



## Managerial, Technical and Co-learning

~ Different Practices in Process Support for Software Development ~

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Blekinge Institute of Technology  
Master Thesis 20p  
People Computers and Work  
IAM & IPD  
2002-05-17

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# Managerial, Technical and Co-learning: Different Practices in Process Support for Software Development

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**Abstract.** This Master Thesis looks into software development processes and the work activities these need to support. Hesitation against process support within Software developing organisations combined with a possibility to develop process support for such a company, made the foundation for this thesis. The reference company where the study took place is a large worldwide Telecom company where we focused on one design department with 25 people. Instead of using Participatory Design (PD) [Schuler, Namioka] as a method for Software development as traditionally, we used it for developing process support together with the people at the department. Three different supports for different project processes were created with PD and an evolutionary way of work together with the ‘designers’. We came to a complex project environment which required control in several aspects such as project sponsoring, project management, line management, design maintenance etc. We saw a way of working that was following a common agreed way of work by the group that is formed by socio-emotional aspects and co-learning aspects [Hägerfors, 1995]. In contrast to this, the study showed that the available process support and also the use of the process support had a clear concentration towards a management focus – the control function. The available process support and the use of this did not really consider the aspects of Socio-emotional or Co-learning. Existing process support was built around documents that became evidence for actual activities during the project. The process support developed during this study (by us and the designers) finally also got that concentration. A conclusion is that when the organisation puts high requirements on control of projects, this will also affect the way the organisation wants support for work. This is the missing point.

# Part I

## 1 Introduction

This thesis is divided into two parts. The purpose is to put emphasis on the different directions those parts have. Part I gives a background to this study, and also describes how the department works today and finally shows parts of the 'product' that was developed during our study which is the base for this thesis. You could say that Part I has a more practical perspective.

The second part is more theoretically oriented. There we use part I as a base for a general discussion around process support in software development. The study that took place serves as input for our discussion and will show the different things that we discovered during the study.

### 1.1 Generally

"Crucial for project organized companies competitive strength and success is the steering of the companies projects. This will also be even more important in a globalised and technical more advanced business environment, there the form of the project constantly wins terrain on the traditional line organisation expense." [Management of Technology, p.8, edition 3, 1999].

Projects are important for many companies, for example, ABB, Astra, Ericsson, Enator, H&M, Pharmacia & Upjohn, SEB, Scania, SKF, WM-data, Bang & Olufsen, Renault, 3M, AT&T, Microsoft and IBM. The list can be made even longer but what is in common for these and other company survivals is that they are completely dependent of their projects and a successful handling and steering of their respective product portfolios [Management of technology, 1999]. If they do not manage to handle their projects, future profit opportunities will decrease considerably.

The number of projects to manage has increased within most software companies and is grounded on higher requirements on deliveries, increased product complexity and a need of cooperation during bigger deliveries. When requirements increases on projects, the necessity of routines and system for being able to manage them also increases. Things that must be improved are possibilities to get overviews (in other words, getting the 'whole picture'), indications on risks, support for work activities, spreading of knowledge etc.

### 1.2 Process support

Within large software companies of today, concept as *processes and*

*methodology*<sup>1</sup> contains a huge part of every day. Making the processes effective within companies could be read and heard whenever the question of process support is mentioned. Accordingly, the concept is often mentioned within many different contexts.

Processes and methodology have been in question and discussed for some years ago too. There were some pioneers that saw the possibilities and benefits with using methods. They also saw the needs of them. But it is not so recently the focusing on processes and developing different kinds of support for these became so popular. What it actually depends on is not hard to establish.

- Large companies with rather high circulation of people need methods to quick introduce and support learning of new employees.
- Project participants situated in different countries often carry out common development projects. A common method supports the work.
- To make the activity more effective, there is a need for learning to specify your own activity. This implies an easier way to see improvements in the activities. It also makes it easier to estimate different processes.
- It simplifies the communication taking place between people due to a model to refer to. It offers a common language.
- Maybe the reason that carries the greatest weight: To be able to compete for customers it is important to be able to show that your company is working with quality assuring. Known quality models of today are for example ISO9000 (Internationella Standardiseringskommissionen), CMM (Capability Maturity Model) [Paulk, Curtis, Chrissis, 1993]. The models require, among other things, documentation and standardisation of the development processes.

More reasons for process support and methodology could for sure be mentioned.

At the same time it should also be mentioned another often occurring perspective on this huge subject within today software development. Why is process support not used and why is there a strong scepticism within the software branch against process support and methodology?

There is a negative attitude against processes (also methodology) among the programmers. Many of them does not to want to use them despite the support they should give. Something must be wrong, but what? A lot of money is invested in consultants who analyses and develop processes and methodology but the most of the fine work seem to be only stickers. How often have you not seen process descriptions that are not used? If the process offers support for making a certain

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<sup>1</sup> A distinction of what we mean with processes in terms of SW development versus methodology is given in the chapter, Methods and Processes.

complex activity in a good way, the programmer should be using it. But it seems that many of the programmers does not want to.

Some articles in one of Sweden's biggest computer papers [Computer Sweden] goes as follows.

"...do a benefit-burden-analyse and you understand why. Check who wins and who will carry the biggest burden! The processes of today make the boss a winner and gaining better control. No, they will not help the programmers. Instead they are the one who will do the job. And the job implies to write documents. Say which programmer who will write documents! No, programmers want's to solve problems through programming/.../Processes will not make them more effective./.../...technicians and engineers uses tools if they make the work easier. As soon as there is such a tool, it will be used..."

"The programmers must be more efficient./.../Development projects are often taking far too long time and costs too much money. Companies have a lot to win if programmers learn to work more systematically so that the programs will be better. The hacker mentality must disappear./.../There is a large need out at the companies to learn and organize the processes. If they who works with software engineering learn to use more engineering methods and to work more systematically, they will be more efficient."

Almost every edition of computer newspapers contains one article or more about processes or methodology. One is about the pros with processes and methodology and another is about the cons. The list of articles could be made long. The interesting thing is that there seems to be a large gap between the processes/methodologies and the use of it. Many people also see the good things with it but when the real use is taking place the most of the users are very dissatisfied.

### 1.3 The company

The studied software project was performed within a world-leading supplier of equipment for telecommunications systems and related terminals. The company was interesting in several ways. It has choose a process oriented way to work as a structure to break down work to work packages, and this is applicable for the whole company as one way to go in their quality strategy. It is also a multinational company who often works distributed over geographical borders which implies that many different perspectives needs to be co-ordinated. And finally, the company is one of the largest and most respected within the software world of today because of its leading position in the market.

The complete business is aiming at producing high technological products where the company focusing in product units. The product units have the responsibility for its own products. This includes also development the products and maintenance.

A significant part of the company business operation is carried out as projects (development projects are taking place at almost every departments). All the new

development is carried out as projects and all concepts concerning this are well defined. Following text could be read in the project model used at the company:

”A project is unique, and has a fixed budget, is time-limited, has a temporary organization, has well-defined goals and is non-recurrent.

The development and introduction of new products, methods and organizations are examples of assignments suitable to organize in project form, due to their dynamic nature. Activities that are primary repetitive, such as maintenance and support, are not suitable for organization into project form.

However, to run a project, you need processes. A process is, in it self, a set of repetitive activities, but because these activities are run in parallel to each other, they give the project its characteristic flexibility.” [Basics about PROPS, s. 5-6].

## 1.4 This Thesis

In this Master Thesis we describe our work to produce process descriptions to the software company. This includes which methods we used to develop the process support, snapshots from the product (the process support), reflections about the process support and the use of those are included in the thesis.

We explain how the company works with projects and the work models that they use during their software development – this to explain and clarify why our product looks like it does.

## 2 How this study took form – Method

In this chapter we describe how this study took form and which methods we used. We also discuss the difficulties to get in to a new culture and the importance of understanding the culture. What we mean is that the company has an own culture and language that you need to learn.

An interest in large software companies was a starting point for this study. We wanted to look into development activities during larger software development projects with focus on support for different work activities. Thanks to an earlier contact with the company, they wanted us to look into process support for some development processes that was not supported yet. Together with the company we decided to concretise the assignment that could have been put on a consultant company. What could be a better way for studying this area than doing a real assignment at a SW development department?

The written assignment from the company resulted in describing processes that where taking place after the product has been developed and should be delivered/sold to the customer.

A general method within the company already existed for the software development phase, but not for the activities after that, the so called industrialisation activities and support activities. These will be explained later in the text (see chapter seven). People who have worked with total product responsibility know that much of the work is to be done after the code is developed. Routines for third party products need to be taken care of, order routines need to be created, error-handling routines, and the product shall be packaged in a good customer manner etc. Support for these activities was missing at the department. There were no specified frames for how those descriptions should look like or which methods that should be used. We had in one-way free hands.

In the beginning many things seemed confusing. How do you create a process description and most of all what is a process? Which methods should be used to get the information that was needed to create the process descriptions? There were a lot of questions that needed to be considered. To have a possibility to understand, or even try to understand these peoples social work environment, we decided to start with three weeks of doing what we call, and the company would call, a pre-study.

The pre-study had the purpose to give necessary knowledge of how things were going on and which routines that were used. We tried to understand the

department culture<sup>2</sup>.

There is a text written by Harold Garfinkel's concerning what he calls 'common culture', this mirrors what was experienced during the start of our 'project' – the pre-study. Garfinkel shortly explains the common culture as: socially sanctioned grounds of inference and action that people use in their everyday affairs and which they assume that others use in the same day [Garfinkel, 1967, p. 76]. At the department it could be; knowing the general way of working, knowing different roles, knowing the project model, knowing the meeting procedures, responsibilities, competence, competitive motives among members, goodwill, knowing the language etc. More generally, in our social life it could be; behaviour at the library, shopping procedures, queuing behaviour, classroom moral.

To get at least a bit of the common culture, situated at the department, took us longer than the planned pre-study. But in order to understand what was going on we had to try to become members of the available common culture.

## 2.1 The common culture

When coming to a 'new world' as a newcomer, you do not understand very much. Everything seems like a mess with a lot of abbreviations and notions. There is no real help available that you can get to take you out of this mess. You have to learn by yourself<sup>3</sup>.

The first impression was that this language was something specific at each department, but we soon understood that all the departments shared part of the culture. A culture that implies a shared language that makes it easy for an employee in Sweden, for example, to work in another part of the world at another office. But the common culture did not only support a language communication between different countries, but also between employees placed at different offices in the same country.

