwe uses a project perspective on business development, and thereby concludes that all business development is done in the project form.

From an empirical standpoint I agree that some improvement work is framed as projects by the persons involved in the improvement. This was the case in the TTM project.

Ekstedt, Lundin, Söderholm & Wirdenius (1999, p. 195) describe a "renewal paradox" that can result when project organizations, which presumably should be flexible, do not renew their organization. Instead, projects tend to be repeated. They propose an anatomy of renewal, in which top management initiates renewal action, which influences knowledge and action embedded in structures, institutions, organization and individuals. This more general idea is more in harmony with the view proposed here. Improvement work can be executed in project form, but this is only one possibility. This view is also similar to the one presented by Greiner (1967).

In the view of Alter (2002) critical success factors may differ for different types of projects. Theories for operative projects and improvement projects can be separated, and more concretely in this case, theories about product development projects can, and to some extent do, differ from theories about process improvement projects. For example, the need for technical competence might be stronger in product development, and understanding of human behavior may be critical in process improvement projects.

	Strategy development work	**Improvement work**	**Operative work**
Definition	Developing the direction of improvements	Improvement *of* daily activities	Daily activities
Empirical example	Developing the Alpha strategy	Improving the product development process	Product development
Specific empirical example	Identification of critical business issues	Time-To-Market improvement process	Development of product 2515
Theoretical examples	Competitive strategy, corporate strategy, management control	Organizational transformation, process management	Marketing, production, product development, accounting
Representative authors	Porter (1980), Argyris (1985), Kaplan & Norton (1992)	Steneskog (1991), Davenport (1993), Rummler & Brache (1995)	Clark & Wheelwright (1992), Slack, Chambers & Johnston (2001), Kotler (2000)
Project form	Strategy development projects	Improvement projects	Operative projects

Table 8. Characterizing three levels of work.

Consultants from RBG provided a method for identifying critical business issues, and then suggested a specific method for carrying out the improvements. The method was used to improve the product development process, but provided little guidance regarding the actual steps to be carried out during product development. This was instead related to best practice for the operative projects, in this case best practice for product development.

There was a relationship between the improvement method and the operative project method that was the result of the improvement work, but the linking mechanism was in the knowledge held by the design team regarding the specifics of the process. Other methods can imply more specific suggestions about steps in the product development process, etc. For example, in the RBG approach the strategy development method of identifying critical business issues was followed by a sequence of improvements that was specified in advance. The steps included describing the is-state, the should-state, and identifying roles and responsibilities in the new process. The improvement sequence *did not* suggest identifying what information systems that could be used to support the new process.

As in the case of improvement work and operative work, the improvement project was *about* the operative projects. There was thus an "influence" from the improvement project towards the operative projects. However, we can also describe an influence in the opposite direction. The results of the operative projects led the management team to initiate the TTM project. Similarly, the strategy development work led to the initiation of the improvements, but the focus can also be described in terms of problems in the current improvement work leading to a strategic focus on improvement. I therefore use the term *calibration* to refer to the interplay between the levels. Since there are several discontinuous levels the interplay can be described as *calibration between multiple levels of processes*.

7.2.2. Relative to the perspective taken

The distinction between operations, improvements and strategy development is relative to the perspective taken. Improvements can be seen as operations by a person working with business development. For the representatives from RBG, the TTM project was just another operative consulting project. It was about helping their customer. On the other hand, from the Alpha perspective, the TTM project was an improvement project. The project was about improving the product development process.

Within Alpha, we can distinguish between the perspectives of the customer teams and the production teams. From the perspective of the customer teams, it seems rather straightforward that the TTM project was intended as an improvement of the product development process, which constituted the daily operations of the customer teams. The TTM project was different from the development of product 2515, for example.

However, what happens when we take the perspective of the production teams? From their perspective, the product development process can hardly be described as *their* operations, even though they had production department representatives in the product development projects. Some of the important preconditions for the production process were established during the product development process. The production teams at Alpha explained that the production specifications were lacking in quality, and the products were not always adapted for effective production, especially not with the existing production equipment.

In their view, this led to increased quality costs in production. This can be connected to the ideas of concurrent engineering where product and process are designed in an integrated fashion. Hayes, Wheelwright and Clark (1988, p. 279) explain that the possibility to influence the outcome of a product development project is high at the start, but low at the manufacturing ramp up.

It is difficult to draw the line between operative projects and operative production. Improvement of the product development process, to some extent, led to improvement of the production process. In terms of results, improvement in the production process could be described as indirect results, or effects (cf. Lundeberg, 2003). The improvements of the product development process were not related to the production process in general. It was rather an improvement of how the specific production process for a specific product was established. We can use the terms *operative product development work* and *operative production work* to clarify the difference. The people in production can then be seen as internal customers. In the continued change efforts, a specific project was started and focused on TTC. This was intended to directly improve the production processes.

7.2.3. Summarizing three levels of work

In the beginning of my analysis, I have discussed some theoretical classifications and compared them to the Alpha case. The terms *operative work, improvement work* and *strategy development work* have been used to provide a first structure of the analysis. The three levels were separated in order to be more sensitive to differences between the levels. Project work has been described as one possible form of work, indicating a distinction between strategy development projects, improvement projects and operative projects.

It was noted that different "best practices" influenced the work on the different levels. Ideas from Rummler & Brache (1995) influenced the strategy development and improvement work, whereas best practice for the operative work seemed to be inspired by ideas like the "product development funnel" (Clark & Wheelwright, 1988).

We have also started a discussion about the relationships between the levels. At the current level of analysis, I have proposed that strategy development work refers to developing the direction *of* improvements,

and that improvement work deals with improvement *of* the operative work. The results of the operative work provides a basis for deciding on what improvements are motivated, and the current improvements provide a basis for deciding on what new improvements are needed, thus indicating that relationships between the levels can be described in both directions.

7.3. Orders of change

The concepts strategy development, improvements and operations have a weakness in that they only briefly touch on the relationships between the concepts. The stated reason for carrying out the TTM project was to improve the operative product development projects. Can we find a more specific description of how the *improvement level* and *operative level* are related? This involves introducing time into the description. The TTM project was carried out before the improvements materialized. We therefore need some theoretical structure that can provide both classifications and descriptions of events in time.

We can now refer to the zigzag theory structure. Before attempting to use this structure, a first part of the analysis will use the idea of orders of change, provided by Bateson (1972) and Watzlawick, Weakland & Fisch (1974). The reason for this is that I think it provides an entry point to the more complex idea of form and process on different levels of abstraction. Starting with orders of change is thus done to simplify the analysis. As we shall see, the distinction between orders of change invites us to separate the process of change (process) from what is being changed (form). This way, the analysis gradually evolves to utilize the zigzag theory structure provided by Bateson (1972, 1979).

7.3.1. First and second order changes

In the Alpha case, operative work referred to the product development projects where the project teams worked with customer requirements, designing components, testing prototypes, fixing production tools, etc. The work in the TTM project was aimed at improving the product development work. As we have seen it, the TTM project seemed to be a project of a higher order. Watzlawick, Weakland & Fisch (1974) distinguish between first and second order changes. To repeat, a first order

change is a change within a system. A second order change is a change *of* the system.

If we view the people working in product development at Alpha as a delimited system within the total Alpha business, a change within the system would have been to start to use the project development handbook they already had. There was documentation presenting milestones for product development projects. The handbook contained different routines intended for use depending on if the product was a new concept, or a new variant. This documented work method was already within the system, and many people knew that it existed. However, they chose not to pay much attention to it. This is suggested by the joke that no project had ever passed product review 3, which meant that the product was ready for serial production.

Instead of starting to use the existing work methods, it was decided by the management team that a new process should be developed. This new process was to some extent *something else* than the already existing work method. It can thus be described as a change of the system in which the product development projects were conducted, or a second order change. One of the stated arguments for the change in the product development method was that the existing method existed in two different versions (concepts and variants). Several people felt that this was confusing, since it seldom was clear whether the specific product was a concept or a variant. They stated that this confusion led to a situation where none of the product development methods were used.

This is of course a claim that can be challenged, and brings out the question of balancing between first and second order changes. To what extent could the goals of the TTM project have been achieved by starting to use the existing product development method? For example, product review before ramp-up was an important part also in the new process. Furthermore, the new process also seemed to involve two versions, one in which a feasibility study was not conducted, and one in which special considerations were taken into account in the feasibility study. Even though it was graphically "one" process description, it clearly had two distinct types of execution.

7.3.2. Third order changes

The TTM project was a noteworthy undertaking within Alpha at the time. Traditionally, change was constant and somewhat unstructured in the organization. Every employee had a "screwdriver" in his or her pocket. When something broke down, it was fixed. If quality was bad, people inspected all components manually in order to be able to deliver. It was an entrepreneurial, just-do-it culture. It was a company in a somewhat chaotic state, but predominantly in a good and positive way.

When the company grew, this culture led to a situation that also can be described as chaotic, but people started to see the consequences of poor coordination. Similar improvement projects started in different parts of the organization without coordination. For example, there were four different projects going on related to document management at the time when the TTM project was started. None of these were coordinated or linked to the TTM project. Project managers had to cope with the expansion, and invent procedures for the work at the same time. Due to the high turnover in personnel, new project managers came in but got very little support. They had to invent their own ways of working, sometimes by trial-and-error. On the positive side, the employees continued to be committed since the customer teams were tight, with their own resources and customers or markets. They had much authority and high degrees of freedom. On the negative side, it was difficult to implement the company product strategy, and difficult to get the customer teams to release resources for long-term platform development. It was also difficult to share resources between teams. This was negative from a standpoint of functional learning.

For several reasons, John Svensson and the management team decided that they needed to address the problems. The approach they took was different from the approach they had taken before. It was the largest organizational improvement project in the company history. It was a cross-functional effort, involving more people than usual and facilitated by external consultants. This was a change in the way in which improvements were carried out. They left the "screwdriver-in-the-pocket" approach, and decided to carry out a planned process improvement project. If improving the work methods of the operative product development projects is a second order change, *a change in the way in which these improvements are carried out* can be described as a *third order change*.

It was a change of how improvement methods were selected. A third order change is thus a *change in improvement methods.*

7.3.3. A basic model for orders of change

In order to condense and structure the discussion of first, second and third order changes, a basic model is suggested. This basic model will be further differentiated later on.

The term *first order change* refers to changes in the way the operative processes are carried out within the existing system. The operative work processes were conducted in the project form. Within Alpha, the processes in the product development projects were improved in a learning curve, as the people became more experienced. I use the phrase *change in project processes* to refer to first order change.

In *second order change,* the system is changed. In the Alpha case, this was related to creating the new TTM-process, implementing new information systems etc. I use the phrase *change of operative preconditions* to refer to second order changes. The operative preconditions are thus described separately from the project processes that are carried out. One important conceptual distinction between operative preconditions and project processes is that descriptions of project processes explicitly involve dynamic time, whereas descriptions of operative preconditions are related to a specific point in time. In Bateson's terms, operative preconditions are examples of form, and descriptions of project processes are examples of process.

The phrase *third order change* refers to changes of the way in which improvement processes are carried out. The term *change of improvement methods* is used to refer to this type of change. Improvement methods are examples of forms with Bateson's terminology.

The three main concepts used at this point are thus project process, operative preconditions and improvement methods (cf. Figure 51). In terms of levels, these can be described as form and process. Project process refers to the operative work processes carried out. Operative preconditions refers to descriptions of static "infrastructure" for the project processes, which can be classified as form. Improvement methods refers to the methods (form) used to carry out improvement processes.

A note should be made here regarding recursions and the summary model presented here. We could continue to discuss changes of how the improvement methods are changed and then changes of the changes of how improvement processes are changed. Engquist (1996, p. 54) has argued that it is difficult in most situations to talk about more than four or five orders of change. The discussion becomes abstract and difficult to understand.

For normal uses, I simplify the presentations to three orders of change: project processes, operative preconditions and improvement methods (cf. Figure 51).

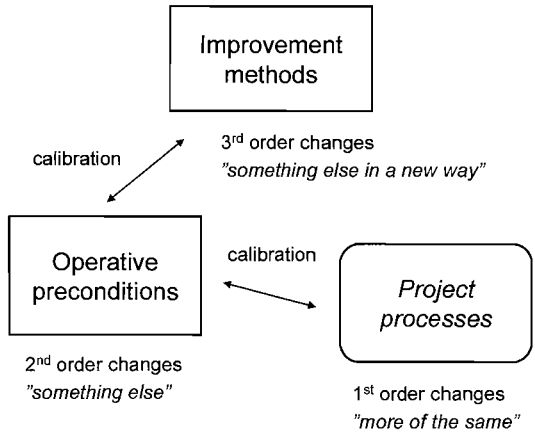

Figure 51. A basic model for orders of change.

When changes are carried out within a specific project process and this does not directly influence the operative preconditions, it is described as an example of a first order change. The change is "more of the same" within the operative preconditions. When changes of the operative preconditions are carried out, it is described as second order change. The change provides a discontinuity, or "something else" than already exists within the operative preconditions. Changing the improvement methods is referred to as third order change. This is a change of the way in which improvements are carried out. "Something else" is established in a new way. Put simply, we can thus change the project processes, the operative preconditions and the improvement methods.

The relationships between project processes and operative preconditions, and between operative preconditions and improvement methods,

are here described as *calibration*. The project processes carried out influence the operative preconditions. For example, lessons learned from one project process become a part of the operative preconditions for future projects. The improvement processes carried out based on improvement methods influence the operative preconditions. For example, information systems that are implemented in improvement processes become a part of the operative preconditions. The information systems that exist within the operative preconditions influence future improvement processes.

In Table 9, definitions and examples are provided in order to describe the three orders of change.

Change	Definition and example
1st order	Changes in project processes *Learning to use an existing project method*
2nd order	Changes of operative preconditions *Introducing a new project method*
3rd order	Changes of the way in which improvement processes are carried out *Introducing a new improvement method*

Table 9. Orders of change.

The relationship between the two levels of operative work and improvement work is now expressed somewhat more specifically than in the introductory analysis. The improvement level consists of improvement methods and links to operative preconditions. The operative level consists of project processes and links to operative preconditions. These relationships are shown as arrows in Figure 51. In the following, I will make use of the zigzag theory structure to provide further details about the relationships.

7.4. Levels of form and process

In the following, forms and processes will be explored. To structure the discussion, I will try to characterize the types of influences that were involved. The guide for this analysis is the link to results. There are therefore many potential influences that will not be covered in the following.

We can start by discussing the central term project and relate it to the zigzag theory structure. When we think of projects, we are working on the description, information, map or name level. The project exists in our minds. The definition proposed by PMI states that "a project is a temporary endeavor undertaken to create a unique product or service" (PMBOK guide, 1996). In this definition, there is no difference between reality and knowledge about reality. The project "is" something. We could thus go out in reality and find examples of "projects" and other things that are "not projects". This can lead to discussions about whether making a cup of tea *is* a project or not.

In my view, the identification of beginnings and ends, and the classification of uniqueness involve interpretation. What "is" and "is not" unique is in the eye of the beholder. Beginnings and ends do not exist in reality itself, but in our minds. The term "project" is a map that we create. Following Bateson, we can say that the names of the activities carried out in the real world are not the activities carried out in the real world. Rather than stating that a project is this or that, we can state that we define a project *as* a temporary endeavor undertaken to create a unique product or service. This difference between *is* and *as* is subtle but important.

We can continue with an example of the relationship between method, process and reality. Here I gather inspiration from the term "method". In one definition of method, the Greek "methodos" is the fundamental origin (Merriam Webster). This is built from the term "meta", which means "about", and "hodos", which means way, road or path. A method is thus *about the way*. The method is abstract in relationship to the actual way. For example, if a method suggests a chain of activities to be carried out, the method is abstract in relationship to the actual activities that are carried out when the method is used. A description of the process in which the activities are carried out, is not the described phenomenon itself. It is only a description (cf. Figure 52). The line of reasoning here is the same as in the distinction between dialog process and dialog type (cf. Figure 38, p. 170).

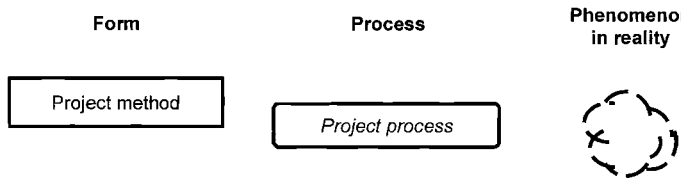

Figure 52. Phenomenon in reality, description of project process, and classification in terms of project method.

The distinction between form and process provides a possibility to increase the precision in descriptions. The term *project* for example, can be used to refer both to something as a project, and to the particular project process. Whenever we find situations in which there is not a clear distinction between form and process, there is an opportunity for increased precision.

In the treatment of improvement so far, the people responsible for the improvement have been referred to several times, but mostly in an indirect way. However, the persons had a strong influence on improvements. This discussion will therefore start from people, and their influence on the improvements through their actions. With the OIP model and WSF framework as important parts of the perspective behind the thesis, this interest for people is natural (cf. Lundeberg, 1993, Alter, 2002).

I have chosen to use the term *persons* in the framework rather than the more common term *people*. In english literature the term people seem to be more widely used. In my view the term persons emphasizes that what is referred to is a collection of *individual* persons rather than a more anonymous group. This becomes more clear in the Swedish translations of the words. I would use the term people as the equivalent of "människor" in Swedish, and the term persons as the equivalent to the Swedish term "personer". In the following text, I will use the term people to some extent, but when including the term in the framework I will use the term persons.

7.4.1. Personal work methods and personal work processes

In the Alpha case, many people were involved in different ways. John Svensson had a strong influence on the TTM project both through his work of initiating the project, as project manager for the improvement

and as temporary process owner. The CEO stated that when John started to propose a process improvement project, he was proactive, but when they finally got going, it was rather a reactive project.

The management team influenced and selected the focus of the improvements, or what was to be improved. They decided to focus on the Time-To-Market process. The reason for this was that they argued that it was strategically important for Alpha. The consultants provided the method in the improvement project. If we compare this influence to the influence of the management team and John Svensson, there was a difference in level. The management team influenced *what* was to be improved, but the consultants influenced *how* the improvement work was conducted. The consultants did their work within the limits set up by the management team. Thus the management team made decisions *about* the work of the consultants and the TTM-design team. The work of the management team can be described on a higher level in relation to the work done by the consultants and the design team.

The same relationship seems to hold for the relationship between the work of the consultants and the work of the design team. The method and support provided by the consultants established a frame for the design teams' work. The work carried out by the consultants can thus be said to be *about* the work of the design team, or on a higher level.

The design team influenced the process design. The RBG-method provided the general tools for describing the process, but the content of the process was selected based on the knowledge held by the design team. The implementation teams influenced the way in which the process was implemented in templates, role descriptions and information systems.

A first level of form and process can be related to the perspectives of persons (form) and the work they do (process). Since a person can view a problem from different perspectives, the form, or pattern, in the perspectives used in action is on a higher level (cf. Figure 49). I use the term *personal work methods* to refer to this classification.

What we have discussed here is that the actions can be described on several levels of forms and processes, where the higher levels set limitations for, or control, lower levels. That is, freedom of action by the design and implementation teams was reduced by the RGB-method. The degrees of freedom for the actions of the consultants were limited by the selection of strategic focus on the TTM-process, which was a decision

made by the management team. They in turn were influenced by John Svensson's actions in proposing a perspective emphasizing process improvement. In the next section, these levels will be further explored.

7.4.2. Strategy methods and strategy development processes

John Svensson wanted to get the management team to initiate improvement efforts regarding the business processes in the company. One way he did this was by inviting speakers to the management team meetings. The process John Svensson initiated dealt with the forms of improvement, and to some extent the direction of improvements. In his view, Alpha should be process oriented rather than a functional organization. John Svensson selected the process perspective as the form of improvement, and the TTM-process was focused for improvements since it was perceived as "core business", and strategically important.

The processes in which a direction towards a goal is decided in a company could be described as direction-setting processes (cf. Mintzberg, 1978). The setting of direction (towards a goal) in an organization can be described as strategy development. In the strategy development process, goals are defined and the means to take to achieve the goals are decided.

In this case, the strategy development process was initiated by John Svensson, and then formalized in the method provided by the consulting organization. In the RBG-method, a starting point was to identify critical business issues, which was done in August 1998. Three critical business issues were found. The first was to create and implement visions, strategies and common goals in the organization. The second was to achieve more proactive (business driven) product development upwards in the value chain. The third issue was to improve the product development process (TTM). The next step was to create a project definition worksheet for the improvement project. This involved delimiting the process, setting project goals, identifying stakeholders, appointing the process improvement team, creating the main project plan and identifying risks and constraints.

I use the term *strategy development methods* to classify strategy development processes of different types. The strategy method is about the way in which the strategy process is conducted. For example, John and the management team could have selected a method for implementing a

balanced scorecard (Kaplan & Norton 1992, 1996), which could have influenced the strategy development process, and thereby improvements, in another direction.

A strategy development process may over time come to influence how people act. It should be noted however, that the people's perspectives are used to interpret the documented or communicated strategy and thereby influence their actions. In other words, it is a person's interpretation of the strategy that counts, not the documented or communicated strategy itself. For this reason, the personalities of persons, and their personal work processes, are on a higher level of abstraction than the strategy development method and the strategy development process. The strategy development process resulted in a partially shared view of the direction to take, and the artifact result was a documentation of the intended strategy.

In the previous discussion, the links between strategy development processes and improvement processes have been described as if the strategy development process leads to, or at least can lead to, initiation of improvement processes. Can we then describe improvement processes as strategy implementation processes? A first comment on this issue is that we can identify at least two types of improvement processes. The first refers to improvements within the existing strategy, and the second refers to improvements to fulfill a partially new strategy.

The problem then becomes to distinguish between "different" strategies. How do you tell whether a strategy is new or not? In the Alpha case, John Svensson and the management team concluded that the means they had used to fulfill customer needs were no longer sufficient. They wanted to increase the structure in the work processes. How does this relate to the term *strategy*? In the case, the means were changed, but fulfilling customer needs had been important also before. In this respect it was an improvement project within the strategic goals, but the improvement was realized by partially new means.

There were also examples of goals that can be described as new compared to the earlier realized strategy. Alpha had a strong tradition of flexible manufacturing. The product development work was, to a great extent, driven by customer requirements and most products were variants on already existing concepts. During the strategy development process, the emphasis was on Alpha as a product development organi-

zation. TTM was believed to be the most critical issue from a strategic perspective. Specifically, a more proactive approach to product development was sought. This is relatively more related to the goals of the company than to how existing goals were to be realized.

Thus, the TTM project can partially be described as an improvement project and partially a strategy implementation project, or tactical project. With this view, improvement processes related to implementing partially new strategies can be described as strategy implementation processes, whereas improvement within the existing strategy is framed as improvement of the operative business.

This is a matter of framing. Since the level called *goals* in a means/ends hierarchy is relative, what we call *strategy implementation processes* and *improvement processes* is also relative. If the goals of the organization are described on a high level, such as "make profit", most changes can be described as improvements related to achieving this goal. The TTM project was just another case of improvements ultimately targeting profit. On the other hand, if the goal had been defined more narrowly, such as to sell and manufacture a specific type of components on the Asian and European markets, a change even in the product offer could have been described as a new strategy.

A note should be made regarding the identity of the company. During the time the TTM project was carried out, another project was carried out with the purpose to improve the graphical profile of the company. The project manager of this initiative highlighted this as a successful project at a meeting. John Svensson commented that it was only a matter of graphics, and that it had no influence on the business activities. This type of activity can be described as corporate communication, and is often described as enforcing the corporate identity. It is often argued that the corporate image is a valuable asset. This is a rather basic example of activities carried out to develop the identity of the organization. It can influence both external stakeholders and the employees in the organization.

Identity development methods, and identity development processes, could be described as at a level above the strategy development level. What is the unquestionable starting point for the strategy development work? What is the essence of the organization? This can also be discussed in relation to the merger with a competitor after the TTM project.

Can this be meaningfully described in terms of strategy development, or was it a process related to the core of the organization, its identity?

Within this thesis, I have chosen not to go further in this discussion. The main reason for this is that the complexity of what is covered would increase. This would include ideas related, for example, to mergers and acquisitions, branding, corporate responsibility, corporate ethics, and corporate communications.

7.4.3. Improvement methods and improvement processes

The strategy development process conducted by the management team and partly aided by the consulting organization led to the initiation of the TTM project, which in turn led to the TTM-process for product development projects. The TTM project was a step out of the project methods used, and dealt with changes in project methods. This indicates the links to the operative preconditions. Within Bateson's view of form and process, execution is an example of process. The improvement project is therefore here described in terms of an improvement process, and the form is referred to as improvement method. In this case, the RBG-improvement method can be described as providing a perspective on improvement processes that emphasized planned and radical process changes. This is only one type of method. Goldkuhl (2003) differentiates between project based change, as in the TTM case, and change without a separate change organization. Other examples of improvement processes are running adaptation and recurrent refinement.

Different people in Alpha had different views on the design of the TTM-process. During the design of the TTM-process, the task knowledge held by the persons seemed to influence their input in the design. In the BOE-phase, the global account manager and project manager had significant input, but the production engineers were less active. On the other hand, when the SPPV-phase was discussed, the production engineers were most active. The task knowledge within the area seemed to influence the importance or focus put on the area. In the design team, the understanding for the different parts of the process was built up during the design, which seemed to make it easier for people to appreciate different perspectives rather than taking their own perspective for granted. For example, the global account managers were not interested in sales estimates after the product development project was finished. During the design phase, the global account managers learned about the conse-

quences of lacking sales estimates for production. This seemed to influence the importance they attributed to providing sales estimates.

7.4.4. Project methods and project processes

The TTM-improvement process established the preconditions for the project processes. The main initial delivery was the TTM-process description, which provided a method for the project work. This project method influenced the project processes.

In line with what has been said about the relationship between the strategy development and improvement levels, the method for the work is here seen as an abstraction of the project process.

I have chosen to use the name *project method* to refer to the abstraction of the project processes. In Alpha, the name used was the TTM-process. However, this name was used both for the TTM-process description and the work "in" the TTM-process. I have chosen to use two different terms for increased clarity.

7.4.5. Summary of levels

To recapitulate, John Svensson was focused on business development (personal work methods). In his view, the results from the operative product development projects needed to be improved. He acted by inviting consultants to the management team meetings. Their actions can initially be described as a strategy development process, since it dealt with the direction of the business. TTM was selected by the management team as the process in which improvements had the highest strategic priority. In the first part of the strategy development process, the strategy method can be described as "lobbying". In the latter part of the strategy development process, the initial part of the RBG-method was used in order to identify critical business issues. At the end of the strategy development process, the management team created a specification for an improvement process (TTM project), which was based on the RBG improvement method. This improvement process established partially new preconditions, for example a project method, for the operative product development processes, which influenced the results of the operative project processes.

In Figure 53 below, the levels of form and process are shown. The organizational work processes are shown extended with gray shadowing.

The intention with this is to indicate that several persons were involved in the processes.

