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ON INTRODUCING INFORMATION SYSTEMS IN ORGANIZATIONS

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<p>New information systems (IS) are continuously being introduced in organizations. Every new information system is a large investment and it is hence crucial to smoothly get the users to accept the system and the new ways of working. Therefore, it is vitally important that the information system projects succeed. But it is commonly known that information systems projects are very seldom completely successful and every project has to tackle various challenges. The aim of this thesis is to open up these challenges and discuss the critical success factors of IS projects.</p> <p>Theory on the topic is presented in a literature review. The empirical part of this thesis consists of an investigation of the case company Wärtsilä's functions related to IS projects. This investigation is conducted through interviews with people who have experience of IS projects. Based on synthesis of theory and interview findings, conclusions are drawn and improvement recommendations are given to the case company.</p> <p>This study confirms the general notions that IS projects face a lot of challenges and often fail in one way or the other. It is noted that best practices and above all the practical methods are still being developed. Furthermore, this study concludes that practising organizational change management in IS projects is important since a notable part of the issues in IS projects are related to people's attitudes towards the system. The reality is though, that few information technology professionals are familiar enough with the concept and methods of organizational change management.</p> <p>The importance of finding management commitment on all the management levels is highlighted in this study. Thorough enough planning of the project and the project-internal methods are furthermore important for project success. Handling the data migration, handling the cooperation with the partners, and acknowledging the risks related to overoptimistic schedules are moreover found to have a place on the list of critical success factors.</p>		
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<p>Organisationer introducerar hela tiden nya informationssystem. Varje informationssystem är en stor investering och det är därmed viktigt att så problemfritt som möjligt få användarna att acceptera systemet och det nya sättet att utföra arbetsuppgifterna på. Följaktligen är det mycket viktigt att informationssystemprojekt lyckas. Det är dock allmänt känt att informationssystemprojekt sällan är framgångsrika och varje projekt tvingas tackla diverse utmaningar. Detta diplomarbete strävar efter att konkretisera dessa utmaningar och diskutera de kritiska framgångsfaktorerna i informationssystemprojekt.</p> <p>Teoridelen av detta diplomarbete utgörs av en litteraturoversikt. Den empiriska delen består av en undersökning av exempelföretaget Wärtsiläs funktioner i anslutning till informationssystemprojekt. Detta görs genom intervjuer med sådana personer i företaget som har erfarenhet av informationssystemprojekt. Diplomarbetets slutsatser formas genom syntes av teori och slutsatser från intervjuerna. Exempelföretaget ges därtill rekommendationer för hur utförandet av informationssystemprojekt kunde förbättras.</p> <p>Denna studie bekräftar den allmänna uppfattningen om att informationssystemprojekt ställs inför många utmaningar och misslyckas ofta på sätt eller annat. Det är noterat att bästa praxis (best practise) och speciellt de konkreta metoderna ännu utvecklas. Därtill visar denna studie att förändringsledning (organizational change management) är viktigt i informationssystemprojekt eftersom en anmärkningsvärd del av problemen är relaterade till människo- och organisationsfrågor. I verkligheten är det dock en liten del av de människor som jobbar med informationsteknologi som är bekanta med metoder för förändringsledning (organizational change management).</p> <p>Studien bekräftar även att det är kritiskt att projektet finner stöd på alla chefsnivåer. Noggrann planering av projektet och de interna metoderna är även viktigt för projektets framgång. Denna studie visar därtill att hantering av data migration, hantering av samarbetet med utomstående partners samt erkännande av riskerna med överoptimistiska projekttidtabeller borde finnas på listan över kritiska framgångsfaktorer.</p>			
Nyckelord:	Informationssystem, förändringsledning framgångsfaktorer	informationsystemprojekt, (organizational change	implementering, management),

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TABLE OF CONTENTS

1	Introduction	1
1.1	Background of the study	1
1.2	The case company	2
1.3	Objectives of the study	2
1.4	Central notions	4
1.5	Research methodology	4
1.6	The structure of the thesis	4
LITERATURE REVIEW		
2	Information Systems	6
2.1	The characteristics and implementation of information systems	6
2.2	The relation between information management and business management	10
2.3	Information systems induce change in an organization	11
2.4	The strategic importance of information systems	11
2.5	Information Systems and Competitive Advantage	12
2.6	The evaluation of the success of an information system implementation	14
3	Organizational Change Management	19
3.1	Managing organizational change	22
3.2	Change management in IS projects	24
4	Critical Success Factors in Information Systems Implementation Projects	26
4.1	Connection between the technical application and the business processes	28
4.2	Process redesign	28
4.3	Management support and commitment	29
4.4	Project team and manager	31
4.5	Project management and planning	31
4.6	Organizational change management issues	33
4.7	Communication	35
4.8	Training	36
4.9	Evaluation of project success	37
4.10	Technological issues and system design	37
5	Product Data Management Systems	40
EMPIRICAL PART		
6	Research methods	42
6.1	Execution of interviews and the analysis	43
7	Information Systems Projects in Wärtsilä	45
7.1	Information Management at Wärtsilä	45
7.2	Evaluation of Information Systems projects in Wärtsilä	46
7.2.1	Project Management, Planning, and Project Progress	47
7.2.2	Project Organization	50
7.2.3	Cooperation with Partner Organizations	51
7.2.4	Relationship to Business Divisions	51
7.2.5	Customer and Management Commitment	53

7.2.6	Technical Issues and System Design	54
7.2.7	Organizational Change Management Issues.....	57
8	Deployment of Product Data Management System in Wärtsilä	60
8.1	The Product Data Management System Project in Wärtsilä.....	60
8.2	Evaluation of the PDM System Project	61
8.2.1	Project Startup, Planning, and Progress	61
8.2.2	Cooperation with the Partner Organization	63
8.2.3	Project Organization and Project-Internal Processes	64
8.2.4	System Design and Technical Issues	66
8.2.5	Attitudes towards the Project and Relationship to Business Divisions.....	70
8.2.6	Management Commitment	71
8.2.7	Organizational Change Management Issues.....	72
9	Discussion	76
9.1	Conclusions	77
9.2	Recommendations.....	88
9.2.1	Improved sharing of lessons-learned.....	88
9.2.2	Project schedules should be carefully prepared	88
9.2.3	There should be attention put on how the application is selected.....	88
9.2.4	Requirement collection methods need to be developed	89
9.2.5	Methods for monitoring project progress need to be improved.....	89
9.2.6	Project-internal processes in IS projects need to be improved	89
9.2.7	Work related to the data migration should get more attention	89
9.2.8	The evaluation of project success should be agreed upon in the plannin....	90
9.2.9	Projects with too little resources should not be launched.....	90
9.2.10	More weight on the planning phase	90
9.2.11	Hand-over to support should happen before go-live.....	90
9.2.12	Guidelines for evaluating possible partner's competencies should be	91
9.2.13	Need for best practices for monitoring the progress of the work perfo	91
9.2.14	Need for more knowledge about organizational change management	91
9.2.15	The mutual understanding between IM and business divisions should	91
9.2.16	The integration of all information systems need to be improved	91
9.2.17	Increased usage of process models	92
9.2.18	Responsibility for the whole life cycle of an application	92
9.2.19	Readiness to work over team boundaries	92
9.2.20	Need to put attention on what the IM organization's role is	92
9.3	Limitations of the study	92
10	References	94
	Appendices.....	101
	Appendix 1: Questionnaire	101
	Appendix 2: Template for interviews focused on general IS project experience	103
	Appendix 3: Template for interviews focused on the PDM project.....	104
	Appendix 4: Recommendations in table format.....	106

LIST OF FIGURES

Figure 1. Hallikainen’s framework for IS evaluation (source: Hallikainen 2002)	15
Figure 2. DeLone’s and MacLean’s model for evaluating information system success (source: DeLone & MacLean 2003).....	16
Figure 3. Kotter’s eight steps to organizational change management success (source: Kotter 1995).....	23
Figure 4. Model of functionality risk factors’ influence on perceived project functionality risk. (source: Tiwana and Keil 2006)	38
Figure 5. A model for approaching organizational change management.....	57
Figure 6. Overview of the PDM projects in Wärtsilä.....	60

LIST OF TABLES

Table 1. Four barriers that need to be crossed in order to achieve competitive advantage through IT investments (source: Piccoli & Ives 2005).....	13
Table 2. Four criteria for change effort evaluation (source: Salminen 2000).....	17
Table 3. Burke’s four critical dimensions when managing change (Source: Hamlin et al 2001).....	23
Table 4. Summary of critical success factors in literature.....	27
Table 5. The five dimensions of PDM systems according to van den Hamer and Lepoeter (source: Van den Hamer & Lepoeter 1996)	40
Table 6. Profiles of interviewees.....	43
Table 7. Critical success factors in information system projects according to the interviewees.	46

ABBREVIATIONS

CAD	Computer-aided Design
CM	Change Management
CRM	Customer Relationship Management
CSF	Critical Success Factor
ERP	Enterprise Resource Planning
IM	Information Management
Wärtsilä IM	Wärtsilä Information Management department
IS	Information System
IT	Information Technology
PDM	Product Data Management

1 Introduction

1.1 Background of the study

The amount of information in organizations is heavily increasing and it has become vitally important to efficiently manage and share information inside the organization. Companies have to be swift in adopting new technology in order to remain competitive in a continuously developing business environment. This is where information systems (IS) come into play. Companies and other organizations are investing great sums in introducing information systems in the organization hoping to be able to make business more efficient and information sharing smooth. But are these expectations fulfilled?

The reality is that companies often fail to get the enhanced business value out of the IS investment. The general notion is that introducing an information system is mostly just an expensive endeavor and the actual benefits are marginal. But regardless of this, companies continue investing in IS systems hoping to one day achieve expected benefits. Therefore, pressure is put on the Information Technology industry to develop increasingly user-friendly and convenient systems, but there is also pressure on the organization itself to succeed in implementing of the system. It is vitally important that the IS is properly introduced in the organization and accepted by the users.

A successful implementation of the information system is not an easy task; it is commonly known that information system projects are very challenging and often fail. The Standish Group's first survey on IT project success; The CHAOS report from 1995 is frequently cited and it shows that 89 % of IT projects could be called failures in some extent. Later research has shown that this is not completely true (see e.g. Molokken & Jorgensen 2003) but information system projects are still very prone to failure. Also IT professionals themselves view information system projects as challenging and the attitude is a sort of "we do our best, but ...". Research shows that companies in general have a long way to go before they fully master their IT efforts (see e.g. IT Service Management Forum itSMF Finland 2008).