The notable language was a sort of way to communicating just like the English. The alphabet in the company language is extended with this remarkable abbreviations (often consist of three letters), status, conditions and terms. What is impressing is that all the different offices around the world use the same 'language' to communicate; the company language and the English language<sup>4</sup> that

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<sup>2</sup> Afterwards we can only point out that without this pre-study it had been almost impossible to manage the study within the timeframe. Though, we did not manage to finish this report as planned, the promised 'product' was finished within the time scoop. We did learn a good lesson.

<sup>3</sup> To facilitate your own learning we used an abbreviation lexicon on the Company's Intranet containing abbreviations for models, products, organisational parts, issues etc., but this was not enough covering and not especially good as support. The explanations often didn't say us anything because it was explained in their own language. To use a famous philosophical quote: "If a lion could talk, we could not understand him." [Wittgenstein: 1953].

<sup>4</sup> A special kind of English, which have been created due to that a lot of the employees, are from other countries than English spoken countries. The written English is therefore rather short and concise.

is the general language at the company.

Part of the common culture is their way of using the same models<sup>5</sup> around the world for develop products and run projects, a strength that few other companies have. It gives the employees an internal security, which can both be good and bad. At the same time it can cause organisational problems to introduce changes in models.

When you have learned a few abbreviations you begin to understand what people are talking about, although you will understand far away from everything (Lave and Wenger's theory about Legitimate Peripheral Participation could also be referred to). It will take long time to learn this language (according to the people we have talked to at the department, it will at least take 6 months). After 3 months we felt that we started to understand a bit of the language, but that we were not members of their common culture that we of course tried to be.

Every organisation has its own language and as a newcomer it is not easy to get into the organisation and understand both the official and informal language. Knowing the people and getting an understanding of the work they perform, will narrow the gap between the newcomer and the more experienced employees. If the result of our work should be used and accepted, it was important that the language used at the department also was used in our result. The developers had to recognise themselves in the process support, or they would not use it.

By giving this description of how we interpreted the environment that we had to understand, we want to show how complex such technically influenced environments can be. Without meaning that this environment is an exception from other researchers' environments, which is not the case. We just want to show how we faced a complex environment, as every ethnographer has to face when starting a new study.

During the three weeks of the pre-study and also further on, we realized that to get to know this complex environment, our roles had to be chosen careful. We realized that to be able to move on it was necessary to start with being around in the corridor and trying to understand as much as even possible<sup>6</sup>. That is the way of acting you as an ethnographer<sup>7</sup> often has to take [Anderson, 1996].

“...in order for the investigator to decide what he is now looking at he must wait for future developments, only to find that these futures in turn are informed by their history and future.

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<sup>5</sup> The company also generally uses the same templates for different documents used in the daily work. We want to mention this because it is an interesting way of working, that is using the same models, abbreviations and document templates all around the world.

<sup>6</sup> Of course we also tried to participate in relevant project meetings and as much as possible in all activities at the department. ‘...the move of learners toward full participation in a community of practice does not take place in a static context. The practice itself is in motion.’ [Lave & Wenger, 1991, p.116]

<sup>7</sup> At the study program where we studied, People, Computer and Work (Blekinge Institute of Technology), this research method is widely used. A method that is build on collecting empiric material through observing the field and (for example, through writing about it) in that way one understand what has previously been seen.

By waiting to see what will have happened he learns what it was that he previously saw. Either that, or he takes imputed history and prospects for granted.” [Garfinkel, Harold p.77, 1967].

We had the privilege to have our own room at the department in which we worked four days a week. The fifth day was dedicated for writing about the experiences. It felt that we were the strange persons doing some mysterious work because we were not able to show any concrete results in the beginning (as have been said before, several weeks were spend on trying to understand the culture). People were nice and kind but reserved, they were probably curious on us and of what we were doing, since we were “strangers” within their environment. After a few weeks they were used to have us in their office and we had become a natural part of the daily work. They came by and talked about both work and leisure.

During our work to create the process descriptions we often performed audio-taped interviews. During these the people interviewed described how they worked and they really gave us important input. The audio taped interviews were limited to a small category of people at the department. The reason was that we thought if we use this method more often on the same people they should get more or less used to it. Those cassettes stored important material for us and also often worked as a sort of library that made it possible to go a step backwards and check the information one more time.

We worked a lot with informal interviews in the way that we discussed and after the discussions created proposals that we showed and discussed further. The main goal was to get the members of the department participative in our developing work.

## 2.2 Ethnography combined with Participatory Design

The goal from the very beginning of this ‘project’ was to use Participatory Design [Schuler & Namioka, 1993] as the leading method together with ethnography. Getting the software developers actively participate in developing process support was one our strongest belief to be able to be successful with our ‘project’. They could provide the base information and we could hopefully guide them to put all the information together and get a good result in the end. To be able to reach the dead-line for our thesis we realised that this was the most appropriate way to go. We otherwise had been forced to get their experience to be able to create the support that would be useful. This could not have been realistic. In the same time we got the opportunity to try out Participatory Design as a method in reality and in a realistic environment.

Instead of using Participatory Design as a method for Software development it was interesting to use it for development of process support. A different way of working since you don’t have any ‘product’ to use during the process. Meaning that no Graphical User Interface (GUI) for example can be used in discussions,

which also is more concrete for developers as a reference. It made the process for us even longer since we didn't want to influence the support with our own thoughts. Especially in the beginning this was hard for the developers to handle. A new way of working and also producing process support instead of the usual project activities.

### 3 The nature of process

In this chapter we discuss what a process is and make a distinction between the words 'process' and 'method'. Reading Software development literature often gives a confusing picture of what the content of the word 'process' really means. First of all a definition of the word is often missing. Also different other words are used in the context and are mixed with this back and forth, as for example the word methodology. We argue that this confusion creates one part of the problem with regard to process support and its use.

Our intention here is not to create a new definition of the word 'process'. Instead we want to make a distinction with the purpose of giving the reader the content of what we mean when using the word 'process' in this thesis. Especially to reflect over its signification and meaning.

What can be decided is that the conception of 'process' means some kind of development. If it is looked up in a Swedish list of words or an Swedish encyclopaedia, some words of explanation constantly returns: *development, lapse, flow, change of condition, variation, transformation, continuous activity*. There is not one single word that constitutes the meaning of the concept. Instead it symbolises a certain phase where the words above can be features of this phase.

What seems to be a rule for a process is that it is something that is taking place between two time points. What is taking place is some kind of change. Out from this reasoning it seems to be hard, almost impossible, to define 'process'.

There are different kind of processes, for instance production processes, computer processes and thinking processes etc.. With respect to this different kind of processes, the word has a wide meaning and at the same time a rather clear signification. Bruzelius and Skärvad (1993), write that a production process must consist of some input that is transformed (get processed), and later generates an output. Between input and output a process has taken place.

An interesting aspect to mention is the following example concerning input and output of processes. It is not a process of production in the same way as Bruzelius and Skärvad mention it, but still a kind of production: A working process where the human brain takes in row data as input, process the row data, e.g. associating that data to earlier experiences and knowledge and finally results in new knowledge and information. Also for computer processes some kind of input and an output are generated.

Albert Danielsson discusses organisations in his book 'Företagsekonomi en översikt' (1983). He writes, among other things, about decision taking in organisations and mention Herbert A. Simon's (a pioneer in organisational learning) opinion. The central part in Simon's theory is that he wants an organisation to be seen as a process, where decision taking is the most important



just the list – you need to go to a store, you need something to put the groceries in, money to pay and so on.)

This paradoxical use creates an interesting point of view. Especially today when a debate is ongoing, and have been ongoing for many years, about software design and the developers and designers way of work when they develop software. Much critique have been pointed against the so-called old way of working (Gilb, Winograd), i.e. to follow different steps and lock the work after every step and not go back. A model that often is mention in these contexts is the so-called waterfall model. The principal characteristics for the waterfall model are in short words:

- All planning is oriented towards a single delivery date. If phased delivery is used, the phase units are substantial, and there is no formal concept of 'reworking' unsatisfactory phases.
- All analysis and design are done in detail, before coding and test. (Gilb 1988, s. 84).

Developing software in large development projects maybe demands that the work is divided into parts. At least to be able to keep moments in mind, i.e. what need to be done and what has already been done. Development companies of software often use models as maps to follow during the development process, often follow the waterfall model. These maps are often divided into different processes or activities. We agree that these models offer a great tool in large development projects when many people are involved. What this way of working is offering the developer is another thing.

In the system development context the notion process is probably used due to the fact that system development implies to walk through different sub processes (Njörberg, 1994). It is often complex parts that will be created.

To have a common expression when communicating about the complex work in system development is important due to the same reason as for similar contexts. Though, the notion process seems to be a notion which works as a sort of keyword when communicating about development of systems. It is a word that is used, as many other words, to get a mutual understanding of things and to be able to communicate about these things.

Another interesting aspect of the word is what can be called the tool aspect. This will be referred to what the concept really offers in development of systems - a valuable tool to use in daily work in many ways. To divide work in different parts makes it easier when talking about it, and in that way, makes the work more concrete and easier to study, understand and co-ordinate.

Anyhow, the notion is probably one of the system development areas most used notion, but maybe also on of the most misused words. It is easy to get a feeling that it is a word that people not exactly know the meaning of, just like the word Internet in the beginning, many talked about it without really understanding it.

## 4 Project model and work model at the company

This chapter will describe the two models that are used at the company when a project is running and also how a new project is formed and carried through. It is hard to make justice when describing these complex models but hopefully the text will give the reader a picture of which complex structures they are and which requirements they are putting on the project. This we needed to consider when we developed our process descriptions. (The models that we describe in this chapter are not the ones that we used during our work. It is the ones that are used at the department at the company during the software development.)

The department that performed the project were using the company existing standard model for project management. The model is used worldwide through the company and is based on experience gained from its use within the company all over the world. The model offers a total concept for project work and should be used in all kind of organisations and for all kind of projects. In this study it concerns development of software.

The model is conceived to meet the need for a uniform terminology and a common view of the working form in projects within the organisation. Since it does not just describe the different phases but the procedures for decision making as well, it actually serves as a tool for the project sponsor (part of the organisation which pays for the development). The model describes what to do in the different phases in the project, what documentation, what decision points and what roles should exist, but it does not describe or put any restrictions in the content itself.

One purpose with the model is to use two models in parallel, one general project model and one work model, which is up to the project to choose.

The description below is supposed to give a brief insight of the used model in this project. It is far from a complete description of the model, something that would not let itself be done within a few pages. The description is to be considered as background knowledge, helping the reader to follow and understand the company's culture and used terminology, not as a description of the projects proceeding.

### 4.1 The project model's four different phases

**Pre-study phase** is the starting phase. The purpose of this initial phase is to assess feasibility from technical and commercial viewpoints based on both expressed and unexpressed requirements as well as needs from external and internal customers. Preconditions for this phase is an assignment specification document. In other words, what it is that the customer wishes from this eventual project, and is it possible to do? A rough estimate made for the time schedule and

amount of work needed for the project's various implementation alternatives.