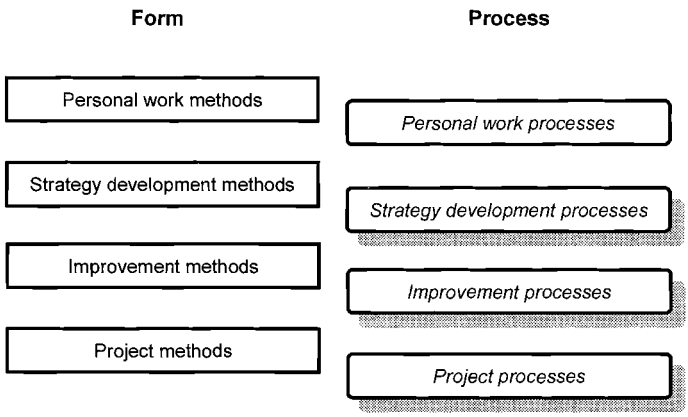

Figure 53. Levels of forms and processes related to project result improvement.

The summary of levels in Figure 53 provides a frame for describing project result improvement in organizations. This is an extension of the basic model in Figure 51. The improvement process level has been added, and further levels above have been provided. Operations preconditions are here only exemplified by project methods.

We can observe personal work processes and describe personal work methods of the person based on patterns in the work. The person can choose in what way he or she wants to participate in organizational work processes. The personal level is therefore on a higher level than the organizational level of strategy development processes, improvement processes and project processes.

7.5. Generalized zigzag model

The focus on methods, used as an introduction to classify the levels identified, can be extended to preconditions in a more general sense. For this, the adapted X-model for personal work processes will be used. This is, in turn, based on the selected material ontology. By using the material ontology, the generalized zigzag model builds on the assumptions about reality provided earlier.

7.5.1. Personal work processes

We have seen that the processes on higher levels influenced the preconditions for processes on lower levels. The focus on methods we have had during the analysis can be left for a more general description. The strategy development methods, improvement methods and operative project methods were only parts of the preconditions that influenced the strategy development and improvement processes. We can at this point describe the strategy preconditions, the improvement preconditions and the operative preconditions.

The personal work process model can be described in a summary fashion where the preconditions, the work process and the results are shown in the form of a "tuning fork". The intention with the tuning fork is to provide a tool for a summary analysis. The tuning fork tool can be differentiated if necessary in terms of levels of learning and acting and levels of preconditions (mind, body, and artifact). The metaphor of a tuning fork can also be used to relate to the performance of the process. What is the tone resulting from the process?

In Figure 54, the personal work process model (cf. Figure 49, p. 195) is complemented with the detail model of learning and acting (cf. Figure 48, p. 192), and graphically simplified to a "tuning fork" design.

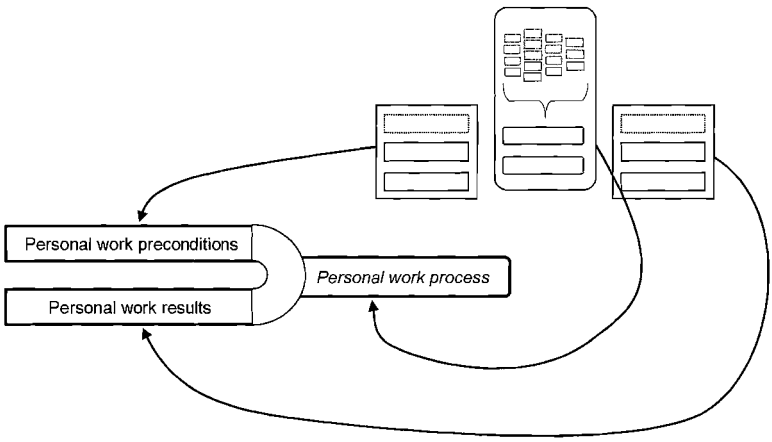

Figure 54. Condensing the personal work process model to a "tuning fork".

Based on this condensed model, we can more easily describe the relationships between the levels. Strategy development processes, im-

provement processes and operative project processes can be described in a similar way, but with the added complexity that the processes involve several persons.

7.5.2. Principle for linking the levels

In the generalized zigzag model, the preconditions on one level influence the process on the same level. The process leads to results. The results on the higher level can be used as preconditions for the next lower level.

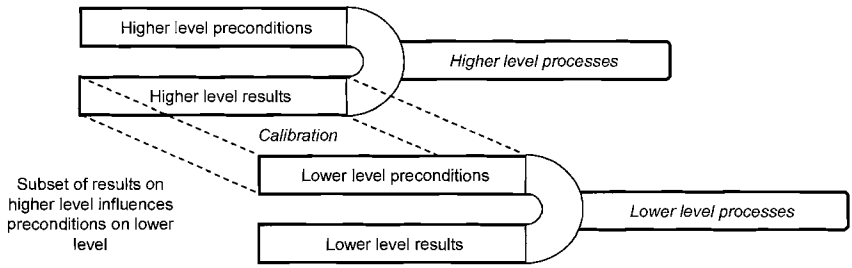

Figure 55. Principle for linking the levels.

A subset of the results of one process on a higher level provides part of the preconditions for the next level of processes. That is, a process on a higher level may provide some results that are relevant as preconditions for processes on a lower level, and some results that are not relevant. The relevant preconditions can then influence several processes on the lower level. For example, not all detailed material resulting from the TTM project was used in training. Only parts of what was presented was remembered by the participants.

7.5.3. Organizational work processes

Personal work processes have been described as if the work was carried out in relative isolation, but the levels of strategy development, improvements and operations were described as organizational processes where coordinated efforts of several persons were involved.

The personal work processes are related to the organizational work processes that are carried out by several people. However, the personal work processes are critical in that each person has a mind and the potential to decide and influence organizational processes.

From the model of learning and acting I described the relationship between phenomena in reality and knowledge about these phenomena as indirect. A person perceives phenomenon in reality and interprets the phenomenon using knowledge from different perspectives. In principle, other people are phenomena, just like any other part of reality which needs to be interpreted. Customers, products and team members are understood based on processes of interpreting, explaining and framing. When a person acts, the performed acts become a part of reality, and this reality is available for perception to other people.

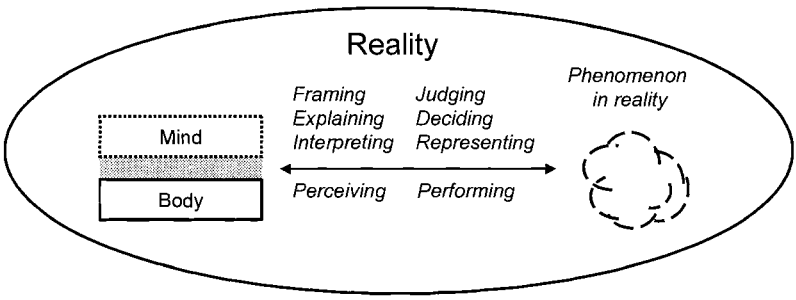

Figure 56. Indirect relationship between personal and organizational work processes.

Organizational work processes are carried out under the fundamental limitation that no communication of information between persons is direct. With similar frames of references, the processes of interpreting, explaining and framing can lead to sufficiently intersubjective ideas to support processes of judging and deciding on shared projections and representing them for performing. Establishing such intersubjective views was one of the main ideas behind the TTM project. By sharing a method, the structure in the work could be increased.

The organizational work results can also be described as linked to the customer. The organizational work processes are delivered and transferred to the customer. Parts of the results become preconditions for the customer. The customer preconditions influence the customer processes, leading to customer results. The customer organization can be described in a separate model, as suggested by Lundeberg (1993).

7.5.4. Relating back to orders of change

We have earlier discussed orders of change, and can now relate to this with a more detailed view.

First, second and third order changes

The idea of first, second and third order changes (C1, C2 and C3) can now again be approached from a somewhat more detailed point of view (cf. Figure 57 below).

First order changes are changes in the operative project processes. This involves the preconditions and how these preconditions are related to the operative project processes. An example of this is the process of learning to use an existing project method. The knowledge gained during a project becomes a part of the preconditions, influencing the next process. First order changes are thus not isolated to the operative project process, but deal with the relationship between the operative preconditions, the operative project processes and the operative project results.

Second order changes were changes of operative preconditions. In such a change, improvement preconditions influence the improvement process in which operative preconditions are established. An example of this is when the "screwdriver-in-the-pocket" method was used to establish four different systems for managing documents. These systems for handling documents became parts of the operative preconditions for the product development projects. That which has been called second order changes thus describes the relationship between improvement preconditions, improvement processes and operative preconditions.

Third order changes were changes of improvement methods. An example has been given in the change of approach from the "screwdriver-in-the-pocket" approach to the RBG-method. This was a change of improvement preconditions in that a new improvement method was used. This change was related to a strategy development process, which was influenced by the strategy preconditions. A third order change is thus related to the relationship between strategy preconditions, strategy development processes and improvement preconditions.

First, second and third order improvement

Were the changes also examples of improvement? This requires us to relate to the criterion used to evaluate the improvement of the change, in

relationship to the "actual" effects of the change. From what perspective was the change an improvement?

First order changes were, for example, using an existing method for product development, or learning from earlier projects. During 1998, it was noted that project leaders learned from their own experiences, but that it took a long time to become productive. This led to both long lead times and poor quality. The trial-and-error approach used was problematic in this sense. A possibility that was not taken advantage of was use of the existing project method. The existing method had benefits in that it emphasized quality control. The project method did not inspire the projects. By starting to use the existing project method as a frame for inspiration, the focus on quality could have been improved. John Svensson's intentions to initiate the process improvement project can be interpreted as discontent with the results of first order changes.

The TTM project was a second order change in that it established new preconditions for the product development processes. There were documented goals, or criteria, specified in advance, which give us a starting point for evaluation. The goals were to decrease lead time, increase net present value of product development investments, and to increase customer and employee satisfaction. We have information from the interviews after the project that we can compare to those criteria. In the interviews, we found that the lead times in some cases increased. For the projects in Asia, the new process involved too many steps that were not judged as necessary by the project managers since the development often involved minor adjustments of existing concepts.

However, it is difficult to know what the general effect was since the measurement system was not used. Did the net present value of the investments increase? It was difficult to find any direct links to profit. There were activities, for example, related to profit calculation and standard costs in the process description. In terms of employee satisfaction, the result was mixed. The global account managers were not happy about their decrease in autonomy. On the other hand, new engineers and production engineers were very positive about the process. Customer satisfaction was also difficult to evaluate. Even though the evaluation, to some extent, is inconclusive, the criteria are possible to interpret. The goals provided help in judging whether the change was an improvement or not. However, the criteria changed during the project. The importance of lead time was not seen as critical when they had some

time to reflect. Instead they emphasized what was delivered to the customer. The time lag between the TTM project and when the effects of the change could be seen is, of course, a factor which influences the evaluation. From the follow-up interviews, it was clear that many persons at Alpha were surprised that the time lag was so long. They had expected to see results earlier.

The third order change is more difficult to evaluate. This might be because it was a less structured change. The change process involved lobbying and then the selection of the RBG-method. Why was this change of improvements required? What were the criteria used to motivate the change from the screwdriver-in-the-pocket approach to a structured improvement process facilitated by consultants?

One clue can perhaps be found in one of the critical business issues documented in the first phase of the TTM project. A critical business issue was to create and implement visions, strategies and common goals in the company. There are several strategy methods available for this type of work.

Another possible explanation is that Alpha may have hit a crisis of leadership, in Greiner's terms (Greiner, 1972, p. 41). The third order change could then be described as an improvement of direction. The growth could not be managed without direction. Since the organization was still young, there were few methods available for managing improvements, and a third order change was required.

Another interpretation is that the process orientation was a way of showing that the company was "modern" (Abrahamson, 1996). New management trends may lead to third order changes motivated by such interests, rather than by a need to carry out changes in new ways. It should be emphasized that third order change is related to a change in the *pattern* in improvements rather than the name used to refer to the improvements.

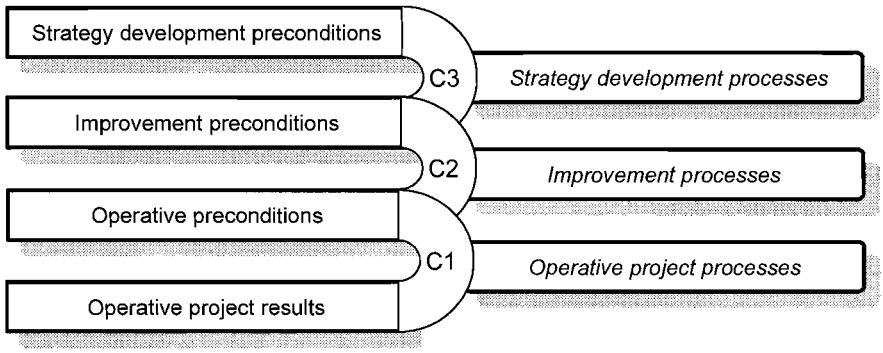

Figure 57. First, second and third order changes.

It should be noted that the relationships between the levels in Figure 57 are assumed to be cybernetic calibration. Higher levels influence lower levels, but the lower levels also influence the higher levels. For example, it is not certain that the management team would have agreed to start the TTM project if they did not perceive any problems in the operative product development processes.

7.5.5. Linking the levels

One of the observations that I made in the case was that many people in the organization were under stress. The screwdriver-in-the-pocket approach to improvements was one indication of this. People did not think that they had time to work with improvements. The result was a reactive approach. It is interesting to link to the growth phase that Alpha was in during the period. Penrose (1959) has proposed that growth can be limited by the management resources that are available for the expansion (Penrose, 1959, p. 200). This could be particularly relevant in Alpha since the organization was perhaps approaching a crisis of leadership as described by Greiner (1972).

A question is then if the limited management resources directed to support improvements at Alpha hindered its growth. It does not seem to be that way if we judge by the increase in sales, and the increase in employees. The company was considered a high-growth company in the press. It is of course difficult to know what would have happened if additional management resources were directed to the improvements. Perhaps even stronger growth could have been achievable. The manager of Alpha commented that the TTM project was reactive when it was ac-

tually initiated. With more resources earlier, the timing of the project could have been better and a less drastic approach could perhaps have been used.

A rather comprehensive project was initiated, contrary to the principles at Alpha in the past. Was this a necessary over-correction due to negligence in the past? To some extent, it could be described in those terms. In the interviews before the TTM project, there were many comments in regard to the structure of the work processes. It was clear in their view that something had to be done. In one interview, a global account manager stressed that only a few people controlled the organization. The availability of those people was a limiting factor in improvement work. This was one of the reasons for waiting with the TTC-project. The key people needed to be active in both projects, and they were under pressure. The management resources were not sufficient to run two major improvement projects at the same time.

A key improvement precondition is then the availability of personnel who can work with improvements. In this case, John Svensson provided an important link between the strategy development process and the improvement process. He was the initiator of the strategy development process and also became the project manager in the improvement process. During the TTM project, there were many discussions regarding what person should be appointed to process owner. In the end, John Svensson was appointed as temporary process owner. He did not fulfill the role at the end, since he became ill from the stress in his job. This can be used as an argument that there were insufficient management resources available. The workload of central people was too high. The design team, and later the implementation teams, provided a link to the operative project process. John Svensson carried with him the background from the strategy development process into the improvement process. The design team and implementation teams carried the background from the improvement process to the operative project processes.

There were several examples of when allocating resources between the processes was problematic. The TTM and TTC projects could not be run at the same time since the key people did not have time. When the measurement system was to be developed, the problem was that other projects dealing with the year 2000 had higher priority. The personnel at the IT department were busy with other projects. Further, the relation-

ship between improvement processes and operative project processes can be exemplified with that several persons left the measurement team since they were needed in the operative processes. People have to choose what processes to engage in.

7.6. Levels of preconditions

In the following, I will analyze the preconditions level further in order to provide a model for levels of preconditions with more detail than mind, body and artifacts, which has been used in the previous analysis. In this analysis, the focus will mainly be on operative preconditions, since these are central for improvements.

The discussion about preconditions will first be linked to the personal work process model. In the following, preconditions will thus be described on the levels mind, body, and artifact. I start with the artifact levels since this is the most concrete.

During the TTM project there were several artifacts that were created. We now face the problem of developing categories for artifacts. What types of artifacts should be suggested in the framework? As in the prior analysis, the guide is to select the artifacts that contributed to project results.

7.6.1. Physical infrastructure

On the most basic level, I use physical infrastructure as an important type of artifact. This was highlighted by John Svensson in the project with the office expansion. In his view, it would have been best to run the TTM project first, and then design the office layout. The reason for this was that the physical infrastructure influenced what operations were possible when it was finished. He tried to design the building so that there were at least no physical limitations that would prevent the process orientation. Flexibility was therefore an important part of the building project, for example when designing the workplaces.

The physical infrastructure in the Alpha case could also include the conference rooms, for example the "war room" that was used during the TTM project, and the data and phone networks that were used.

Alter's framework also includes infrastructure (Alter, 2003). He highlights infrastructure as one of the supports for a work system. Ekstedt,

Lundin, Söderholm & Wirdenius (1999, p. 182) use physical structure as one of the areas of focus in "renewal" action.

7.6.2. Physical artifacts

A distinction can be made between the infrastructure and artifacts which are specific to certain activities. For example, the computer network supported many parts of the organization, but the "measurement room" in Alpha was designed specifically for measuring the performance of the products with specific measurement appliances.

It should be noted that it is not given what artifacts are part of the infrastructure and what artifacts are seen as physical artifacts beyond the infrastructure. Mårtensson (2003) describes several views on IT-infrastructure. One interesting aspect is that a certain type of information system can be seen as a strategic information system for some organizations and as infrastructure for other organizations, depending on how it is used. In analogy, it is therefore difficult to generally describe what artifacts are parts of the infrastructure. It depends on the perspective taken.

Within the information management field, a line is often drawn between hardware and software. A question then is if this distinction is important in the framework, or if it can be omitted. In the frameworks of Alter (2003) and Lundeberg (2003) this distinction is not made on the basic level. What hardware to use was not problematic in Alpha. I have therefore selected to view hardware as a part of the physical infrastructure.

7.6.3. Information systems

In the Alpha case there were several operative and directive information systems that were relevant for the project processes (cf. Sundgren, 1996).

The process graph was developed with a graphical tool and then saved as a web page. Using the web page, it was possible to access the templates that had been developed.

We can distinguish between information templates and the information resulting from using the templates. For example, the quality documentation system supplied templates to the document management system, where they were used to create documents. In addition to the operative information systems (for example the document management system)

and the directive information system (for example the measurement system) there was a category which can be described as *guidance information systems*. This is most closely related to office automation systems in the system types presented by Alter (2002). However, one difference is that the system consisted of templates and instructions that were represented in the system. Developing the templates was a major task. The primary use was not to support decision-making in the traditional sense of decision support systems, or of executive information systems, but to provide guidance for the operative work. This type of system can be said to provide guidance for semi-structured work.

7.6.4. Represented information

In line with the infological equation (Langefors, 1966), information has been seen as the result of a process of interpretation. The resulting information exists only in people's minds. In the Alpha case, what we in everyday language call *information,* such as documents, had a central function. For example, both prototypes and CAD-models were created during the product development projects.

In terms of levels of reality, both prototypes and CAD-models are examples of inorganic nature, or artifacts. Let us for simplicity use an example with a drawing on paper. There is a problem here. In terms of reality itself, there is no difference between the reality of a prototype and the reality of a drawing. The main difference arises when we perceive them. The drawing is different from the prototype in our minds, but is their real existence different in terms of levels? Is the paper with the drawing different from the prototype the drawing represents in a fundamental way? Are they artifacts on different levels?

One alternative would be to include time in the description and argue that the prototype is developed based on the drawing. The prototype thus depends on the drawing. In reality there would be no difference, they would both be inorganic nature, but in our description we could choose to see the drawing as the base on which the prototype is built. However, do we really mean the drawing itself? Do we not mean the idea of the prototype, or the "drawing" that exists in mind? The idea in mind would then be on a higher level than the prototype in the partial dependence. That is, the idea of the prototype generally guides the body that is crafting the prototype. But then we are left at zero on the data level. The drawing is not important, or different from other forms of re-

ality, until it becomes information in mind. What arguments do we then have to distinguish between different data, and in extension between different artifacts? If we follow idealist thinking, there would be no artifacts in reality – only in our minds.

In the differentiation of the material ontology to include body and artifact rather than the general forms of organic and inorganic nature, the argument was used that the artifact is created in a process. The difference between a stone and a statue is that the statue is crafted. The same type of distinction can be used to discuss represented information. Examples of data can be anything that we can perceive. Artifacts are created. Represented information is then a special type of artifact. The TTM-method was an example of represented information. It was represented information in the sense that it was thought of by the design team, and then documented. It can even be described as represented knowledge, since it dealt with the general case rather than information about a specific instance of a project process. Forms of artifacts thus include represented information, represented knowledge and represented perspective. However, it would be data for a person who did not realize that it was created by people.

What I am doing here is using the material ontology, and an analogy between evolution and action. Similar to the way evolution builds up order, so our actions build up artifacts. Data here is described as anything that can be perceived. Represented information is the result of processes of representation and the implementation of those representations. We can distinguish between data, which refers to everything around us that can be perceived, and represented information, which refers to data that consciously has been created by people through their actions. Represented information thus refers to a subset of the data that is available for perception to mind.

A person who represents information, for example when writing a letter, can be convinced that the result of the action leads to represented information, since he or she is aware of the process of coding the message. However, to other people the represented information is understood based on data, and the question is then whether the person sees it as a message. I agree with Bateson that "The messages cease to be messages when nobody can read them" (Bateson 1979, p. 48).

The difference between artifacts and represented information is based on the fact that there is a conscious process of representing information, such as in writing a document. Footprints in the sand can be perceived and interpreted as messages, but in the terminology suggested here, it would be classified as represented information only if the person making the interpretation believed that the person consciously tried to represent a message. The footprints are thus definitely data, and can be described as artifacts, but to classify it as represented information requires that we have some idea of the process in which it was created.

With this view on represented information as a type of artifact, we can continue with describing the documented work methods for the new TTM-process. What information was represented during the improvement process?

On a high level, the goals aimed for were described in the TTM project goals (cut lead-times, maximize net present value of R&D investments, and increase customer and employee satisfaction). However, the links to these goals were implicit in the method content and sequence. During the TTM project, much emphasis was put on the activities and roles in the process.

During the course of the design team meetings, I started to identify patterns in that which persons in the design team focused on. For example, one type of concern that seemed to recur in discussions was that it was important to gather as much information as possible from the customer early on in the project. Having access to information early was positive since it could cut lead times and improve quality. For example, by knowing the logistics requirements, the packaging of the products could be considered early, rather than being fixed at the last minute and risking delay of the project. By identifying requirements for tools, the tool suppliers could be involved in the design of the product, and thereby contribute with their skills regarding materials. This could cut lead-time since tool development often required several calendar weeks. It could also improve quality and reduce costs through improved production capabilities. By specifying quality requirements at the start, the risk of having to redesign the product was reduced. Several activities related to collecting information in order to be able to act proactively, were described in the process. However, it was not formally spelled out that this was the purpose behind these activities.

We can make a distinction between the concrete description of the process in terms of content and sequence, and the abstracted ends that the activities in the process meant to contribute to. I use the word *methends* to refer to the ends the use of the method is designed to contribute to. To some extent the division into macroblocks can be seen as methends. The end with the activities collected under the macroblock heading "Business Opportunity Evaluation" aimed to ensure that the business case was profitable. The Feasibility aimed to ensure that the product was possible to develop and produce within the specifications, etc.

The TTM-method can be described as a hierarchy of means and ends, or a hierarchy of goals. The activities carried out were means to ends, which in turn could be means to higher-level ends. Examples of such levels are activity ends, activity group ends, macroblock ends and TTM-process ends.

During the implementation, the macroblock teams worked with representing roles and responsibilities, and with developing more detailed routines for different activities. This was managed in templates and documents.

Measures were developed to evaluate the performance of the TTM-process. The manual process measurement system was later replaced by measures related to the time spent on the projects and evaluations of customer satisfaction.

Another type of information that was relevant to the projects was the feedback provided, by the people in the product development projects to the process improvement team. This information was used to support further improvements, for example, when the pre-sales phase was added and the visual guidance of the process was improved.

Represented information	Description
Goals	General documented goals for the TTM-process.
Methods / methends	Patterns of activities and the ends strived for in the design of the patterns.
Organization charts	Descriptions of reporting responsibilities.
Roles and responsibilities	Descriptions of types of actors and descriptions of the responsibility of each role.
Routines	Detailed descriptions of activities.
Operative project information	Product models, project plans, quotations, calculations, presentations, etc.
Measures	Measures of costs, customer satisfaction, etc.
Feedback	Feedback from using the preconditions in the TTM-process.

Table 10. Examples of represented information in Alpha.

During the workshops arranged by the information management team, it became obvious that the people in the macroblock teams did not have a clear view of what represented information that was needed and handled in each macroblock. The TTM-process owner recognized that the process was really implemented when all the document templates were created.

7.6.5. Body

In Alpha, there was clearly a high level of stress for the personnel in the projects. The tempo in the organization was considered high. This was partly because the market was dynamic, and there was pressure to deliver with short lead times. However, ambitious employees can also have contributed to the fast work pace. John Svensson was involved in many projects connected with business development, and was generally very busy. At the end of the TTM project, he could not continue to work at all due to the stress he felt. He was sick for the remainder of the project, and later started to work for Beta, the second division in ComCorp. The human body provides an important resource for work processes. Everything we do involve our bodies in some way or another.

It is important to again emphasize that the distinction between mind and body is analytical. I will not go deeper into the body level here. The body level is included since it is necessary, and provides a link between critical mental processes and how these are externalized. Processes can

have consequences for body and vice versa. The problem is difficult, and what matters is the mind and body as a whole. In less dramatic senses, lack of exercise, frequent travel and habits related to food can have health effects related to body. In Alpha, the hectic work tempo often resulted in staying late and eating fast-food. This level is probably more important in the long perspective than in the short.

7.6.6. Reactivity

The preconditions on the *mind level* are here summarized. The reason for this is that it can be an advantage to have a simplified alternative to the somewhat complex model of learning and acting.

Reactivity refers to a person's capability to translate receptivity to action. To what extent does a person perceive and interpret certain data? To what extent does a person act based the information?

Rather than describing specific processes of interpreting and acting, the main use of the term reactivity is to describe patterns. A specific person or a group of persons may be described as having low reactivity, if they do not perceive, interpret and act on certain types of data.

For example, in the Alpha case, the people in production knew that there were problems in the product designs, but they did not act on this information. Rather, they fixed the problems in each case. They had high reactivity related to production problems, but low reactivity related to product development problems.

In the TTM project, it was clear to the design team that the process would require IT support. However, they did not act on this information. Similarly, the production manager felt that they could have acted differently related to IT support for performance measurement. The design team saw the need for including suppliers early in the process, and acted on this information during the TTM design. However, they did not make use of this insight when establishing information systems for the new process.

I do not mean reactivity to mean only passive reaction. I view this term as describing recurring patterns of how persons perceive, interpret, represent and perform acts. What types of data are perceived, interpreted as relevant and acted upon? Reactivity is of course strongly dependent on the knowledge and perspectives held by a person. What knowledge

is selected to decide on a course of action? How is the situation framed and explained?