It is not hard to understand that there is an evident need to enhance the knowledge of the best practices of information system projects and develop methods that would ensure successful information system implementations. Particularly when considering how large investments the information systems really are. Furthermore, many of the challenges are not related to technical issues but rather to the people and the organization (Wognum et al 2004). Therefore, it would be well-founded to put more effort into these issues and, for example, also use the methods of organizational change management to ensure project success. But organizational change management is still considered to be somewhat abstract in the eyes of business people.

This Master's thesis tackles the question of which issues an organization can be faced with when executing an IS project. The thesis sets out to map critical success factors and best

practices related to IS projects. The IS project related functions in the case company Wärtsilä and specifically in the company's ongoing Product Data Management (PDM) system project constitute the input from practice. The case company's experiences are mapped through interviews with people involved in IS projects at Wärtsilä. Previous research on the topic is reviewed before an analysis of the interviews and the theory is then compared with the experiences of Wärtsilä. The study furthermore presents the concept of organizational change management and its relevance in IS projects. The aim is to draw conclusions about the biggest issues that Wärtsilä has been faced with and how these correspond to previous research. Also recommendations about how Wärtsilä could improve the work related to IS projects are given. This thesis was initiated by Wärtsilä's Information Management organization.

1.2 The case company

Wärtsilä is a global company with locations in 70 countries around the worldwide and with headquarters in Finland. Wärtsilä operates in the marine and energy markets and provides customers with complete life cycle power solutions. The business is divided into ship power solutions, power plants, and services. The provided ship power solutions include engines, generating sets, reduction gears, propulsion equipment, automation and power distribution systems, and sealing solutions. In the power plants chapter Wärtsilä is a leading actor on the decentralized power generation market and supplies flexible power plants. All customers are supported with a broad service portfolio. The operating income in 2007 was 379 MEUR. Wärtsilä employs around 17000 persons. Wärtsilä is listed on The Nordic Exchange in Helsinki, Finland.

Wärtsilä has an in-house Information Management (IM) organization with responsibility for information technology and process related issues. This thesis is done for Wärtsilä IM and more specifically within the project that implements a Product Data Management (PDM) system for the whole company. The function of the IM organization and the PDM project is more thoroughly presented in chapters 7.1 and 8.1.

1.3 Objectives of the study

This Master's thesis studies experiences and best practices related to IS projects. The purpose of the thesis is to list critical success factors (CSF) in IS projects and bring forward such issues that have made IS projects challenging and should thus be avoided in future projects. The starting point is the argument of previous research which says that the majority of IS projects turn out to be very challenging and that the reputation of IS projects is not very good.

The question which are the critical success factors and how they effect IS projects will be answered from two sources. The first source is previous research on the topic which will be

presented in the form of a literature review. The second source is interviews with people who have experience of IS projects within the case company Wärtsilä. By in the interviews partly focusing on one specific project, the PDM project, it will be possible to go a bit deeper into the methods and reasons for challenges in IS projects. These both sources, the literature and the interviews, will contribute with viewpoints on what the biggest challenges in IS projects are and how they would need to be conquered. The findings from each of the sources will then be compared and conclusions will be drawn from that.

Hence, the first (/main) and the second research questions are:

- *What are the critical success factors in IS projects according to*
 - a. *previous research?*
 - b. *Wärtsilä IT professionals?*
- *How does the view on IS project challenges in literature correspond to the views of IT professionals in Wärtsilä?*

In order to create an understanding of why IS projects are so difficult the characteristics of information systems and their impact on organizations will be discussed. The basis for this discussion will be findings of previous research. The attitudes towards IS projects are also of interest in this thesis as the attitudes of all stakeholders will have a direct effect on project success as well as on how different critical success factors are handled. An additional purpose of the interviews is thus to map these attitudes.

Hence, the third and fourth research questions are:

- *What are the characteristics of information systems?*
- *What are the attitudes towards IS projects?*

This thesis will furthermore investigate how organizational change management is noticed in IS projects – if it is noticed at all. This thesis aims at presenting how the methods of organizational change management can contribute to IS project success. Literature is studied in order to present the basic concepts and ideas of organizational change management. The interviews on the other hand will give an idea of how organizational change management is included in IS projects in practice.

Hence, the fifth research question is:

- *How do IT professionals view the concept of organizational change management and what are the concrete ways of including it in IS projects?*

The comparison between literature and the interview findings will form the conclusions of this research. The findings of this thesis will hence contribute to developing best practices and guidelines for conducting IS projects in general. The recommendations that are given are directed to specifically the case company and will help develop the quality of future IS projects (for example the subsequent PDM projects).

Hence, the sixth research question is:

- *How could Wärtsilä improve the quality of their IS projects? And in particular, which areas should be given extra attention in the future PDM projects?*

This research does not cover general project methodology but concentrates on such issues that are typical for IS projects. Furthermore, focus is put on such information systems where a technical application is part of the system (see the definitions in the beginning of chapter 2). Detailed suggestions for project-internal methods are not given.

1.4 Central notions

The concept ‘information system (IS) project’ is in this thesis refers to a project whose purpose it is to introduce an IS in some organization. A project starts with initiating and planning the project and ends when the end users start using the system. Information systems are defined in detail at the beginning of chapter 2.

In this thesis the term implementation is used to describe the whole process of introducing an information system into an organization. The term is defined as “*the process that begins with the managerial decision to install a computer-based organizational information system and is complete when the system is operating as an integral part of the organization’s information system*” (Zhang et al 2005). Additionally, the term deployment is used in the empirical part where it refers to the process of bringing the system to some site and executing preparing actions so that the system can be used. The term deployment is also used in Wärtsilä’s IS project terminology as a name for the project phase where the system is brought to usage.

1.5 Research methodology

This research is conducted through interviews. The execution and analysis of the interviews follow a methodology called the “general interview guide approach” by Patton (2002) and “interviewing according to theme by Hirsjärvi and Hurme (2000). The methodology is presented in more detail in chapter 6 Research Methods. The theoretical chapter is a literature review.

1.6 The structure of the thesis

This thesis consists of an introduction, a literature review presenting relevant theory, presentation of the research methods, presentation of interview findings, synthesis of theory and empirical findings, and a summary.

The introduction presents the background of the thesis followed by a description of the objectives of the study and a presentation of the research questions. The research constraints and research methods are then briefly presented.

The literature review begins with a presentation of the characteristics of information systems and information system projects. It is discussed how a new information system affects the organization as well as how evaluation of information system project outcomes should be done. The second chapter in the literature review presents the concept of organizational change management and best practices for managing change projects. The third chapter of the literature review presents first and foremost an overview of critical success factors presented in literature and subsequently proceeds to a discussion of the factors in groups. The last chapter of the literature review presents product data management systems.

The empirical part begins with a presentation of research methods. It then continues with a report on the interview findings concerning IS project experience in general at Wärtsilä. The Information Management function is also presented. After that, the interview findings on the PDM project in particular are reported together with some background information on the project.

The last chapter of the thesis is the synthesis of theory and empirical findings. The discussion also includes the conclusions of this thesis as well as the recommendations given to Wärtsilä. The thesis ends with a summary and list of references. The appendices include the outlines for the interviews and the survey as well as the recommendations given in this thesis in table format.

2 Information Systems

Information systems (IS) are sets of components that are organized in a way that supports the execution of some function(s) (The Institute of Electrical and Electronics Engineering IEEE 1990). Nickerson (2000) does not limit the components to being only technical – such as computers and code – but sees that the people, the processes, and the information are also parts of an information system. This view on information systems is kept in this thesis where focus is on how to implement an IS so that it best supports the business and work routines in companies. Similarly the Finnish Tietohuollon sanasto (The Finnish Terminology Centre TSK 1993) define information systems to be permanent sets of components such as people, rules, data, and transmission equipment. Information technology (IT) is a closely related term and is defined as the equipments and methods used for automatic information processing and transferring as well as the knowledge of using these equipments and methods (The Finnish Terminology Centre TSK 1993). This thesis focuses on information systems that include some sort of an IT application.

An information system is also defined to be a set of information resources used to collect, store, process, maintain, use, share, disseminate, dispose, display, or transmit information (Committee on National Security Systems 2006). And similarly Wognum et al (2004) note that information systems purpose is to support companies in their information needs. Examples of such information systems investigated in this thesis are Enterprise Resource Planning (ERP) systems, Product Data Management (PDM) systems, Customer Relationship Management (CRM) systems, Supply Chain Management (SCM) systems, other document handling systems, project follow-up systems, and other tools that impact the way of working in some part of an organization.

The first part of this literature review will discuss the relations between information systems and organizations. The focus is, in accordance with the topic for this thesis on the implementation of information systems. And as Salminen (2000) stresses, the most crucial stage of a project that induces change in an organization (e.g. IS projects), is the implementation phase. Good planning is most certainly a prerequisite for succeeding in an IS project but plans are nothing without good realization.

2.1 The characteristics and implementation of information systems

Organizations are investing a lot in information technology and information systems. As markets are getting more and more competitive companies simply have to be swift in adopting new technology to keep up the phase of the changing environment (Kadiyala 2005). This heavy investing is confirmed by the European Commission's statistic (Eurostat 2007) that show that the expenditure on information technology is about 2.7 % of GDP in Europe and 3.3 % in USA. The expenditure in Finland is about 3.2 % of GDP. PDM systems are believed to be important and investments in them have increased continuously

(Crnkovic et al 2002). Crnkovic et al (2002) report that the industry invested 1.1 billion USD in 1997 and 1.7 billion USD in 1999 in PDM systems.

And indeed, information systems can do a lot for the organization in effecting the processes and the handling of information. Li (1999 cited in Al-Mashari et al 2003) argues that ERP systems have made business more efficient since they provide everybody with seamless access to information they need. Similarly Smith (2004) discusses that PDM systems can facilitate information sharing. Information technology in general has made new organizational forms and new ways of working and collaborating possible (Mukherji 2002). Davenport (1998) reports that information systems have been used to align operating practices between the companies' units. In fact, information systems will almost inevitably reshape the ways of working in an organization (Davenport 1998) – and not the other way around.

Dewett and Jones (2000) have closely investigated how IT impacts an organization and its characteristics. In the model they present, IT functions as moderator between the organizational characteristics (e.g. size and culture) and organizational outcomes. They argue that this moderating effect of IT is due to the fact that IT generates *information efficiencies* and *information synergies*. Information efficiencies are the possible cost and time savings that can be achieved if IT enables employees to work more efficiently. Information synergies are the performance gains that can be achieved if IT enhances collaboration and cooperation possibilities. These two concepts are benefits in themselves (the authors call them “meta-benefits”) but they also lead to 5 more concrete organizational outcomes; (1) IT links and enables employees, (2) IT codifies the knowledge base, (3) IT increases boundary spanning, (4) IT promotes efficiency, and (5) IT promotes innovation (Dewett and Jones 2000). I will here briefly present what Dewett and Jones include in each of these five outcomes. These outcomes make up a basis for possible IS project benefits.