**Feasibility study phase** - the purpose of this second phase is to form a basis for the project and to prepare for a successful execution of the project. Different realisation alternatives and their potential consequences as well as their potential capacity to fulfil requirements are analysed in this phase. During this phase the project goals and strategies are also defined, project plans are prepared and the risks involved are assessed. Contract negotiations are initiated and the project organisation is defined at the comprehensive level. The questions to be answered are: is the product possible to do, what does it cost in resources, total costs and time to do it, which alternative should be chosen, and should it actually be executed?

**Execution phase** - the third phase purpose is to execute the project as planned with respect to time, costs and characteristics. This should be done to achieve the project goals and the customer's requirements. The technical work is executed according to the process and working methods that have been decided. The work in the project is controlled to check that the project is keeping the right track.

**Conclusion phase** - in this fourth and last phase the project organisation is breaking up. Other purposes are for the project manager to compile a record of the experiences gained and see that all outstanding matters are taken care of. In this phase the resources are phased out and measures are suggested for improvements of the models.

#### 4.1.1 The project model's decision points

The project model has five decision points called tollgates (which also goes for the work model), these tollgates constitute the backbone of the model. Position and function for the five tollgates are standardised and are decision points for the project. Formal decisions are made concerning the aims and execution of the project. It is the project sponsor who takes the tollgate decision, and takes the overall responsibility for the entire project and its outcome.

Tollgate decision must be well prepared. Before the tollgate meeting the sponsors have to read documentation from the project. This documentation forms the base for the tollgate decision, which decides if the project should move on or be closed. In these tollgate meetings the project and its outcome must be evaluated from different aspects. It is important to note that at each tollgate the sponsor can cancel the project, if he thinks it is the best alternative.

Following decisions are made at the five tollgates:

- **Tollgate 0:** Decision on start of project pre-study
- **Tollgate 1:** Decision on start of project feasibility study
- **Tollgate 2:** Decision on execution of the project
- **Tollgate 3:** Decision on continued execution/confirmation of the project or revision of limits/implementation of design

- **Tollgate 4:** Decision on making use of the final project results/hand over to customer/limited introduction on the market
- **Tollgate 5:** Decision on project conclusion

#### 4.1.1.1 Milestones

There are also different smaller decision points called milestones. These are used within the project and are handled by the project itself that means no sponsor is involved. Before each tollgate a milestone meeting is held with the purpose of being well prepared before the meeting. There are also milestones placed within the different phases with the purpose of helping the project in different ways.

It is the milestones that link the project- and work model together. The milestone also provides a way of structuring the time schedule and will give an early warning of potential delays. They make the projects progress visible for both the project members and the sponsor.

A review of each milestone is performed before each tollgate procedure. The project model describes when the milestones should exist, but it does not describe what content they should include or how this content should be described. These are issues left to the project manager to consider and decide upon. The project manager is responsible for the different milestone reviews.

Besides this project model, a work model is used within the project.

## 4.2 Work model

The work model can be different for different projects. It is up to the project to decide which model to use. The model used during the project for this study (also the project before) was called SDPM (System Development Process Model). The model describes the activities to be performed and arrived at specific results. It also includes a definition of the milestones.

SDPM do not support redesign or reworking<sup>9</sup>. To get a complete description of the work in a specific project, the work model should be mapped to the general project model.

### 4.2.1 The used work model's different phases

SDPM has three entry criteria's: at the Ordering of Pre-study, at the Ordering of Feasibility Study and at the Ordering of Establishment and Execution. The exit criteria is usually when the product has reached the status of PRA (Product Release A - the first available product release). It is from here we focus our development in this study.

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<sup>9</sup> Yet this takes place in reality. The designers often go back after the phase has been locked and redesign of the product. The model does not give an opportunity to go back and do redesign, because it is a very structured model. But as someone said; "...everyone know that they can go back and do some redesign. And this is always happening". [ref...]

SDPM consists of a number of activities, every activity has entry- and exit criteria. The exit criteria consists of a number of items that have been taken into consideration, and also that the documentation that should be done in the activity have been reviewed and approved.

Most of the activities are executed in parallel, but in order to monitor the project progress there are some milestones defined. The passing of a milestone includes that the exit criteria for a number of activities has been fulfilled. Configuration management<sup>10</sup> for documents and documentation levels are also defined at the milestones.

The activities in the SDPM model are divided into five categories. One category deals with overall co-ordination of reviews and configuration management, i.e. activities to sum up that criterion for passing milestones are fulfilled. The other four groups cover more detailed development work.

**Test activities:** Test is initiated and evaluated by a user, i.e. in the surrounding to the system.

**User docware activities:** Course & User docware describe the system interfaces and provide guidelines for usage (e.g. for testing).

**Requirements & composition activities:** Requirements are also directed primarily to interfaces and capture the needs of the users. Composition is aimed at describing the realisation results, i.e. products, for the production (and installation) personnel within the order process (and marketing).

**Implementation activities:** Implementation information is kept within the design responsible unit.

### 4.3 A new project is taking form and carried through

In the end of a development project of a new product version, the work with another new version is started at the department. There is no real break between two development projects, instead the different projects are overlapping each other.

Decision of a new product release (or a new development project) is not taken by the development department in Ronneby, this decision, or request which it actually is, is coming from the head office<sup>11</sup>. They have also different requirements on new functionality on the product that the development team must pay attention to and check if they are realistic to develop with the resources they have at hand.

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<sup>10</sup> Configuration management (CM) is a well established concept in the software engineering area. CM implies document control, code control etc within software projects.

<sup>11</sup> Every product within the company is included into a special category of products. One organisation is responsible of these products and their development. The organisation orders new projects against the product department. We refer to this organisation as the head office in this text.

Not only the head office sets requirements on the new application but also the operational product managers at the department. The operational product managers are the interface to the customer and have the responsibility to collect customer requirements.

The staff at the department, who has their own ideas about new functions and improvements can of course come up with new requirements. They can for example get ideas when an application is delivered at the customer site and they are there to support the implementation. However, not many suggestions to improvements are coming through this contact because of the sort of work that is taken place, that is what we have been told.

"...the work that are taken place at the installation and 'babysitting' ,at the customer site, do not result in any special suggestions to improvements. The work there is much like a 'low-level work' so to speak, that is for example changes from a comma to a dot in a specific configuration<sup>12</sup>..." [ref...]

Instead the operative product managers are coming with customer proposals. Customer requirements can be collected through different contacts with the customer that the product managers have. For example, through product demonstrations at the customer site. At these occasions someone can for example say; "...could the application do that or this? If we will buy the product we want these functions in it...", and so on.

Accordingly, there are three main parts that have some kind of impact on the functions of the product and the way it's working out; the head office, the operational product managers and the developers themselves.

When the end of a development project is approaching, that is when the product has reached a certain status, someone in the organization starts to work with the next product version. A new development project is in its initial stage. The manager of the department has a written document with specific requirements on the application; the document is called Application Requirements Specification (ARS) and contains, among other things, requirements from the head office on the product.

#### 4.3.1 Pre-study

The ARS constitutes the requirements that will be handled in the so called pre-study for the next development project. Every project have been assigned a certain amount of money and a project dead line (usually a project is running over one year), these criteria's should be tried to reach in the project if they are realistic. This will be investigated during the pre-study.

The pre-study in a project implies that a project manager and the product

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<sup>12</sup> Improvements could for example be changes in configurations, settings formatters etc.. This could imply improvements in performance or simplifying different processes for the administrator.

managers handle the requirements in the ARS. Each one of the requirements is analysed to find out if it is possible to realize. The team bring questions up to discussion like: Are we able to realize these functions within the frame of the budget? How long is the project going to take? Will the requirements be fulfilled? A time and cost estimation is made to every requirement.

#### 4.3.2 Feasibility study phase

The project has now left the pre-study and gone into what is called the feasibility study phase. Between the two phases, pre-study phase and feasibility study phase, there is hand-over meeting.

During the feasibility phase a time of negotiations and priority's is taking place where the project manager has a central role. Usually there are no problems with this if the resources are available.

The frames for the project are now settled, plans for develop the product shall now be made - A plan for the development project and a plan for the FOA INDUS project<sup>13</sup>. These plans have a complete different content then the earlier ones in the pre-study phase. The plans are containing dates for when different parts of the application shall be ready, test strategy, when tests are going to take place, contacts with external nodes for tests, time estimations and costs for the activities, construction of a support organization etc.. When these plans are ready and approved the development project can start, in reality this means that the coding starts.

#### 4.3.3 Execution phase

Two different project organisations are running different activities parallel during the execution phase - the development project organization and the FOA INDUS project organisation. To shortly describe the two organizations it could be said that the development project organisation is focusing on constructing the application and to test it. An important part of the FOA INDUS organisation is to build up well working contact with the customer during the development project. To keep the customer informed, get customer technical data, work out a test that the customer likes and verifies the functions and stability.

Another important part is to build up a well working support organization that can take over the responsibility of the product when it is ready for sale worldwide. These two organisations are working parallel during the time the product is growing.

When the product has reach the status of General Availability (GA), the

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<sup>13</sup> FOA INDUS (First Office Application – Industrialisation) means that a first release of the product should go out to a customer for testing. The customer has agreed to test this first release and to give valuable feedback. When this project is concluded and the product with this is ok, the product will be sold worldwide.

development of the product is ready and can now be sold worldwide. This status implies that the responsibility of the product is handed over to the support organisation. In the middle of the execution phase a new pre-study is started for a new product version. A new project has started before the earlier one is finished.

#### 4.3.4 Conclusion phase

To learn the lessons from the project, every development project is ending with what is called conclusion phase. The project manager is 'cleaning up' and will write an experience report for the project.

## 5 The three processes to design and our design for process support

As in chapter four this chapter will contain abbreviations that can be hard to understand for the reader. This does not really matter since the abbreviations themselves are connected to the specific company and will not do justice if they are not used in that environment. Without fully understanding these we believe that the reader still will get the picture of the work processes we try to visualize, and hopefully also understand how we came to the conclusion of our proposals.

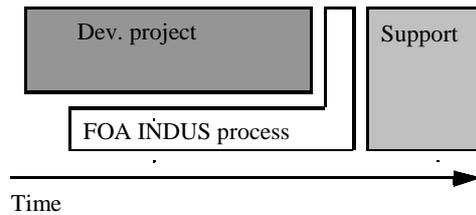
As mentioned in chapter four the development goes through different phases during a project. In the first phase (development) the process support already existed, but for the next coming phases we were asked to develop process support (the phases were FOA/INDUS, INDUS and Support). *This chapter closely describe the three phases and give examples (snapshot's) and comments from our process support that was developed. We are trying to explain why we designed the support the way we did and how we have been thinking during the development.* In the snapshot's from the documents that is included in this text we have replaced all the company related things, which can make the reader understand which company and product this is about. When such things are mentioned they are replaced with an X.