7.6.7. Task knowledge

Task knowledge refers to a person's ability to use selected knowledge in a particular situation. To what extent does a person make use of relevant knowledge?

In the Alpha case, there were several areas of expertise that were relevant in the projects. The tasks that were carried out were, for example, related to sales, financial evaluation, product development, machine design, production, and logistics. In the cross-functional customer teams, different persons provided different task knowledge.

For example, there are differences between the task knowledge needed in order to be a successful global account manager, and the task knowledge required to run an effective production unit. A person with many customer contacts (such as the global account managers at Alpha) may find it important to be flexible and meet the demands of the customer. Task knowledge, about how customer needs can be found, is then important. For a person in a production unit (such as the industrial engineering coordinators at Alpha), following the customer requirements too closely can be problematic, since it can disturb the production process and lead to increased costs. Knowledge related to optimization of production processes might feel more relevant in this context.

Even if a person has knowledge in an area, it is not certain that he or she will make use of the knowledge in the specific case.

7.6.8. Perspective understanding

At Alpha, it seemed as if the functional perspectives in the different departments had grown stronger over time. For example, the engineers in R&D were described by persons in the marketing and production departments as focusing on the technical features; and persons in production described the persons at the marketing department as having little interest in quality production. One description of the problems at Alpha was that the "sense of the whole" that they had during the entrepreneurial phase was difficult to sustain. People started to guard their territory. The problem did not seem to be that the people in production did not have production skills, that the people in R&D did not have product

ideas or that the people in marketing had problems selling. The problem was rather a lack of understanding of "the whole".

Too much focus on technical features was negative when it led to too little focus on preparing the products for production. Too much focus on establishing new projects was negative when it crowded out learning from previous projects in regards to features and production. Even though they were skilled in marketing, R&D and production, the links between the departments were problematic.

The term *perspective understanding* refers to the ability of a person to frame and judge from different perspectives. This term has also been inspired by Engquist (1996, pp. 50-55). Put differently, perspective understanding is about putting a specific problem into a larger context.

At Alpha, the projects in Asia were problematic since the customers wanted prototypes before the project was approved within Alpha. What was this an example of? We can only speculate about what went on in the minds of the people involved. However, we can describe a scenario. One possibility is that the project leader explicitly or implicitly took a customer perspective, whereas the person at the R&D used a frame of "orderly work". The situation was simply another execution of the general and orderly TTM-process. This structure was important in avoiding the chaotic situation they had before the TTM-process. In a standard case, the prototype should not be created if the project has not been approved and started. They were both aware of the TTM-process as a general structure for the work, but they differed in their framing of the relevance of this general case in the particular situation. The conflict resulting from these different framings of the situation is understandable. We can hypothetically ask what would have happened if the perspectives were acknowledged. Yes, the customer perspective is important as a general principle, and yes, having structure in our work is also important as a general principle. We now have this specific situation with a customer wanting a prototype, but no formal project is started. What decision about the course of action should we make in this specific case?

How can this situation be improved? With the view presented here, at least a part of the solution lies in increasing the possibility of framing. The intended course of action is based on the combination of information about the specific situation, knowledge about the general and the perspectives of the persons involved. The project method is on a lower

level in relation to the perspective used in the application of the project method.

This highlights the ends represented in the method. Providing information, about the purposes behind activities or groups of activities described in the process, can contribute to processes of judging regarding their relevance in the particular case. If the main purpose behind requiring a formal decision about the project startup was to stop resource drain from strategic projects to operative work, this information could help in deciding on a course of action. In this case, it might lead the person at the R&D development to argue that the project leader should first get authorization. Strategic priorities would then have been the frame he found most relevant. On the other hand, if the reason for requiring a formal approval was to get a project account needed to set up the project information in the document management system, the requirement of a project account could perhaps be sidestepped in the specific case. It was not even sure that the lead would result in an actual project. In that case, it was not so important to save information in the document management system.

Perspective understanding and task knowledge makes it easier for the persons to judge on a course of action in the particular case. In line with Engquist (1996), this requires persons to learn some task knowledge in areas outside their own domain.

Within the implementation phase, all employees who worked in the TTM-process attended a training session in which the TTM-process was described. This training was primarily on the task knowledge level, providing descriptions of activities in the process. The higher-level of perspective understanding was not focused on during the improvement project.

This focus on the task knowledge can be one explanation for the bureaucratic application of the process in some projects. The general manager of Alpha made an important statement. In his view, all projects should *follow* the process from a specific date. From this perspective, the process of judging is reduced, leaving the employees to follow the general process as closely as possible. This meta-information about the TTM-process framed the TTM-process as a norm or rule, rather than as a frame for inspiration that could be used in judgments about courses of action in the specific projects.

Explicitly trying to foster perspective understanding and task knowledge can be said to be about changing how people think. From an ethical perspective, it can be discussed whether influencing people's minds is acceptable. Explicitly working with improving task knowledge and perspective understanding can perhaps be described as "mind control". In differentiating between task knowledge and perspective understanding, I would say that perspective understanding is important since it gives a person the possibility to perceive reality better and provides degrees of freedom through framing. By taking a step back from the specific task, the person can become aware of possible alternative framings. Rather than taking specific knowledge for granted, the person is trained in selecting what knowledge to use. It can thus help people to cope with reality and provide a basis for dealing with frustration. Rather than viewing an exception from the method as a failure, it can be seen as a success in judgment. By having skills to apply the method, the person is sensible rather than foolish. Providing task knowledge without putting this knowledge in perspective could be seen as trying to turn people into machines. The demand to "follow the process" is limiting for people's minds, while helping to improve perspective understanding can provide degrees of freedom.

An example of perspective understanding can also be given in the relationship between the people in the IT department and the people in the Alpha business. The people on the business side wanted the "IT muppets" to understand more of the business, whereas the people at the IT department wanted the business people to learn more about IT so that they could improve their ability to specify what they wanted. In the TTM project, John Svensson excluded the IT department in the design team since he was not sure that they would contribute productively. The perspective understanding held by the persons before the TTM project can be described as an improvement precondition, which influenced the improvement process. By learning more about IT and business, the preconditions for future improvement projects could have been improved.

7.6.9. Summary of preconditions

The *mind* and *artifact* levels have here been differentiated in the discussion above. Within mind, we have distinguished between *reactivity, task knowledge* and *perspective understanding*. On the artifact level, the terms *represented information, information systems, physical artifacts* and *physical*

infrastructure were used. The *body* level is also a part of the preconditions. The selected levels are shown in Figure 58.

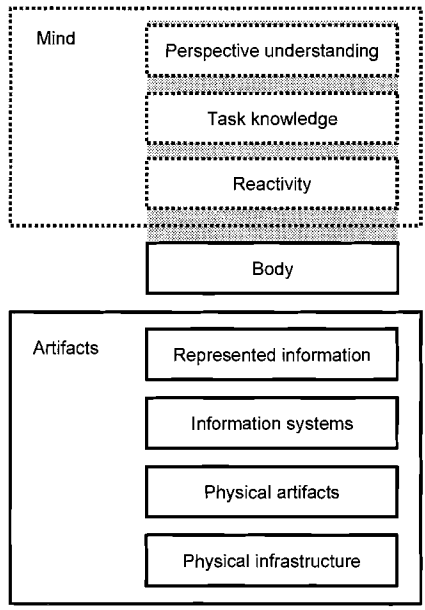

Figure 58. Levels of preconditions.

In the Alpha case, the main focus of the improvement work was on creating a representation of the product development process (represented information). Relatively less effort was put into developing the task knowledge and perspective understanding of the people involved in the product development work. On the physical artifacts level, the relatively large amount of time needed to implement information systems was a surprise to the design team.

7.7. Integrating analysis

In the previous analysis, several models have been presented. The model of learning and acting has provided a frame for describing selected forms and processes of mind (cf. Figure 48, p. 192). The personal work process model provides a frame for describing learning, acting and performing tasks (cf. Figure 49, p. 195). The model of organizational process levels has provided a frame for describing how persons work together in coordinated processes to achieve results (Figure 57, p. 230).

The model of preconditions has been developed with further details (cf. Figure 58, p. 244).

The zigzag theory structure has been used increasingly during the analysis. The purpose now is to develop an integrated framework for project result improvement using the zigzag theory structure in each part. This will involve some additional analysis in order to relate each presented model to the zigzag theory structure. I have chosen to use the "fork" design for each level of form and process in order to emphasize calibration.

7.7.1. Integration model of personal work processes

That persons influenced the activities in Alpha has been shown in the previous analysis. Personal work processes can influence results on several levels.

The PRIO framework is designed to allow for different levels of detail in the analysis of a project-intensive organization. In the following, the personal work process model will be related to learning and acting, as well as to preconditions.

The personal work process shows both preconditions and results using the structure of the X-model. The feedback loops between preconditions and results emphasize the dynamic aspects of the process. In the tuning fork design, this feedback is represented by the "vibrating" tuning forks. What is interpunctuated as preconditions and results is rather a continuous (analog) process.

In the model of learning and acting, the processes involved have been presented as closely related. The constructed time-line in the model (where the line of reasoning goes from learning up to perspective, and then down to action) could be shown by extending the forms and processes "forward" horizontally. This way of presenting the model has the advantage that it is relatively intuitive. However, with the close relationship between them, the model might be interpreted as linear rather than as a model of calibration between multiple levels. I have therefore decided to distinguish between the general forms available in learning, and the specific actions that are taken, but graphically show them closer together.

An example might clarify this difference. Even if I am aware of several perspectives, it is difficult to use all perspectives at the same time in framing and judging. From a specific selected perspective, I can judge and decide to use a specific argument for a specific projection. In reality, I assume that these processes are highly vibrant, and the calibrations, or changes, on the different levels may be so fast that they appear as continuous. Further, in many cases the processes are unconscious. This can be described as if the relationships between learning and acting in the specific situation is tacit, or that a person uses his or her intuition, or experience. However, in my view, these processes are possible to separate analytically on different levels.

In the fork model of learning and acting, I have separated the general and specific with a slash (/). I have also placed the general as a superscript and the specific as subscript. This is intended to show that the superscript influences the specific subscript level. For example, what general knowledge a person has influences what specific arguments can be put forward. The specific arguments influence the decision-process, leading to a specific projection.

Learning has been described as changes on the different levels of information, knowledge and perspective. This is shown with the abbreviations L0, L1, L2 and L3 in the integrated personal work process model (cf. Figure 59 below). The lowest level (L0) is not discussed further here, since it is only distantly related to project result improvement in organizations.

In the analysis, information, knowledge and perspectives have been extended to include not only the mental processes related to learning, but also the close relationship to acting. The terms *reactivity* (RA), *task knowledge* (TK) and *perspective understanding* (PU) have been constructed to summarize interactions.

The model of learning and acting provides a link between mind and *body* (B). This link is shown with lines in the model. What has been selected in this relationship depends on the theory used and the empirical material from Alpha. The model should therefore be seen as providing a frame for describing selected relationships between mind and body.

The artifact level has been differentiated to include *represented information* (RI), *information systems* (IS), *physical artifacts* (PA) and *physical infra-*

structure (PI). This is also indicated in the model in order to provide an extended possibility for analyzing personal work processes.

The integration model of personal work processes is shown below in Figure 59.

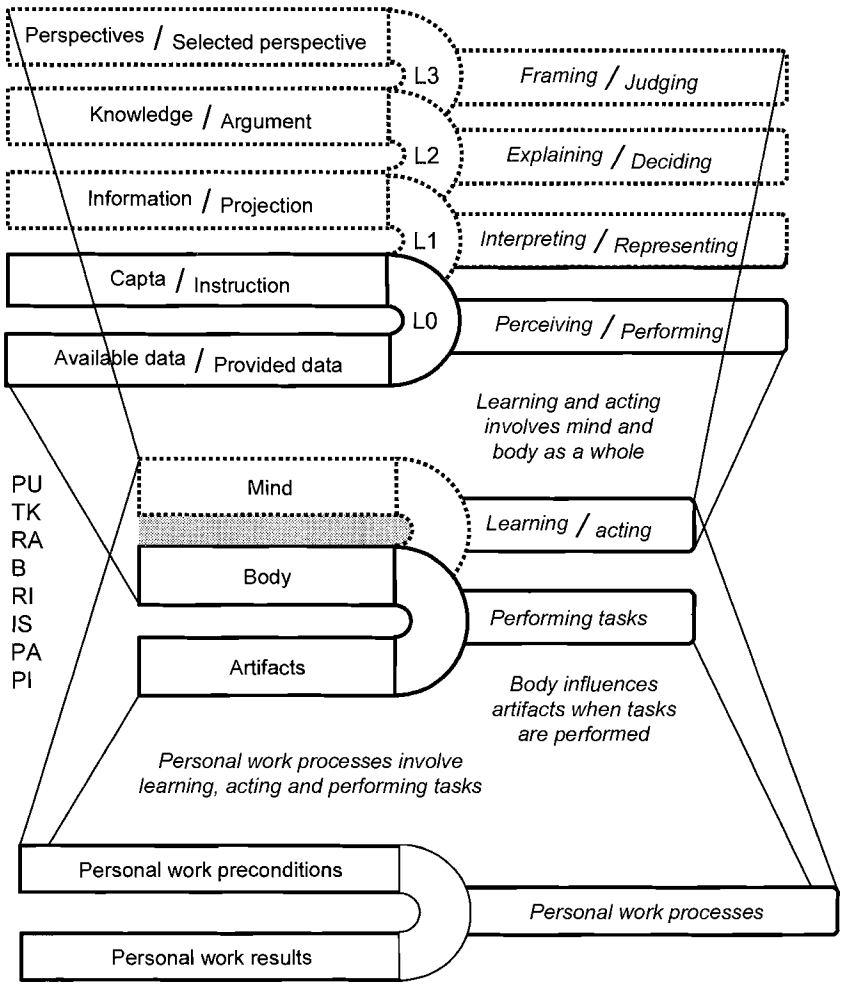

Figure 59. Integrated model of personal work processes.

In the next section, the levels of change in the PRIO framework will be discussed.

7.7.2. Integration model of organizational processes

Personal work processes in a project-intensive organization have been described on three levels of organizational work processes.

The main levels have been the strategy development, improvement, and operative levels. On each level, preconditions, processes and results have been described. The relationship between the levels has been described as if a subset of results of a process on a higher level influenced the preconditions on the level below. In each specific execution of a process, a subset of the preconditions is used. In the process of execution, feedback is provided on different levels. The feedback can be provided after the execution of the process, but it is also continuously calibrated. A person who learns by working in a project process can be described both as a part of the operative preconditions at a certain point in time, and as working in a specific project process.

The relationship to the customer has been discussed in that project results are used by the customer in customer processes. However, in this integrating model, I have decided to show the customer perspective in more detail. The reason for this is that the process of transferring to, or integrating project results with the customer is complex, and that the ways in which the project results are used by the customer are not given. Project results can be described both for the project-intensive organization, and for the customer for whom the project is carried out. Further, the results of the customer project process establish preconditions for the specific customer operations that the project results are going to support.

What we previously have treated as project results can now be differentiated to three types of results: internal project results, customer project results and customer operations results. These are shown in Figure 60 with the abbreviations R0, R1 and R2. In the figure below, customer project results are shown behind the customer operations preconditions, following the general principle for linking the levels in the model (cf. Figure 55).

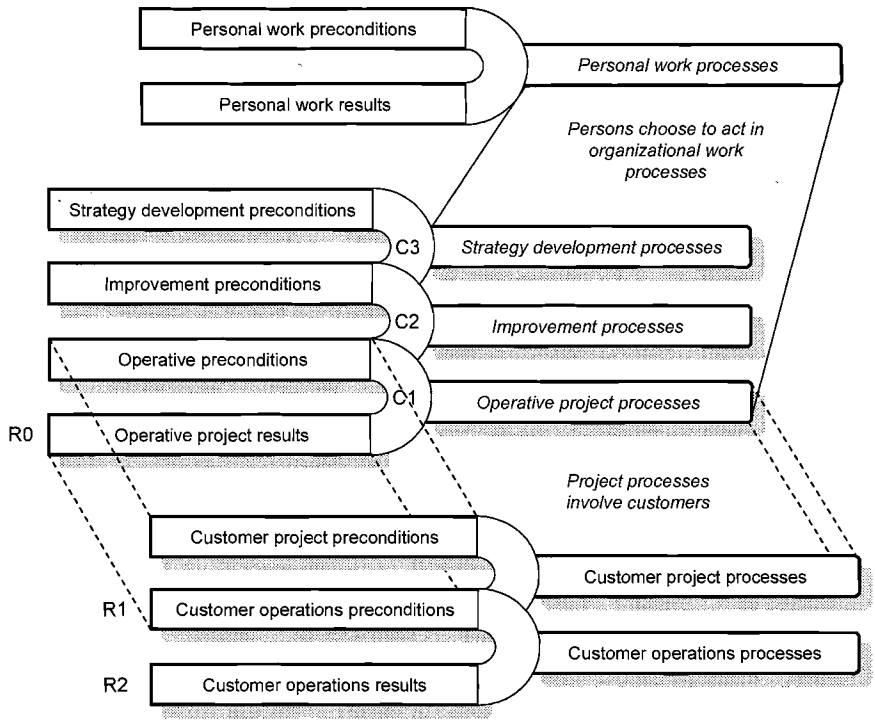

Figure 60. Integrated model of organizational processes.

The customer organization in the figure above is not shown in the same detail as the project-intensive organization that is helping the customer. The reason for this is that the project may be directed towards different parts of customer operations. For example, in the Alpha case the consulting organization Rummler-Brache Group performed an operative project process when helping people in Alpha design the TTM-process. The operative project process helped the customer with an improvement process. On the other hand, when people in Alpha used the TTM-process to help their customers, mobile phone developers, the operative project process helped the customer with their operative project process, which involved developing mobile phones.

Since the PRIO framework has been developed with a specific purpose to provide a frame for project result improvement, the levels of the PRIO framework cannot be used directly for levels in the customer organization. What is important in each case is to identify what customer operations the project process should help in establishing preconditions for, and what is required to establish those preconditions.

7.7.3. Integration model of project results

By including the customer in the framework, different results become more visible. In project management literature, it is emphasized that projects have goals (cf. Meredith & Mantel, 2000). The relationship between these goals and the work in the projects is then interesting.

From the personal work process model, we can use the information/projection level to describe the goal status (projection) and current status (information). A project is time-limited by definition. The goal (projection) should be reached before the project is completed. However, the effects of the project can arise after the project. Lundeberg (2003) distinguishes between delivery and effect. The delivery is made in one process, and the effect is achieved in the next process. Including the wider context is also supported by Westerveld (2003), who argues that in some projects, the results for stakeholders should be considered in addition to narrower project results.

I have chosen to use the term *status* instead of *delivery*. The reason for this is that one important part of the delivery is made on the mind level. Since we do not have direct access to other persons' minds, we cannot "deliver" on the mind level. We can however try to influence other persons through communication and artifacts, and this may lead to information, knowledge or perspectives in other person's minds.

We have already distinguished between project results, customer project results and customer operations results. A difference between the project results and the results in customer operations is that while the project is time-limited, customer operations typically continue after the project has been completed. In the normal case, the customer project results will make a difference in customer operations preconditions. These preconditions will then influence several customer operations processes, leading to a difference for a class of customer operations processes, rather than a difference in a specific process execution. That is, the relationship between the project and the influence on customer operations processes is one-to-many. In each execution of customer operations processes, the preconditions will change. This is similar to first order change in the project-intensive organization. The three types of results are shown in Figure 61 as an extension of R0, R1 and R2.

Customer operations results are then first *not* a result from the project process, and second, *not* a result of a specific execution. The second-

order result is of a different type than the first order result of the project process. For this reason, I use the term *effects* for second order results. This is inspired by how Lundeberg (1993) uses the term.

In terms of goals, the project is complete when the current status matches the projected goal status. When the project is completed, the status in the customer organization influences customer operations processes. However, the customer operations processes are influenced by the totality of customer operations preconditions, rather than only by the difference made through the combination of operative project process and customer project process.

Since a project process normally is calibrated with the customer during the execution, customer project results (and thereby partly customer operations preconditions) may be delivered during the project. Part of the intended effects can then be achieved during the project process, even though the effects are indirect in relation to the project process (inspired by Lundeberg, 2003).

For example, the product development projects carried out by the customer teams in Alpha led to trained machine operators, manufacturing tools and material requirements specifications as preconditions for the internal customer (TTC). However, in many cases, large volumes were produced in operations processes before the quality status of the production was secured (the goal status of product development project). This carries on to Alpha's customers, the phone manufacturers, and finally to the individual mobile phone customer. Quality problems experienced by the end users were then the effect of customer operations preconditions not being established, which influenced the customer of the customer in the phone manufacturing process, and finally the individuals.

The dynamic relationships between levels can be shown in the example where production employees in Alpha stayed late and checked components to see if there were problems. Even if the goal status had not been reached by the customer project process, flexibility in customer operations processes could counter this problem. Over time, the goal status was reached in customer project results, both through the work in the project and through the internal feedback in customer operations processes. In other words, the levels should be seen as calibrating rather than as performed in a sequence.

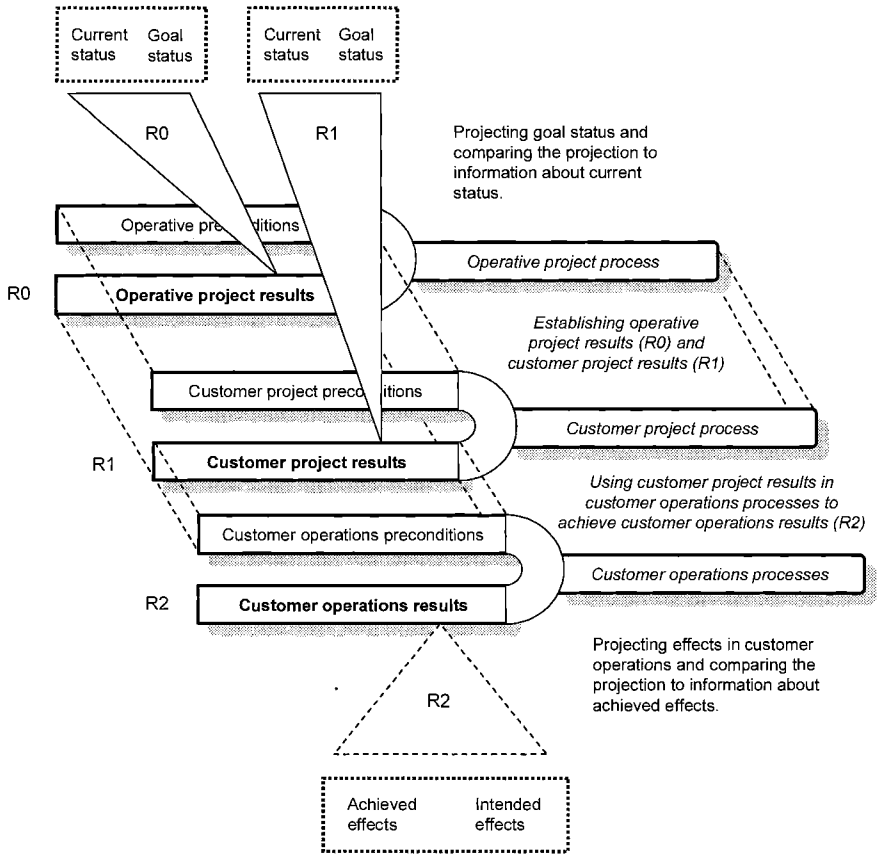

Figure 61. Operative project results, customer project results, and effects on customer operations (inspired by Lundeberg, 2003).

In the TTM-project, there were also specific goals for the projects in general. The most important were to increase net present value of investments in product development, cut lead times, and improve employee and customer satisfaction.

How can we understand the link between the TTM-process goals and the results in the specific projects? My way of structuring this discussion has been to relate levels of *mind* to operative project processes and customer processes. The TTM-process goals were communicated by the manager at Alpha (*body*) and documented in the TTM-process (*represented information*). The goals then existed as operative preconditions, in the minds of the employees and as represented information. However, how did this influence results?

It is important to note that the TTM-process goals were general. They were not project goals, that is, goals for specific projects. If we should be careful to transfer the general to the specific, we might also be cautious to directly transfer the general lead-time goal of one month for variant development to the specific project. The specific customer might want to have a product that is very similar to the last one, so waiting one month to deliver seems unnecessary. On the other hand, if the customer is proactive and contacts the company three months in advance of their production start, there seems to be no reason to produce large quantities to stock before production begins, thereby increasing capital cost for the customer.

In my view, information about the lead-time goal is not sufficient for reasonable use of the goal in the specific case. The general goal does not know what is important for the specific customer in the specific project.

If we "move" the goal to the knowledge level in our minds, we get a different situation. If a particular person identifies the goal as one potential pattern that can inspire the work, this can influence the projection of the project process. If he or she makes use of this pattern, and combines it with information about what the customer wants, the projection has the advantage of *combining* the two levels. The general importance of lead-time inspires the projection of the project process to be as fast as possible, given the restrictions and possibilities provided by the customer in the specific case.

However, there is a further problem if there are several goals. In the Alpha case, lead-time was highlighted as an important goal, but it was also important to increase net present value, as well as to improve employee and customer satisfaction. How can this be handled? If there are several goals, there is a question of what general pattern should be used in the specific case. If we argue that there is a fixed "percentage", say that lead-time and profitability are equally important, we get the locking effect of the general on the specific. It may not always be the case that they are equally important. For example, if a customer was strategically important, the global account managers could carry out projects with a low profit to satisfy the customer, hoping to get more profitable projects later on.

If we think of a situation when the TTM-process goals are sorted as perspectives in the mind of a person, the goals would be used in framing

and judging in connection with what knowledge to use in deciding on a course of action. For example, when framing the situation from a lead-time perspective, a person could select knowledge related to how lead time can be cut. In the TTM-process, there were several patterns suggested in order to achieve this end. Information about quality requirements and logistics issues could be collected early on, and suppliers could be contacted in order to develop tools, secure capacity, etc. This could be compared with information about the specific situation, for example what suppliers to contact. In combination, a projection of a project process which is carried out with short lead time could be created.

When framing from an employee perspective, a person could use knowledge about patterns identified as important from an employee perspective. That person could, for example, use knowledge about resource scheduling in order to make sure that the specific project team is not scheduled over capacity.

The person could then compare the projections made from the different perspectives, and judge and decide on a projection which is reasonable in the specific case. It might not be possible to consider all perspectives equally. With this view, the course of action is tailor-made to each situation, but each goal is considered. This is similar to the view presented by Samuelson (2000), who emphasizes control as a balance.

7.8. Concluding comments

In this chapter, the parts of the PRIO framework have incrementally been developed. I have summarized main distinctions using the zigzag theory structure.

One important part has been the personal work process model, with its detail of learning and acting. This has been described as particularly important since personal work processes, what people really do, influence organizational processes, and thereby results. The last part that has been discussed was customer project processes and customer operations. It was emphasized that value-added to customer operations is important.