The first is claimed to be the most fundamental. IT links and enables people to communicate and collaborate over the borders of divisions and functions in an organization. Two things are worth noting though; first, merely a technical link is not enough - the communication needs to be supported with organizational methods as well and secondly, increased communication also means increased amounts of unnecessary and unusable information sharing. But overall, increased communication and possibility to communicate is the most important effect IT can have on the organization. (Dewett and Jones 2000)

The second outcome; that IT codifies the knowledge base means that IT is a facilitator in knowledge sharing and capturing. Hence, IT is a tool in a company's knowledge management. The third outcome; that IT increases boundary spanning is related to the first outcome but focus is on the tools that IT creates for searching new information from e.g. other organizational units. This means that e.g. information needed to solve some problem can be taken from another division that has had the same kind of problem. The fourth outcome means that IT promotes efficiency in the way that IT enables more efficient ways

of working in e.g. decision making, communication, information storing, and information retrieving. (Dewett and Jones 2000)

The last outcome; that IT promotes innovation is the result of all the above mentioned outcomes. IT promotes innovation through enabling virtual organizations and other new organization forms, through making information seeking easier, and through enhancing monitoring of project progress. Dewett and Jones further argue that this effect of IT should get more attention in the discussion on how IT's effect on an organization is measured; they claim that focus is now very much on efficiency-enhancing properties while IT's ability to develop the organization through e.g. promoting innovation should be more noted. (Dewett and Jones 2000)

The discussion above clearly presents the fact that information systems have a notable impact on an organization. Hence, implementation should not be regarded as a project that concerns only the IT department (see further discussion in chapter 2.2). Slowly organizations are realizing this. IT and information systems are more and more viewed as an important part of the organization's business and not only as an expense. Similarly, companies are constantly putting effort on developing their information management and IT-processes. Despite this it has been reported that Finnish companies still have a long way to go in order to master their IT efforts. (IT Service Management Forum itSMF Finland 2008)

Nickerson (2001) discuss possible benefits of IS. Better information as basis for more accurate decision making is one area of benefits. Another is improved service for both the customers and the employees. Furthermore one benefit is increase productivity i.e. people can execute there duties much more efficiently. Shang and Seddon (2000 cited in Al-Mashari et al 2003) for example group the benefits of ERP systems in operational, managerial, strategic, IT infrastructure, and organizational. These same benefits can also be results of other information systems. But as also Nickerson (2001) points out benefits will not be realized simply with installing the application; the organization has to adapt the system and include it in the processes. This aspect is utterly important to remember in IS projects.

Companies invest great sums in information systems and naturally expect them to bring about a lot of economical and organizational benefits (Hallikainen 2003). But the reality is that most organizations fail to get the expected enhanced business value from an IS investment (Cameron & Green 2004, p.243). Daniels (1998) says that information systems do help organizations in automating processes and information storage i.e. they improve efficiency, but their actual impact on strategic improvement is questionable. Daniels believes that the only way to improve this is to understand how the information best support the corporate and competitive strategy. As you will see in later chapters many other researchers agree on this.

Thorp (1998 cited in Klein and Jiang 2001) has also concluded that despite the not so good performance record of new systems, organizations continue to invest in IT. This phenomenon is something that Pozzebon et al (2006) have looked into more carefully. They ask why companies are continually ready to invest in newly launched systems although the experience of the old ones is often not satisfying. They offer an explanation using the rhetoric closure theories by Bijker. Bijker's theories say that some problem is or will be solved because a relevant group of people think it is solved, while, in fact, it is not really solved (Pozzebon et al 2006). Pozzebon et al use this theory to suggest that new information systems etc. are simply adopted because all parties agree and convince each other that the system will indeed solve central managerial problems.

All organizations face challenges in the area of information management but in a varying amount. Kim and Oh (2000) have found it surprising that although the systems are equally important and equally expensive for all organizations, the systems are exploited in very varying degrees. And many organizations still have a long way to go if we believe what Salazar and Sawyer (2007, p.16) are saying; that in a typical organization 90% of the information is still on paper and information systems are still not even close to being fully integrated. The pressure for companies to introduce information systems and get integrated with also the surrounding stakeholders comes from the collaborative nature of the business environment of today (Ho & Lin 2004).

But as Kadiyala (2005) notes organizations should not run head over heels into new IS implementation endeavors but should carefully analyze the costs and benefits. Information systems investments can be very expensive projects. The licenses cost a lot but the most of the expenses are due to the excessive amount of personnel and consultancy needed. The Computer Technology Research Corporation (1999 cited in Al-Mashari et al 2003) confirm this and report that companies that go for a "basic" IS implementation spend up to three times as much money on the services – e.g. customization - done by consultants than on the system itself. Therefore it is important to carefully decide on the level of customization etc. Crnkovic et al (2002) has further noted that it is indeed services that account for the greatest part of PDM system project costs.

As the discussion so far in this chapter tells us information systems are more than just technical applications and can indirectly have both positive and negative effects on business. Introducing a new information system is hence not an easy task and failure rates are high. The quite famous "Chaos Report" by the Standish Group (referred to in Molokken & Jorgensen 2003) reported that up to 89% of software efforts fail. But Molokken and Jorgensen (2003) have reviewed several other surveys and conclude that a more correct figure would be that 60-80% of the projects encounter some sort of effort and/or schedule overrun. The figure is still quite remarkable. Crnkovic et al (2002) note that PDM system projects have often been associated with a lot of problems but as the management of the implementation, the hardware, and the software have evolved the project success rates have increased.

2.2 The relation between information management and business management

As the discussion in the previous chapter shows information technology overall has a great impact on organizations; both internally and in their relationships with other organizations (Mukherji 2002). In cases of large information systems the system will actually often determine the ways of working (Davenport 1998) and hence, have an impact on the shape of the business processes – contrary to what one would maybe assume. Therefore it is worth underlining how crucial it is to understand the proximity of business processes and information systems and consequently, align business management and information management (Reich & Benbasat 1996; Cameron & Green 2004; Daniels 1998). Reich and Benbasat (1996) analyze the situation further and argue that the main task of information management is actually to coordinate the relationship between the business and IT domain.

The report on the level of Finnish companies' IT management done by itSMF Finland (2008) shows that this topic is also what companies regard as their greatest challenge. Finnish companies feel that the communication between information management and business management would need to be enhanced but they are not yet quite sure on how to do that. They also feel that there is a challenge in getting the business processes in line with the information systems. (itSMF Finland 2008)

The first lesson would hence be that implementation of information systems should not be treated as merely technical endeavors. Crnkovic et al (2002) note that when introducing a PDM system in a company it is crucial that there is enough knowledge about all processes that will be affected by the system. This also means that there should be a thorough analysis of what processes will be affected by the system. Davenport (1998) argues that not considering the business implications of an ERP system could be disastrous for the company. Similarly Reich and Benbasat (1996) report that IT managers and business executives feel that a weak linkage between IS plans and organizational objectives result in big problems for the organization. Also Teo and King (1996) discuss the results presented by Kearny which say that such organizations that *do* link business plans and IS plans perform better than such that do not. Information system projects should hence be considered as business projects, and need the full attention of the business management – not only the IT managers. This notion is indeed understood by many organizations regarding ERP systems; European companies feel that the single most important criteria in choosing an ERP system is that there is a good fit with the business (Van Everdingen et al 2000).

Shupe and Behling (2006) offer another reason to why it is important to keep IT and business close together; such an alignment enhances the organization's ability to flexibly change to meet business needs. They argue that an effective IT strategy can only be developed if the strategy of the whole organization is understood. Additionally, King and Zmud (1981 cited in Teo & King 1996) propose that information systems can also influence, not only support, business strategies. In IS projects the focus of business

management need to be in line with what kind of a function the IS will enhance. One example is that when it comes to PDM systems business management would need to understand that PDM systems enable collaborative engineering and hence, attention need to be put on organizational productivity and not on individual or task productivity (Gott 1995).

2.3 Information systems induce change in an organization

McLoughlin and Clark (cited in Salminen 2000) report that extensive research shows that technology in general imposes change on many levels in an organization. Salminen (2000) also reports that Sharratt and McMurdo note that information systems implementation brings about new ways of doing business. It is clear that information systems will bring about some degree of change in an organization (as was also noted in chapter 2.1) and hence, information systems projects should be treated as change projects. Cameron and Green (2004) support the same view and dedicate a whole chapter in their book on organizational change management to IT-based process change.

Wognum et al (2004) summarize this issue in quite a descriptive way; 'implementation of technology with an impact on several functions and levels of an organization not only induces organizational change, but also requires organizational change'. This point of view, that information system implementation projects are change projects by nature, is kept throughout this thesis. And already now we can note that change projects are in all their forms challenging endeavors for organizations (Buhanist 2000; Salminen 2000; Cook et al. 2004, p.1). And as Sammon (2001 cited in Loonam & McDonagh 2007) has concluded the biggest implementation risks in IS projects are in the change management field. So if the organizational change factors in IS projects are overlooked the project is almost bound to be challenging.

2.4 The strategic importance of information systems

Literature is clear about the fact that the IT strategy and information systems plans of an organization need to be in line with the business strategy (Shupe & Behling 2006; Reich & Benbasat 1996; Teo & King 1996). But the actual strategic value of IT itself is still subject for debate (Oh & Pinsonneault 2007). To begin with, Hallikainen (2003, p.45) notes that nowadays information system projects are often means in larger strategic development and change projects which would indicate that their strategic importance is rather notable. Similarly, Lee et al (2006) claim that a global business must not only have a global business strategy but the strategy must be backed up by information systems in line with the strategy. But there are different opinions about the shape of the strategic impact.

First of all, not all information systems have a strategic role. The management has to be able to evaluate how and in what extent an information system contributes to the

organization's strategy in order to decide upon the amount of attention that the IS project needs. This is yet another reason for business and information management to work together. (Cameron & Green 2004, p.246)

Secondly, there are different aspects to the strategic value of IT. Oh and Pinsonneault (2007) discuss this issue. They investigate two approaches to assessing strategic value of IT; the resource-centered perspective and the contingency-based. The first approach says that IT is a strategic resource in itself and that IT can – in combination with other strategic resources – influence business. The other approach says that the strategic value of IT is only realized if it is planned to support the main strategy; i.e. IT in itself has no strategic value, but when managed to support the general strategy its strategic role is realized. The findings that Oh and Pinsonneault report indicate that both approaches should be used as they are actually complementary rather than competing approaches, though the authors do slightly lean towards the contingency-base approach. Furthermore, they report one concrete finding which is that using IT to reduce costs rather than to increase revenue seems to be more beneficial for the organization. This can be seen to have implications on how to address the issue of information systems implementation; information systems should be strategic instruments mainly used to create savings for the company. (Oh & Pinsonneault 2007)

We can conclude that the strategic impact of information systems varies depending on the characteristics of the system. But this possible strategic role of IT and information systems implies that business management should consider also the information systems when creating the business strategy and that these systems will have an impact on business and are not merely technical efforts. Nickerson (2001, p.394) presents an own term for such systems that have a strategic role; Strategic Information Systems (SIS). It can be noted that Crnkovic et al (2002) report that many companies are considering PDM system to be of strategic importance for the company.