The chapter is divided into six subchapters. The first gives a general background, the second describes how we have been thinking and been working during design of our process support. The following three subchapters show snapshot from the three process supports that we created. We end up with a short summary.

### 5.1 General background

During a software product life cycle, the product passes through three major phases, the development process, the FOA INDUS process and the support process. A procedure well established in the product development through out the organisation worldwide due to a standardised process to follow. The positive thing here is that using the so called FOA INDUS process in software development implies that many errors in the code can be solved before the product reach the market. The phase will get the function of giving user feedback in the end of projects. But the feedback mentioned here is concerned with high technical aspect's meaning that the purpose is not what it could have been – a possibility for adapting the product to the user needs after they got something to try out.

So, the idea with a FOA customer<sup>14</sup> is to getting the chance of testing the new functionalities on site and finding critical errors before releasing the product. The figure below shows how these three phases are connected to each other during time.



The development process is executed in form of a project. The change between the development process and the FOA INDUS process is done successive, still there is a hand-over meeting between the two. It is just when a new product is in development it passes the FOA INDUS process. The second, third and forthcoming sale of the product, it just passes through the so called INDUS process because the first application already has been developed and will be considered stabile. The name INDUS is an abbreviation for industrialisation, and means that the product is being installed and tested into the customer network. The industrialisation phase normally takes between one and two weeks depending on the circumstances.

When the customer has accepted the product through different tests<sup>15</sup> performed at the customer site, it will be handed over to the support organization. The support organization offers support on the product two versions back, and then it ends.

## 5.2 Our way towards process support

When we began to seek for processes, we started with looking at earlier project documents, that is documented development of earlier versions of the product. The development project documents all activities during the project so every

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<sup>14</sup> A FOA customer is the customer appointed for the project, that is the customer that is letting the company to use them as test pilot. They are then the 'customer' within the FOA INDUS process. Of course they have pro's being the FOA customer because they have already tested the new project when it is released at the market and it is often important to be in the front line when introducing new products.

<sup>15</sup> This test is called 'acceptance tests' and developed by the project and accepted by the FOA customer. When the FOA customer accepts the product, he signs a document saying that the customer has agreed the product status. This is done avoid that problems should arise after the project organisation has left the customer site. A procedure always used.

document belongs to an activity so to speak. Although is it not always when a new activity takes place that a new document is produced, instead the document writer often uses an old document from earlier versions of the product as a sort of frame and only changes what is new for the current project.

We saw this introductory way of working, searching in old project document for activities, as something necessary for different reasons. Partly because all the activities should have been in these documents and partly because both the company and we thought that it would be an adequate method to start with.

We were putting a lot of weeks to read and to interpret these documents. After a while we had created a document with all the activities, according to the documents, that took place in the first development process. We thought we had a good base to start from. The base could be complemented with data from interviews and discussions.

A meeting was held to discuss the process and its content. The result of this meeting was that the description of the process mapped very badly to the reality. A big part of the activities were never taking place in the way they seemed to take place. A lot of decisions were done in the corridors, that is, if the system developers ran into each other by an accident they then took a quick decision about something. There were seldom any formal meetings, which the documents said.

In the same way many problems were solved. When something urgent turned up that where important to solve quickly or when an activity took place by more than one person at a time, much co-operation and work were happening through that one person went to another's room. The most of the work are although done in this way and not like the documents told us. Many activities do not become visible because of this.

The company's working ideology is built on document all activities that are taking place during a development project. Every activity should become a document. The existing work/process descriptions were built around documents. It looked like the documents steered the development process. We also, after a while, found out that much of the activities in the documents never took place. Accordingly, much activity was not necessary to perform but obviously still the document should be produced and most of the documents were produced just to satisfy the steering group. In some way it was the most important thing that the documents were created, the content of the document was not so important as the document itself. The reality looked as we supposed it should do. There were a lot of things that should be done according to the rules but far from everything was done.

We wanted to develop the processes support out from two different perspectives. The reason for this was that some of the users just wanted to get the overall picture and someone a more detailed view dependent of different level of

knowledge. Viewing such large processes would be impossible if only viewing them at a deep level. In that case it would be very hard for the user to get the whole context. The interviews at the department confirmed that this probably would be a good starting point (It was often heard that if the experienced people at the department should even use these process descriptions, a presumption was to minimize the documentation). The two different perspective were:

1. The possibility to get a quick picture of the overall process, where the user should have the possibility to see the process context within the decided time frame.
2. A very detailed view of different work activities taking place at time points. Respective responsible role in the project should be visible according to the work activity.

Together with three members of the department<sup>16</sup> we continuously held small workshop's where the focus was to find out an appropriate structure for the process descriptions and which different activities to describe. A whiteboard was used together with post-it notes complemented with written texts directly on the whiteboard. This method gave the group possibilities to move around the notes and the written text on the whiteboard.

During the development of the process support we had a lot of discussions with the involved people from the department. The meetings often took place ad hoc and we more or less picked up a certain person when we needed their feedback. It was very much like, what do you think about this or that? If we are doing it like this instead, what do you think about that? They came by when they had got a new idea and wanted to discuss something. This made our whiteboard in the room always filled with drawings.

The department had been through the different phases a few times by the time and had a lot of ideas about how they wanted it to look like. The ideas they had were very much based on the existing process support for the development phase. A lot of the ideas they came up with derived from already existing development methods used at the department (SDPM). We saw very early a recurrent pattern in their requirements that was very much like the existing pattern of the process support. For example they wanted some kind of checklist describing that criteria's for different status were fulfilled, otherwise they could not say that the product has reached a specific status. As one of the involved in the FOA INDUS process said at one interview:

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<sup>16</sup> These three people were selected for the Workshops because of their experiences, roles and most of all, they were dedicated to this work meaning that they really thought this work was needed. They would also be the user of the process descriptions. The different roles were training and user documentation responsible, Indus responsible and an Operative Product Manager.

“You can’t just say that we have reached GA (General Availability) status, quite a lot of criteria need to be fulfilled. Criteria that has been set up by us or by the main project leader.” [Interview 970304].

As this was what they requested, our process description included entry and exit criteria.

There is a large need of having control in the way of work and to visualize work that gives control over what’s happening. We never heard anyone wanted to take away or even not use the checklists included. Instead everyone had desire of control functions. Indirect this must lead to that the way of work will be very much steered to certain extent. *Our theory is that when the organisation puts high requirements on control of projects this will also permeate the way the organisation wants support for work.* Meaning that the process support, according to the personnel, must include control functionality. We can’t see any other reason for why there was such a great need of control functionality in the descriptions as they had.

In the same time as we often heard the desire of control functionality built in the process descriptions, we also heard following statements:

“The development model used today is not especially good but no one has the energy or time to make changes in it.”

“The model suggests a way of working that is not followed by the department. The project manager has to do the best with the resources he has. The analyse phase is for example completely missing...”

We leave the discussion if these things are connected, although we have to admit that is an interesting aspect. How are they connected and what will this imply for the way of working at the department?

After several workshops discussing the content of the process descriptions, we came to an important insight when different activities were discussed. During a discussion about what really took place at a certain point of time the personnel had really hard to agree with each other. What this depended on came to affect all the three process supports created. Some of the personal involved described the work that really took place but some described the activities they wanted to take place - Quite a difference. The discovery of this made that we had to start over with a lot of work already performed. We couldn’t be sure of what was included in the already collected material. Had they described what work actually took place or had they described how they wanted to work? Or even, how they wanted to visualize their work?

The best way of getting this material collected had been to video tape all the FOA Indus activities but this would have forced us to be at the department for a very long time which was not possible for the study.

We made a good experience during this workshop although it meant a lot of extra work. The decision necessary to take when creating process support is to decide what should be included in the support.

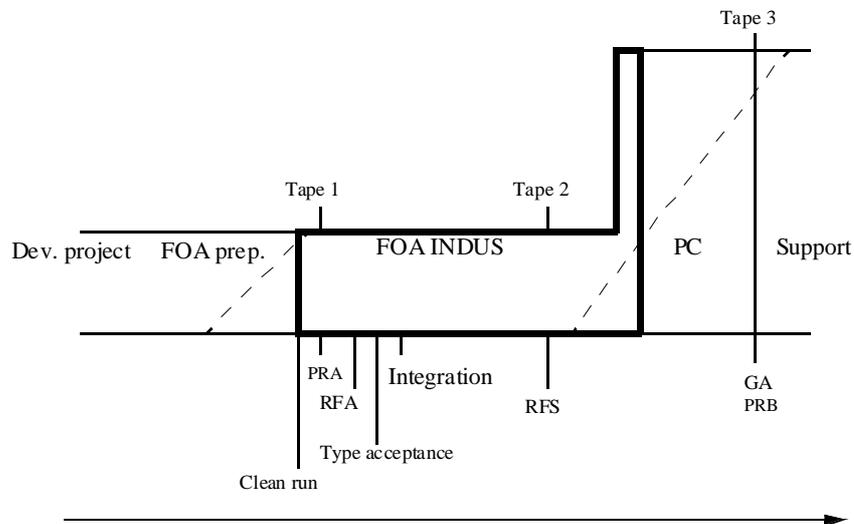
1. Should it describe how they should work according to them selves?
2. Should it describe the work that actually takes place? Also very important;
3. Who is the user?

*The point of departure for this study has been to start from what work is actually taking place. Even if we do not succeed to develop process support that is really going to help them, at least they have a view of how they work today and that is a good starting point for future development.*

### 5.3 The FOA INDUS process – description

Below is an overview of the FOA INDUS process that illustrates which status the product passes during the FOA INDUS process. The bold line in the figure illustrates the FOA INDUS phase.

To the left of the FOA INDUS phase is the FOA preparation phase, and to the right the Primary Consolidation (PC) phase. The dashed diagonal line indicates that the transitions between the different phases take place successively.



Overview of the FOA INDUS process. See below for a description of the abbreviations.

The planning for FOA INDUS process will start early in the development process. The organization that runs the FOA INDUS process is then taking over the product from the development organization when a preliminary version of the product, called Product Release A (PRA), has been released. This product (product release A) is the first version that is delivered to the customer for tests

(Tape 1, 2 and 3 indicates that tapes are produced with Software that has gone through different development phases).

At these tests one person from the company is at the FOA customer plant and executes the tests. This is done together with the customer. During this time the customer has extra support by the company staff on site.