Alpha was a part of a larger business network. Each project involved the customer as well as suppliers and their suppliers in turn. What has been said about the relationship between the operative project process and the customer project process can be discussed from a broader perspec-

tive. Each operative project process connects with multiple processes, not only the customer project process. Within this thesis I have chosen not to differentiate the framework further in this direction. Using the PRIO framework for analyzing multiple relationships increases the importance of the fundamental pivot point of perspectives. There are more perspectives to consider. Framing and judging is likely to be even more important in such situations since the perspectives of different stakeholders need to be considered.

How can project results in project-intensive organizations be improved? In order to answer this question, the PRIO framework provides a background context that explains the results, but also a foreground on which the project results can be evaluated. What project results to aim for depends both on the perspectives of the people in the organization, and on the perspectives of the people in the customer organizations. Project result improvement involves calibrating operative project preconditions in such a way that when they are used, they contribute to establishing the operations preconditions the customer needs to reach results that are important for the customer.

In the next chapter, the PRIO framework will be described in a condensed way. Since the intention has been that the chapter should be possible to read relatively separately from the thesis, some main points will be repeated.

8. PRIO FRAMEWORK

The PRIO framework provides a frame for describing and analyzing how project results can be improved in project-intensive organizations. A brief background introduces the chapter and the PRIO framework is then described starting from a simple structure which is then differentiated. Finally the intended use of the framework is discussed. This presentation of the framework corresponds to the main purpose of the thesis.

8.1. Project result improvement in organizations

In the two previous chapters, empirical, theoretical and philosophical foundations were used in an analysis to develop the PRIO framework. This chapter will provide a condensed description of the complete PRIO framework.

The PRIO framework is designed to help people in project-intensive organizations to improve the results of the projects they carry out. The term *project-intensive organization* is used to refer to organizations where a central part of the operative work is performed in project form. This is often the case in product development, software development, business development, industrial construction, etc.

The basic question addressed by the framework is "how can project results in project-intensive organizations be improved?" The acronym PRIO stands for "Project Result Improvement in Organizations".

Before describing the PRIO framework, I will present an introductory model which captures important parts of the PRIO framework's logic in a simplified form.

In project-intensive organizations, the work is often dynamic since unique situations in each project must be handled. In this situation operative "fire fighting" is common. For example, resources might be transferred between projects due to unexpected problems and plans might be changed due to new requirements. In many cases, this is a

good sign. The problems or possibilities that emerge in the projects are taken care of.

However, it may also be the case that the recurring fires really are symptoms of systematic deficiencies in the business. The same problem may emerge in many projects, and it may be common that some possibilities are not exploited.

Rather than handling all aspects of each project uniquely, it may be possible to improve the *preconditions* for the projects, and thereby influence results in many future projects. With this type of work, we can get a leverage effect on the improvement work, compared to solving the problems in each project separately.

If improvements of preconditions are carried out in the organization, but the problems in the specific projects are still not solved, the problem may be related to the way the improvements are carried out.

One key to project result improvement is to solve the problems on the right level. Bateson (1972) and Watzlawick, Weakland & Fisch (1974) distinguish between different types of change. If you have attempted a specific solution to a problem, and the solution has proved to be ineffective, it is not meaningful to continue with *more of the same*. In order to improve the situation *something else* has to be tried. This can be described as changes of different orders.

A first order change is to work with changes within specific preconditions, such as learning to use an existing project method. A second order change is to change the preconditions, such as introducing a new project method, or adapting the project method so that it has a stronger link to the specific situation and type of work carried out in the organization. Finally, a third order change is to change the preconditions for the preconditions, for example by introducing a new improvement method.

Based on this logic of orders of change, the introductory model consists of three parts: project processes, operative preconditions and improvement methods.

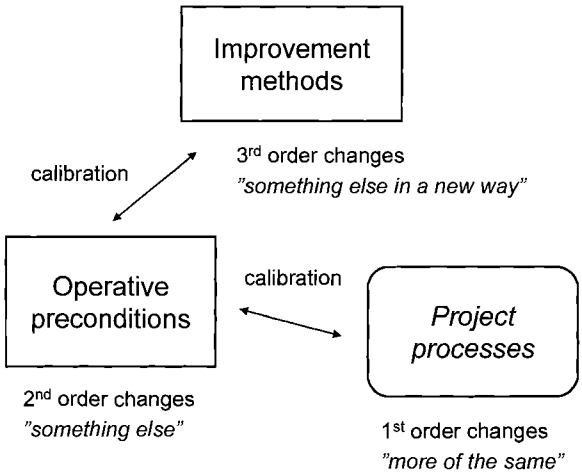

Figure 62. Introductory model.

The term *project processes* refers to the operative project processes that are conducted in the organization (execution of the specific projects). *Operative preconditions* refers to the preconditions that form the "infrastructure" for carrying out the project processes, or expressed differently, what "exists" in the organization as support for the project processes. The term *improvement methods,* refers to patterns in how this infrastructure is established.

8.2. Framework structure

The PRIO framework has been developed based on specific assumptions about reality. These assumptions have influenced the theory structure that has been used to develop the PRIO framework and the basic concepts used. Since the theory structure is fundamental to the design of the framework, I will provide a brief description of the structure underlying the framework.

8.2.1. Relationship to reality

I use the term "framework" to refer to a conceptual structure for developing descriptions of reality. The framework can help me to direct my attention when I develop descriptions. Certain phenomena become interesting since their importance is indicated in the framework.

The framework is on a higher level of abstraction than the description of the specific situation. The frame that is used to make the description is different from the description that is the result. The framework is on a *meta-level* in relation to descriptions of actual situations.

Further, the *description* of the specific situation that is created using the framework is not the *reality* that is described. We can use the metaphor of map and territory to clarify this view (Korzybski, 1941). The map is not the territory. In a similar way, our description, or map of reality, is not the phenomenon that we describe. The description is *about* the described phenomenon. It is abstract in relation to the phenomenon itself.

With this view we have positioned the framework as abstract in relation to descriptions of reality, and descriptions of a phenomenon in reality as abstract in relation to the phenomenon itself. The level of abstraction is indicated in Figure 63 by the vertical position of the three main parts of the figure.

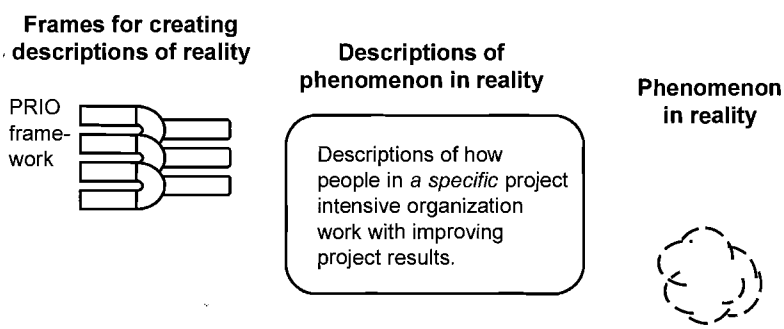

Figure 63. PRIO: a frame for creating descriptions of reality.

The message here is that the PRIO framework should be seen as a *frame for making descriptions of reality* rather than a model of reality.

8.2.2. Form and process

In the framework, I make use of two types of concepts: form and process. These concepts are based on the work of Bateson (1972, 1979).

The term "form" refers to abstractions, or classifications of phenomena. The term "process" refers to descriptions of things that happen in a wide sense. A process is dynamic and can be described as unfolding partly stochastically over time.

For example, specific project processes (process) that unfold can be described. Based on these descriptions; we can classify the project processes as examples of a general type of project (form), or as executions of a specific project method (form).

When creating descriptions of form and process it can be relevant to describe forms at different points in time. This is achieved by describing preconditions influencing the process, and results of the process (Lundeberg, 1993). Preconditions and results are examples of form.

8.2.3. Relationships between levels

Form and process can be described on several levels in a zigzag pattern (Bateson, 1979). The relationships between alternating forms and processes can be described in terms of *calibration on multiple levels*. I view the relationship inspired by cybernetics, where control or governance influence through restraint rather than direct causality. With the term *calibration* I want to signal that restraints influence processes over time, and that the influence between restraint and what is being restrained can go in both directions. The process can influence the restraint. From this view, it is not clear what is seen as "cause" and what is seen as "effect", as it depends on the starting point of the analysis. In the terminology of form and process, forms are examples of restraints, and the processes are what are restrained.

A form on a higher level influences the process on the higher level and this influence can be described in terms of calibration. The process on the lower level is limited by the process on the higher level. The restraints on higher levels are of a higher logical type. When describing phenomena, descriptions of what is generally seen as controlling levels are higher in relationship to the levels that are seen as generally controlled.

When a higher level controls a lower level, the repertoire of available alternatives is reduced on the lower level. The lower level can provide feedback, influencing the higher level. Since the relationship between levels is mutual, what is seen as "cause" and what is seen as "effect" is relative. What is seen as results on one level can be seen as preconditions on another level.

8.2.4. Personal and organizational work processes

The PRIO framework consists of two main types of processes: personal work processes and organizational work processes. The reason for this distinction is that with the world view behind the framework, persons as individuals are seen as important for the work that is performed. When we describe work, we can choose to describe it on a personal level, where an individual is in focus, or on a collaborative level of organizational work processes.

8.3. Personal work processes

A fundamental part of the PRIO framework consists of persons and the work they do. Using the personal work process model, we can describe how persons learn, act and perform tasks. The personal work process model is designed as a frame to describe processes conducted individually, or to describe organizational processes from the viewpoint of a particular person.

8.3.1. Condensed personal work process model

The personal work process model can be described in a summary fashion, where the preconditions, the personal work process and the results are shown in the form of a tuning fork. The intention with this model is to provide a tool for a summary analysis, which can be differentiated if necessary in terms of levels of learning and acting and levels of preconditions.

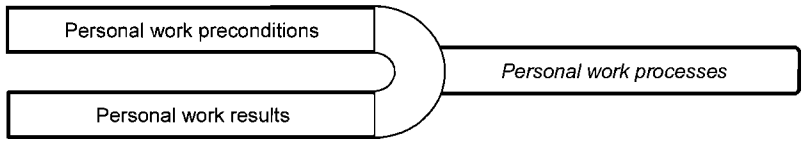

Figure 64. Condensed personal work process model.

The possible feedback between results and preconditions can be described between the prongs of the tuning fork.

8.3.2. Learning, acting and performing tasks

The analytical difference between mind and body is shown in Figure 65 with a dotted box representing mind, and a solid box representing body. The area linking mind and body is shown with gray, indicating that the two are assumed to be inseparable and interwoven in reality.

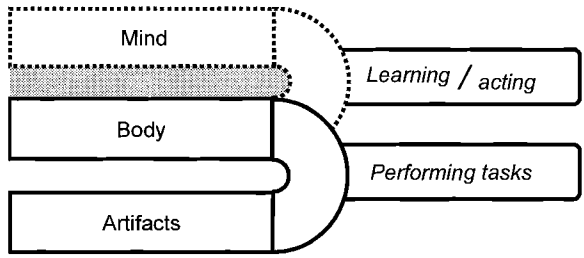

Figure 65. Personal work process model.

Learning and acting is described as a process of calibration between mind and body. Tasks are described as performed in calibration between body and artifact. Higher levels generally control lower levels, but the relationship is characterized by mutual influence so that lower levels can have an influence on higher levels. The term calibration indicates that there are multiple adjustments during the processes of learning / acting and performing tasks. The close relationship between learning and acting is indicated in Figure 65 by being visualized as inseparable within the same process.

8.3.3. Details of learning and acting

To describe learning and acting in more detail, a model with several analytical levels is used. Figure 66 refers to how data from reality is perceived, forming capta in sensory organs, which is interpreted to information in mind. Information can be compared to existing knowledge in processes of explaining. Knowledge is selected from a specific perspective in processes of framing.

Acting is here described closely interrelated to learning. Acting is described in processes on several levels. Judging from different perspectives, knowledge can be used as arguments. Arguments are selected based on information about the specific situation in decision processes,

forming a projection of the intended action. The projection is represented as instructions for performing the action.

The lower level of the detail model of learning and acting shows a schematic interface between mind (dotted boxes) and body (solid boxes). *Available data* is outside the sensory organs of the body. The levels of *perceiving/capta* and *instruction/performing* refer to body functions for processing of difference. *Information* and *projection* are described as levels of mind. Actions of persons become data when they are performed. That is, when a person acts, the actions are a part of reality (provided data). When a person acts, we cannot in principle know what actually goes on. The actions are sources of available data that require interpretation.

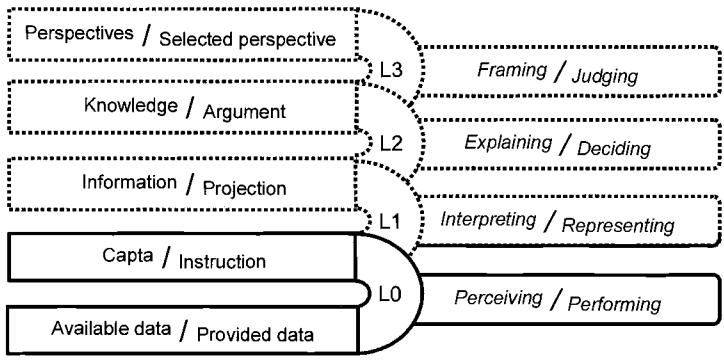

Figure 66. Detail model of learning and acting.

When performed in interaction with artifacts, the process of interaction is referred to as *performing tasks* (cf. Figure 65)

It is important to note that the detailed model of learning and acting does not cover all mental processes. These forms and processes have been selected based on what I have found relevant in the context of performing organizational processes in a result-oriented way.

Patterns of interaction between the levels of learning and acting can be learned to the extent that they become habits or unconscious processes rather than conscious reflection and action.

8.3.4. Details of preconditions and results

The preconditions and results in the personal work model can be described in terms of levels. These levels can be presented in different detail.

Persons can be described in terms of *mind* and *body*. Interactions between mind and body can be described in terms of *perspective understanding, task knowledge* and *reactivity*. These concepts are based on combinations of the detailed model of learning and acting (cf. Figure 66). Perspective understanding is related to the ability of a person to analyze a situation from different perspectives (framing and judging). Task knowledge refers to a person's ability to use selected knowledge in a particular situation (explaining and deciding). Reactivity refers to a person's ability to translate receptivity to action (perceiving/interpreting and representing/performing).

Perspective understanding, task knowledge and reactivity as concepts are classifications (form) of the abilities shown concretely in processes. For example, if a person in action has shown that he or she can frame and judge from different perspectives, we can classify the person as having perspective understanding with respect to the perspectives used.

Examples of *artifacts* are *represented information, information systems, physical artifacts* and *physical infrastructure*. Represented information is based on information systems, which are based on physical artifacts, which are based on physical infrastructure (in a broad sense).

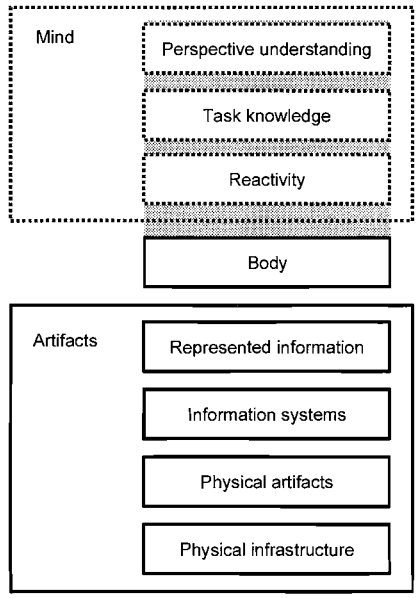

Figure 67. Levels of preconditions and results – increased detail.

With an increasing detail in preconditions and results, the description and analysis of the organization can be made at a level of detail that is judged to be appropriate in each situation. The differentiation here is provided as one suggestion of what I have found relevant when working with project result improvement. However, additional levels of mind and additional types of artifacts may be included to increase variety.

8.4. Organizational work processes

In an organization, it is important that personal work processes contribute to organizational work processes. In the PRIO framework it is suggested that persons can choose to act in organizational work processes to contribute to achieving shared goals of the people in the organization.

8.4.1. Interaction between people

When persons engage in organizational work processes, the PRIO framework presents interaction as indirect. A person can perform actions. These actions can be interpreted by other persons. It is also possible for a person to use his or her body to perform tasks, thereby

influencing artifacts. However, performed actions and artifacts are only indirectly available to other persons in processes of learning (cf. Figure 66).

The concept *organizational work process* is used to refer to processes in which several persons are involved. Each person can have only indirect knowledge of other persons or artifacts. In principle, what we call customers, team members and products are all phenomena that require interpretation. In processes of perceiving, persons gather capta for interpretation of other persons' actions and the artifacts they have created. In processes of performing, persons can provide data for other persons.

Organizational work processes are carried out under the fundamental limitation that no communication of information between persons is direct. With similar frames of references, the processes of interpreting, explaining and framing can lead to sufficiently similar ideas to support processes of judging and deciding on shared projections for performing.

Coordination of persons and tasks is usually required during organizational work processes. Examples of coordination problems are situations where the knowledge of one person is required by others (such as in knowledge transfer), if actions of one person are required (such as a specialist in team-building), if tasks performed are required for subsequent stages (such as database programming) or if artifacts are required in subsequent stages (such as sub components for manufacturing products).

Basic coordination challenges can be described in terms of the availability of persons to act and perform tasks, and the availability of artifacts to be used or produced.

8.4.2. Three levels of organizational work processes

Persons can choose to act in organizational work processes on several levels. The three levels of organizational processes presented in the framework are *strategy development, improvements* and *operative projects*. Strategy development processes, improvement processes and operative project processes are shown in Figure 68.

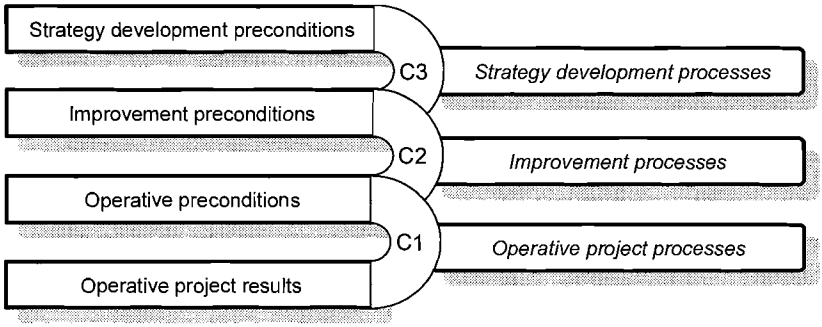

Figure 68. Model of organizational work processes on three levels.

Processes on a higher level are continuously calibrated with processes on the next lower level. This can be described as sub-results being provided during the process.

A subset of the results of one process on a higher level can provide parts of the preconditions for the next lower level of processes. That is, a process on a higher level may provide some results that are relevant as preconditions for processes on a lower level, and some results that are not relevant. The relevant preconditions can then influence several processes and related results on the lower level.

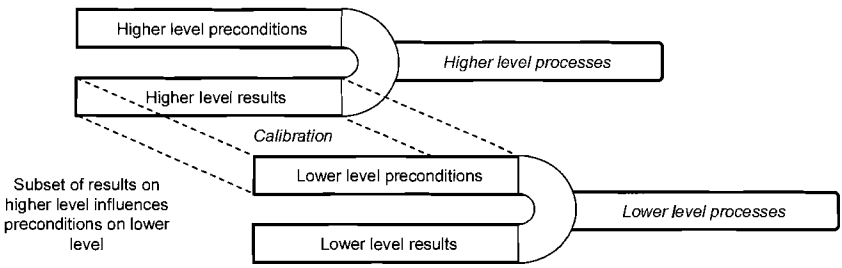

Figure 69. Relationships between levels of processes.

The three levels are related as indicated in Figure 69. Strategy development preconditions influence strategy development processes. Parts of the strategy development results become improvement preconditions. The improvement preconditions influence improvement processes. Parts of the improvement process results become operative preconditions. The operative preconditions influence operative project processes. The operative project processes influence the operative project results.

8.4.3. Orders of changes and differences

We can describe change on each level. The term *change* comprises a *change process,* leading to a *difference* in what is changed. We can then describe orders of change processes, leading to orders of differences.

Since operative project results are in focus in the PRIO framework, the term first order difference refers to differences in the results of the operative project processes. The first order change process is an integrated part of the operative work.

Changes and differences	Example
First order change process (operative project process)	Learning to use an existing method for quality control by using the method in the projects
First order difference (difference in operative project results)	Higher quality in the produced artifacts

Table 11. Example of first order change and resulting difference.

However, not all first order differences can be achieved with first order change. Sometimes *something else* needs to be done. A first order difference can be achieved with a second order change, in which case the operative preconditions are changed.

Changes and differences	Example
Second order change process (improvement process)	Introducing a new method, focused on risk management
Second order difference (difference in operative preconditions)	New method for risk management and knowledge about method
First order change process (operative project process)	Using knowledge and risk management method in product development
First order difference (difference in operative project results)	Improved budget reliability

Table 12. Example of second order change and resulting differences.

However, not all first order differences can be achieved with second order change. In some cases *something else* needs to be done in *a new way*. A first order difference can be achieved with a third order change, in which case the improvement preconditions are changed.

Changes and differences	Example
Third order change process (strategy development process)	Deciding to climb in the value chain by using a process improvement method to improve the product development process
Third order difference (difference in improvement preconditions)	New strategy document, new process improvement method and knowledge about process improvement method
Second order change process (improvement process)	Use of strategy document and process improvement method in an improvement process
Second order difference (difference in operative preconditions)	Integrated method for developing more complex products
First order change process (operative project process)	Use of product development method in product development projects.
First order difference (operative project results)	Products with higher complexity and value

Table 13. Example of third order change and resulting differences.

To summarize changes and differences on the three levels, the terms first, second and third order change can be used. This is shown in Figure 68 with the abbreviations C1, C2 and C3. The principle is that each order of change links a process on the higher level to a difference in preconditions on the lower level in such a way that it provides a discontinuity in preconditions on the lower level.

8.4.4. Relationship to customer processes

The work in the organization is performed for customers. Parts of the operative project results become internal operative project results. Parts of the operative project results become customer operations preconditions. The customer operations processes influence customer operations results. The customer processes that are influenced vary depending on what customer operations the project process is directed to.

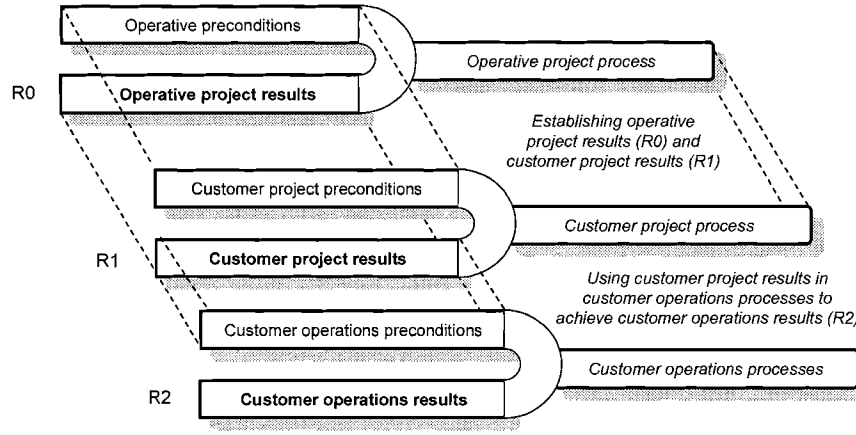

Figure 70. Model linking operative project results to customer results.

Operative project results are not necessarily provided at the "end" of the operative project process. Processes on higher levels can continuously be calibrated with processes on lower levels, providing a continuous transition or delivery. For example, if the training of customer employees is a major part of the project, the operative project process will increasingly establish preconditions in the customer organization.

8.4.5. Relationships between levels

The relationship between the levels of processes can also be further defined.

On each level, a subset of the results of processes on the higher level influences the preconditions for the next lower level. In each execution on the lower level, a subset of preconditions on its own level is used. Each level involves a feedback process linking a subset of the results of a process to preconditions on the same level.

The principle in the described relationships between levels of preconditions and processes is that:

> Each process on a higher level makes a difference in preconditions for processes on the level below (primary difference), as well as a difference in preconditions on its own level (evolved difference). In calibrating higher and lower levels, preconditions on the lower level restrain the possibility to make a difference by the process on the level above.

The levels of the framework then include both relationships to higher and lower levels, as well as a feedback process on its own level.

8.5. The PRIO framework

The PRIO framework provides a frame for structuring descriptions of project-intensive organizations with a specific focus on how project results can be improved.

The personal work process model provides a frame for describing how persons learn, act and perform tasks.

People can participate in organizational work processes such as strategy development, improvements and operative projects. Strategy development preconditions influence strategy development processes, which establish improvement preconditions. Improvement preconditions influence improvement processes, which establish operative preconditions. Operative preconditions influence operative project processes, which influence operative project results. These are in turn used by customers in customer processes, which influence the results achieved by the customer.

The description of an organization using the PRIO framework can be made with increasing levels of precision. A summary picture is shown in Figure 71 on the next page.

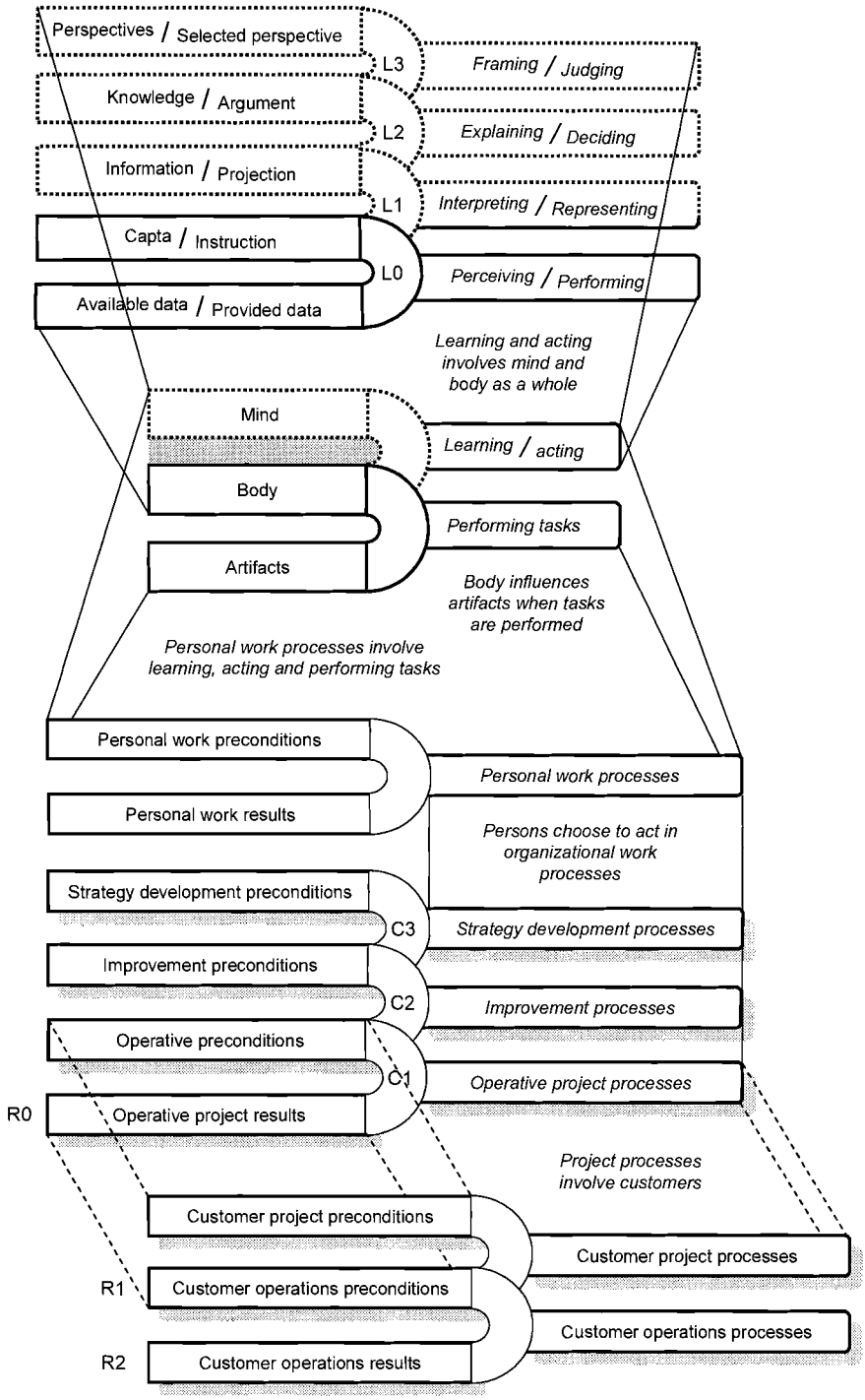

Figure 71. PRIO: a framework for Project Result Improvement in Organizations.