2.5 Information Systems and Competitive Advantage

Whether or not ISs enhances a company's competitive advantage has also been the topic of frequent debate. This is a very relevant question since IS investments need a lot of resources - both financial and human. It seems that although ISs and IT in general is playing a rather important role in companies the impact of IT on performance is still something of a puzzle (Dehning & Richardson 2002). We would hence need to underline the "can" in the claim of Nickerson (2001) that "information systems can provide a competitive advantage for a business".

Williams and Williams (2007) note that many researchers have found that IT in general is nowadays an essential part in a company's competitiveness. Similarly Mabert et al (2003) note that ERP has an important role in an organization gaining competitive advantage, but that only if the organization has competence enough to get the full power out of an ERP

system. But Cameron and Green (2004, p.264) note that it has also been suggested that since IT is no longer a rarity in business and easily available it is not something that creates a competitive edge for a company.

Fisher and Kenny (2000) argue that the decision to invest in and implement an IS must always be taken by first asking whether the system will improve the company's competitiveness or not. The IS must also support business goals and objectives. This would mean that ISs simply must contribute to increased competitive advantage since that would be the reason why they are even implemented in the first place. Hallikainen (2003) on the other hand draws the conclusion that some IS investments are seen as sources of competitive advantage while others are simply a mean in execution of basic business processes.

Piccoli and Ives (2005) have created a framework based on previous research that shed light on how strategic IT-investments impact the competitive advantage of a company (see *Table 1*). Their conclusion is that there is an appreciable possibility to use IT investments to gain competitive advantage. The framework identifies four barriers that need to be crossed to achieve competitive advantage with the help of IT. The first is the *IT resource barrier* which implies that a company with superior IT resources can gain competitive advantage in a way that cannot be replicated by a company with less superior IT resources. The second barrier is the *complementary resource barrier* and is similar to the first one, although now the non-technical resources are in question; personnel, organizational attributes etc. The third barrier, the *IT project barrier*, implies that the more time consuming, expensive, and complicated the implementation project is the higher is this barrier to gaining competitive advantage. The last barrier is the *pre-emption barrier*; competitive advantage can not be achieved if successfully imitating a competitor since this competitor holds the position of the leader and hence, has a sort of power to preempt the access to customers. (Piccoli & Ives 2005)

IT Resource Barrier	
Complementary Resource Barrier	
IT project barrier	
Pre-emption barrier	

Table 1. Four barriers that need to be crossed in order to achieve competitive advantage through IT investments (source: Piccoli & Ives 2005)

Piccoli and Ives (2005) further identify three important areas that need to be focused on to gain competitive advantage. These are efficiency improvements, differentiation, and channel domination. This is, according to the authors, a widely accepted conclusion in the research on this field. And hence, it can be concluded that it indeed is possible to gain competitive advantage with the help of information systems and IT in general. It is just a matter of doing things right.

2.6 The evaluation of the success of an information system implementation project

As stated in the previous chapter an IS investment is a large investment and companies often expect to gain a lot from the implementation. It would therefore be natural that a company would thoroughly evaluate whether or not the IS has brought about some financial development or other improvement. But Hallikainen (2003) reports that about one third of the organizations he has interviewed, do not have any formal methods for evaluating IS investments. Hallikainen further reports that there is only a small portion of advanced companies that systematically evaluate IS project success in different stages of the system's life cycle. And lastly, Hallikainen's findings indicate that most companies use *ad hoc* and informal methods to evaluate the success of an IS investment. Similarly Sherer et al (2003) as well as Seddon et al (2002) conclude that indeed, measuring the payoff from IT investments is still a challenge for companies. A recent investigation done by IT Service Management Forum Finland (2008) include a similar conclusion as it shows that Finnish companies feel that measuring IS success is problematic - partly because measures are lacking. The companies call for more research on the area and concrete and straight-forward ways to evaluate especially the financial benefits of IT investments. (IT Service Management Forum Finland 2008)

The results presented above and other of the same category become quite thought-provoking in relation to the fact that the evaluation of IS implementation both during and after a project is regarded as rather important (Hallikainen 2003; DeLone & McLean 2003; Williams & Williams 2007). Al-Mashari et al (2003) list measuring and evaluating the implementation project success among the critical factors in their list of critical success factors in ERP system implementation. They further argue that regular audits and benchmarking can increase a company's ability to cope with change through bringing forward new ideas, learning, and innovation. (Al-Mashari et al 2003.)

The reason that the evaluation of IS investments is done so seldom is naturally that the benefits that IS bring about are difficult to list and even more difficult to measure. But as Sherer et al (2003) conclude it is important to research this topic because an understanding of how IT really affects business is needed. Hence, several ideas and inputs have been presented in literature and the aim here is to present thoughts on what the benefits of an IS investment are and how they could be measured. What is not discussed in the literature

reviewed here but a relevant practical matter is that in any case the measures and metrics that are chosen need to anyhow be quantified in some way.

Hallikainen (2003) presents a framework (see *Figure 1*) for the IS evaluation process. The framework divides the process of evaluation into three processes; business process development, IS development process, and IS procurement process. For each process there is an outcome that should be evaluated. These are, respectively; success of IS investment (i.e. how the IS has affected business), success of IS functionality (i.e. whether the system is working as it should), and success of IS project (i.e. how well the project itself succeeded). The author argues that each of these outcomes can be analyzed and should be analyzed - but not only in order to justify the project but also to learn from the project. (Hallikainen 2003, p.21)

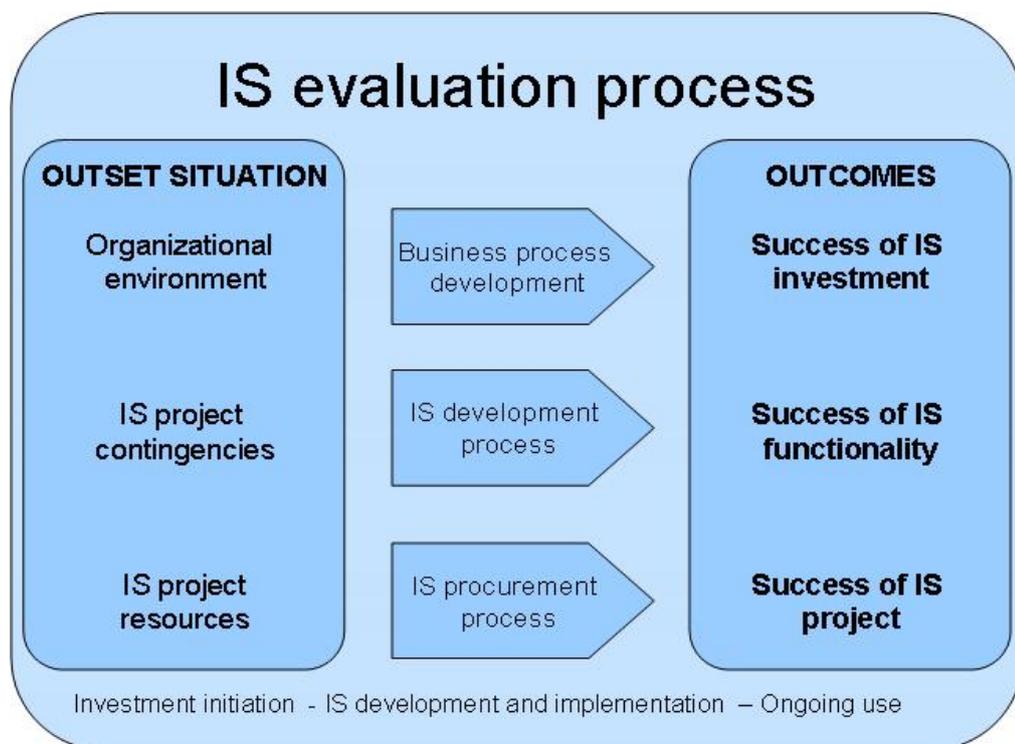


Figure 1. Hallikainen’s framework for IS evaluation (source: Hallikainen 2002)

The benefits of an information system can be classified as either tangible or intangible (Computer Technology Research Corporation 1999 cited in Al-Mashari et al 2003). The tangible benefits are such that are, so to say, easier to measure: e.g. cost reductions, increased efficiency, and more rapid delivery. The intangible benefits are not as easy to measure. This category includes such benefits as improved business processes, easier accessed corporate data, and improved responsiveness to customers. It is easy to see that all these benefits are as important as the other but differ clearly in how concrete they are. Furthermore, it is reported that it can take eight months to notice the effects of intangible benefits (Al-Mashari et al 2003).

Besides pinpointing the benefits and determining how they can be measured, another challenge is to determine what the actual goal for the project is and what the criteria for success are. According to Lyytinen (1988 cited in Soja 2006) implementation success involves reaching goals and implementation scope within planned time and budget but still achieving user satisfaction. Tanskanen et al (1996 cited in Buhanist 2000) additionally note that it is important not to judge the success of some change project against unrealistic and idealistic goals and expectations. What makes the situation even more complicated is the unique nature of IS implementation projects which means that two projects seldom have the same goals. Therefore, it is important to discuss and agree on what the expected outcomes of every project are.

Despite the fact that every project is unique and the nature of IS success is multidimensional and dependent on many other variables it is still important to try to develop a harmonized way to evaluate IS success (DeLone & MacLean 2003). The – still young – IT business has to be developed and hence, it would be important to be able to compare results of different IS projects. DeLone and MacLean (2003) propose a model for IS success (see *Figure 2*). In the article from 2003 they have updated their model from 1992 by taking into consideration modern organization structures and proposed enhancements from other researchers. The model's basis is divided into three quality dimensions; *information quality*, *systems quality*, and *service quality*. The authors argue that these dimensions should all be measured separately. These quality dimensions further impact the *user satisfaction*, the *intention to use* and the *usage of the system* – which also affect each other. Lastly, these usage-related factors have impact on the *net benefits*. The realized and perceived net benefits then again impact the usage and user satisfaction of the system. The model hence shows how the quality of a system has impact on the usage of the system and the perceived benefits and that the usage itself affects further usage through user satisfaction. DeLone and MacLean's research provides us with a model that could be used in any information system project and attempts to concretize the multidimensional and interdependent nature of IS success.