An agreement is taking place between the company and the customer when the product is ready for delivery. The support organisation is then taking over. It will happen when the product is stable and the error frequency is acceptable according to the functional requirements. The company uses error classifications that are used to know how the errors should be taking care of.

During the FOA INDUS process, a well working support organization shall be built. When the FOA INDUS process is finished the product has reached status General Availability (GA), and with that also PRB (Product Release B). This means that the product is ready and can be sold to customers worldwide.

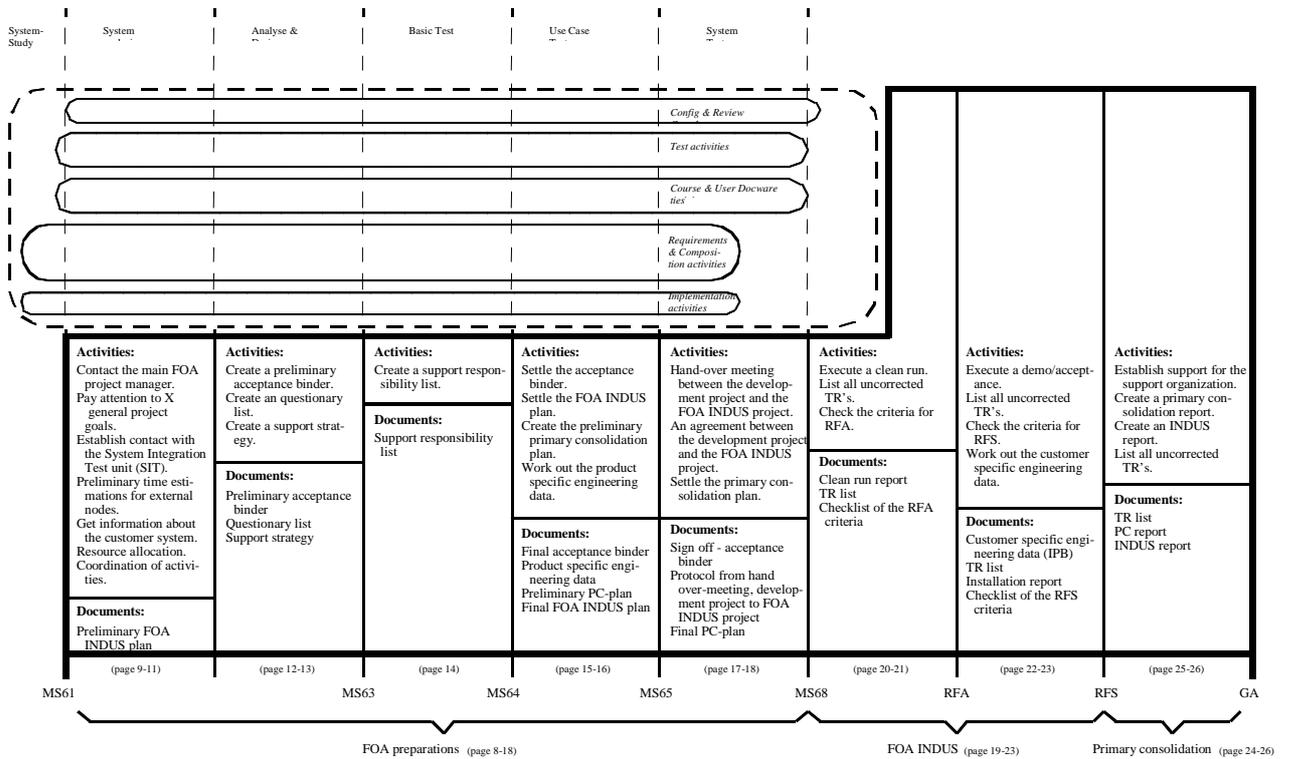
A one pager where created there the overall process were described in parallel with the design process. Because of many activities taking place in parallel, meaning that for example a certain activity in the FOA INDUS process has to take place early in the development process – in parallel. The designers need to see when they should start a certain FOA Indus activity during the development project, also when they need to have it completed.

All activities are verified through a document describing how the activity took place. Therefore we choose to focus on showing the documents that should be produced during the process and at which time during the project they should take place. The most important activities are also visualized.

To conclude, the one pager had the purpose of showing which activities, documents that should be produced and also at which time. A lot of work was put on creating this and it was one part the final result of this project. It was a new way of showing the different activities which should take place during the FOA Indus phase. We know that it was really used after we had left the department<sup>17</sup>. The one pager we created is shown in the figure below.

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<sup>17</sup> The one pager created was something that the department as a whole (ca 25 people) had an interest in since even if they didn't worked specifically with that phase, all of them needed to get the overall picture. With having the page on the wall, they could check quickly what should be done and when, also where they were in the project connected to a specific activity.



## The FOA INDUS process

~ activities and documents ~

The next description with the purpose of being more detailed had the aim of really describing the different activities. For example which criteria the activities demanded and which document they should result in. The headings at every phase description, without the ones specified above, were selected to be:

- Goals
- Entry criteria
- Input documents
- Activities
- Exit criteria
- Output documents
- Information note

Following headings came out from the meeting with the employees:

- Abstract

- Application
- Purpose
- Reading instructions
- Background
- Description of the process
- Documents that will be produced
- Different phase dividing, e.g. the phase between MS61 and MS62 (Milestones).
- Appendix containing concept explanations, document explanations and which role that is responsible for respective document.
- References to other documents
- Glossary

All those headings mentioned above are included in the process description that we created to the company. In the snapshot below not all the headings are included.

Below is snapshot from the FOA INDUS process support that we developed. We want to show the degree of precision in this description. The snapshot is just one piece taken out from the whole process support (see also the one pager) which includes several pages.

## **8.5 The phase between MS65 and MS68**

### **8.5.1 Goals**

The goal of this phase is that the customer should accept the functionality of the product. This take place through a sign off of the acceptance binder.

Also to hand-over the product from the development projects to the FOA INDUS organization.

### **8.5.2 Entry criteria**

- A final acceptance binder exists.
- The documents from the development project and the FOA INDUS project should be checked and OK.
- A preliminary PC-plan exists.

### 8.5.3 Input documents

- Final acceptance binder.
- A preliminary PC-plan.
- List over documents from FOA INDUS project and development project.

### 8.5.4 Activities

#### **Hand-over meeting between the development project and the FOA INDUS project**

The meeting shall contain the activities:

- Check all the documents during the phases up to MS68, against a checklist. This often takes place through looking at the previous project document and making necessary changes and additions, see Reference [1].
- The hand-over meeting shall result in a meeting protocol.

PM is responsible for this activity.

#### **An agreement between the company and the customer where the customer accept the acceptance binder**

The acceptance of the binder takes place at the customer site. Either the development organization goes to the customer or the company local office visits the customer to get the acceptance. If the company local office visits the customer, the binder must be sent to the local office.

If the customer does not accept the binder, it will be returned to the development organization for adjustments.

The FOA INDUS manager is responsible for this activity.

#### **Settle the primary consolidation plan**

The preliminary primary consolidation plan which were created in the phase up to MS65 must here be settled.

The FOA INDUS manager is responsible for this activity.

### 8.5.5 Exit criteria

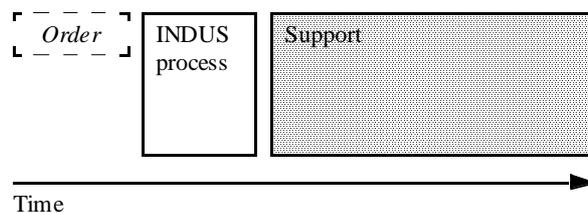
- A hand-over meeting between the development project and the FOA INDUS organization has taken place and been documented.
- An agreement has been made between the customer and the company regarding the acceptance binder.
- A final strategy for the PC-phase has been worked out.

### 8.5.6 Output documents

- A Sign off between the company and the customer.
- A protocol from the hand over meeting.
- A final PC-plan.

## 5.4 INDUS – description

The INDUS phase is quite similar to the FOA INDUS phase. But the product is already tested so there will not be any regular product testing. On site support is nothing that are common here, but the customer can ask for and get it. For example it can be mentioned that the department have developed their own service routines to offer if the customer wants any. The figure below shows an overview of the INDUS process related to the order and support.



The INDUS process description includes the following headings:

- Abstract
- Application
- Purpose
- Reading instructions
- Background
- Description of the process
- Documents that will be used and produced during the process
- Activities during the process
- Appendix containing concept explanations, document explanations and which role that is responsible for respective document.
- References to other documents

- Glossary

All those headings were selected together with the users of the process support. They wanted it to be like a checklist with responsible for each activity.

This description is on a higher level than the FOA/INDUS description. It is more like a checklist for the persons who are involved in the INDUS activity.

The process support has also the following headings:

- Preparation for the process
- Before deliver of the product to the customer
- At the customer site
- Establishing support

All those headings mentioned above are included in the process description that we created to the company. In the snapshot below not all the headings are included.

Below is a snapshot from the INDUS process support that we developed. We want to show how this is more like a checklist, which also clearly shows who is responsible for the different activities. The snapshot is just one piece taken out from the whole process support which includes several pages.

## **8 Activities during the Indus process**

### **8.1 Preparations for the process**

#### **Goal**

The goal of these preparations is to prepare and make efficient the implementation process of a sold product. Much of the work concerns the planning and administration of the entire INDUS process.

#### **Contact the main project manager**

The main project manager is contacted to get information about:

- The customer requirements on the product.
- Which date the customer wants delivery.
- Which date the customer wants a demonstration/acceptance of the product.

- Where the customer site is situated.
- Information about what support the customer wants.

The INDUS manager is responsible for this activity.

### **Preliminary time estimations for the INDUS project**

- Settle preliminary estimations for all activities during the INDUS project.
- Bundling.
- Delivery of the product.
- The installation.
- The integration.
- For the type acceptance.
- Courses, for the customer and the support instances.
- Cut over.

The INDUS manager is responsible for this activity.

### **Resource allocation**

Resource allocation for:

- Installation at the customer site.
- Integration with external nodes.
- Demo/acceptance at the customer site.

The INDUS manager is responsible for this activity.

### **Get information about the customer system**

Specific data about the current customer is needed, such as:

- The number of nodes that are connected.
- Which technical environment the product will be running in.
- User password on the customer's equipment.
- How the machines are connected.
- Which nodes will be interfaced at the customer site.

This information can be reached through the questionnaire list.

The INDUS manager is responsible for this activity.

### **Coordination of activities**

All activities above must be coordinated. This should result in a project plan that describes the INDUS strategy.

The INDUS manager is responsible for this activity.