With this summary it is time to discuss how the framework can be used in practice.

8.6. Using the framework

The question that has been behind the development of the PRIO-framework is "How can results in project-intensive organizations be improved?" The PRIO framework presents a starting point for asking questions and structuring answers.

By using the framework bottom-up, we can make a focused analysis of what types of results we want to improve, and get some support in describing the process levels that may be relevant for the improvement.

By using the framework from the top down, we can describe what persons want to achieve, and their strategy for these achievements. We can describe the ways in which improvements should be conducted, what the necessary operative preconditions are, and how these preconditions should influence the operative project processes.

The PRIO framework is intended as a *frame for inspiration* for people working with project result improvement. When using the PRIO framework, it is important to remember that the framework only is one possible frame for descriptions of reality. Project results are not the only thing that is important. The framework should therefore not be taken as a given frame for the analysis. The framework can contribute with inspiration for the analysis, but other perspectives and other frames are likely to be relevant as well.

PART IV: CONCLUDING REMARKS

The last part of the thesis presents conclusions from the study. The conclusions are structured in questions that have been found relevant when working with project result improvement in organizations. For each question, the answers derived from the PRIO framework are presented. This concluding section also contains reflections, implications and suggestions for further research. Finally, an epilogue is provided in a dialog form, addressing the question "So what?"

9. CONCLUSIONS

The PRIO framework has been presented in the previous chapter as the main result in the thesis, corresponding to its main purpose. In this chapter I will relate back to the research question and provide conclusions from the study as a whole as well as reflections, implications and suggestions for future research.

9.1. Project result improvement in organizations

This thesis is about how project results in project-intensive organizations can be improved. The particular purpose has been to develop a framework for project result improvement in organizations. This purpose was designed so that fulfilling the purpose contributes to answering the question.

The framework has been presented in the previous chapter, corresponding to the main purpose of the thesis. Rather than repeat the framework, I will provide here an answer to the research question structured in the form of five sub-questions I have found relevant. So, based on the framework, what is the answer to how project results can be improved in project-intensive organizations? The five questions will be provided in the sections below. For each question, I will provide answers derived from the PRIO framework.

9.1.1. What difference do you want to make?

When working to improve project results, there is no given criterion for what is "good". You have to decide what difference you want to make. What difference would you like to see between the project results as they are shown today and the project results in your envisioned future situation?

In making this projection of the intended future situation there are rich sources for gathering inspiration. We can gather inspiration by interpreting existing goals and strategies within the organization. We can also be inspired by criteria used by other organizations, or by theoretical

models. However, at the end of the day, the question of what is important to you and what you think is important in your organization is another matter. In the first round, the question is not what difference you *could* make, but what difference you *want* to make.

In the PRIO framework, the top level consists of personal work processes. How do you choose to engage in organizational processes to influence project results?

9.1.2. What order of change is required?

When we have identified a difference that we want to achieve, the question is what order of change is required to achieve the difference.

In the PRIO framework the idea of first and second order change to create a ladder, is used. This builds on Bateson (1972, 1979), Watzlawick, Weakland & Fisch (1974) and Argyris (1977). The use of the theory here is an application of the theory in the context of project-intensive organizations. I have adapted the theory of orders of change slightly to more clearly differentiate between the process of change (process) and the differences resulting from the change (form). I have been inspired by Bateson (1979) and the X-model when I performed this adaptation (cf. Lundeberg, 1993). The definitions below are adapted to the context of project-intensive organizations, with a focus on project results.

First order change refers to change resulting from the execution of an operative project process. First order change leads to a difference in operative project results in the next execution.

Second order change refers to change resulting from the execution of an improvement process. Second order change leads to a difference in operative preconditions.

Third order change refers to change resulting from the execution of a strategy development process. Third order change leads to a difference in improvement preconditions.

Table 14 provides a summary of the orders of change and resulting differences.

Level	Change process	Resulting difference
First order change	Change resulting from the execution of an operative project process	Leads to a difference in operative project results in the next round
Second order change	Change resulting from the execution of an improvement process	Leads to a difference in operative preconditions
Third order change	Change resulting from the execution of a strategy development process	Leads to a difference in improvement preconditions

Table 14. Summarizing orders of change in the PRIO framework.

An example of first order change is learning to use an existing method for concurrent engineering by using the method in the project. The change, in this example, is primarily related to a change in knowledge about the method. This change in knowledge about the method leads to a difference in operative project results the next time it is used as inspiration. The resulting difference may, for example, be that the products developed are better prepared for manufacturing.

In first order change, the work can be described as doing *more of the same*. The project teams gain knowledge and may reuse solutions from earlier projects and results can be improved following a learning curve. Results improve using the evolving preconditions they already have.

An example of second order change is the adaptation of a general project method to the specific situation in an organization. The improvement work is *about* the operative work, rather than an example of it. The documented method and persons' knowledge about the method provides a difference in operative preconditions, which influence the operative project processes.

However, not all improvement processes are examples of second order change. In some cases the execution of an improvement process will lead to more of the same in operative preconditions. For example, if you carry out training sessions using existing project methods, the resulting difference will be similar to first order change. In second order change, the difference created is not more of the same, but *something else* than what already existed. The change provides a discontinuity in preconditions.

An example of third order change is the introduction of an improvement method which provides a new form for the improvement work. The strategy development process leads to new improvement preconditions.

As in the case with improvement processes, not all strategy development processes are examples of third order change. The question is whether the change results in a discontinuity in the improvement preconditions. If the strategy development process results in a difference where more of the same types of improvements are carried out, the strategy development process is not an example of third order change.

So, the question is: what level of change is required in order to make the difference we are interested in.

In some cases the difference in project results can be made within the existing project processes. You can make better use of the artifacts and knowledge that you have, and take care of the artifacts and knowledge resulting from the projects.

However, this type of solution does not work in all cases. Sometimes you need to do something else than what you already did through an improvement process. You need to change the preconditions for the operative project processes. And yet in some cases, it is not enough to do something else through an improvement process. Sometimes we need to change the way the improvements are carried out.

The three levels provide a ladder in which an increasingly wider context is considered. The PRIO framework suggests that the analysis of how to achieve the difference we want can proceed up this ladder. Is first order change enough? Is second order change enough? Is third order change enough?

9.1.3. What can you change?

If we want to make a difference on any of the three levels described above, we have a challenging question about *what we can change* in order to make the difference. If we want to make a difference, we need to make a change. However, we can only influence things that exist. So if we want to make a real difference, we must change things that exist. The question of what we *can* change is closely related to our assumptions about reality. What exists? What differences are real?

In the view taken in this thesis, we cannot know the answers to these questions. In practical situations we therefore need to make *assumptions* about what exists. When we make these assumptions, there is also a question of how reality has become the way it is assumed to be. In this thesis, I have based the material ontology on the two great stochastic processes of evolution and learning (cf. Bateson, 1979).

The answer provided in the PRIO framework is that we can influence three levels: mind, body and artifact. The levels provide analytical distinctions in a world which is only indirectly available to us. The reason for analytically distinguishing between the levels has been that each level seems to have its own logic. The analytical distinctions increase the chance of using lines of reasoning which are suited to the assumed underlying structure of reality.

Processes in *mind* have important consequences for the results of the operative project processes, since processes in mind influence action. One question is then how we can influence mind. According to the PRIO framework, we can provide data to other persons, but the processes of perception, interpretation, explanation and framing are carried out in many calibrating steps, which make it difficult to predict the outcome in processes of learning. The use of what has been learned similarly influences action in several calibrating steps of judging and deciding. The *body* level is relevant to discussion since it provides the only way of externalizing and internalizing for a person. Taking care of body is also important since it can influence mind and the performance of tasks. The *artifact* level is relevant since artifacts can provide tools for performing tasks, and constitute important results, or outputs, of projects.

A structure of preconditions has been developed in this thesis to make it easier to analyze an organization. The mind level has been described in terms of *perspective understanding, task knowledge* and *reactivity*. The artifact level is described in terms of *represented information, information systems, physical artifacts* and *physical infrastructure*. With these distinctions the analysis can be more detailed when required. By providing a material ontology, we can discuss what you *can* change.

9.1.4. How does the change lead to the difference?

With the assumptions about what can be changed, we find the next fundamental question. How does the change lead to the difference?

In the specific case, we can describe how we think that a certain change will lead to a difference. The PRIO framework can provide guidance for this type of analysis, primarily in two ways.

The first guidance provided by the framework is in the relationships between the levels of strategy development work, improvement work, operative project work, and work performed by the customer.

A subset of the results of strategy development processes influences the preconditions for improvement processes. A subset of the results of improvement processes influences the preconditions for operative project processes. A subset of the results of operative project processes influences the preconditions for customer processes.

This means that the change may lead to the difference in operative project results in several discontinuous steps. The attention is then focused on how to establish the translation from higher level to lower, and on the feedback required to calibrate the control. How does the change influence the operative project processes, where the rubber meets the road?

The second guidance provided by the framework, regarding how a change in preconditions leads to results, is provided in the analysis of the relationship between learning and acting. If we believe that persons are aware of a specific perspective, we can aim to increase the knowledge within this perspective so that they can make use of this knowledge in their decision processes. If we believe that they are not aware of the perspective, we can aim to influence the perspectives of the persons so that the perspective is considered in judging what knowledge to use in the decision processes. If we want to support the tasks performed we can provide represented information and artifacts.

9.1.5. What is the pattern which connects the change and the difference?

When analyzing the relationship between a particular change, and a desired difference, a very fundamental question must be posed. What characterizes the relationship? What is the pattern which connects the change and the difference? Is it a relationship in "one go", or is the relationship characterized by multiple calibrations? In other words, what is the structure of the explanation of how the change leads to the difference?

The answer (to the question of what pattern which connects the change and the difference) has fundamental consequences both for practice and theory. If the relationship between change and difference is linear, it would be possible to construct certain solutions which could lead to certain differences in project results. However, if the answer is that the relationship is characterized by multiple calibrations, the process of change needs to be guided uniquely in each case.

In the PRIO framework, the theory structure used is one of calibration on multiple levels. For example, change leading to a difference in data available to a person is calibrated in multiple steps throughout the process of learning. The person may use multiple perspectives in framing. These perspectives make several knowledge structures possible in calibrating the explanation of the interpreted information in the mind of the person. In interpreting the data, we have oscillating processes of perceiving, providing multiple versions of capta.

Rather than viewing the change as "leading to" a difference, I here use a cybernetic explanation based on restriction. My oscillating perception is restricted by the data. There are many possible ways in which the resulting capta can be interpreted. My oscillating interpretations are restricted by concepts used in my description of "the phenomenon". There are many possible concepts to use. The concepts I use are restricted by my oscillating process of explanation, in which different general patterns of knowledge are used. The choice of what knowledge to use, again, is restricted by an oscillating process of framing from different perspectives.

These oscillations or calibrations are sorted along a hierarchy of levels in such a way that higher levels are *about* lower levels. There is a discontinuity between the levels, related by a calibrating process. In the view provided in the PRIO framework, *these calibrating processes on multiple levels set fundamental limitations for in what way we can make a difference.* This zigzag pattern is a *meta-pattern*: a pattern of patterns.

The challenge is to understand the patterns which have the power to control processes, but at the same time provides the required flexibility to adapt to the specific situation. It is this combination of controlling patterns and the performance of the specific process, which will make a difference. The PRIO framework suggests viewing this pattern in terms of calibration on multiple levels.

9.2. Reflections

In these reflections, I will discuss some strengths and weaknesses of the study. I will also discuss the perspective taken in the study to provide some alternative views, as well as discussing the method used.

9.2.1. Strengths and weaknesses of the study

A main strength with the PRIO framework is its theoretical structure. The theory chain underlying the framework can be traced back in several steps, and each step can be explicitly challenged. None of the steps I have taken reflect necessary choices in an absolute sense. There are many alternatives. The path between reality and the framework is a bumpy journey. However, I think that the attempt to describe how the framework is related to reality is important from a theoretical point of view.

Rather than inventing new concepts, the intention has been to make use of existing concepts and work with relationships between them. The main contribution of the PRIO framework is therefore in the whole rather than in the individual concepts. The strength is in the relationships between the concepts.

The framework is rather economical through its recurring structure. The zigzag theory structure is used in several steps to build up the framework. By learning the principles rather than specific relationships between different concepts the total complexity in the framework is reduced. On the other hand the zigzag theory structure is rather complex in itself. This means that its use is not necessarily economical in the short run. There is a learning curve in using the framework. This complexity is a potential communication problem. Based on my previous experiences in using frameworks in practical work, I think that the PRIO framework is best used by internalizing the logic in the framework, and using this logic as a guide in the analytical work. It would be a strength to have more methodological support for performing specific analyses.

It is a strength that it can be used as a simple structure and then differentiated to add details when necessary.

The framework has been developed in several steps. This is a strength from a scientific point of view since it is possible to challenge each step. A weakness with this approach is that the text has been somewhat repetitive.

The framework might look "too structured", which is a weakness. The underlying structure of the framework is important for understanding how it can be used. Due to its graphical design, it might be seen as providing a view which is too simple. Even though I have tried to explain that the framework is a frame for making descriptions of reality rather than a model of reality, I think this can be misunderstood. By providing a meta-model, I have tried to give guidance on what I believe are relevant levels, but I make no claim to be able to predict courses of events. The processes are not deterministic.

The levels in the framework could be further differentiated. For example, the level of mind can be complemented. The perspective behind the selection of the levels has been according to the context of using work methods in an organization. From other perspectives, other levels than those used may be more relevant.

9.2.2. Challenging the perspective

The information management perspective used as a theoretical lens for this thesis has contributed by emphasizing people, operations and information systems as a whole. This approach is not the general rule in theory development related to project-intensive organizations. The thesis thus provides a perspective that contributes with a partly new view.

I have tried to cover several perspectives by selecting three theoretical areas to understand project result improvement in organizations. I have used three foundations to anchor my reasoning. I have collaborated with a research colleague and with the people in Alpha to explore different interpretations.

Even though I have made these efforts, there are many other perspectives that can go deeper in different areas. For example, cognitive psychology can be used to go further in terms of understanding mental processes related to project work in project-intensive organizations. Computer science could contribute with valuable insights regarding the design of the information systems. Stepping out of this people-operations-information systems view, areas such as organization theory can provide understanding for different types of organizations and the processes in which the organization is changed. Through the collaboration with Göran Nilsson, I have had an opportunity to listen to an alternative perspective related to management control. In marketing, the

challenges of selling and supplying intangible services can provide food for thought. These areas are mentioned since they are traditional theoretical areas. Finer distinctions could of course be made. Contributions from other perspectives add to our understanding of the phenomenon. In the view taken here, two descriptions are better than one, and no claim is made to having said anything final with regards to project-intensive organizations.

The information management perspective has been connected with a more fundamental view on reality on several levels. This in turn has been a perspective, since other formal and material ontologies are possible. The contribution has been to consider several levels, rather than framing reality from either a realist or idealist perspective.

9.2.3. Methodological reflections

The selected method emphasizes a deep understanding of a single case rather than comparison between several cases. If I had several cases, it would be an "inductive" strength. I could argue that the situation in Alpha is not unique. In my research, the developed framework can be evaluated based on support from the empirical material, the theoretical arguments behind it and the philosophical assumptions that have been developed.

The project in Alpha has been a very valuable experience for me. It has been important to be able to balance theoretical ideas with practical experiences. Through my participation, I have gained a more direct access to the improvement process than I think would have been possible through interviews. This has made it possible for me to be relatively free from the "process management" perspective that was the basis for the project. Since I had my own experience of what happened during the case, I did not have to rely only on descriptions provided by respondents. When I describe reality based on my own observations, I have some control of the perspective. When I listen to respondents, I must make assumptions about the perspective held. To some extent, the clinical research approach has let me come closer to the "things themselves" than if I had conducted a case study purely based on interviews.

Using the zigzag theory structure during my work has been challenging because of the abstract reasoning behind it. I have tried to be explicit in what I mean with the zigzag theory structure, and tried to provide a the-

ory chain from the basic assumptions to the framework. I have found the theory structure to be a great support in formulating my thoughts. However, it has taken a long time to structure the material according to the principle, and selecting concepts that could be used. When developing frameworks the rigor provided by a theory structure can be motivated since it provides a fundamental view of a phenomenon.

However, in many cases the use of the zigzag theory structure is probably too time-consuming, even though I guess there is a learning curve to this too. I have found the zigzag theory structure most useful in the basic structure of the framework and in my thoughts regarding learning and acting in work processes. These parts of the framework are probably applicable in many situations due to their fundamental grounding. I have chosen not to go into detail related to the use of different types of artifacts.

The framework development has been inspired by theory and empirical material related to project-intensive organizations. A question is in what situations the framework can be useful. The specific empirical material is based on product development where products are adapted to each customer. Does it work for other types of organizations? The main parts of the framework are related to making a difference. This makes the range of potential application wide. Evaluating and modifying the framework in different contexts is an interesting avenue for further research.

Particularly, I think it is relevant for project-intensive organizations working with system development, business development and industrial construction. The suggestion of this range of application is based on my experiences from coaching real change projects within the MSc Program and Executive Education at SSE, and on consulting work in organizations. Through these experiences, I have had the opportunity to analytically apply the general principles in different settings. One observation I have made is that it is analytically challenging to sort descriptions of organizations on levels of processes, but that it increases clarity. These clarifications have helped the improvement teams to communicate in what way their change will make a difference in results.

One issue that I have realized is important is knowledge about analytical processes involved in using frameworks to support business development. During the writing of this thesis, I have taken many analytical

procedures for granted in regard to the practical work with performing the analyses. For example, I have implicitly thought of using the Y-model (cf. Figure 27) to differentiate between descriptions of the current situation, the intended future situation, the need for change, alternative solutions and action plan. With the current framework, I think that one critical development that needs to be carried out is related to the analytical processes in which it is intended to be used.

The main leverage of a framework is not provided in the framework itself but in the analytical process of mapping it to a specific situation, in order to increase the structure in the chaotic situations we face in business development. If I had included a purpose to describe the intended way of using the framework, this issue would have gotten more attention. The combination of a framework and a suggested method for its use is stronger than only a framework.

While writing the thesis, I have increasingly understood how rich the foundations for answering the research question could be. I have only scratched the surface in this work. One of the main problems has been that the answers in the empirical material, theory and philosophy have not been neatly packaged for my purposes. The problem has been one of selection and I have chosen one of many possible sets.

9.3. Implications and further research

The results presented in this thesis can inspire activities in research, practice and teaching.

9.3.1. Implications for research

The normative literature may seem limited in perspective, providing gross simplifications of a complex reality. Both normative project management and normative process management theory have been heavily criticized in recent years. In my view, the criticism should be reframed. It is not the normative models themselves that are the problem. The theory is not naïve. It is the *epistemology* that is naïve. This may rest with the developer of the theory, but it may also rest with the interpreter of the theory.

If we are aware of the difference between the project method and the project process, the criticism that the method is only shallowly applied,

or that bureaucratic behavior results from the use of the method, is surprising. Why would we assume that the project process would follow the method exactly? Is it not rather with peace that we can make this observation? Work processes are "instancespirations" rather than instantiations of work methods. The particular process is *inspired* by the work method, rather than a direct execution of it. When sub-optimization results from following rules in an organization, why should we blame the rule? Is it not rather the perspective with which the rule is interpreted that should be in the line of fire?

In my view, we can re-use many normative theories if we reframe them as *frames for inspiration* rather than as "objective" descriptions of reality. Even if the theories were developed with a naïve view, they can still be used for inspiration, but based on a more developed epistemology.

With the increased precision provided by the distinction between form and process, we can more easily accept the normative literature as frames for inspiration. This is a difference in framing. The literature is the same, but we can change the way we look at it.

Normative models cannot be descriptions of the actual processes that they inspire. The models are on a higher level of abstraction. From a research perspective, it is interesting to provide new frames for inspiration with regards to project-intensive organizations despite the underlying impossibility of predicting all future processes. The key is to acknowledge the indirect way in which the frame for inspiration influences actions in reality, and the processes of framing, judging, explaining and deciding, in which they are used.

Research within management often has a relatively stronger focus in epistemology than ontology. When studying how to make a difference, the question of what *can* be changed, appears central. This, in my view, requires a discussion also about ontological assumptions.

Within the management literature, there are few discussions about the theory structures that provide the starting points for theory development. This is particularly the case in the project management field. The theory structure is often implicit. The present study suggests extending explicit treatment of theory related to formal and material ontology, as well as epistemology. Such extension provides the explicit bases that the domain-specific theory is built on.

9.3.2. Implications for practice

The PRIO framework is intended as an analytical tool that can be used to support project result improvement in organizations. This has been described in chapter eight and in the conclusions. In these implications, I would like to highlight two additional aspects. The first is related to the use of frames for inspiration and the second is related to levels of performance based on the PRIO framework.

With the view provided in this thesis, routines, guidelines and methods should be seen as frames for inspiration, which require judgment to apply in the specific case. Forcing people to follow methods may render an image of control. However, what is the cost of this machine-bureaucracy in terms of opportunity costs for losing valuable freedom of action?

I think that something radical is required here; something that I have great respect for. People who come in contact with rules, guidelines, methods, process descriptions, job descriptions or other forms of abstractions of work processes, must have knowledge about epistemology – about the relationship between the knowledge represented in the method, and the reality the method is thought to be an abstraction of.

Why is this difficult? This question is called for. Is it not obvious that the map is not the territory and the method not the project process? Is it not obvious that the method cannot "know" what is important in the specific situation? Is this discussion really a storm in a tea cup? It is of course true that I am foregrounding this issue to make a point. We make reasonable use of models in our work most of the time. I think that the core of the problem is this: when an example of "unreasonable" method use is given, it is easy to see the error in logical typing, that the project method is not the project process; but to be able to use the insight in daily work, we must know not only the example, but also the principle that describes the relationship between method and project process. For me, this is an epistemological question. It is a question of how we understand the relationship between method and reality.

Specifically related to the framework developed in this thesis, we can ask what knowledge is needed in order to use the PRIO framework. This can be seen as a ladder of increasing precision. On a first level, the analogy with the *map and the territory*, specified as the difference between the project method and the project process, could be used. A second level could be to frame the project method as a *frame for inspiration*.

This emphasizes that persons have an important role, since it is they who are inspired. Third, the idea of *perspective understanding* could be used to highlight the processes of framing and judging involved in the application of the project method to the specific circumstances in the project, that is, when forming combined projections.

It has been emphasized that management control can be related to several different perspectives (Kaplan & Norton, 1992, 1996; Samuelson, 2000). With the view provided here, a balance can also be made with regards to levels of process performance. These have similarities to the perspectives in the balanced scorecard, but have been developed based on different theoretical foundations. To support discussions about project result improvement in project-intensive organization, a summary of levels of performance is provided in Figure 72. Operative project performance is highlighted in the figure since the focus of the PRIO framework is on operative project results.

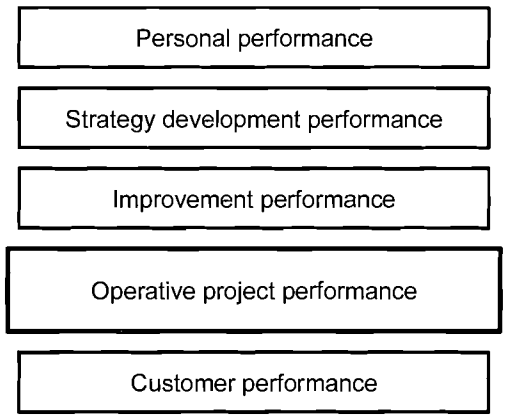

Figure 72. Five levels of performance based on the PRIO framework.

Using the PRIO framework, the analysis can be made with an increasing level of detail. Each level of performance can be analyzed from different perspectives, such as financial perspective, lead times, growth, quality, etc.

9.3.3. Implications for teaching

During the writing of this thesis, I have sometimes reflected on my time as a student. I have learned a great number of models during my stud-

ies, but interestingly I have not come across many situations in which the relationship between model and reality has been discussed.

Bateson wrote, "break the pattern which connects the items of learning and you necessarily destroy all quality"; and further asked "why do schools teach almost nothing of the pattern which connects?" (Bateson, 1979, p. 7). What Bateson refers to as the pattern which connects can be discussed, and many interpretations are possible regarding this abstract statement. One interpretation is that the pattern which connects is related to the basic assumptions we make about how the world is put together. What are the principles on which our theory is based? We see the importance of this in formal ontology, which regulates all possible modification of theory. I have tried to show that the theory structure used influences both how the relationship between model and reality is understood and how different parts of reality are understood to be related.

Bateson argued for including a view of something like cybernetics as a complement to the traditional materialist explanations related to force, energy, etc, when the phenomenon studied was a part of *creatura*. Much can be gained by giving examples of systems with feedback, but I also believe that describing the principle is important. At what stage of university education does such a principle provide most leverage? If introduced early, the principle can be used during the education. If introduced later, the examples of models that have been presented can be viewed from a new perspective. The principle and the examples complement each other. The zigzag principle can be used as a tool for supporting critical thinking. Whenever an "influence" is drawn as an arrow in a model (as they often are), the student can ask about if there is a feedback process in which the "influence" is regulated.

9.3.4. Suggestions for further research

The empirical material for the PRIO framework has been in a context of product development. Inspiration can be sought in contingency theory, to provide approaches which differentiate the framework so that it can be more specifically used in different situations. High-level types could be created to support further development. One avenue for exploration could be to test and develop the framework in regard to different industries, or different types of industries.

Testing the framework in different organizations could provide several advantages. The communicative aspects of the framework could be evaluated. The practical usefulness could be tested. This would likely lead to insights about requirements of methods for analysis using frameworks. What analytical procedures could complement the framework to make it easy to apply? A "mini-PRIO" could be developed, highlighting key issues and suggesting work methods for business development projects using the PRIO framework.