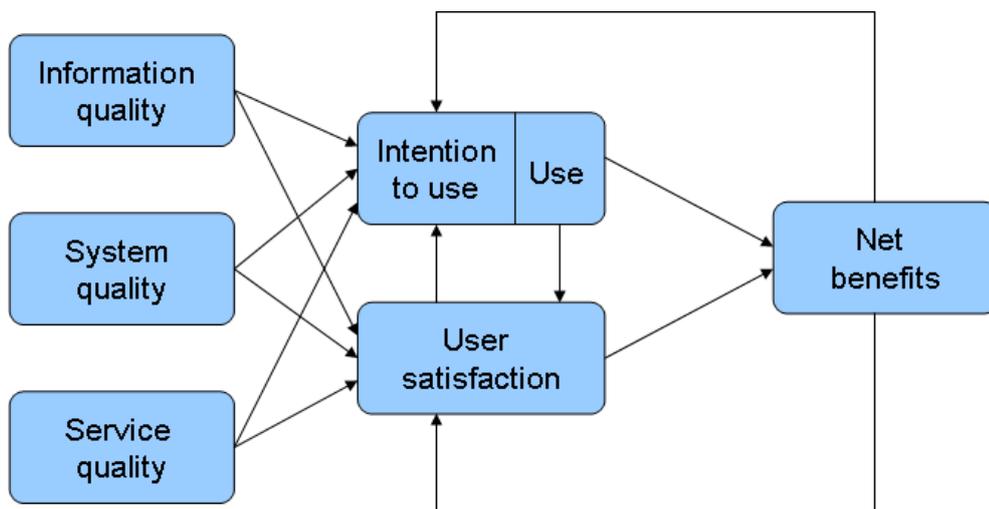


Figure 2. DeLone's and MacLean's model for evaluating information system success (source: DeLone & MacLean 2003)

Salminen (2000) discusses change projects and the estimation of success of such a project. Since an IS project is regarded as a change project in this research, I will report for Salminen's findings in his literature review on organizational change effort estimation. In addition to the concrete and easily measurable success factors it is worth adding that the way how change is perceived is an important criterion as well. An example is that negatively perceived systems will not be used and hence, the project can be regarded as a failure. Salminen concludes that the success of change could be studied in two dimensions: efficiency and effectiveness. The former is concerned with schedule and budget etc. and the latter with the change's ability to induce performance improvements and other positive effects in the organization. A change should be evaluated from both perspectives. Further Salminen presents four criteria that a change effort can be evaluated against (see *Table 2*). The overall success is in the end a product of all of these four criteria.

(1) Meets the goal set for it.
(2) Is implemented on schedule and within budget.
(3) Generates positive operational and economical results that in a reasonable time frame outweigh the costs of implementing the changes.
(4) Is perceived as successful by most internal and external stakeholders.

Table 2. Four criteria for change effort evaluation (source: Salminen 2000)

Lyytinen and Hirschheim (1987 cited in Yeo 2002; Al-Mashari et al 2003) present four categories of IS failures that could be used in evaluating the success of an IS project. The first category is *correspondence failure* which happens when system design does not correspond to the planned objectives. The second category is *process failure* and appears when the system is not developed within schedule and budget. The third category is *interaction failure* and is related to the usage of the system when it has been launched. Note that usage and user satisfaction are not the same also here. The last failure category is *expectation failure* and relates to the systems inability to answer to stakeholder's expectations and requirements. An IS effort needs to be evaluated in all these dimensions of possible failure to get a picture of IS project success as a whole.

Dehning and Richardson (2002) argue that evaluation of IS success could be developed by taking advantage of practices from the field of accountancy. They argue that the knowledge accounting researchers have on business processes and managerial and

financial accounting systems could help in the research on methods to evaluate IT investments returns.

Klein (1991 cited in Klein & Jiang 2001) notes that a common understanding of the metrics to be used in IS evaluation is essential to achieve a goal that all stakeholders can accept. The task of reaching a common understanding is not as straight-forward as one might think since groups perceive the different criteria differently (Jiang et al 2000 cited in Klein & Jiang 2001). For example Linberg (1999 cited in Klein & Jiang 2001) found that IS professionals' and the organization's view on project success might differ; IS professionals can think that the project was a success while the organization thinks otherwise. Linberg also argues that traditional measures of cost/benefit impact of IS are not enough and that more intangible measures such as knowledge advances and improved processes should also be used.

3 Organizational Change Management

This chapter will present some basic thoughts about the phenomenon change in organizations and the need for managing it. Some popular models for change management will be presented followed by other guidelines on managing change in organizations. Organizational change management is of interest in this thesis because previous research has shown that most of the problems in IS projects relate to people and the organization (Wognum et al 2004). But the belief is that organizational change management is not particularly known among IT professionals and hence, the basics of the concept of organizational change management are discussed in this chapter. Organizational change management is furthermore often listed in literature as a critical success factor in IS projects as discussed in chapter 4.6.

The reason for change in an organization can be either external or internal (Lanning 2001). External reasons include things like competition, customer demands, and regulations etc. i.e. these come from the outside of the organization. Internal reasons are due to something that happens inside the organization and the reason can range from a will to adjust to newly discovered market opportunities to a decision to implement new information systems. (Lanning 2001; Kitchen & Daly 2002). Dawson (1994 cited in Kitchen & Daly 2002) has suggested that the external and internal factors are, in fact, interdependent; i.e. the reason for change is often both external and internal. Vollman (1996 cited in Salminen 2000) has said that enterprises change in order to better fit the environment or to soften internal discontinuities. And because some organizations operate in more rapidly changing environments these are more pressured to change and develop (Kitchen & Daly 2002). Organizations do not only change when some specific change effort is launched, organization change every day – as a natural process. But the focus of this thesis – and change management literature in general – is on intended change efforts and the managing of such change.

Buhanist (2001) discusses two different kinds of change: radical (or revolutionary) and incremental change. The author defines radical change as change that ‘includes a clearly new direction and some action steps towards it’. An example of radical change would be the introduction of some information systems that dramatically changes work processes or organizational structures. Hence, the management of radical change might be interesting for the audience of this thesis. While incremental change is something that happens more slowly and under a much longer timeframe. Buhanist notes that the two types of change are indeed different in many ways and hence, need different kinds of management. Radical change will for example need much more support from top management. Buhanist argues that radical change is something that is much needed in organizations and insinuates that there has been a negative attitude towards radical change too long. He thinks that the reason might be that in the case of radical change *force* has to be used at some point and that has not been thought to be wise in organizational management in general. But through case studies Buhanist has noted that radical change is sometimes the best alternative.

Furthermore, it can be unfortunate not to recognize the need for radical change and manage the change as incremental which – as stated above – need another sort of management. Gaddis (1997 cited Kitchen & Daly 2002) has also noted that radical change demands a more innovative responsiveness than incremental change.

Another way to classify change is to focus on the differences between actual change and human transition (Austin & Currie 2003). “Change” is thought to be the actual “object” that changed; the new boss or the new application, while transition is what people experience and think about the change. Austin and Currie believe that management is too much focusing on managing the change and not so much the human transition. In their case report they show that by managing also the human transition and understanding the human forces in change, the disruption on business in the change process will be smaller. The argument is furthermore that information systems projects are often too much focused on the application and the human transition does not get enough attention. The discussion below presents aspects to managing human transition.

First, we can say that ‘change is not just about how people act, but it is also about how they think’ (Kitchen & Daly 2002). Therefore, managing humans in change includes also work with attitudes, beliefs, and thoughts. Similarly Buhanist (2000) believes that real change involves both mind and action. And as French and Bell (1999 cited in Lanning 2001) note, the organizational culture also has to be shifted if wanting to obtain permanent change. Also Poole and Van de Ven (2004) have noted that the deep structures (i.e. the deeply rooted organizational values) and how these interplay with the visible structures need attention in change management and when striving to an innovative business. Furthermore, Austin and Currie (2003) state that ‘change causes loss’. The loss might be superficial (e.g. well-known IT-tools and -applications are no longer allowed to be used) or very meaningful (e.g. loss of job) but in any case this is a fact that needs to be acknowledged in change management. Thus, there are many reasons to focus on the people in a change effort.

Austin and Currie (2003) present a view that human transition happens in three phases and that in each phase different areas need extra attention. The first phase is the “letting go” – phase in which people have to let go of the old situation. Communication is very important in this phase in order to keep the level of confusion as low as possible. It is also highlighted that if managers try to convince the employees that their emotions in the letting go-process are wrong the result will only be that the employees will feel that the managers do not understand them and will only turn to resist the change. (Austin & Currie 2003)

The following phase, according to Austin and Currie, is the “in between” –phase which is the longest and most difficult phase. During this phase people will have a feeling of fear of the future accompanied by uncertainty and confusion. The authors argue that this phase is best managed if it is clearly recognized that this is indeed a difficult period for the teams. Furthermore, temporary but clear organizational structures have to exist for this transition period and the feeling inside the team has to be strengthened. But the authors also note that

this can be a very creative time and should be utilized as such. Hence, in IS-projects possibilities to refine for example working processes by utilizing possibilities of the new system could rise – and should be investigated – during this phase. (Austin & Currie 2003)

The last phase starts when people begin seeing the positive sides of the new solution, and feel that it is better than the old solution; the “starting anew” –phase. Austin and Currie underline that at this stage it is important that the managers are consistent in their behavior and rewarding system so that trust can be maintained. But it is also important to note that there are people who are always eager to embrace new things; these early adopters and the leaders can encourage the rest of the team to move forward much faster. In conclusions the authors state that by putting attention to these different phases and people’s behavior in each of them, change will happen in the organization with much less disruption to the actual business. (Austin & Currie 2003)

The concept of change resistance is very topical when discussing people in change and should be quite familiar to most business professionals and academics. Change resistance is always a risk in a change effort since people inevitably will react on new things. But all change is not resisted. Kailash (1991) has looked into this and he notes that only if the change is considered unfavorable, will it be resisted, while change that is considered favorable is considered more than welcome. Kailash has created a framework which will help managers in understanding how people evaluate change. When a manager has got that understanding, overcoming change resistance in the organization can be much easier. Aladwani (2001) has similarly addressed the issue of change resistance in ERP implementations and argues that it is foremost necessary to address the issue properly and with the correct naming in order to succeed in the implementation. Change resistance should not be swept under the carpet.