### **Bundling**

An agreement should be reached between the customer and the company concerning who is responsible for the ordering of third party products. If the company is in charge of ordering the third party products, they are responsible for getting the equipment to the customer. The ordered equipment will arrive at the company for checking and configuration (OS, routines, memory, expansion cards et cetera). When this is done, the equipment will be sent to the customer.

It is very important to write a correct and detailed package list, in order to get the equipment through customs. The list should always be sent along with the product, whether it is sent with DHL, electronically or in some other way.

All licenses for third party products must be stored in the IPB information for the product. Information that must be stored is for instance the license key for the X.25 license.

All these activities are called bundling.

The INDUS manager is responsible for this activity.

## **5.5 Support – description**

The support organisation is an organisation which main task is to support the customer with the product. To support implies shortly to help the customer when he needs it, for instance to give help regarding questions about the product functionality. Three different instances within the company must be identified for every customer;

- The local office (LC), which is situated nearest the customer (first line support),
- The major local company (MLC), which is a central unit for support at the company worldwide (second line support)
- The support organisation at the company that have developed the product (third line support).

One goal with the support organisations at the company is that the organisation as much as possible will give third line support. Depending on often long distances to the customers. This is for making the organisation more effective. Accordingly,

an important thing for the support organisation is to serve the two instances LC and MLC, so that this activity works as well as possible. Other activities that are parts of the support organisation work are for example to offer a good Help Desk to customers.

When the product has passed the FOA INDUS process, or the INDUS process, the support organisation is taking over. This happens when the customer has accepted the product, that is, when the product has reached PRB. The company offers support of the product, formally two releases back, before end of support.

The support organisation is a line organisation and is not connected to any specific project or product.

This process support differs quite a lot from the other two. In this support we could not point out any role that is responsible for the different activities. It is more like a description over the SUPPORT phase and how the support organization should work. The proposal contains the following headings:

- Abstract
- Application
- Purpose
- Reading instructions
- Background
- The support organisation
- Support personnel requirements
- Hand-over between the INDUS project and the support organization
- Monthly meetings
- Monthly reports
- Frequently Asked Questions – FAQ's
- Test environment for the support organization
- Help Desk activities
- Trouble report handling
- End of support
- Appendix

All those headings mentioned above are included in the process description that we created to the company. In the snapshot from the process description below are not all the headings included.

This was the most “not investigated” area of the three (FOA Indus, Indus & Support) that we described. Also here the largest requirement from the persons at the department was to have checklists. One of the persons that we interviewed said;

“A simply checklist which can be ticked off.” [Interview 970324]

Since this was an area not that much investigated they said that we had totally free hands. They said that we could come with suggestions and discuss those. In the same time we felt that they wanted the process support to be as much like the one that they were used to as possible. They were asking for some kind of checklist so they could be sure that everything was covered. This phase has not that clear time line as the other two. Here, no entry and exit criteria could be defined, instead the different areas of how the support could be performed has to be described and the important things to consider for the different areas.

Below is snapshot from the SUPPORT process support we developed. We want to show how this is more like a description over how the work should be done. The snapshot is from the “Help desk activities” chapter. The snapshot is just one piece taken out from the whole process support which includes several pages.

## Help Desk activities

It is to the Help Desk the customer turns when a problem with the product has occurred. Answering questions about functions in the product are the main purpose of the Help Desk, but other questions need to be handled too.

Problems and questions come in to the Help desk via the following channels:

<i>MHO</i>	XXX-XXX
<i>Product Help Desk</i>	+46 XXX XXXXX
<i>Memo</i>	XXX.XXXXXX
<i>E-mail</i>	XXX@XXX

Questions are only answered during office hours, CET 08.00 - 17.00. In case of an emergency the customer can turn to the 24-hour emergency team (see Section 13.1 on page 10).

When a Help Desk call, memo or an e-mail is received, the person who receives it is responsible for registering it. There are no specific templates for this today but a recommendation is to use a Framemaker document as a template, one document for each month. The document could serve as an information source for the FAQ's, see Section 11 on page 8. The document could also serve as an input to the monthly report over the support activity where it could give a picture of the work comprise.

The document could contain a table with the following data to be filled in:

1. Name of the caller.
2. Position (profession) of caller.
3. Phone number of caller.
4. Name of person who received the call.
5. Time, date and duration of disturbance.
6. Brief description of fault.
7. Brief description of actions taken.
8. Other persons involved.

If the question has been sent to the memo id, it has to be answered in memo. This is to make use of the function that makes it possible to see when a person has read the memo. When a question is answered in memo a copy of the answer should be sent to the product e-mail address.

**The answer to the customer must include the question, in order to make it possible for the customer to understand the received mail.**

Every week there is one person who is responsible for the help desk. This person is indicated by the rooster list, see Reference [1]. At the hand-over of the responsibility the list must be signed by the person taking over the responsibility, that is the person next in line.

It is important that all customer contacts during the month will be reported. For more information about the monthly report, see Section 10 on page 8.

## **Emergency activities**

The emergency activity is a service that the customer can order for a certain amount of money. Through the emergency service, the customer can reach the company 24 hours a day if they have a serious problem with the product system. The emergency service is not to be used for questions concerning the product functions. The team follows a rooster list which lists the members of the team and the weeks of the year. Each person is on duty for one week at a time.

The emergency team is available via telephone.

*Emergency mobile* +46 XXX XXXXX

The emergency mobile phone must not be used for other purposes than reception of emergency calls.

## **Equipment**

The equipment for Emergency Service includes:

1. Mobile telephone with Voice Mail service.
2. Battery charger, including AC-adapter.
3. Rechargeable batteries.
4. Identification card.
5. Emergency Service binder.
6. Lap top.

## **Reporting**

All calls received by the persons on duty are to be answered with “Product-emergency service” plus the name of the receiver. The call should also be documented and reported. The report should be sent to the contact persons at ESO/TAC and FSC/RTAC, and the person in charge of the emergency service at the company, this is department. It must include the following information:

1. Name of caller.
2. Position (profession) of caller.
3. Phone number of the caller.
4. Name of person who received the call.
5. Time, date and duration of disturbance.

6. Brief description of problem.
7. Brief description of actions taken.
8. Other persons involved.

#### **Documentation**

The Emergency Service lap top should contain the following information:

1. Emergency duty roster.
2. Phone numbers of persons in the service (home/office).
3. List of useful telephone numbers (to managers et cetera).
4. Telephone numbers for ticket reservations.
5. Contact numbers/names in country of the ESO/TAC/FSC/RTAC/operator.
6. Support instruction.
7. Customer information (Plant specific engineering data).

The person who receives or changes the information is responsible for keeping the information updated. The person responsible for the information contained in the laptop is the support manager.

## **5.6 Summary**

All three supports are quite different but in the same way quite equal. All of them have the same purpose of being a support for the employees at the department. The reason why they went quite different were that the three areas are different and therefore different support is needed. All the supports have been developed together with the end users and should support the needs that the users have. An intention was to make process support both for persons who had worked at the department for some time and for newcomers. We are sure that they will use them different, but there should be support for both of them in their daily work.

## Part II

This second part is more theoretically oriented. We use part I as a base for a general discussion around process support in software development. The study that took place serves as input for our discussion and will show the different things that we discovered during the study.

## 6 Process support in the software engineering area

### 6.1 A clear concentration

The reference department perspective of today, towards software methods and process support, has a clear concentration against the two directions of a technical viewpoint at methods or a managerial viewpoint. They could also be expressed as two different approaches.

The technical approach treat the software development process from a technical point of view where the focus is on activities such as requirement analysis, architectural design, detailed design and implementation. This approach aims at producing different documents with different focus. For example, the requirement analysis will result in a requirement specification where the goal is to collect and present all the requirements on the future product. The work is done as an ongoing process together with the customer. The rest of the documents, produced during design and implementation phases are more like system descriptions on different levels with a very technical focus.

The managerial approach is concerned with phases within the development, i.e. temporally related groups of activities. Typically, phases start and stop at well defined points in time, and terminate with a review of a document. This document verifies specific activities performed and are in reality a review of performed activities. Out from the review a conclusion of the project status can be made.

As a conclusion of the existing methods at the affected department, they had these two different concentrations. And we dare to state that this is something general through the whole company (probably also general for the software engineering discipline). This was the concentration on methods at the department where the base for this thesis were formed. Later on it was proved that these two concentrations were at the two other design departments developing complete different products within the company. Through viewing the Intranet at the company it could be proved also that very many department uses these concentrations (it very usual that they put their process support at the Intranet). In fact we haven't seen any different.

Using these concentrations depends on general requirements ('templates' to follow) within the company on how to develop or use methods. One of us did

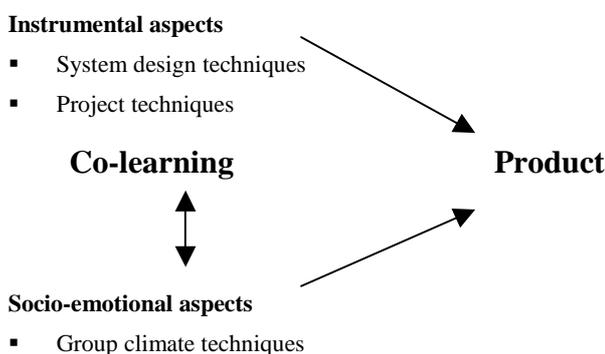
also, after we had left the department, work at the department within the company who states the requirements of much of the company process support. One of us has also worked with method development centrally within the company.

The book, Software engineer's reference book [McDermid et al, 1993], can be seen as a document that shows the mainstream within the software engineering discipline. The chapter regarding software development process models, describes that there are obviously a number of alternative models proposed in the literature regarding software engineering, which could be agreed upon, so McDermid and Rook chooses to just describe some different approaches to modelling. They describe among others the technical and the managerial viewpoint to modelling processes. According to them these two concentrations are the valid ones for processes. Their description verifies our theory concerning the mainstream within software development process models.

We want to point out that we do not want to argue against these two concentrations, quite the opposite. There are probably two concentrations that have to be used in large organisations, i.e. the one we have been visited for this study. But quit obviously there are something missing when there are such a big hesitation against the approach chosen. What we have seen so far, also missed in McDermid's and Rock's paper, is that there should be a third concentration beyond the two mentioned – the technical approach and the managerial approach. The third concentration should be an organisational approach. To explain what we mean, we will continue the discussion.

According to Hägerfors two large aspects form both the process of work and the quality of result, and there should be a focus on both. The two large aspects are the instrumental aspects ant the socio-emotional aspects. Included with these two is the co-learning aspect which is central since it play a major part in the development projects.

Process:



Mutual affection during the process affects the work process and further on, leads to different product quality<sup>18</sup> [Hägerfors, 1993].