It is also possible to provide classifications of different types of operative preconditions, improvement preconditions and strategy development preconditions. Such classifications can, for example, make it possible to describe different types of project methods or improvement methods in more detail. This type of development can contribute to provide a "smörgåsbord" of options that are available on each level.

Further work needs to be done regarding the relationship between methods and reality. Several alternative approaches need to be developed so that the basis on which the theory is created can be compared and challenged. An interesting area for further research is to describe in more detail the process of how frames for inspiration are used. Such descriptions are relevant in order to develop knowledge about judgment in project work. Ideas from hermeneutics and phenomenology can be further explored (cf. Gadamer, 1989; Husserl, 1900; Heidegger, 1962).

Bateson has provided a reasonably focused principle that I have tried to explicate and apply. The ideas provided by Bateson are more concrete than what can be found in more general philosophy. One of the reasons may be that Bateson not only spoke about epistemology, but tried to relate it to the natural world and provide models for specific situations. However, there is a wealth of knowledge in philosophical literature to draw on. A great task is to be found in comparing different approaches. The core of the zigzag theory structure has been based on the work of Bateson, even though several sources have been used. Due to the abstract reasoning involved, comparison between approaches is difficult and time consuming. Comparisons could make it easier to relate the approaches to each other, and thus help researchers with suggestions about literature which deals with similar principles.

The complexity of this task is connected with the theory chain from formal ontology to specific models. It is thus not only a philosophical

problem, best left to philosophers. The challenge is to create theory chains that link the formal ontology, material ontology and epistemology to the domain-specific theory we develop. By establishing such chains, the weak links in the chain can be discussed, rather than just the model artifact, or only the philosophical foundations. This requires both philosophical knowledge, and knowledge about the domain in focus, or the phenomenon that the theory is directed towards.

10. EPILOGUE – SO WHAT?

In this final part of the thesis, I will present the conclusions in an alternative form, as a complement to the previous chapter. In the following dialog, three main themes are discussed: orders of change, change processes and connecting patterns.

Making a difference with orders of change

Reader: OK, so you have presented the PRIO framework, and it has been quite interesting, even though it has been a bit abstract for my taste. But so what? What is the point of the PRIO framework? How will it help me?

Martin: The PRIO framework is about making a difference. Specifically, it is about making a difference in project results. The question behind the framework is: how can project results in project-intensive organizations be improved.

Reader: Yes, I remember, but what is the answer, that's what I am interested in.

Martin: The answer is that if you want to make a difference in the operative project results carried out in an organization, you can make three types of changes: first order changes, second order changes and third order changes.

Reader: Could you run the definitions again?

Martin: Sure. The difference we are focusing on here is a difference in the operative project results. This is not primarily an issue of a specific project. The difference is related to a comparison between projects of the same type, for example product development projects. We are interested in a pattern in the project results, and in making a difference in this pattern.

Reader: So if the product development projects often take twice as long as we would like, that would be a pattern?

Martin: Exactly, and we might be interested in reducing the time it takes to carry out the projects. That is, the difference we might want to achieve could be a difference in lead time.

Reader: OK, but what about the orders of change?

Martin: First order change refers to a change in the *operative project process* itself. Learning to use an existing project method for integrated product development is an example of such a change.

Reader: Yes, I got that. And the difference resulting from understanding the method could be a difference in lead time for the type of projects we are focusing on?

Martin: Exactly. For example, the method may suggest how we can secure resources we will need later in the project. A second order change leads to a difference in the preconditions for the project processes.

Reader: I think that is fuzzy. If I learn to use a project method, my experience in using the method becomes a part of the preconditions for the next project – so first order change also results in a difference in the preconditions for the project processes.

Martin: Yes, that is true. However, the difference in preconditions is an example of *more of the same*. The difference in preconditions is that you know the existing method better. What I mean with a second order change is when the change leads to *something else* than what already existed in the preconditions. That is, there is a discontinuity in the change, rather than doing more of the same.

Reader: Like changing the project method?

Martin: Yes. And changing the project method is not a part of the product development work. If I were to describe when you are working with changing the product development method, I would say that you are not working with product development.

Reader: Because I am not developing products?

Martin: Exactly. But your work is *about* developing products. It is on a higher level of abstraction. Instead, I would say that you are working with improvements *of* product development work, or more specifically, with improvements of the *preconditions* for product development work. The term used for these processes is *improvement processes*.

Reader: So if I cannot achieve the difference in operative project results that I am interested in with more of the same, I can work with improvements of the preconditions? I can carry out second order changes?

Martin: Yes. And a third order change refers to changes that result in differences in the improvement preconditions.

Reader: I think that is pretty abstract. Isn't that really just a fancy theoretical construction?

Martin: Well, look at it like this. Have you experienced a situation where there were lots of second order changes carried out, but where the changes did not really make the intended difference in operative project results?

Reader: Well, I have experienced a few organizational changes that did not really make a difference. And of course, our quality documentation that was introduced was not really used. And then there is the new system for customer relationship management that nobody uses....

Martin: OK...So there are examples when something else is done, where a second order difference is created, like the new computer system. And why do you suppose it did not make any difference in project results? What was the problem?

Reader: Well, the computer people installed the system, but we never really understood what it should be used for.

Martin: And what do you think should be changed in order for the computer system to be used as intended?

Reader: Oh, I see what you are getting at. They should change the method they use to introduce new systems. A change *of the change* of preconditions.

Martin: And that is exactly the point with third order changes. Whenever you have situations where improvements do not seem to lead to the differences you want, you can think about the way in which the improvements are carried out. Maybe you need to change the improvement preconditions. And the improvement preconditions are established based on strategy. This is why changes of the improvement preconditions are referred to as *strategy development processes.*

Reader: So strategy development processes control the direction of improvements.

Martin: Yes, the general direction is developed. And there is a discontinuity between developing the general direction, and the improvement processes needed to change the direction. Developing the general direction is *about* what improvements to carry out.

Reader: So the third order change, the execution of a strategy development process, might lead to a difference in improvement preconditions, which influence improvement processes?

Martin: Yes, and the improvement processes result in differences in the operative preconditions.

Reader: Which influence the operative project processes, hopefully making the sort of difference we would like in the operative project results. I see the point of that. It actually seems to be a rather common problem.

Martin: Yes. Indeed.

Reader: But I see a problem here. If I perform a strategy development process which results in an agreement to take a new direction, how do I know that it will lead to an actual difference in project results?

Martin: You need to make sure that improvement preconditions are established, so that the required improvement processes can be carried out.

Reader: But even if I do, I am not sure that it will influence project results.

Martin: You need to make sure that the improvements really establish the required operative preconditions.

Reader: But even if I do, there is no guarantee that the preconditions influence project results.

Martin: You need to make sure that the operative preconditions are used in a reasonable way.

Reader: It seems very difficult to keep on the road.

Martin: Being aware of the levels and how they are related is one way of increasing the chance of succeeding. Each level, and the relationships between them, must be cared for if you want to improve project results.

Making a difference through change processes

Reader: Well, OK. There are the levels of processes and orders of change that we can use to make differences in the operative project results, but I still think it is a little abstract. I mean the difficult thing is *what to change.* The orders of change do not really help me with that.

Martin: True. The short answer is that to make a real difference, you must change things that exist.

Reader: Now we are in deep water.

Martin: Yes, and we ultimately cannot know what exists, which makes the whole matter even more difficult. We cannot access reality directly. We must make assumptions about reality.

Reader: But you have a suggestion.

Martin: Yes. In my view there are three levels of reality that we analytically can distinguish between: mind, organic nature and inorganic nature. When we talk about project result improvement, the levels mind, body and artifact are more concrete. These categories are based on the fundamental levels.

Reader: So basically, you say that I can change the mind, body and artifact levels.

Martin: Yes, with some inherent limitations, and you can get differences on each level.

Reader: Is that all? What about things like work practices, traditions and culture? Can I change culture?

Martin: If we define culture as patterns of behaviour, the answer is no. You cannot *change* culture, but you can make a *difference* in culture.

Reader: What's the difference?

Martin: If you want to "change" culture, you must "change" individual minds. You cannot change culture directly. If changes on the mind level are effective, you will perhaps see a *difference* in culture, or work practices. That is, you can observe a difference in patterns of behaviour.

Reader: Talk about splitting hairs! That's a change in culture.

Martin: But the "change" in culture you refer to is the result of the change of the particular actions of the individual persons, and *we* did not *change* the actions of the persons. We only influenced their minds.

Reader: Well, OK, it's not a direct change even though I think it is almost the same. What you are implicitly saying is that if I want to change culture directly I have to follow each person and make sure he or she acts in my new way all the time. Then *I* could *change* the pattern in their behaviour.

Martin: Yes. But that is not so practical. You would have to make the difference yourself the whole time. You would get more leverage from your efforts if you could influence their minds so that they made the difference themselves.

Reader: I get the point. Changes that lead to differences on the mind level can lead to differences in patterns of actions.

Martin: Which can give us what we want.

Reader: A difference in project results.

Martin: Yes. But there is a catch.

Reader: I thought you would say that. There is no way to influence mind *directly*.

Martin: Exactly. So what can you do?

Reader: Well, I guess we could make changes that lead to differences on the artifact level, like introducing a documented method. But the problem in my organization was that new methods made no difference in the operative project results. It didn't work.

Martin: The thing is that introducing a documented method is only a difference in operative artifact preconditions. The trick to making a difference in operative project results is to influence the *process*, what actually goes on. And if you have people involved, there is no way to do that except by influencing the mind level.

Reader: If influencing mind is central for improving project results, the PRIO framework should have some answer to how this can that be done. We talked about how methods could be used, but what is the link between the documented method and the actual results?

Martin: I agree, we must address this question, and talking about methods provides an interesting example. We indicated as a fundamental limitation that we can have no direct knowledge about reality.

Reader: Sure. The information I have about reality is based on my interpretation. The map is not the territory and the name is not the thing named. I got the coconut part. What then?

Martin: There are four levels of processes involved when you get information about reality. We have perceiving and interpreting, as you indicated. But we also have explaining and framing.

Reader: Yes. I can use different perspectives to understand the same situation.

Martin: And depending on what perspectives you select in processes of framing, you make use of different concepts and structures in your interpretation.

Reader: The knowledge level. Sure. I can use different general models to understand a phenomenon.

Martin: And the knowledge you use to guide your interpretation influences what information is the result. This process of calibrating knowledge and information is called explanation.

Reader: And where does the method come in?

Martin: I would describe the method as a specific type of artifact – represented information. What you and I now refer to as represented information is available to other persons only as data. The represented information is a part of reality and the persons we want to communicate with cannot have direct knowledge of reality.

Reader: So represented information for us is data for them.

Martin: Yes. They can perceive this data in reality as capta in their sensory organs and make interpretations of the capta, forming information in their minds. When they first look at it, they might not be sure what it is.

Reader: And we have these calibrating processes in which it is framed from different perspectives, selecting knowledge to explain what we see.

Martin: Exactly. And when a person reads the document and looks at the graphs describing the phases suggested in the method, he or she

starts to understand the information. That person realizes that it is not a description of a *specific* project. The method describes a *pattern* in project execution.

Reader: And pattern belongs to the knowledge level.

Martin: At least if it provides meaningful explanation. So, if you remember information about specific projects carried out, you can map these descriptions onto the method, and see if you think the method is meaningful.

Reader: But what about perspective?

Martin: Well, the question is from what perspective you found the explanation to be meaningful.

Reader: You mean why it is a relevant pattern?

Martin: Something like that. So the method is an example of something more fundamental.

Reader: But what?

Martin: What do you think? Why are methods meaningful to you?

Reader: Because they tell me what to do. If I follow the best method, I will get the best result.

Martin: So methods are meaningful because they provide a "best way".

Reader: Yes.

Martin: OK. Let's say that. So in your mind, the project method was framed from, hmm, let us call it an "optimal work" perspective. The specific project method was an example of a "best way". When you frame a situation from an optimal work perspective, you can compare the best way suggested in the method with what happens in the particular projects.

Reader: And I can *explain* what they do wrong!

Martin: I suppose you could. But our question was how we could achieve a difference in operative project results using project methods.

Reader: And what is the answer?

Martin: One possible answer is that we can sort the project method on the knowledge level in our mind, framed from an optimal work per-

spective. We can then take an optimal work perspective, and use our knowledge about the "best way" of carrying out projects. We can then follow this best way in our work. We perform all the steps in the method, making sure that we miss nothing.

Reader: It sounded good before, but I am starting to suspect that there is a catch.

Martin: And what is it?

Reader: Well, the project method deals with the general case.

Martin: And what is the problem with that?

Reader: The project method does not "know" what is important in the particular project process.

Martin: Exactly.

Reader: So the method is wrong?

Martin: I wouldn't put it like that. It is just of a higher logical type. And transferring logic from one level to another is risky.

Reader: But if I cannot trust the method, what can I trust?

Martin: Well, before we go there, let's think about the problem. Let's go back to the perspective we used to understand the method.

Reader: We framed it from an optimal work perspective. It was the best way. Oh, I see – the problem is in the *framing* of the project method.

Martin: Go on.

Reader: If we confuse the project method with the project process, it will lead to a mechanical execution, where we do not consider the particulars of the project process.

Martin: For example what the customers really want.

Reader: Yes. And this is why project methods should be *seen* as frames for inspiration. I get that now. I can use different frames for inspiration, depending on the situation.

Martin: Like a smörgåsbord. And the richer the smörgåsbord, the more alternatives you have.

Reader: But that is a problem. How do I know what part of the smörgåsbord to use?

Martin: That has to do with judging and deciding, and there is no general answer.

Reader: So judging from different perspectives, I can select what frames for inspiration to use.

Martin: Yes, and that will help you to find arguments for deciding on what to do.

Reader: So I have to trust my judgment?

Martin: And the good part is that the more perspectives you can see, the better the preconditions for judging become. By being aware of different perspectives, you can consciously judge from the different perspectives as a basis for your decisions.

Reader: You mean that if I am not aware of them, my arguments are automatic, without reflection.

Martin: At least without conscious reflection.

Reader: I am not sure about this. I mean this framing and judging seems to be pretty implicit in what we do.

Martin: Yes. Many times these processes are carried out almost automatically. Some people would say that you use your experience, intuition, or that you use "tacit knowledge".

Reader: But you don't like that?

Martin: Well. Look at it like this. When you get lots of experience of something, you can use your experience to solve the problems that you have experience of.

Reader: Sure.

Martin: But how is that possible? The next assignment may not be exactly the same as the previous. What is guiding you to use your experience?

Reader: OK, I identify patterns in my experiences and use these as frames for inspiration.

Martin: Exactly. And pattern is not the same thing as your experience of a particular case.

Reader: The difference between knowledge and information.

Martin: Yes. But how do you know what knowledge to make use of in a particular case?

Reader: I just know. That's the point with my experience.

Martin: So experience involves not only information about past work, and patterns in past work, but also the selection of what patterns to use?

Reader: Well, I think you are twisting it, but go on.

Martin: So would you say that when you use your experience, or your intuition, or your "tacit knowledge" all three levels are involved? Each case involves information, knowledge and perspective, even though the actual use might be unconscious.

Reader: I guess. But what is the point of this discussion? It sounds awfully academic. We are splitting hairs again. So what?

Martin: OK. What we want is to make a difference in operative project results.

Reader: Yes. That's what I am interested in.

Martin: And we have said that we only can change things that exist.

Reader: Sure. What else could we do?

Martin: And we have said that we cannot change mind directly.

Reader: Taken.

Martin: But we have said that we must influence mind to get what we want.

Reader: Basic.

Martin: But then, what is it that exists in mind, that we can influence, that will make a difference in project results?

Reader: And if I said intuition you would not agree.

Martin: Well, how do you influence intuition? Let's use the zigzag theory structure to increase the precision in our analysis. Does intuition refer to form or process?

Reader: I guess both.

Martin: So intuition is a term that refers to something that a person "has", but also something that a person uses, or shows in a mental process.

Reader: And *we* cannot *change* the mental process.

Martin: For two reasons. First, we do not have access to other people's mental processes, and second, it would be awfully time-consuming to change every mental process even if we could. So the difference we are after in the first round must be a difference of form.

Reader: So we want to influence the form, which controls the process of intuition?

Martin: And that form has to do with the selection of what pattern to use in the particular case.

Reader: Which is about framing and judging from different perspectives, and making use of knowledge.

Martin: Yes. By influencing what perspectives, knowledge and information a person is aware of, we can get a difference in judging and deciding, or what we called experience, intuition, or tacit knowledge.

Reader: Perspectives seem to be quite influential.

Martin: Yes. Perspectives are influential since they influence the knowledge that is used in decisions. And decisions are important for results.

Reader: I think you are taking a shortcut here. You are talking as if we actually could change mind.

Martin: Yes, we were talking as if we were inside other persons' minds. So what *can* we change?

Reader: Well, that is the problem. Since it is in the person's mind, we cannot change it directly.

Martin: But we can use our body to communicate with the person, and we can use artifacts, such as documented methods. We exist in reality, so we can provide "data" to other persons.

Reader: So we can carry out change processes using body and artifacts in order to try to make a difference in people's minds.

Martin: Exactly. And what is the difference in people's minds we are after?

Reader: Let's start with an easy one. I would like my team members to more easily find the project documents.

Martin: OK. And you mean more than one document, so it is not possible to just inform them about the location of each document.

Reader: No. I want them to know the pattern. I want them to have knowledge of the pattern we use to store documents. What type of document goes where.

Martin: So communicating the document structure could make the difference, if the team members sorted it as knowledge and used it as inspiration in their work.

Reader: And the inspiration has to be provided in such a way that the "data" we provide makes it through the processes of perception and interpretation and then does not "get stuck" on the information level. It has to go on the knowledge level in the mind of the person.

Martin: Yes, and this is not so easy. People are picky with what to sort on the knowledge level. Not all patterns are meaningful to a person. It is much easier to succeed if the person sees the knowledge as an expression of a perspective that is important to the person. If that is not possible, you must help the person to reframe.

Reader: What do you mean?

Martin: From what perspective is it important to store the documents in a structured way?

Reader: Well, sometimes we send the wrong document to the customer since the right one was stored in the wrong place. Also, it saves time since we do not have to search for the documents.

Martin: So it is important from a quality and efficiency perspective. If you can help the persons reframe document storage from being a boring routine to something which is important for them, it might be easier to make a difference.

Reader: Well, OK, but we have bigger problems. The people in R&D make all sorts of fancy designs, but the products are impossible to produce.

Martin: Perhaps we here want to make a difference in the *selection* of the patterns to use as frames for inspiration in the particular projects. We

might want to influence the processes of judging and deciding so that people, to a greater extent, consider the production perspective. And we cannot change the process of framing each time.

Reader: Clearly impossible.

Martin: But if we could make a difference in what perspectives the persons are aware of, could that get us what we want? For example, we could discuss what different perspectives are important in product development – what types of knowledge are relevant.

Reader: Well, if a person could frame from different perspectives, these perspectives could be used in processes of judging, which would provide arguments from different perspectives, for example a production perspective. And this could of course provide arguments that could influence decision processes.

Martin: And the person could combine arguments for production preparation with information about the specific project process carried out.

Reader: And this could influence the projection that guides the person's actions.

Martin: Exactly. So if the persons identified the production perspective as important, and had knowledge about production preparation, this could lead to a difference in how easy it would be to produce the products.

Reader: Yes. But *we* did not make the change. The person made the change. It was the person who sorted out the different perspectives.

Martin: We perhaps provided inspiration to that person, who made use of it in his or her own way. We cannot *make* people learn. We can provide data, that's all. We can provide inspiration, but we cannot do the learning, and we certainly cannot do the doing.

Reader: What do you mean?

Martin: Between what we can provide, data, and the actions of the person, there are several discontinuities. And on each level, the process is uncertain. There are *multiple calibrations on multiple levels.*

Reader: So our change led to a difference in represented information, or data, and the next change was then related to a mental process in the

mind of the person, leading to a difference in identified perspectives, and in additional knowledge. Our actions provided data, which was a basis for a process of learning.

Martin: Yes, and instead of knowledge in the form of a pattern, a pattern of patterns was identified as a new perspective.

Reader: So this process of learning was a change of patterns of patterns.

Martin: Third order learning.

Reader: I see. First order learning is learning information.

Martin: *Refers* to.

Reader: Whatever. And second order learning *refers* to recognizing explanatory patterns.

Martin: Exactly, forming knowledge.

Reader: And third order learning refers to recognizing patterns in explanatory patterns.

Martin: Yes. New perspectives.

Reader: So this is what we can aim at?

Martin: In order to get what we want, a difference in operative project results, we can use our body and artifacts in processes of change to provide differences in represented information, or data. We can *try* to influence the minds of persons. The changes we make can be aimed at three sorts of differences: differences on the information level, differences on the knowledge level and differences on the perspective level.

Reader: OK. And depending on what we want to achieve, we may want to address different levels.

Martin: Yes. If you want to make a difference in a specific type of decision process, you can provide knowledge. The person can then use the arguments from the knowledge in their decisions. But if you want to make a difference in the processes of selecting different types of arguments, you need to provide new perspectives.

Reader: So improving judgment cannot be done by providing more of the same knowledge?

Martin: True. The important part for project results is the whole of the three levels. Information is needed to build up knowledge, and knowledge is required to build up patterns in knowledge, or perspectives.

Reader: But actually I think all this is a bit fuzzy. I mean if I am the manager, I want to control the business. I would not want people to use any "frames for inspiration" as you say.

Martin: You have a good point. And what is the solution?

Reader: Well, obviously, there are different sorts.

Martin: Sorts of what?

Reader: Well, we have frames for inspiration, like you say. But then we have guidelines, which are a little more controlling. And then we have rules, which are really strict. And laws of course, which is, well, the law.

Martin: And what is the difference between them?

Reader: Well, it is...

Martin: Would you say that they are different expressions of patterns.

Reader: Well, yes, because they all deal with the general case.

Martin: But the difference is on a higher level.

Reader: Yes, the difference is in my *view* on the relationship between the general pattern and the specific case. The frame for inspiration is...well...more loosely related to the specific case than the rules. You should actually *follow* the rules.

Martin: But there is still a difference between the rule and what you actually do. The rule is an abstraction, or the general case, and you have to do something specific.

Reader: I guess. And there can be exceptions to the rule, when it is not reasonable to use it.

Martin: So you want people to use their judgment even when there is a rule.

Reader: Yes. A little.

Martin: Otherwise you risk using a specific pattern as a dogmatic frame in a mechanical decision process, like the true bureaucrat.

Reader: Well, when we put it like that it does not sound so good to follow methods.

Martin: The word "follow" downplays the difference between the method and the project process. A method provides inspiration to me, but I have to judge and decide on if and how to make use of the method in a particular case, and the same applies to rules.

Reader: But what if I really want the rule to be followed?

Martin: No rule, no matter how exact it is, says anything about the particular case. There is a *discontinuity* between the rule and what you actually do.

Reader: But I am not sure I like this. You say nothing about what differences we *should* make. That is like saying nothing.

Martin: The question is what differences you *want* to make, and I do not know that.

Reader: But what about goals?

Martin: What about them? Whose goals do you refer to?

Reader: Well, I mean the goals of the organization, for example to cut lead times in product development.

Martin: The organization is an abstraction. We only have the levels of mind, body and artifact. You could have information about goals in mind, or you could have goals represented as information on the artifact level.

Reader: Oh, I forgot. I mean the goals in the minds of the persons. How does the goal of reducing lead time by 50% relate to actions?

Martin: If we conducted a strategy development process and decided to reduce lead time by 50%, this would influence the improvement preconditions, and we would carry out the improvements we think would be required to reach the goal.

Reader: Like training, work method development and information systems implementation.

Martin: For example. And the improvements would lead to differences in operative preconditions.

Reader: And we would probably be careful to try to influence the mind level, so that people would know about the goal of reducing lead time.

Martin: Clearly a good idea.

Reader: But where would the goal go in mind?

Martin: Let's try to put it on the information level first, metaphorically.

Reader: OK. People could compare information about the lead time goal, for example one year, with the projections they make about the lead time in their specific project.

Martin: So it would influence the development of the specific project plan.

Reader: Yes, but it is odd though. The lead time of one year might not be suitable in that project.

Martin: You are right. It's the difference between the general and the specific again. The goal is set for the class of projects, but the project plan is developed for a member of the class, and we should be careful in transferring logic from the class to the individual members.

Reader: But the goal can provide inspiration?

Martin: Yes.

Reader: And it can guide the persons' selection of what patterns to use in their actions.

Martin: Yes. For example to make use of methods for concurrent engineering to complete the specific project as quickly as possible.

Reader: So the goal is a perspective?

Martin: If you use the goal to select what patterns to use in your actions, I would describe it as belonging to perspective.

Reader: And the patterns would be general ideas about what is important to finish projects quickly?

Martin: Yes. These patterns could be sorted under the lead time perspective.

Reader: And there may be many goals.

Martin: Yes. Sometimes contradictory.

Reader: So it is a balance between perspectives.

Martin: You have to decide.

Reader: So it is about framing and judging again?

Martin: If you want to make a difference in project results, you must influence processes in individual minds. This is the difference which will make a difference.

Understanding the pattern which connects the change and the difference

Reader: But in this discussion, it seems as if we have come back to some basic messages.

Martin: On a basic level, the message is that improving project results is a personal endeavour. The first question is then what difference you want to make.

Reader: That's actually a quite tricky question.

Martin: I agree, but it is a good place to start. And then we have the second question, which is about what order of change is required to make the difference you want.

Readers: And this is where the orders of change can be used to structure the analysis.

Martin: Exactly, and further, we have a question of what *can* be changed. And the deeper question of what *exists* then becomes quite important.

Reader: But what you said about things that exist, the mind, body and artifact levels – they do not really exist, do they?

Martin: No. Of course not. The analytical distinctions between mind, body and artifact provide one possibility. What is important is the question. What do *you* think exists? What do *you* think you can change?

Reader: And the explication of what I believe exists are important, even if I cannot ever know what *actually* exists.

Martin: Exactly. And a place to start is with the things you *think* you can change, and if it doesn't work, you can always change your assumptions. Develop your ontology.

Reader: But there are so many things that can be changed. It could be a very long list.

Martin: Yes, so it might be fruitful to make a list of *types* of things you can change.

Reader: You mean levels such as mind, body, represented information, information systems, and so on?

Martin: Well, you might have other terms. For practical purposes the list should not be too short and not too long. But let's go on. The next central question is how the change leads to the difference you want to make in the specific case. In what way will the change make the difference?

Reader: That's an important part!

Martin: But there is a more fundamental question.

Reader: The one about the assumed structure of reality?

Martin: Yes. In order to guide your changes, you need some idea about what characterizes the way in which the change will make a difference. That is the question that must be answered if you want to understand how you can make a difference. Onto what sort of surface can a theory of project result improvement be mapped?

Reader: And you use the zigzag theory structure.

Martin: In the PRIO framework I do. And the zigzag theory structure, with its many levels of form and process, provides quite a challenge for people who want to improve project results. The pattern connecting the change and the difference goes through several discontinuities, and on each level the process is uncertain.