Strebel (1996) has also looked into why people resist change. The explanation he offers is that while change is seen as an opportunity by managers, employees might see it as pure disruption. In order to bridge this gap Strebel suggests that what he calls *personal compacts* (and defines as the mutual written and oral obligations and commitments between the organization and the employee) should be handled first so that new terms are laid and hence, employees can more easily accept the change. Only then can change be induced successfully. (Strebel 1996).

The discussion above illustrates the fact that change management is a lot about managing people. This view is also supported by Cameron and Green (2004) who argue that without understanding how change influences people a manager cannot hope to succeed in a change project. Cook et al (2004) notes that every person who is in charge of other people in an organization is in a crucial position with regard to the success of the change. Additionally Katzenbach (1995 cited in Lanning 2001) says that real change leaders focus on the fact that change efforts are people intensive and performance oriented – whether it is fast or slow, one-time or recurring etc. is secondary.

Cameron and Green (2004) believe that the leader needs to master three dimensions of leadership in order to succeed in change management. The first dimension is the managing of business outcomes – a fairly commonly mastered area. The two other areas are not that obvious for many managers but nevertheless very important (especially in change management efforts); managers need to pay attention to underlying emotions and to hidden patterns of power and influence in order to sustain change. (Cameron & Green 2004)

It would be important to note that an organization will benefit from managing technological change and organizational change as a whole – not as separate fields (Dunphy and Griffiths 1998 cited in Salminen 2000). Turner (1999 cited in Lanning 2001) also backs up this view by pointing out that the majority of change projects include change in people as well as in systems and organizations. Turner calls such projects PSO-projects for People, System, and Organization. Duck (1993) also argues that change needs to be managed with the *whole* in mind and not in small pieces. She presents the idea of having a Transition Management Team that oversees the whole change and is responsible for keeping the “big picture” in order. Austin and Currie (2003) also highlight the importance of focusing on the “big” change and not on the situational change.

3.1 Managing organizational change

The discussion on organizational change so far makes it rather clear that there are several reasons why managing change is not an easy task at all. The foremost reason being that changing an organization means changing people, and as Austin and Currie (2003) report, that is demanding work and often even an effort that is over-looked by managers. Cummings and Worley (1993 cited in Lanning 2001) have further noted that "even planned change is chaotic by nature, involving shifting goals, surprising events, and unexpected turnarounds".

But since companies nowadays are more or less forced to change continually there is a great pressure on companies to be able to manage change successfully (Hamlin et al 2001). There is hence, a lot of research giving advice in change management. Kotter (1995) has done a quite renowned work in change management research and studied 100 case companies in change efforts. From his findings he has developed an eight step model for what has to be done right in a planned change effort in order to succeed. The eight steps are presented in *Figure 3*. Kotter underlines that every step is important; mistakes in any one of the steps can be devastating for the whole project. Furthermore, it is important not to skip any steps; although some can be quite difficult to carry out.



Figure 3. Kotter’s eight steps to organizational change management success (source: Kotter 1995)

A pioneering phase model for planned change is Lewin’s three-stage model (Lanning 2001; Salminen 2000; Cameron & Green 2004). The phases in the model are (1) unfreezing the old, (2) moving to new, and (3) refreezing the new behavior or situation. Lewin’s model might not be easily applicable to practice but give good food-for-thought especially in the beginning of a change effort (Cameron & Green 2004).

(1) Planning change
(2) Managing the people side of the change
(3) Managing the organizational side
(4) Evaluating the change effort

Table 3. Burke’s four critical dimensions when managing change (Source: Hamlin et al 2001)

Burke (cited in Hamlin et al 2001) presented a model for managing change with four dimensions (see Table 3). Burke’s model is somewhat limited since it does expect that managers already have knowledge of how to manage change efficiently while failure rates

of change projects give evidence that such knowledge can not be found in most organizations (Hamlin et al 2001). But this model does highlight what was concluded earlier in this chapter, i.e. that both the organization and the people need attention. Furthermore it confirms the need to evaluate a change effort (see chapter 2.6) and to exercise careful planning (see chapter 4.5).

Phase models have been criticized for simplifying the reality and not being realizable (Lanning 2001). But for example Kotter (1995) point out that the phases in his model should be considered as overlapping and not strictly subsequent. Burnes (1996, 1997) also criticize different models and books that prescribe how success in change management is achieved. He argues that there is no “one best way” to follow and that instead organizations should themselves contemplate how the change in question should be managed. Further, Burnes believes that it can be misleading to speak of a “good” or “bad” approach to change and that the approach should be chosen according to how it suits the specific situation. Cameron and Green (2004) have a similar view. After studying 9 different approaches to change and finding that all are convincing only up to some point they conclude that managers and consultants foremost need to be able to choose the most suitable model for the situation. And as Carnall (1990 cited in Lanning 2001) notes, one prerequisite to being able to choose the right approach the knowledge about the organization has to be profound. Therefore continuous learning about the business is essential in striving towards successful change management efforts. In conclusion, it can be noted that the way change is managed will have a notable effect on the outcome of the change effort (Salminen 2000).

Collins and Porras (1996) have noted that when a company changes and adapts to the ever-changing world it is crucial to know what can be changed in the company. They argue that companies that succeed in change projects have core purposes and core values that remain fixed while everything else might change; strategies, practices etc. Managing through change can thus be said to demand careful thought of what to keep as it is and what to change.

3.2 Change management in IS projects

It has already been noted in this thesis that implementing an information system is actually a change project (see chapter 2.3). Cameron and Green (2004) express it in this way: “It [IT-based change] involves people doing different things in different ways with different inputs and different outputs”. Cameron and Green hence believe that it would be important for IT-people to learn about managing change and to understand what organizational change actually is. Champy and Nohria (1996 cited in Hamlin et al 2001) has furthermore defined technology, and in particular IT, to be one of three major drivers for organizational change in companies. Another reason why social and organizational change and innovation should be closer linked to technological change is that technological change is almost happening too fast for the organization to be able to keep up with the pace (Miles 2007).

This means that people are still figuring out and adjusting the organization to best fit some software when the software is already changed to a newer one. So, as already discussed in chapter 2.2 information management has to be brought closer to other areas of management, for example business management and change management.

Williams and Williams (2007) report of findings that show that business benefits from IT are only likely when the implementation project is supported with change management. But although many organizations would need a better acknowledgment of change management it should be remembered that only bigger IT projects which affect routines in several places need comprehensive change management (Roy et al 2006).

Markus (2004) has given technology-driven organizational change situations its own name; technochange. He argues that technochange situations cannot be managed in merely a traditional IT project management way but that the situation calls for change management methods. But Markus believes that it is not enough to only combine these two management fields because neither of them addresses the key risks of technochange; risk of IT-nonuse, misuse, and non-benefits as well as the risk of a bad IT-solution. Instead a special iterative so called technochange prototyping approach is needed; i.e. integrated technical and organizational management. The idea follows the traditional prototyping approach which means that something is first realized and tried out and then on the basis of that trial a decision about what to do next is taken. In the technochange both the technical solution and the organizational change are prototyped on the same time. (Markus 2004)

Organizational change management is about managing people's attitudes and reactions to change. This chapter has discussed the basics of organizational change management and shown that this concept should be taken into consideration also in IS projects since it is quite evident that an IS project induces some degree of change in an organization. This chapter also serves as a presentation of some approaches to managing change in an organization. Whether or not IT professionals have acknowledged the role of organizational change management in a sufficient extent will be investigated in the empirical part of this thesis.

4 Critical Success Factors in Information Systems Implementation Projects

The most crucial process in making the information system investment worth while is to succeed in the implementation of the system (Siddiqui et al 2004). It is therefore evident that there is a lot of research on how to conduct a successful implementation. Many research reports include lists of critical success factors (CSF) which are factors that are critical for succeeding with the implementation. Lanning (2001) has investigated whether or not a practical construct including CSFs for change projects is needed to help managers. He concludes that there is indeed a need for such a construct and also that it is possible to create such a construct. Mabert et al (2003) support the same view; i.e. that listing best practices etc. does serve a purpose, because although every project is unique there are always some common problems that can be easier solved if studying lessons-learned from other similar projects. Some critique has been presented on the CSF approach. Davis (1979 cited in Loonam & McDonagh 2007) has presented the thought that CSFs only underline such information that project managers *think* they need and not the information that they actually need. This view is somewhat supported by Soja (2006) who presents results where the perceived importance of some CSFs is another than the actual importance. Other researchers have answered this critique by pointing out that IS implementation research has to begin somewhere and identifying CSFs is a good start (Loonam & McDonagh 2007).

Wognum et al (2004) give an important addition to the discussion of CSFs' role in implementation projects. They say that CSFs give necessary but not sufficient support in the project and argue that since implementation projects are so complex the organizations need foremost to be prepared to deal with unexpected disturbance. Wognum et al also characterize the implementation processes' dynamic nature by noting that the processes are actually formed by the participating people and hence, a product of their knowledge and interests. This readiness for handling disturbances can be viewed as a sort of additional CSF to all the "traditional" ones that will be presented here below.

Soja (2006) underlines the importance of taking the characteristics of the organization and the starting point of the project into account when discussing the influence of different CSFs. Wognum et al (2004) have similarly concluded that the context in which the system is implemented has an impact on both the course of the project and on the outcomes. Other research highlights the fact that the different CSFs' role varies from one project phase to the other (Brown et al 2007, Teo and Ang 2001).

What will be noted in the following presentation of CSFs found in literature is that most of them are in one way or the other connected to people and not technology. As Wognum et al (2004) report, technical problems actually cause only 10 % of the problems in the implementation while the people and the organization account for 90 % of the problems. Below follows a discussion on CSFs found in literature and their influence on information systems' implementation process.

	Al-Mashari et al 2003	Loonam and McDonagh 2007	Mabert et al 2003	Wognum et al 2004	Siddiqui et al 2004	Soja 2006	Brown et al 2007	Biehl 2007	Lanning 2001	Salminen 2001	Teo and Ang 2001	SUM
Application vs organisation												
Focus primarily on business, not technology					X						X	2
Connection to business and strategy				X	X	X			X			4
Application should match organisation	X											1
Business process reengineering	X	X						X				3
Legacy systems management												
Management commitment and leadership												
Top management support and commitment	X	X	X	X	X	X	X	X	X		X	10
Leadership	X							X	X	X		4
Project champion		X										1
Project team and organisation												
Team composition		X		X		X	X	X	X		X	7
Project manager											X	1
Team involvement						X						1
Commitment							X					1
Project planning and management												
Project management	X	X		X					X	X		6
Planning	X	X	X	X	X	X	X	X	X		X	9
Financial planning and control					X	X						2
Risk management									X			1
Ability to adjust to environmental changes				X				X			X	3
Cooperation over functional barriers									X			1
Organizational change management	X	X										2
Dealing with change resistance									X		X	2
Clear need for change exists									X			1
Consider IS project as organizational change project				X								1
Supporting environment									X			1
Motivate people									X			1
Participation									X	X		2
Culture									X			1
Organizational change strategies updated continually												1
Communication	X	X	X	X			X		X		X	6
Training	X	X	X	X	X				X			5
Evaluation	X	X	X	X								2
Technological issues	X	X	X	X	X	X	X					7

Table 4. Summary of critical success factors in literature

4.1 Connection between the technical application and the business processes

As I already mentioned in the introduction to this literature review (see chapter 2.2) research has shown that it is important that the system that will be introduced is aligned with the company's strategy and general organization. Here I raise the same issue again, in the shape of a CSF. Davenport (1998) argues that the organization's core business has to be kept in mind in an ERP project and that it is important to directly from the beginning of the project highlight the organizational and strategic role of an ERP system. The same goes for every other change project, as Lanning (2001) notes. And for example is it critical in PDM projects to have thorough knowledge of all those business processes that will be even slightly affected by the system (Crnkovic et al 2002).