To understand how and why work groups work as they do, both the way of working (instrumental aspects) and how the participants co-operate and communicate with each other (socio-emotional aspects)), need to be studied. What she says beyond the instrumental aspects (according to us; the technical and the managerial viewpoint to modelling processes [McDermid, Rock]) is that another aspect is important to treat – the socio-emotional aspects – The organisational approach. She puts the finger on an essential part here, the importance of also focus on co-operation in the group.

What was seen during this study was that the development group used a special way of communicating. They had a need of fast and face-to-face communication that were shown through their way of checking things, ask things and just solve immediate problems. They went to each other's rooms and solved the problems that came up. Most often 'problems' were solved in the corridor. The documents produced then visualised that the things that the method required to be done at a certain time, was done. But it almost never shows how it is done, that is, the work that actually took place.

If a document not describes how something is done but 'just' when it has been done, it's major function turns out to be a function of control. In that way it will be hard to anchor the meaning of process support in the design projects. The designers in the project missed the description of how different things were solved. The documents were often written just before they needed to be delivered to the project manager and not during the activity. Designer's want's to code and not write document.

A design department is unique in different ways. All individuals are individual and different in their way of thinking and act. The work will be completely different dependent of which individual that is performing the activity. Different experiences also affect the way of acting. Newcomers do not work as experienced workers. A certain culture impress the department in its way of act and work. In the middle of this comes the requirement of using a certain method. Often with little interest or knowledge about methods, this has to be implemented in the development project. No easy thing to manage.

The method used at the reference department is concentrated against the managerial direction – the control function. *Too little notion takes of the socio-emotional aspects and this is the missing point. For example how do they actually work and why, what is the work containing of, how do they communicate, is there*

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<sup>18</sup> We would like to add that the product in one way also would affect the instrumental aspects and the socio-emotional aspects. Hägerfors does not mention this and we do not want to go deeper into that but it is important to point out the opposite direction of the arrows.

*support for co-learning, which culture(s) is there? If these aspects not are considered the changes of succeed is not big. Co-learning is central and a major part of socio-emotional aspect since this is helping them to learn by each other, which is missing here. The documents will only be prof's for activities and does not support learning between the developers.*

At the company generally, there is a requirement of quality improvement that requires process support. Generally there is an indirect requirement of using the general project model. Which work model to use, is often up to the local company or the department to decide. So we are not saying that the departments are forced to use a certain support but too little effort is put on choosing methods. Another essential thing is probably that knowledge of how to develop your own process support is missing<sup>19</sup>. And if you do not consider these aspects (socio-emotional) the process support will natural get a managerial concentration, that is, a control function.

So the philosophers stone here is probably what it depends on that the implementation of process support does not work properly in this company. It should be mentioned that the company has a clear strategy of using process support through out the company.

## 6.2 Four explanations

Answering the question cannot be done in an easy manner because it is individual for each organisation. Though we have four explanations to the question, regarding this company.

1. The socio-emotional aspect is not enough considered. Several questions need to be answered before starting to develop an own method. The managerial and technical aspects should of course be considered also in the future. Without them it will probably be impossible to handle larger SW development project. But the socio-emotional aspects need to be considered and be put into relation to the other aspects. Without them the focus on the process support will be too strong against the control function. Question to rise are: Which way of co-operation do we have in our organisation (informal activity)?
2. It is important to have in mind that the total optimal rational process probably never will be developed<sup>20</sup> [Parnas, Clements, 1986].

“...although we will not succeed in designing a real product in that way, we can produce documentation that makes it appear that the software was designed by such a process”[Parnas,

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<sup>19</sup> No easy thing to manage. We have discovered the little knowledge we have of the subject, although we have some experience.

<sup>20</sup> And how could it be when activities never are exactly the same twice? Two SW development projects are never exactly equal shaped.

Clements, p.251].

Parnas and Clements theory is build on the impossible thinking of creating the optimal rational process. As they say: We can state that we have built the ideal process even if we still cannot follow it completely. But, we can still follow it as closely as possible and we can write the documentation that we would have produced if we have followed the ideal process.

3. The development speed is today very fast due to the high pressure from the market<sup>21</sup>. New advanced functions need to be developed all the time. The designers have a hard pressure in the projects to develop for the ‘final’ release. What will be suffering out from this is following the methods.
4. It is hard to get acceptance in the organisation when raising questions about socio-emotional aspects. There could be a conflict when this aspects meets the design organisation.

#### 6.2.1 Hard thinking – Soft thinking

We have tried to deepen into the problem with getting acceptance in organisations. Not saying that this problem always is there but in fact it very often is. It is hard to answer what this depends on. The first three points above are big reasons but another aspect needs to be added.

Hägerfors discusses the need of different thinking in system development processes. She refers to Checkland’s theories concerning different types of thinking<sup>22</sup>, and of course states that both of these two types of thinking are needed.

Designers often see his/her mission as to reach the given aim in the most effective way. Hard system thinking, according to Checkland, is the assumption that;

”...the reality is objective and the goal is clear. Which who is a designer is considered meaningless. The hard system thinker thinks that the reality looks like it does, regardless who is studying it. This kind of thinking suites for problems which are well defined and easy to find and understand.” [Hägerfors 1995, p. 28].

Typical questions in the hard system thinking are:

- What is the problem?

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<sup>21</sup> We saw this at the department. Later on, through discussions with two other software development departments within the company, it has been showed that this was the case at these departments as well. One of the departments had, according to high time pressure, taken the decision to not use design documents during the execution phase of the project. Meaning that an important part of the method was left out. This was obviously a big mistake that caused a lot of problems.

<sup>22</sup> Checkland, P., 1981, Systems Thinking, Systems Practice, John Wiley & Son.

- Which is the best solution?
- Which is the best way of building the system?
- Which is the best way of implementing the system?

The soft system thinking is when:

”...something feels strange or that one in the company thinks that there need to be improvements, then it is concerning problems hard to define and delimit./.../The problem situation is lighted up and is described from many different visual angles and views. The system looks different dependent of who describing it. The one who studies the problem situation stands in the centre.” [Hägerfors 1995, p. 28]

Typical questions in the soft system thinking are:

- Who sees something?
- What are we choosing to see?
- How do we comprehend what we see?
- What should we see as the system?
- What will our purpose be?

During our study we came to realise that what we were working with what probably was seen as something abstract. Nothing is strange about that. We came from outside the company trying to help them with developing support for their work and had no idea how they really worked, besides that, with an abstract subject. Our academically background where not any traditional background at the department. We sooner understood that we should have had tried to anchor our work more often within the department. The work we were carried out was not totally in phase with their traditional way of thinking, not saying that they did not agree in the final work, quite the opposite. The missing point within the department was instead commitment, commitment for working with ‘soft issues’. Checkland’s reasoning is probably right.

The major issue to solve when developing process support is to have this in mind and to have a clear strategy how to reach commitment.

There is no doubt that both these types of thinking are needed in software development projects. The problem is, like Hägerfors writes, that a person who basically thinks that there is an objective reality has hard to understand the soft way of system thinking. The hard system thinker is sure about there is a true picture of the situation and is about to find this. The problem sees to be the same who ever finds it. In the same way a person with soft system thinking sometimes can have problem with suiting him self to the context where hard system thinking is situated and the problem and goal are considered given.

Process support from the developer’s perspective seemed to miss the soft aspect, that is the co-learning and co-operation aspects. The developers saw the

support as more of a controlling function (managerial focus) since they focused on showing that certain activities have taken place. Once again, there is a mismatch between the need and the used process support.

## 7 Reasons for low use of process support

Ann Hägerfors is discussing the subject *process quality* [Hägerfors, 1993]. She declares straight and simple - To ensure quality within SW development the concentration is in the description of the process, not in the valuation. Documentation of a standardised processes or method is automatically often seen as a guarantee for high product quality. The quality standards of today support this application [ISO, CMM, TickIt etc].

It is well known that there are a large amount of system design methods and more there will be. A famous problem is that the real use of them is very low. Even if the method is in the shelf and says to be the company's system design method.

As this thesis indirectly, Hägerfors raises the question: What it depends on? Four possible reasons (answers) are given by Hägerfors.

- The method does not fulfil the needs of the user.
- Subsystem designers want's to invent more than they want's to analyse and discuss.
- Methods and processes are drawing-board products and not anchored in real activities.
- Use of methods does not give other or better results than not using them.

According to us, two additional aspects need to be added:

- The fast speed as a requirement during the development process will make the processes suffering. There is often to little time to use process support.
- We will never find a process that allows us to design software in a perfectly rational way [Parnas, Clements, 1986].

Below we discuss the reasons for low use of process support with the experiences that we got from our study and what we think a process support developer need to consider when developing the process support.

### 7.1 The method does not fulfil the needs of the user

Who is the user and how does the user work? What way is the best to present the process support so the user really use it in a natural way?

Letting the user develop support by them selves (with support of us) sounds at a first listening to be realistic and a good manner. Who can know the needs better than they that have them – probably no one? But people who are creating things together with their customer knows that knowing the needs and define them, by

the stakeholder, is not always an easy part. Another hard thing is the process of interpretation as well. The common picture of their needs had been stated and there were no problems with that.

The second question mark is in what manner should the user have the possibility to form the product. As much as possible of course, will be the first answer. The second answer will be that it must be in parity with the user knowledge of his needs and the capacity of exercise these on a product. This can easily be misunderstood but given a metaphor this maybe will be explained further.

Take for example a craftsman with many years of experience travelling around between different places. Knowing exactly how to act in many hard situations. Through the years he sees a need of a new means of assistance. He thinks it should be much easier to do his work if he had this new tool – a tool that helps him with coordinate his work. He needs a calendar. But he has not the knowledge to develop this calendar (according to himself he probably can do it, but definitively he has not the time). So he hires a company that lives on developing calendars. The company spends some time to analyse what he needs together with him. The requirement analysis will take place and the calendar development starts.

The company have the purpose of really letting the user of the product develop it with help of them selves. “This is the way I want the calendar to look like...” is often heard and accepted during the project. In this way of working they strongly believe that the final product must be what the user really wants because they really are involved into the developing process. It is not hard to get blinders (blinders that some kind of way are positive and not as blinders usually are associated with that is something of a negative nature) that hides that they actually need the company to say stop sometimes. Maybe not literally but it is about to try to convince the craftsman that all these stuff are not the optimal things for his use. After the product is ready and everyone is satisfied, the company starts analysing what they really did during the development. This to see if anything can be better next time. After every project they goes through this process aiming at improve their own abilities.

It is with some hesitation we afterwards think that a mistake maybe was done when not saying stop sometimes and try to show other alternative ways. Going native is a risk for you as a developer in participatory design (Dittrich, Lindeberg, 2001). There was a strong influence from their work model (SDPM). They seemed to be satisfied with that structure and wanted the new process support to have similar structure, that is well defined what to do and when, during the development project. The process itself seemed more important than the result.