Reader: What you describe using the zigzag theory structure seems to be different from models of cause and effect, but still you talk about change and difference. This seems to be a contradiction.

Martin: It depends on what you mean by cause and effect. There are several questions intertwined here. Let's break it down. Are cause and effect examples of form or process?

Reader: Form. The cause is what is causing, and the effect is the result.

Martin: And where is the process? What happens in between?

Reader: Well...

Martin: There is a difference in the type of relationship in the "chain of causation". In the causal theory, the effect is *the* result, but in an explanation based on cybernetic calibration, like the zigzag theory structure, what "leads to" effect is restriction.

Reader: What do you mean?

Martin: The particular effect is only one of many *possible* effects, depending on how the restrictions are applied in the particular case. And there are several levels of restrictions, each calibrating a larger context.

Reader: Can you give an example?

Martin: Well, my interpretation of a situation is restricted by the concepts, or knowledge I have available. My perception does not linearly "cause" my interpretation. The concepts I evaluate for use in my interpretation are restricted by the perspectives I take. The process of framing does not linearly "cause" my use of specific knowledge in my explanation.

Reader: So linear causality achieves the effect in "one go", but in the zigzag theory structure there is a calibration in multiple steps.

Martin: Exactly. There is a certain flexibility and freedom in processes in the world of the living, which in my view makes the *causal* theory structure less appealing than the theory structure of *calibration on multiple levels*. There is a difference in the assumption about the characteristics of the process involved in the linking of the "cause" and "effect" and between the change and the difference.

Reader: That seems to be a rather fundamental difference.

Martin: Yes, and in addition to this difference is the question of feedback. In a system with feedback, what is seen as "cause" and what is seen as "effect" is relative. For example, in a project-intensive organization we can describe both improvement processes and operative project processes.

Reader: Sure. And improvement processes lead to improved results in the operative project processes. That's your point, right?

Martin: But why are the improvements carried out?

Reader: Because the results have been bad.

Martin: So the operative project results lead to the improvements?

Reader: Well, the influence does seem to go in both directions.

Martin: And this is why we have used the term *calibration*. The improvement processes and operative project processes are calibrated to each other, rather than one causing the other. This is why the PRIO framework is built up by "tuning forks". But let's go on with another

type of difference between traditional causality and the zigzag theory structure as described here. Are causes and effects real?

Reader: What do you mean?

Martin: When one billiard ball hits another, does the first billiard ball actually cause the other one to move?

Reader: Well, it sure looks that way, but I know this is a trick question!

Martin: And what is the trick?

Reader: Well, since I cannot access reality directly, the causes and effects I identify must be my descriptions of reality.

Martin: Cause and effect when used carelessly describe "real" causes and "real" effects. We have made a leap to a higher level, where we always think in terms of *description* of cause, *description* of process and *description* of effect.

Reader: Yes, I know you like to add description as a sort of prefix everywhere, but is it really necessary? The billiard ball is still hard – and it will break the window if I throw it hard enough. That is cause and effect!

Martin: Let us practice some reframing. Let's think of a phenomenon, like the billiard balls again.

Reader: OK, I see the two billiard balls, one approaching the other.

Martin: Now, let us take out two metaphorical boxes. One is labelled phenomenon, and one is labelled description.

Reader: OK. And where do the billiard balls go?

Martin: Let us first place the billiard balls in the box labelled "phenomenon". The phenomenon is what we study.

Reader: OK. The billiard balls are in my phenomenon-box.

Martin: What we have to do now, is to look at the billiard balls, and realize that *the billiard balls do not go into the phenomenon box*. What you have put in the phenomenon box is your description of the phenomenon, not the phenomenon itself.

Reader: Because what I did was in my mind.

Martin: Exactly. Always in your mind. We have no direct access to phenomenon. So we have to move the *name* of our billiard balls from the phenomenon box to the description box. And then we close the lid on the phenomenon box, and never open it again. We can never know what is *actually* inside the phenomenon box.

Reader: OK, but what did we put in the phenomenon box?

Martin: What goes into the box is everything about the phenomenon except the names you use to refer to it. No names of the phenomenon make it into the box. We must put forms, shapes and names in the description box.

Reader: OK, so all causes and effects we can be aware of are our descriptions of causes and effects, and these do not have a direct link to phenomena. All I have is my description of how the two billiard balls move, and my description is not what is described. So I don't know what *really* happened.

Martin: Yes. We move the anchor point from reality to *descriptions of* reality. We are on a higher level of abstraction than how we usually see "cause and effect". The causal explanation exists in mind.

Reader: But what is the point with that?

Martin: Well, if we say that all knowledge about reality is indirect, we have already said that the anchor point cannot be reality itself. The point, as you say, is one of consistency.

Reader: I guess. So "causality" exists only in mind, as an assumption about the phenomenon.

Martin: Yes. We can take a causal perspective. When we frame the situation from a causal perspective, we make use of a causal structure in our explanation of our *description* of the phenomenon we are trying to explain.

Reader: So the causal perspective is wrong?

Martin: No. It is not "wrong". It just doesn't say anything about reality. It is not "right".

Reader: Now I do not follow. If it is not right, then it must be wrong!

Martin: Well, the question is if we can find alternative explanations. If we can, they are not right or wrong, but rather complement each other.

Reader: So it is a matter of what structure we choose for our explanation?

Martin: That is precisely the question. What is the pattern which connects? What is the structure of the theory which you think can explain differences in project results?

Reader: Well, it is good to be able to choose. The selection of this structure does seem to have consequences for how we understand project result improvement.

Martin: But let's go on with differences between the causal explanation and the calibrating zigzag theory structure. Are your descriptions of causes and effects examples of the general case or a specific case?

Reader: Well, it depends. Sometimes I want to explain a particular case, and sometimes I want to explain that something in general causes an effect in general.

Martin: And what have we said about the difference between the general case and the particular case?

Reader: They should not be mixed without careful consideration. So we should be careful to say that the cause and effect that we identify in the particular case holds in the general case, and vice versa.

Martin: Exactly. Because in the particular case, you can describe the process in which the "cause" *leads to* the "effect".

Reader: But that is an example of a specific process. We can never be sure that the next process is exactly the same!

Martin: We can map our descriptions of reality onto the model of cause and effect that we have specified. We did that in the example of the improvement processes leading to improved project results, but this model is tautological – it contains no information about reality.

Reader: Yes...

Martin: If there is no description of the process in which the cause causes the effect, there is no basis for saying that the relationship is "causal". All we have is correlation in our description.

Reader: That is interesting. The causal structure is often used to "explain" the general case.

Martin: Which it doesn't. At least not in the world of the living. The processes of evolution and learning are in my view partly stochastic, and so is acting. The processes cannot be determined beforehand. You never know for sure how a "cause" is interpreted, if the dog will fight or flee.

Reader: But does it work on the inorganic, or artifact levels, with the billiard balls?

Martin: In principle I think it does not. In my view there is always a partly stochastic process linking the "cause" and "effect" that we describe. But it works for many practical purposes. What we, in practical situations, describe as artifacts is based on a *collection* of underlying processes, each of which has a random component.

Reader: But the random component in each process is small enough so that we do not notice it?

Martin: We name the class but not the processes which underlie our classification. With a large enough "microscope" you will see different processes. And of course, what we see is based on classification – the classifications used in creating the description of the process. So they come in pairs, form and process.

Reader: But what about reality itself? Is it *really* based on form and process?

Martin: That I cannot know. Ultimately, we can have no knowledge whatsoever of reality itself. However, it makes a difference what you believe – so the question is relevant.

Reader: I think I agree with some of the ideas in the PRIO framework, but I must say that I think many parts of it could have been done differently.

Martin: Well, ultimately, selecting the theories you want to believe in is a personal choice. What we have talked about are open questions and we are basing the foundation on assumptions. I believe that each mind must make its own way. However, I think we can provide some inspiration to each other on the way. And that is what the PRIO framework can provide: inspiration for making a difference in project result improvement.

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APPENDIX

In the following section, parts of the PRIO framework will be used to describe the Alpha case. The purpose here is to exemplify mappings of the framework and the empirical data. In the development of the framework, some examples have been used. The added value here is the use of a timeline in the case in order to describe how processes on higher levels led to a difference in project results at Alpha. The figures shown in the Appendix are based on analysis carried out during the development of the PRIO framework.

Since the PRIO framework is designed to provide different levels of detail in the analysis, I will not describe all processes in the same detail. When a model has been exemplified, I do not provide all the details related to the model again, unless there is some particular aspect that has not been described in the examples before.

There are many concepts used in the framework. In order to simplify reference to the concepts, I have used abbreviations. These are provided in the table below. In some cases I will use subscripts as indexes to further specify the abbreviations used. For example, the abbreviation P_{pm} refers to a process management (pm) perspective (P). The meaning of each index will be described in each case.

Concept	Abbreviation
Acting	A
Argument	ARG
Body	B
Capta	C
Data	D
Explaining	E
Framing	F
Information	I
Intended future situation	IFS
Interpreting	INT
Improvement process	IP
Judging	J
Knowledge	K
Learning	L
Learning & Acting	LA
Operative project process	OPP
Perspective	P

Physical artifact	PA
Person (mind and body as a whole)	PE
Persons in action	PIA
Projection	PN
Performing tasks	PT
Personal work process	PWP
Represented information	RI
Strategy development process	SDP
Task knowledge	TK

Table 15. Abbreviations used in the Appendix.

The examples shown here start with John Svensson's work of establishing the strategy development process, followed by the improvement process, and then by the operative use of the process.

11.1.1. Problem identification

John Svensson was actively involved in major improvement projects that took place at Alpha (PWP). He generally approached the situation at Alpha from a business development perspective (P) and can be described as being result-oriented (P). His engagement was generally energetic (B). In his job description (RI), he formally held the position as head of business development. His schedule (RI) was often very busy. The main tools (A) he used for his personal work were his phone, his computer and office. Figure 73 summarizes John Svensson's personal work preconditions. The context figure shows that the details in the figure are related to the model of learning and acting.

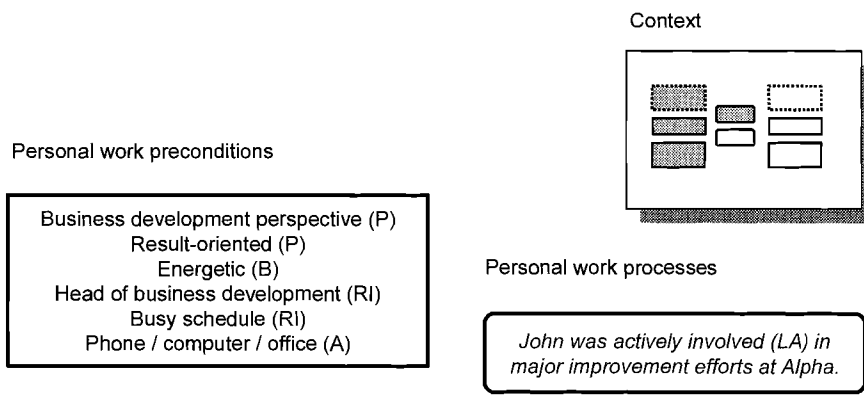

Figure 73. John's personal work preconditions.

When John Svensson analyzed the situation at Alpha (LA), he found (I) that there were problems in the operative project processes that led to poor quality and long lead times in development. The result of his personal work process (PWP) was that he had collected information (I) in his mind that there were problems of poor quality and long lead times (cf. Figure 74).

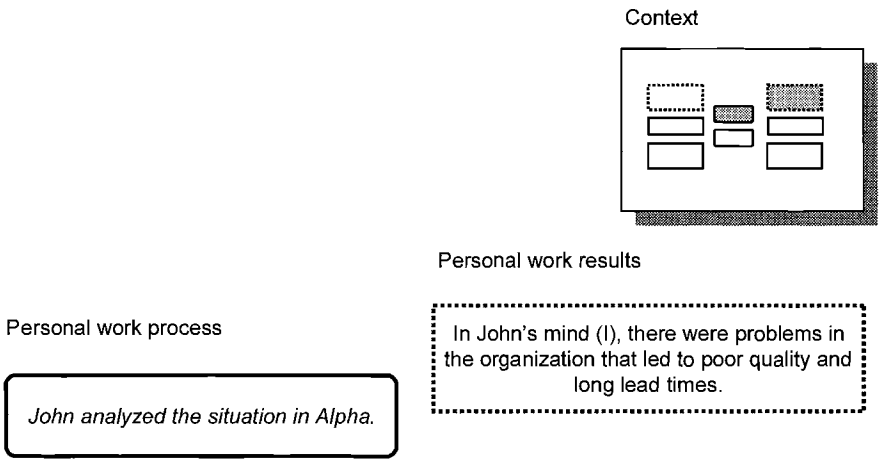

Figure 74. John identifies problems.

Describing the operative processes in terms of quality and lead time was based on his perception (PERC) and interpretation (INT) of the situation. Data (D) from his environment was perceived (PERC) forming capta (C) in his sensory organs, and interpreted (INT) forming information (I) in his mind (cf. Figure 75).

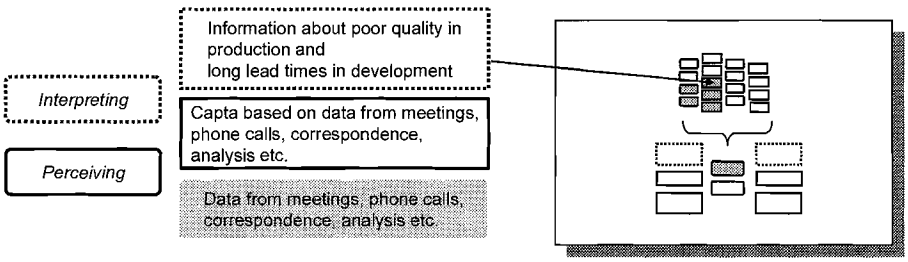

Figure 75. Perceiving and interpreting.

Since the text written in the boxes is based on my interpretation, I describe my interpretation of the basis for John's interpretation. In my interpretation, the capta (C) was selected from data (D) available in John's environment such as in meetings, phone calls, e-mail correspondence, analysis of production measures and contacts with customers and suppliers. From John Svensson's point of view, this data and capta was available only as information in his mind. He was unaware of the processes in which it was created (cf. section 5.2.3).

That he was interested in quality and lead times is not so surprising since his business development perspective (P_{bd}) and knowledge about Total Quality Management (K_{TQM}) influenced his interpretation of the situation (I). He had also worked (LA) in production for several years, and was familiar with concepts (K) such as lead times and quality. His business development perspective and knowledge about TQM seemed to influence his framing and explaining of the problems in Alpha (cf. Figure 76).

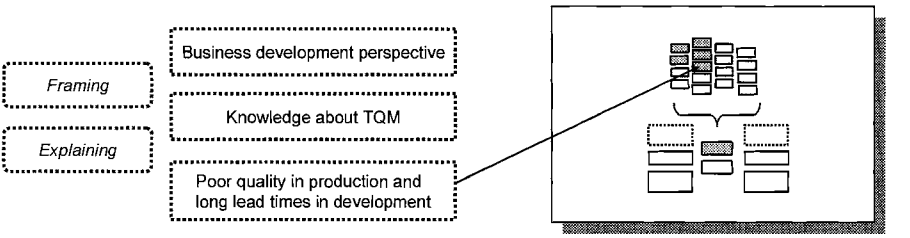

Figure 76. Framing and explaining.

The perspectives and knowledge he had built up were used during the interpretation.

11.1.2. Learning about potential solutions

From his university studies, he had knowledge (K_{TQM}) about TQM. He also had information (I_{pm}) about the growing "process management" trend. From a business development perspective (P_{bd}) John Svensson judged (J), that there were arguments (ARG) for learning (L) about process management (K_{pm}), and he decided (D) to act (A) in order to learn (L) more about it.

Over a period of time, John Svensson learned (L_{pm}) about process management by performing the tasks (PT) of communicating with col-

leagues, visiting process management conferences, reading process management books and visiting web resources (cf. Figure 77). He learned (L) examples (I_{pm}) about successful process management projects, general process management models (K_{pm}), and identified cross-functional process management as a perspective (P_{pm}) that complemented the traditional intra-functional processes often described in TQM (I_{TQM} and K_{TQM}). He saved some of the conference material, books and printed web pages for later reference (RI_{pm}).

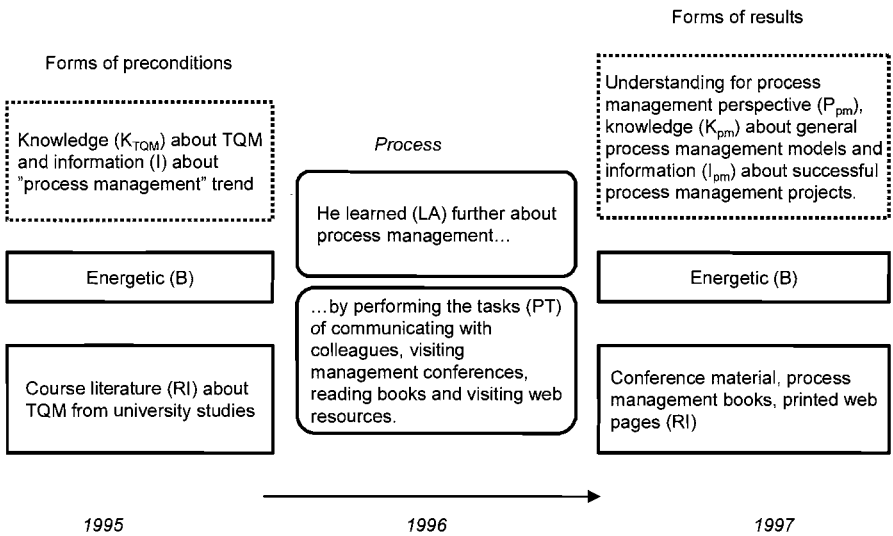

Figure 77. Learning about process management.

In a more detailed description, we can further describe the tasks carried out by John Svensson. He learned (L) about process management by using his body (B) to perform tasks (PT).

When he communicated (PT) with his colleagues, he used his body (B) to represent information (RI) in speech and through body language (A). His speech was an example of a physical artifact (PA), where information was represented as vibrations in the air. In his body language, information was represented in his bodily movements (A).

There is a difference between John Svensson's actions in a general sense and the actions in which he consciously represented information. Sending an e-mail to a colleague, or making enthusiastic gestures, John Svensson performed a task of communicating. When he, for example,

drove to work in the morning, he was not consciously communicating. His actions could still be interpreted by other people. They could interpret his coming to work early as a sign of enthusiasm for the company. However, everything in nature is potential data for an interpreting person. From the perspective of the CEO of Alpha, there was in principle no difference between John Svensson's coming to work early and his e-mails. From his perspective it was data with a potential for interpretation. Data is everything that can be perceived, including the actions of other persons.

The interpretation of the CEO in this case would probably depend on his knowledge about John Svensson and communication in general. When receiving an e-mail, he would recognize that it was meant as represented information. The meta-information in this case was provided by the interpreted context. E-mails in general contain represented information. In this example, John performed the task of representing information, and the general manager performed the task of reading the represented information. They both understood the e-mail message to be an artifact mediating representing information.

John Svensson sent and received e-mails as correspondence with his colleagues. He then performed the task (PT) of representing information (RI) using e-mail programs (IS) and his physical personal computer (PA).

He performed the tasks (PT) of viewing and listening to represented information (RI) that was provided by the speaker (PA/B) and presentation systems (IS) in the physical conference facilities (PA).

He also performed the task (PT) of reading represented information (RI) in physical books (PA) and using a web browser (IS) and physical personal computer (PA).

11.1.3. Explaining the problems

In further detail, he learned examples of successful process management projects (I_{pm}) and general models for process management (K_{pm}). The general models (K_{pm}) could to some extent explain (E) the successful cases (I_{pm}).

When John Svensson learned process management models (K_{pm}), he could compare them to the TQM models he already knew (K_{TQM}). One

difference between them was that TQM models had a higher focus on intra-functional processes, such as manufacturing, whereas the process management literature highlighted cross-functional processes. For example, in the RBG terminology, the functional "silos" were complemented with cross-functional processes.

Knowledge (K_{pm}) in the cross-functional process management models was partially different from the knowledge (K_{fm}) in the traditional intra-functional TQM models. The *functional silos* were complemented with cross-functional *business processes* in the RBG terminology. The cross-functional process did not "fit" into the functional silos. The two models were of different types.

By distinguishing between the two types of models, it was possible to consciously select what perspective to use. In a process of framing (F), he could choose to apply a functional perspective (P_f) or a process perspective (P_p). The process framing is illustrated in Figure 78).

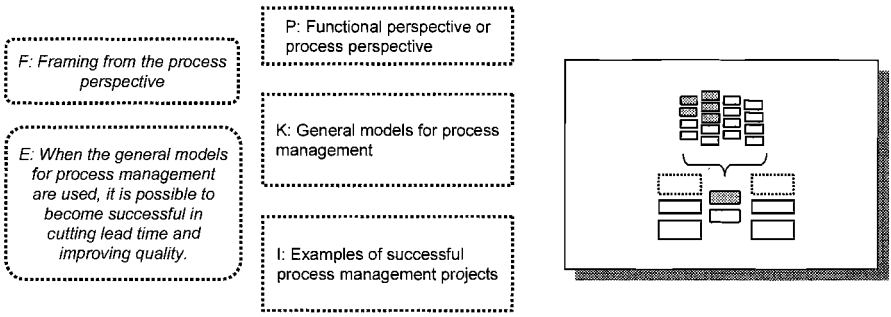

Figure 78. Framing from a process perspective.

When taking the functional perspective (P_f), he could use knowledge (K_f) to explain (E) the operative problems at Alpha (I_{op}). The functional silo orientation (K_f) could explain (E) the poor quality in production and long lead times in development (I_{op}). The explanation (E) was that the lack of coordination between functions (silo orientation) during product development led to products that were not adapted for production, and delays in establishing the production process (poor quality and long lead times).

The tautology "lack of coordination between functions" could be mapped to his description of Alpha, where the "lack of coordination" between product development and production led to poor quality and

long lead times. The situation at Alpha (I_{op}) could be mapped (E) to the functional tautology (K_f). The functional perspective contributed to explaining the problems (cf. Figure 79).

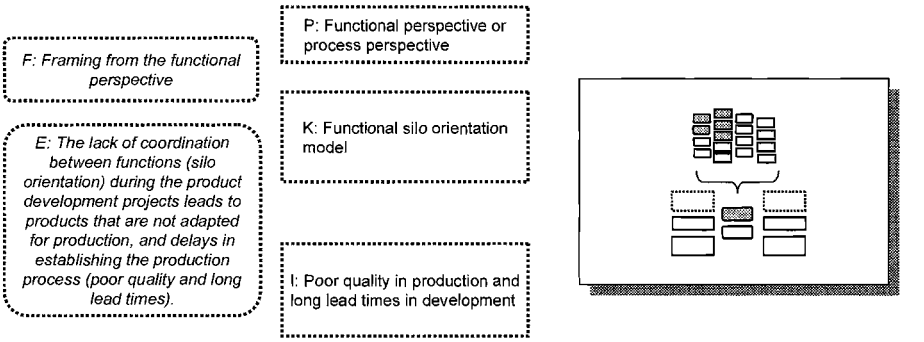

Figure 79. Explaining the problems.

When the problems were identified the challenge was to find solutions.

11.1.4. Forming a projection

The opportunity to consciously select (F) the perspective (P) made it possible to judge (J) from different perspectives. He found that *more of the same* from a functional perspective (P_f) was not the solution to the problems at Alpha. By reframing (F) the situation from a process perspective (P_p), he could use process management models (K_{pm}) as inspiration to find arguments (ARG) and decide (D) on a projection (PN) that could contribute to solving the problem (I_{op}).

The problems of poor quality in production and long lead times in development (I_{op}) could be solved by introducing a cross-functional process (K_{pm}). This could improve coordination between the functions so that products could be adapted for production, which would contribute to quickly establishing the production process. With a cross-functional process, the operative project processes would lead to good quality and short lead times in the intended future situation ($PN_{Kpm/Iop}$). The forming of the projection is shown in Figure 80.

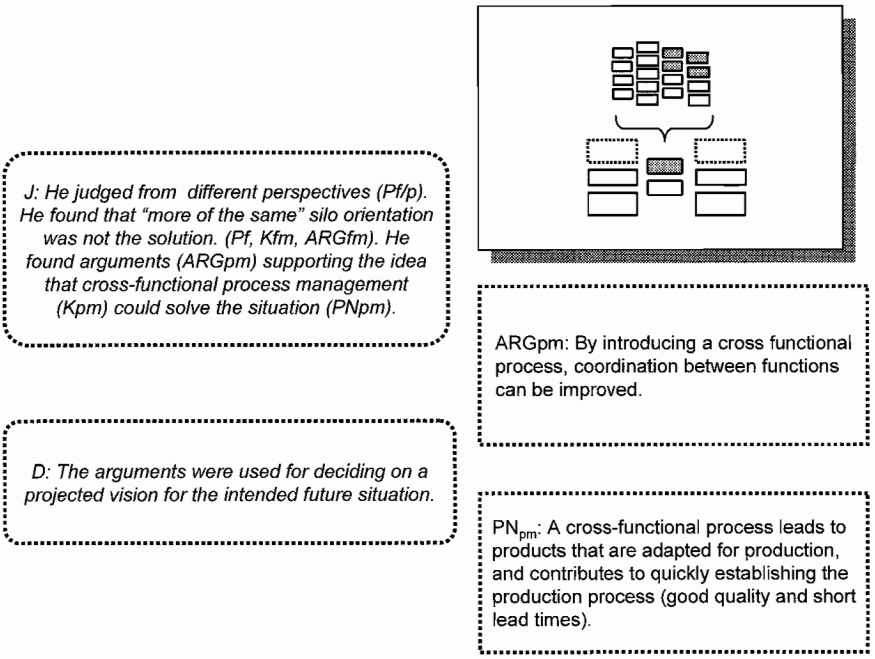

Figure 80. Process management projection.

By framing (F) the situation (I_{op}) from a process perspective (P_p), he could use knowledge from process management (K_{pm}) as a frame for inspiration. The knowledge (K_{pm}) could help him to find arguments (ARG) to decide (D) on a "model projection" (PN_{pm}) for the future situation. This model projection is shown in Figure 81.

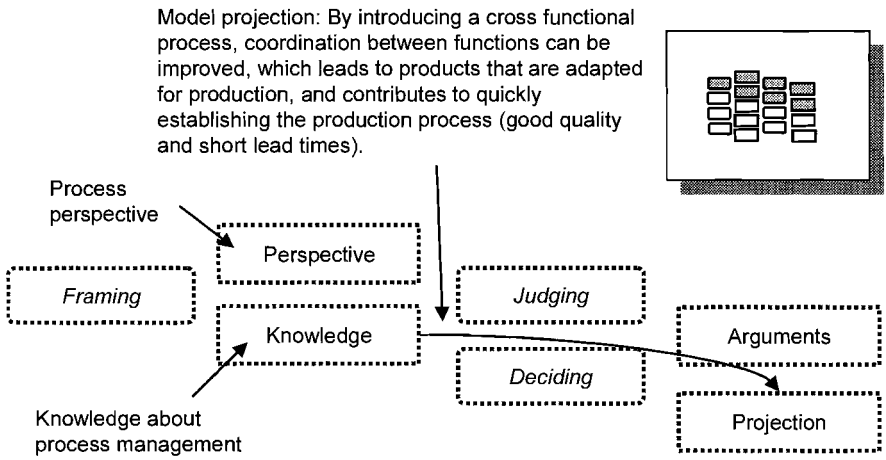

Figure 81. Model projection.