Among the CSF that Loonam and McDonagh (2007) list we also find the importance of focusing primarily on the business – not the technology – in an implementation project. Teo and Ang (2001) note the same and argue that a big problem in IS project is that business goals are ignored especially when the implementation plan is created.

Al-Mashari et al (2003) present a list of CSFs in ERP implementation. In the setting-up phase they argue that selecting a software package that matches the organization is crucial. Similarly, Ho and Lin (2004) and Wognum et al (2004) believe that the IS should be aligned with the business and the organization. Furthermore, Yetton et al (1999) have investigated how much the characteristics of the system itself impact the system implementation success. Their results say that the system's characteristics have impact on the implementation success, more than the implementation process itself has. Hence, choosing the right system can be very crucial.

4.2 Process redesign

As stated above the processes of the business need to fit those of the system. In order to achieve this, the design of the processes might need some attention. The question is whether the processes or the system should be changed. Literature seems to insinuate that it is often motivated and less expensive to change the processes instead of doing extensive customization to the system. Here I present a structured theory of process redesign called business process reengineering.

Business process reengineering (BPR) is the “radical redesign of a business process to gain dramatic improvements in performance measures such as cost, quality, service, and speed” (Alavi & Yoo 1995 cited in Motwani et al 1998). IS implementation often involves some level of BPR if the business processes need to be re-arranged to fit the system (Loonam & McDonagh 2007). And as stated in the previous chapter an IS will not create benefits for the company unless it is in line with the business processes. According to Biehl (2007) process reengineering is often a better alternative than customizing complex systems.

BPR in itself can be a big project, posing several challenges on the organization and hence, organizations are encouraged to assess the readiness for BPR before launching the effort (Abdolvand et al 2008). There are several frameworks to help the management in managing the BPR, for example Motwani et al (1998) have proposed a practical framework consisting of 6 steps; understanding – initiating – programming – transforming – implementing – evaluating. But in the area of this thesis where BPR is merely a supporting part of the big project, BPR frameworks might not be that useful. Although a closer look at such a framework shows that BPR frameworks could give guidance also in the general management of the IS project as the content is similar to IS project frameworks.

The reality is that many BPR efforts have not succeeded (Cameron & Green 2004). One reason for this is that the “soft” side is often forgotten; for example the change resistance can be extensive in a BPR project (Marjanovic 2000). Another problem is that BPR often means that new processes are built from scratch and for practical reasons all employees cannot be involved in designing the new processes. Consequently, the totally new processes are often rejected by some part of the employees. (Cameron & Green 2004).

But when it comes to information systems implementation the work to align the system and the business processes is probably something that has to be done from both ends. BPR is seldom needed in full extension. It might be that the situation is simply that the introduction of an IS brings along work to refine existing processes and improve the quality of those, as we will see in the empirical chapter of this thesis.

4.3 Management support and commitment

Several reports, both case studies and literature reviews, show that management support is crucial for an IS project’s success (Siddiqui et al 2004; Davenport 1998; Mabert et al 2003; Brown et al 2007; Soja 2006). Loonam and McDonagh (2007) report in their literature review on CSF in IS projects, that sustained top management support is in fact the most often cited CSF. Teo and Ang (2001) review the importance of IS planning problems in relation to different phases of the project and conclude that top management support is critical in all phases of the project. Brown et al (2007) underline the importance of commitment, including management commitment, in especially the acceptance phase i.e. when users begin to employ the system. It is further emphasized that project managers need to be supported by top managers in order to create confidence for the project among the end users in every kind of change project (Lanning 2001). Another reason why top management support is needed is to secure financial and human resources for the project (Biehl 2007).

Biehl (2007) reports of a case where middle managers were left alone with the responsibility for an IS project. Despite the fact that the system was eventually taken into

use, a large part of the middle management left the company due to frustration over the problems in implementation project – problems that top management would not give attention to. This underlines the importance of giving enough support to middle management in bigger IS projects so that they can do their job properly and without getting burned-out.

Sharma and Yetton (2003) propose a more complex view on the matter of top management support. They conclude that the main effect of management support on IS project success is weak. The contingent model they present says that the effect of management support is moderated by task interdependence, and hence top management support only indirectly has influence on IS project success. Also Buhanist (2000) questions the role of top management support. His case study shows that good local or external (e.g. an external change agent) leadership in a change project can in fact be enough for project success, with or without strong top management support.

Researcher also highlight the importance of a committed steering committee for the IS project (Mabert et al 2003). The steering committee has to include people from different functionalities and units especially in big IS project, such as ERP implementation projects. The steering committee is especially important in the launching phase (Teo & Ang 2001). In general companies will benefit from having a person who understands IT among the directors to ensure understanding and support for IT projects (Siddiqui et al 2004; Cameron & Green 2004, p. 264).

Leadership is one of the most important but also most elusive success factors of any project (Lanning 2001). Among other things strong leadership can get creativity and energy out of the employees and through that, get the organization closer to succeeding with the project (Al-Mashari et al 2002). Salminen's (2000) case study shows that successful change projects are pushed forward by a leader with authority and power and self-confidence to achieve the desired results. It is important that the leadership is executed on also the local level – in balance with the leadership executed on the global level. Furthermore Salminen notes that keeping the quality of leadership high is important throughout the change project.

Loonam and McDonagh (2007) notes that it is often mentioned in literature that a project champion is needed. The project champion is a person that is able to motivate people and get them to believe that the change project is necessary. A business leader is thought to be the best person to take the role of champion.

One of the reasons that strong leadership and true management commitment is needed is because people have to be kept motivated to minimize for example change resistance (Siddiqui et al 2004). Motivating people is sometimes listed as its own CSF in change projects but it is hard to recognize as a separate factor. Motivation is such a complex factor that it is easier to regard it at parts of other CSFs such as management support, project management and communication (Lanning 2001). Bryan and Sackett (1997 cited in

Siddiqui et al 2004) report that a common difficulty in PDM projects is to maintain interest and support for the project since it might not show benefits right away.

4.4 Project team and manager

As well as it is important that top management commits to an IS project it is crucial that commitment is found among the people in the project team (Brown et al 2007). And in order to be able to commit every person must clearly understand the goals of the project, especially in the launching phase (Teo and Ang 2001).

Cleland has pointed out that the project organization shape can vary from project to project and there is no overall superior solution (Lanning 2001). The important thing is that the organization involves people from different units, roles, and cultures (Biehl 2007). Kotter has further pointed out that people with good reputation and ability to influence other persons, are needed in the organization (Lanning 2001).

The people in the project team need to be able to commit to the project full-time and have the needed competence (Loonam and McDonagh 2007). The general IT knowledge in the team is rather critical, especially when initiating the project (Brown et al 2007). Wognum et al (2004) as well as Teo and Ang (2001) identify lack of competence as a clear risk and further note that the number of people in the project also has to be sufficient. Soja (2006) has found that both project team composition and project team involvement are among the most important elements for project success, this according to both IT project experts and enterprise representatives. General project management research also emphasizes the importance of personal skills and competencies in the project teams (Ruuska & Vartiainen 2003, Loo 2003).

The project manager is especially critical. Teo and Ang (2001) report that it is crucial to find a manager with sufficient experience and ability to motivate people for leading an IS project. It is important to find such a person already when launching the planning of the IS project. Roy et al (2006) have more closely investigated the project manager's role in IS projects. They have compared the role of directors in projects of varying degrees of transformation. The conclusion is that a manager in a project with high organizational transformation has several roles to play and hence, need a great number of management skills. The manager of such a project needs to master both technological and organizational complexity. In a project on a lower level of organizational change the role of the project manager is more transactional than transformational. (Roy et al 2006.)

4.5 Project management and planning

It is rather evident that an IS implementation needs to be managed as a project and it needs an organization different from the one of the daily work (Wognum et al. 2004.).

Consequently, project management of high quality is needed in order to succeed. This has been noted by several authors and hence, project management in itself is often listed as a separate CSF (Al-Mashari et al 2003; Loonam & McDonagh 2007; Mabert et al 2003; Wognum et al 2004; Lanning 2001; Salminen 2000). In other words research shows that bad project management can be the reason that an IS investment fails. It is also pointed out that good project management is needed *throughout* a change project (Salminen 2000; Loonam & McDonagh 2007).

According to Lanning (2001) the most important elements of project management are monitoring the progress and exercising project control so that the project will be able to meet its targets. Another important part of project management is to keep people motivated, as noted previously in the chapter on management support (Lanning 2001). Wognum et al (2004) note that although implementation efforts are discontinuous it is important to use lessons learned from previous projects since there is always the risk that a project will suffer from the same mistakes as previous projects. Another important element in project management is to manage the relationship to vendors and consultants (if such are used) and therein the most critical is to establish a functioning knowledge transfer mechanism (Al-Mashari et al 2003) during the project as well as after project closure.

Financial control is naturally a very important part of IS project management. The often enormous costs of bigger IS efforts is a clear risk (Loonam & McDonagh 2007). The license fees stand for only a small part of the costs. Scheer and Habermann (2000 cited in Loonam & McDonagh 2007) report that companies can spend up to seven times more money on consultancy, organizational change management, communication, and personal resources etc. than on the actual license fees. According to Soja (2006) the budget and being able to keep it, is especially important in smaller ERP projects. Siddiqui et al (2004) also identify cost as a possible obstacle to successful PDM system implementation.