The department was satisfied with the process support developed, although it felt like there finally was too much steering in the support. Still not to forget, it was developed as the users wanted it to be, or maybe as they thought it should be.

Another reflection is concerned with the way that we delivered our product, i.e. the process support. We delivered them in paper form and as files. If we instead had delivered the descriptions in form of a web page on the local Intranet, then everybody easy could reach it and use it<sup>23</sup>. There was a strong interest in the Intranet and the possibilities it could offer. Programmers often want to use the computer as far as possible. Documents in paper format were not especially popular.

To be sure that someone would do updates after we had left we should have pointed out a person that had the responsibility for the web page. In that way the descriptions should have been dynamic and more suitable to the users and in that way probably adapted to the user in a higher way.

## 7.2 Subsystem designers want to invent more than they want to analyse and discuss

This is both true and false. Maybe the designers' want to analyse and discuss more, but they have those high time pressures<sup>24</sup> so they do not have the time to analyse and discuss. This time must exist, especially in the beginning of projects. To develop better products it has to be a balance between inventing and analyse/discussions.

Two different attitudes were seen at the department concerning the work models. One wanted to analyse and discuss the way of working and to test new models. Another one wanted to work after the already existing way of working; "It works with that one, why bother to have a new one?"

"...some people at the office, the half I think, wants to change the work model to a new one. The one's that have gone four year at the university want this to happen, and the one's that have gone two years want the old model to stay. It is not popular to talk about changing model..."<sup>25</sup>

The personal that wants to change work model think it is not enough

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<sup>23</sup> After the study was performed we discovered that the company a year later had a special department that developed and offered process support for Telecom software development in one certain product area (not the one concerned at the department and probably no one there had seen it). The 'method support' (as they called it) had the purpose to support all the design centres around the world. For each process to be performed a description existed and templates for the documents that needed to be produced. For each document to be written at least one example existed. This support was to be reached from the Intranet where all the different documents could be reached and downloaded. With this new tool the user at the design centres could see the total flow of the development and hopefully see how all the parts belonged together and how important every part is. Through experience from the department and from a user perspective, we know that this site is heavily used within the company.

<sup>24</sup> The hard time pressure during the project was there during the big parts of the project. After the study this have been experienced in many other SW development projects at other departments within the company. This is not any unique within the this especially department.

<sup>25</sup> Interview with one of the project members in the current development project.

supportive and it is hard to follow during developing the product. The other part, who want to hold on to the old model, think it is safe and motivate it with that the other Companies offices are using the model. However, it is going to be hard to change model, many people do not want to meet changes. Nothing is strange about that.

One other reason for this division into two different attitudes could be that some of the employees feel comfortable in their existing roles, they know what to do and when, and which expectations they have on their shoulders in the development work. They had their own repertoire of experience and maybe they were afraid of losing some of their special areas if changes would take place in their way of working.

### 7.3 Methods and processes are drawing-board products and have not been tested in the project reality

There is reason for the assumption that this is happening very often. But we are not sure that this is the case within this company. Meaning that today there are many departments that adapt process support to their activity but what they miss is to handle the socio-emotional aspects and the informal way of work within the organisation (see chapter 6).

As mentioned, much activity are performed and solved situated in the corridor. Much problem solving and knowledge spreading in groups are also taken place in the corridor. So there is a paradox here when using very much structured methods for work that mostly is done very much situated and ad hoc.

### 7.4 Use of methods does not give other or better results than not using them

If you look at it in the short run it may look like this. But if use wider perspective of this and look at it in the long term, it will be better results. We need process support and methods because they are providing us with structure and that is always needed in SW projects.

The structure gives frames of possible help to map the ideas against. That is, with the frames, the user have something to apply his/hers ideas against. Without them, there is just a black box so the methods are generating knowledge. It also gives a common language if a department can refer to different decision points and phases. As a newcomer this makes it easier to get in to the work.

For larger software projects it is important to have a model to work with. There have to be deadlines when different things shall be finished, and the project has to follow deadlines to be able to handle big projects. The problem is probably that the process itself often seems more important than the result.

## 7.5 Fast speed as a requirement implies less time for process support

Today the projects need to be run very fast. There is a high time pressure to get the product to the market. Customer requirements turns out to be what were not expected and also new internal requirements from the organisation are added to the project<sup>26</sup>. All these are different factors that affect the development.

To be able to fulfil the requirements the use of process support is often left out or minimized. We have often seen that projects need to be updated because of things that have been missed during the development. The product does not work as said. If process support had been used we think that the quality of the product would probably have been better. Other benefits would have been: internal security within the project organisation and work activity, shorter lead times, easier to perform follow-up activities within the project. We have seen this in several SW development project after this study took place.

## 7.6 We will never find a process that allows us to design software in a perfectly rational way

No process support can be the perfect support for rational design. It is impossible to create the optimal process support since the reality is always changing. Process support is static since it is visualized through text on paper. After a development project when you have all knowledge about all the activities that took place, it's easier to create your process support. When using this support in the next project reality has changed such as new requirements, people, organisations, environment etc. What me mean is that of course good process support can be created but not a perfect one.

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<sup>26</sup> New requirements or changed requirements are handled with what is called Change Requests (CR's) within the company.

## 8 Conclusion

The research question was to get answers on what the big hesitation within the software engineering area against process support actually depends on. Also to get some answers of how to act when developing support for software development in larger organisations. The development process has given us many answers but it has of course also generated new questions. Answer on how to develop the optimal process support can probably never be given but we have come one step further in this knowledge. We have also realized the complexity of this subject. The development of process support was our contribution to the department, the 'product'<sup>27</sup>.

We have seen a way of working that is very structured in a way that you always follow a plan. The truth is that what is followed is a common agreed way of work by the group that is formed by socio-emotional aspects. That is, informal rules created through the way they had choose to work, informal. The documents got the roles of proofs that the project members could choose what to prove with, which activities. They were evidences for plans and way of reconstructing the project reality (Suchman, 1987). Every member of the project did know this, that made this way of work possible. When the organisation puts high requirement on control of projects this will also affect the way the organisation wants support for work.

But how do you create process support for this way of work? The answer we will give is:

*Consider the socio-emotional aspects in the organisation, the co-learning aspects. Aspects as how do they actually work together and why, what is the work containing of, how do they communicate, is there support for co-learning, which culture(s) is there? Instead of only focusing on management concentration in the process support, the support must also contain support for sharing experience and knowledge. Meaning that the support must contain more then only one concentration – the control concentration.*

Then try to develop techniques and process support for work that corresponds to the situation/context, such as organisation, people and goals.

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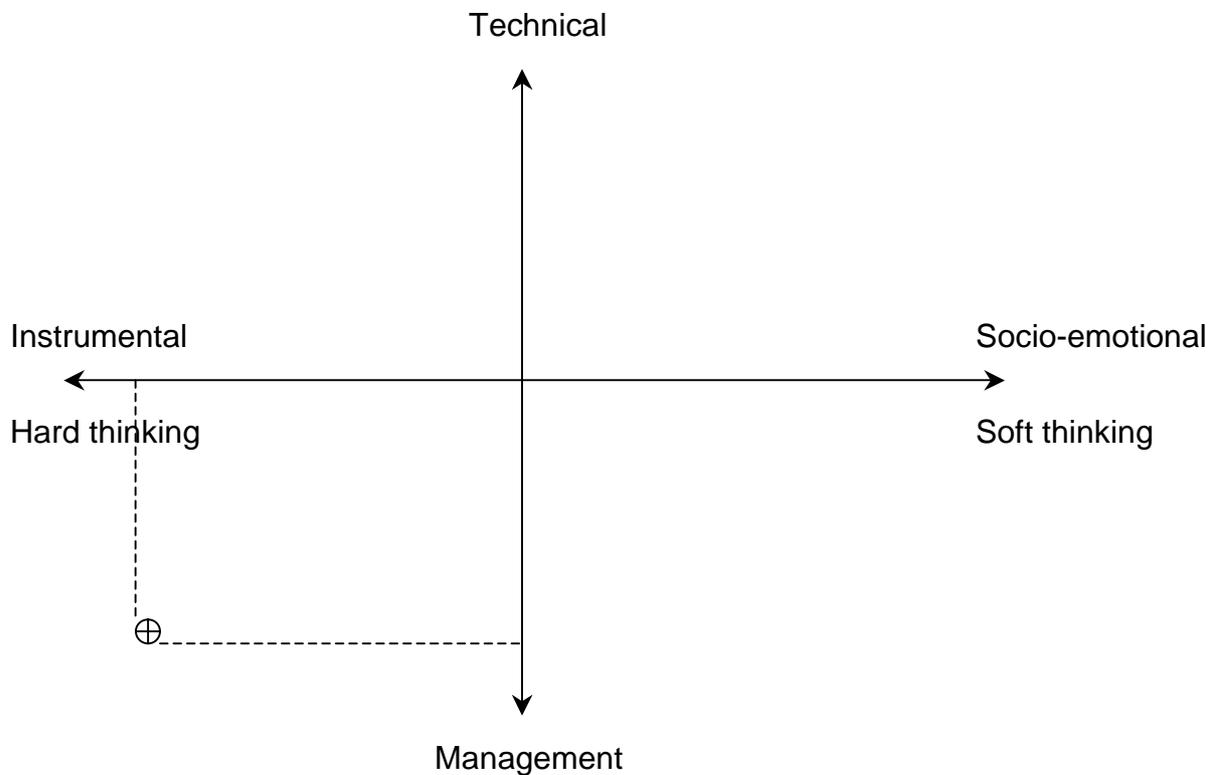
<sup>27</sup> The process support was produced during the study, descriptions for the processes FOA INDUS, INDUS and support. They were also delivered to the department as promised. Snap shot from these are included into this thesis, (see chapter five).

## 8.1 Direction of Process Support

What we saw during the study we have tried to visualise in the figure below. We use Hägerfors, Checkland and McDermid's perspective as a framework to show the reference company's use of process support.

There is a clear concentration towards the managerial concentration, both in the use of the support and also how support look like. The support has a technical focus but the documents (for example Requirement Specification, Implementation Proposal etc) are not supporting the actual work process enough. Also hard thinking is in majority and the Instrumental aspect is very important as such.

Socio-emotional aspects are very little considered.



## 9 Acknowledgements

We would like to thank the reference company and all the people at the department where the study took place.

We would also like to thank Björn Andersson for his support.

Finally we would like to thank our supervisors Yvonne Dittrich and Berthel Sutter for valuable critic, engagement and support.

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