However, the process management knowledge (K_{pm}) needed to be mapped to the situation at Alpha (I_{op}) in order to be useful. In a decision process (D), he combined knowledge (K_{pm}) from process management with information (I_{op}) about Alpha. He selected a subset of the potential arguments (ARG_{pm}) from process management (K_{pm}), and mapped these to the situation at Alpha (I_{op}). What could be achieved at Alpha ($PN_{Kpm/Iop}$) if knowledge (K_{pm}) from a process perspective (P_P) was used?

Some of the problems were lack of a product strategy, unclear criteria for starting projects, functional orientation, ad-hoc improvements, lack of measurement systems, many new employees and chaotic work processes (I_{op}). In a decision process (D), John Svensson selected arguments (ARG_{pm}) from process management (K_{pm}). He found that arguments (ARG_{pm}) regarding customer orientation, structured cross-functional processes, process owners, measures and continuous improvements could be used from process management (K_{pm}) to address the problems at Alpha (I_{op}), forming a combined projection ($PN_{Kpm/Iop}$).

The projection ($PN_{Kpm/Iop}$) of the intended future situation was then based on a combination of knowledge (K_{pm}) about process management and information (I_{op}) about the specific situation at Alpha. The forming of the *combined projection* is shown in Figure 82.

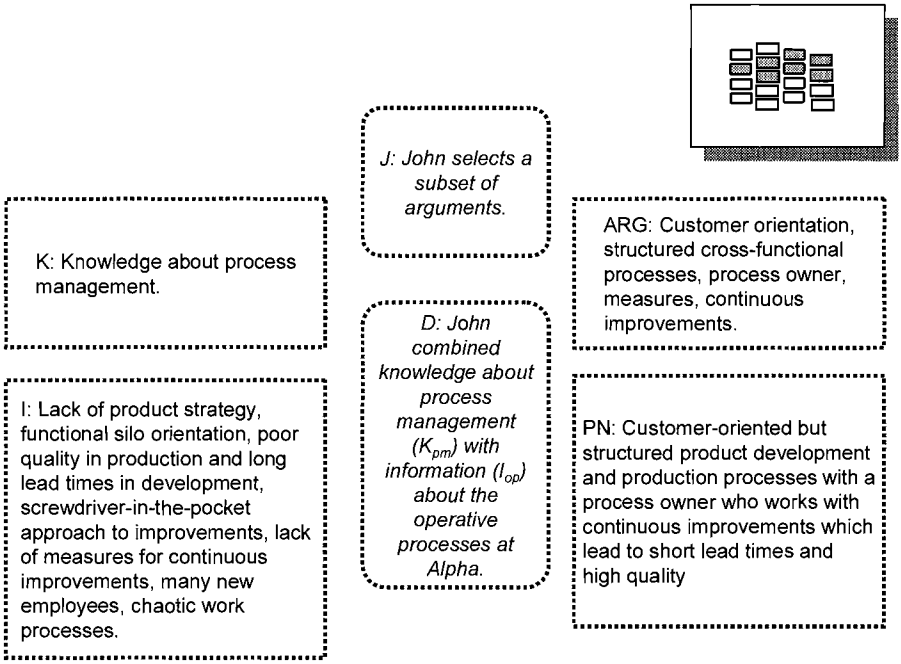

Figure 82. Combined projection.

John Svensson used knowledge as a frame for inspiration during his analysis and formed a projection combined of selected arguments and information about Alpha.

11.1.5. Strategy development

John Svensson finds ($PN_{Kpm/Iop}$) that the process management perspective (P_p) can contribute to solving the problems in Alpha (I_{op}). However, he realizes that the people in the management team (PE_{mgmt}) do not have a shared projection ($PN_{mgmt/Iop}$) of the intended future situation.

He decides to initiate a strategy development process (SDP) from a process perspective (P_p) in order to cultivate a shared projection of the operative project processes at Alpha ($PN_{mgmt/Iop}$). The link between his personal work process and the strategy development process is shown in Figure 83.

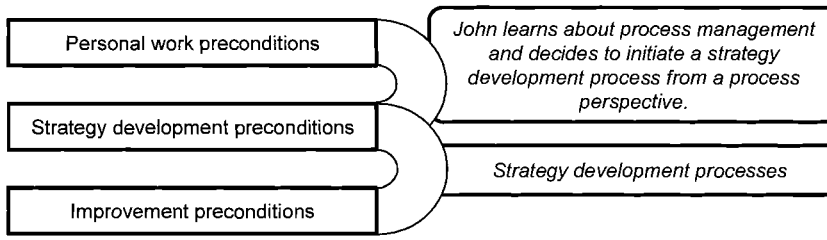

Figure 83. John initiates a strategy development process.

Strategy development preconditions included John Svensson's projection/vision ($PN_{Kpm/Iop}$) of customer-oriented but structured product development and production processes with a process owner who works with continuous improvements which leads to short lead times and high quality. Strategy development preconditions also included persons in the management team having different views on process orientation (Kpm) and on what processes to have (PN_{mgmt}). Further, there were documented schedules for the planned management team meetings (RI).

John Svensson acted (A) by performing the task (PT) of inviting consultants to present process management ideas (PT) during the scheduled management meetings. The management team (PE) agreed to hire two consultants from RBG who could provide a method for the improvement project ($PN_{mgmt\text{-}mip}$). This was represented (RI) in a contract (cf. Figure 84).

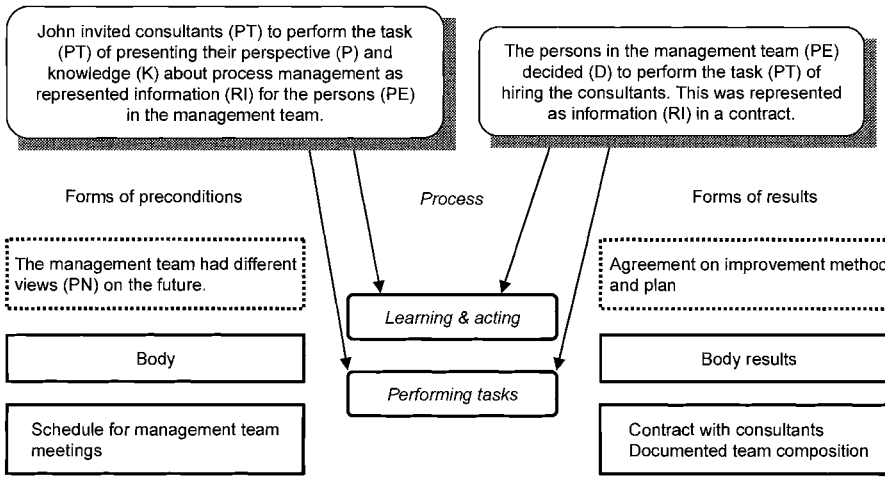

Figure 84. Inviting consultants and deciding on a plan.

The consultants had knowledge (K_{pm}) about process management from a "planned improvements" perspective (P_{pi}). The management team (PE) had decided (D) to use their help ($PN_{mgmt\text{-}mip}$). The RBG-method was documented in a folder (RI). Using the planned improvements perspective (P_{pi}), the RBG consultants suggested using a structured project definition method (K_{spd}) in order to decide (D) on a project plan and appoint a process improvement team (PN). The management team performed the task (PT) of mapping the project definition to information about Alpha (I), decided (D) on a project plan, and appointed a project team as improvement preconditions ($PN_{mgmt\text{-}ip}$).

The consultants (PE) represented information (RI) about process management by performing the tasks (PT) of communicating, using their voice, body language, presentation systems, leaflets, whiteboards and personal computers (B/RI/PA). The data was perceived by the management team as capta and interpreted to information in their minds. Through examples and general models they started to understand the process perspective (cf. Figure 85).

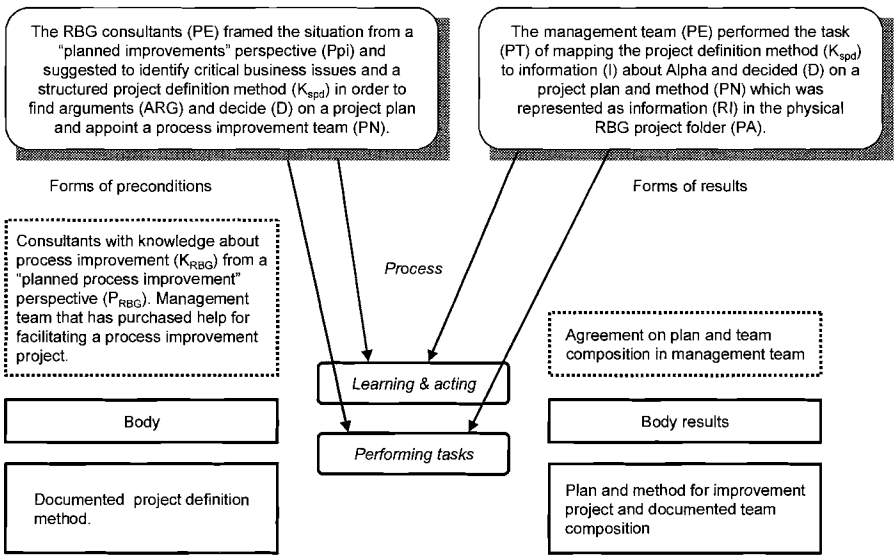

Figure 85. Forming an improvement plan, detail.

The strategic direction of focusing on product development was set and the preconditions for improvements were created in terms of a selected team (PE) and a method/plan (RI) for the work.

11.1.6. Improvements

The management team at Alpha (PE_{mgmt}) supported the improvement project (PN_{ip}). They selected and documented a design team (PE, RI). The team had a documented plan and a method for the improvement project (RI). The design team performed the task (PT) of using the RBG-method in order to create recommendations (RI) for implementing the new process. This calibration from strategy development process to improvement process is shown in Figure 86.

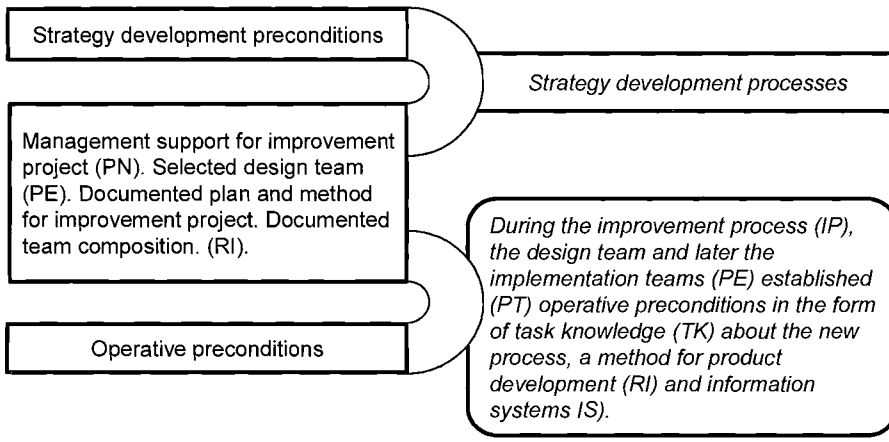

Figure 86. Improvement process.

The design team (PE) used the documented improvement method (RI) as a frame for inspiration during the improvement process.

Using the RBG-method, the design team (PE) performed the tasks (PT) of describing (RI) the "is-state" and "should-state" in process graphs and developed recommendations (RI) to the management team (PE_{mgmt}). John performed the task (PT) of presenting the recommendations (RI). The management team (PE_{mgmt}) decided (D) to accept the suggestions (PN) and appointed implementation teams (PE, RI). The process of developing the recommendations is shown in Figure 87.

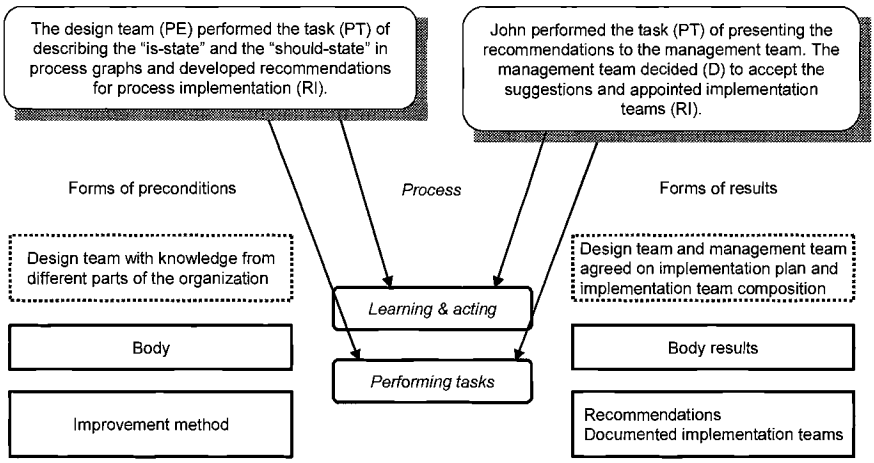

Figure 87. Developing recommendations.

The implementation teams (PE_{impl}) performed the tasks (PT) of developing templates for the process (RI) and implemented (PT) information systems (IS). They also performed the task (PT) of conducting training in the steps of the TTM-process. The general manager of Alpha performed the task (PT) of clarifying that the new TTM-process should be *followed*. He did this both in speech and in writing (B/RI).

In my description of the case using the framework, the body level has been implicit. However, an important result on the body level from the improvement process was that John became exhausted and left the business (cf. Figure 88).

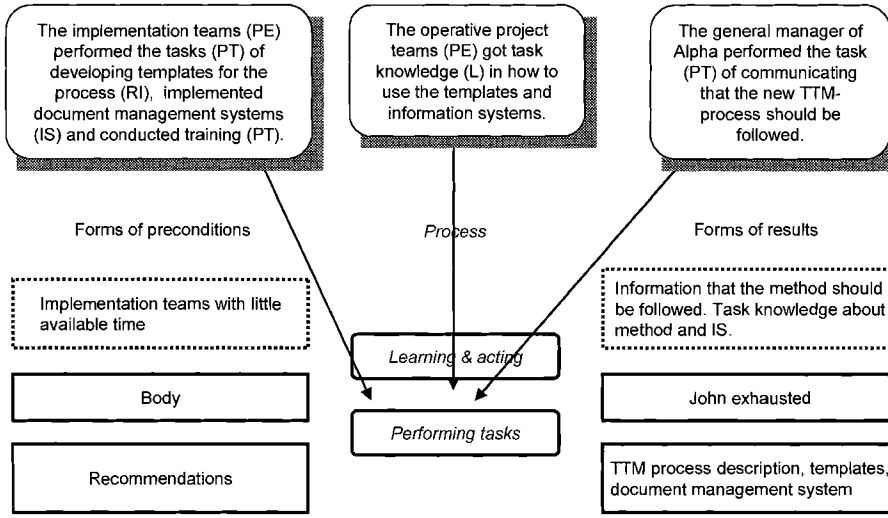

Figure 88. Implementing the TTM-process.

The design team used knowledge about improvement work (K_{RBG}) as an inspiring frame for the execution of the improvement process (PN_{ip}). This provided a *model projection* of the activities in the improvement work.

The "fixing" of the planned improvements perspective (P_{pi}) and selection of the RBG-method (K_{RBG}) led to alternative perspectives being downplayed. The process of judging (J) was therefore also downplayed. Framing (F) the situation from different perspectives (P) became more difficult. The suppression of alternative perspectives is shown with the process of judging being crossed over in Figure 89.

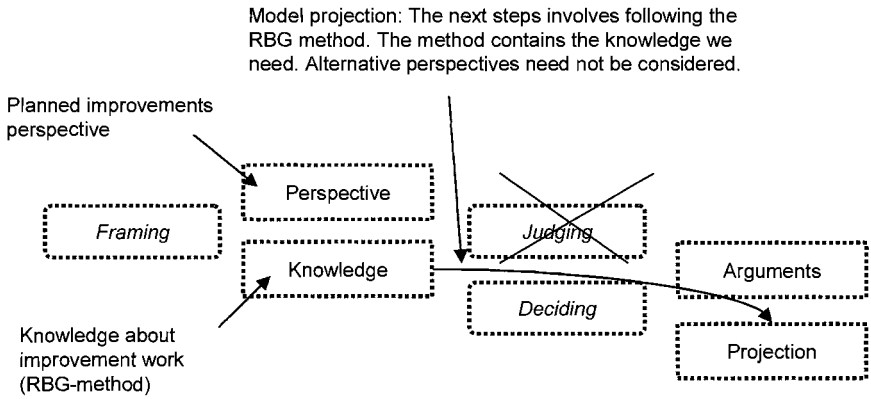

Figure 89. Using the RBG-method in Alpha.

One example of the processes of judging being downplayed was when it surfaced that information systems would become critical in the implementation (I); but this was not considered in the design phase since it was not a part of the method (K_{RBG}). If the situation had been framed from an information management or socio-technical perspective, it would probably have been easier to find arguments (ARG) for deciding (D) to perform the task (PT) of analyzing information systems support in the design phase.

However, John Svensson explained (E) that he had learned (K) that involving people from the IT Department often leads to it being impossible to make changes in the information systems (I). He thought that information systems would become important, but he used the argument (ARG) that the design team should develop the requirements and then let the IT Department follow the specification.

From an information systems development perspective, he provided arguments for a "waterfall" model of systems development. This was in stark contrast to his perspective on the TTM-process, where involving production engineering and suppliers early was thought to improve quality and cut lead time in the production process. Artifact support was considered early in the operative product development projects, but not in the improvement projects.

11.1.7. Operative projects

The people in the product development teams had knowledge about the TTM-process and knew that it should be followed. They also had access to process descriptions, templates, routines and information systems. These operative preconditions were established by the improvement process (cf. Figure 90).

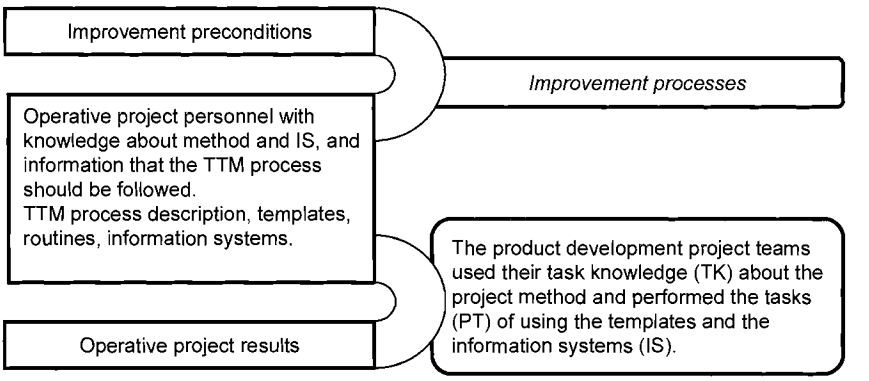

Figure 90. Operative project processes.

The product development teams (PE) used their task knowledge (TK) about the method and performed the tasks (PT) of using the templates and information systems (cf. Figure 91).

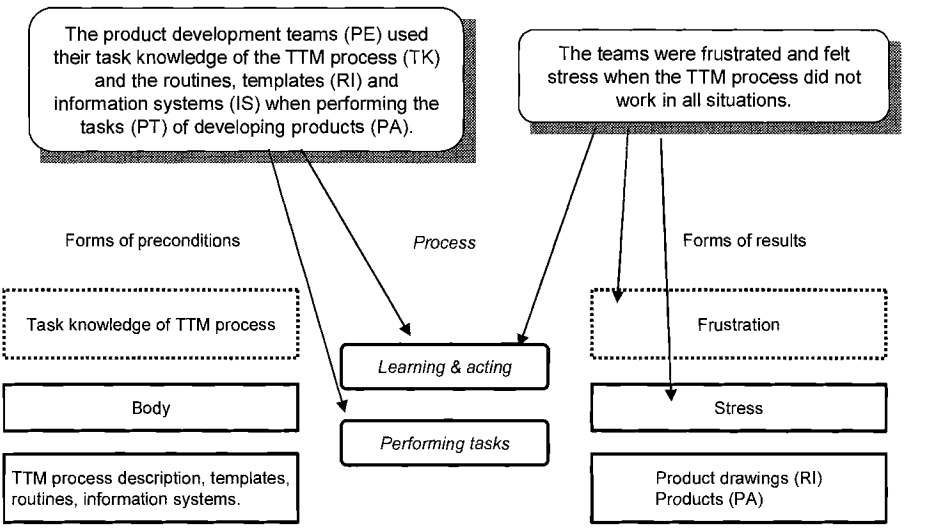

Figure 91. Using the TTM-process.

The perspective taken during the work was an "orderly work" perspective, which emphasized that the method should be *followed*. A common view was that project results could be improved if work was carried out in an orderly fashion. Following the process was then an end in itself.

The TTM-process was followed even though the teams had information that the customers wanted prototypes early in the projects. The emphasis on following the method is shown in Figure 92 by the process of judging from alternative perspectives being crossed over.

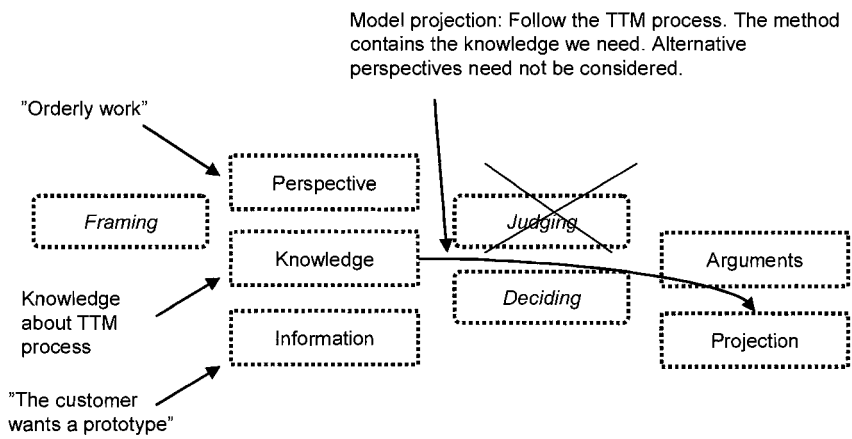

Figure 92. Using the TTM-process in the operative project processes.

The operative project results were that quality was improved but lead times were, at least initially, longer than before. The reason for the longer lead times was that the team members did not have perspective understanding which would make it possible to judge how the TTM-process should be applied in each situation. They did not question the perspective of orderly work. Alternative framings, such as taking a customer perspective or financial perspective were not considered initially. It would have been possible to use other model projections, for example based on customer orientation or sales. The links between operative preconditions, project process and project results are shown in Figure 93.

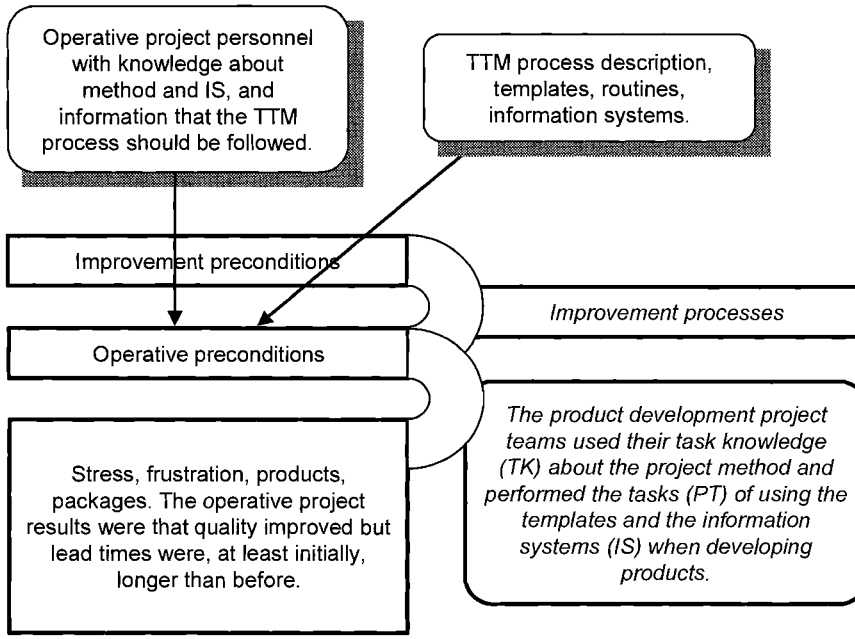

Figure 93. Operative project process and result.

When the TTM-process was used in the operative project processes, ideas for modifications surfaced. These changes were carried out as improvement processes. The modifications became a part of the preconditions.

GLOSSARY

In the following list I have collected central terms. I have also provided examples in some cases.

Abduction: Refers to a process of finding combinations of tautology and description of phenomena which are cases under the same rule and can be mapped onto the same tautology. Example: realizing that project methods and process descriptions both can be seen as examples of work methods.

Capta: Refers to the result of a process of perception. Example: neurological stimulation resulting from listening to a presentation.

Cybernetics: Refers to an interdisciplinary field of science dealing with patterns of control, recursiveness and communication in the animal and the machine.

Form: Refers to classifications of processes. Example: methods.

Framework: Refers to a conceptual frame for making descriptions.

Improve: Refers to a process in which a change leads to a difference which is beneficial according to a specified criterion. Example: introduction of a project method which leads to shorter lead times.

Information: Refers to ideas in mind about something specific (real or imagined). Example: product 2515, John Svensson, Alpha.

Information system: Refers to a system of parts which involves collection, processing, storing and distribution of represented information. Example: binder, document management system.

Knowledge: Refers to patterns available in mind, contributing to explanation of information. Examples: understanding of a project method, critical success factors.

Level: Refers to a type of classification where the relationship between classifications is such that one classification (higher level) is *about* another classification (lower level). Example: motion is *about* position.

Method: Refers to a path, way or technique of or for doing something on a general level.

Orders of change: Refers to a recursive structure where a higher order of change is *about* change on the level below.

Organization: Refers to patterns of interaction of people working towards a set of goals which are shared to some extent.

Perspective: Refers to a pattern of patterns used in processes of framing in order to select knowledge to use for explanation of information.

Process: Refers to something that goes on in reality. Examples: evolution, learning and acting.

Project: Refers to a specific execution of a project process as a whole.

Project-intensive organization: Refers to an organization in which a central part of the operative work is carried out in the project form.

Project process: Refers to persons working together to achieve a certain result within a limited time. Example: developing a specific product.

Represented information: Refers to information which has been coded and represented in a form which makes it available for later use. Examples: electronic documents, paintings.

Result: Refers to something that results as a consequence.

Tautology: Refers to connections between propositions. Examples: Euclidean geometry, general model of critical success factors, relationships between phases in project method.

Truth: Refers to a result in mind of a successful mapping of information onto knowledge in a process of explanation, framed from a specific perspective.

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