In the same way as project management of good quality is crucial for IS project success, project planning is crucial. This is mentioned in several CSF-research reports (see *Table 4*). Biehl (2007) notes that planning in global IS projects need to be done with a sense of urgency but not discarding the fact that the planning has to be properly done. Davenport (1998) notes that “a speedy implementation of an enterprise system may be a wise move; a rash implementation is not”. Siddiqui et al (2004) further mention that the planning has to be realistic and based on a clear understanding of the as-is situation. The authors further say that it is also important that the implementation plan reflects the organization’s ability to change. Mabert et al (2003) has noted that in such ERP projects that are successful in the sense that they keep to budget and time schedule, a “Mini Big-Bang approach” (i.e. introducing all modules at once) was a better alternative than a “phased-in approach” (i.e. introducing modules one at a time). But an organization should always choose the approach based on the culture and attitudes towards change in the own organization. And what has to be kept in mind is also that the plans should take into consideration the relatively considerable amount of time that people need to digest change (Kotter 1996 cited in Lanning 2001).

According to Soja (2006) having a detailed schedule is critical in IS implementations. While Lanning (2001) on the other hand talks about realistic and purposeful planning and notes that it is no use planning on a too detailed level. But good planning will in any case need to include clear goals, objectives, and visions. Both Loonam and McDonagh (2007) and Lanning (2001) mention this as a separate CSF. Teo and Ang (2001) highlight the importance of being able to translate these goals and visions into concrete action plans. Lanning (2001) offers two additional reasons for good planning; he argues that good planning is needed to ensure lasting top management support and to keep the change effort credible. The assigning of resources is moreover an important element of planning (Lanning 2001).

It is worth keeping in mind the conclusion that Soja (2006) offers; the wider the project, the greater the need for planning and setting implementation goals. This finding is also supported by Biehl (2007) who argues that planning is much more important in global IS projects than in local IS projects.

A risk that is connected to planning is the risk that plans, once developed, are forgotten and neglected (Teo & Ang 2001). It is therefore justified that the organization and management is flexible enough so that changes that happen around the project can be taken into account and plans updated accordingly (Biehl 2007). Wognum et al (2004) have, as presented in the beginning of this chapter, concentrated on understanding the dynamics of an implementation process and argue that it is crucial that an organization is indeed prepared to handle sudden disturbances.

One CSF that Lanning (2001) mentions is cooperation over functional barriers in change projects. This is important in such IS projects where more than one unit or function is affected by the system. It is crucial that all units and functions are taken into account. Furthermore is it important that project management co-operates with business managers and, as Eichelberger (1994 cited in Lanning 2001) argues, these should be held responsible for the project together. Kim and Oh (2000) similarly say that global coordination of information systems in global organizations is important in order to achieve operational flexibility.

4.6 Organizational change management issues

Most of the literature on implementing information systems mentions, more or less directly, issues that are connected to organizational change management as critical for implementation project success. In this chapter some elements of organizational change management that should be considered in IS implementation projects will be discussed. In chapter 3 change management and its general challenges are discussed more closely.

Wognum et al (2004) note that it is critical to regard IS implementation as a process involving organizational change and evolution. They point out that implementing such technology that affects several units and functions “not only induces organizational change, but also requires organizational change” (Wognum et al 2004). Moreover it is, as Teo and Ang (2001) argue important that the change process is accepted and understood by people at all levels of the organization. One way to get people to accept and understand the change process is to establish a “sense of urgency”, i.e. make sure that people have realized the need for the change (Lanning 2001).

Loonam and McDonagh (2007) have listed change management as one of the top 10 CSF in ERP implementation. Al-Mashari et al. (2003) similarly include “cultural and structural changes” in their list of critical factors. They underline the need for careful planning of the transformation. Mabert et al (2003) also mention the need for planning the organizational change and continually updating these plans.

In order to successfully bring about the change in a change project the supporting environment need to be consistent with the intended directions of the change (Lanning 2001). The supporting environment includes organizational structures, systems, and procedures; for example incentive systems, leadership manners, reporting relationships, and communication channels. Middleton and Harper (2004) have investigated this more closely and they argue that organizational alignment (salary, promotion, staff selection, retention etc.) should be in order before starting an IS project if wanting to succeed.

A fundamental element in successful change management is participation (Lanning 2001; Salminen 2000). Salminen (2000) found that in successful change projects a high degree of participation with real decision power could be noted. Lanning notes that the degree of participation is dependent on the project characteristics and that the purpose of participation is two-folded. Firstly, it is a way to get people committed to the change and to get the expertise available in the organization collected. But the main purpose of participation is to achieve the project goals as efficiently as possible. (Lanning 2001). But participation is not (in the same way as any other CSF) an instant key to success (Lanning 2001).

Closely connected to organizational change management lays the research of organizational culture. As stated in chapter 3 culture has to be altered in order to obtain lasting change (French & Bell 1999 cited in Lanning 2001). Lanning (2001) has thus listed paying attention to culture as its own CSF in change projects. Similarly Leidner and Kayworth (2006) discuss the relationship between IT and culture. They conclude that there is a two-way relationship; culture has an impact on how IT is introduced, accepted, and used but IT has also – in the long run – impact on the culture. The report by Leidner and Kayworth covers an extensive amount of literature on IT and culture and this relation is definitely worth noting also in IS implementation projects.

Change resistance is another element of organizational change management that needs to be acknowledged as a risk and dealt with in projects that induce change (Lanning 2001). Resistance to change is a real risk in an IS project since the system will often bring about new ways to work etc. Siddiqui et al (2004) note that getting the users to accept the new system is one of the biggest obstacles in PDM projects. The way resistance to change is dealt with is not always the right, though. Often managers try to treat merely the symptoms and not the underlying, often fundamental, problem (Lanning 2001). Change resistance is further discussed in chapter 3.

It is possible that this is the CSF that is the most difficult one to understand and to manage in IS projects. Pawlowski and Boudreau (1999 cited in Al-Mashari et al 2003) have reported that about half of the ERP projects fail because the effort needed for change management is underestimated. And the claim is that organizational change management should get more attention in IS projects. Williams and Williams (2007) argue that business benefits from IT will get realized only when change management is exercised throughout the implementation process. And in the end, organizational change management has simply to do with motivating people and to get them to accept the change.

4.7 Communication

Burke (1987 cited in Lanning 2001) has said that “it is difficult to communicate too much in a major change effort”. And indeed, communication is a CSF according to several authors (see *Table 4*). Implementation plans and the progress have to be regularly communicated to stakeholders (Mabert et al 2003). Teo and Ang (2001) note that if the communication is not floating freely there will be problems especially in the launching phase of the project. According to Brown et al (2007) communication is the second most critical area in IS implementation – and especially important in the adoption phase.

As Lanning (2001) underlines the communication has to be *effective*. Lanning further argues that using many different means of communication makes it as effective as possible. The communication need to focus on the strategic and organizational aspects of the implemented system (Davenport 1998). But also the technical aspects need to be communicated so that people, who need to understand the more technical side, can do so (Wognum et al 2004). Also Loonam and McDonagh (2007) list communication as a CSF and adds that it is not necessarily a straight-forward and easy task. Additionally, excessive and unnecessary communication also poses some risks, e.g. the possibility for cost overruns (Mabert et al 2003).

The need for communication also put demands on other areas. For example is it worth noting that a successful vision has to be communicable (Lanning 2001). In Kotter’s (1995) 8-step model for change management (see *Figure 3*) communicating the vision is given a lot of attention and it seems that many companies make the mistake of not communicating the *vision* enough. Kotter believes that managers should also “walk the talk” i.e. try to

become a living symbol for the vision. Furthermore communication has to be credible and give a credible image of the vision. (Kotter 1995).

All in all communication is indeed needed when managing people. In change management communication is the tool for announcing, explaining and preparing people for change and bringing forward both the positive and negative effects of the change at hand. (Kitchen and Daly 2002)

4.8 Training

End user training problems are frequent reasons for IS implementation challenges or even project failure (Loonam & McDonagh 2007). Lanning (2001) argues that the main objective for training is to get people to understand and accept the change and then, in application-specific training, teach people how to use the new tool. Hence, the problem of user acceptance can, at least partially be solved with training (Siddiqui et al 2004).

Sharma and Yetton (2007) have investigated the effect of training on IS implementation success more closely and have a less common view on the issue. They report that the effect of end user training on user acceptance and implementation success is influenced by two contingencies, namely the complexity of technology and the task interdependence (i.e. the degree of mutual dependency between the tasks executed in the system). In the model they propose the effect of training is only a function of technical complexity and task interdependence. This would mean that the importance of training is dependent on the characteristics of the system. (Sharma & Yetton 2007)

But in any case training needs a remarkable amount of resources and is therefore often not arranged properly according to Kotter (1996 cited in Lanning 2001). Williams and Williams (2007) also raise the concern that training and end user support is not given enough human resources in IS projects. They believe that this is a sign that awareness of potential future problems in the usage of the system, is lacking. The figures that Volwer (1999 cited in Loonam & McDonagh 2007) report on are worth noting; by reserving 10-15% of the budget for training, the organization will have an 80% chance of succeeding with the IS project.

Al-Mashari et al (2003) note that a challenge – in all IS implementations – is to create an appropriate plan for the training. Furthermore is it important to understand that as well as all the other project strategies also the training strategies need to be updated continuously so that they reflect changes in and around the project (Mabert et al 2003).

4.9 Evaluation of project success

Also evaluation of the project's success has been listed as a CSF in IS implementation. Al-Mashari et al (2003) include this in their list of critical factors in ERP projects as its own specific part and underline its criticality. The evaluation should cover both tangible and intangible benefits. Also Mabert et al (2003) note that companies that succeeded in the implementation had clear guidelines on how to measure the performance: both technical and business measurements. Evaluation of IS projects is discussed in more detail in chapter 2.6.

4.10 Technological issues and system design

An IS project without technological problems does most certainly not exist. It therefore comes as no surprise that also technological issues are considered to be a CSF (see *Table 4*). The first issue related to technology that needs to be considered when launching an IS project is the degree of customization to the chosen system (as discussed also in chapter 4.2). Loonam and McDonagh (2007) speculate that a package off-the-shelf might compromise a company's competitive advantage. Similarly Kadiyala (2005) argues that business information systems should be customized to better fit the business. While Mabert et al (2003) and Davenport (1998) both see that only *some* customization to large systems – such as ERP packages and PDM systems – is smart and financially manageable. Ward et al (2005) further underline the fact that enterprise-wide systems are indeed very complex and large systems and customization is hence very expensive and time-consuming. Instead the effort should be put on efficient business process reengineering.

The risk that an information system will not meet the users' needs is called functionality risk (Clemons 1991 cited in Tiwana and Keil 2006). In information systems project this potential risk needs extra attention because the system development is often outsourced and hence, the understanding of user needs can suffer (Tiwana and Keil 2006). Tiwana and Keil (2006) have created a model on functionality risk factors' influence on perceived overall project risk. The factors are worth mentioning here in order to create understanding of the reasons for functionality risk (see *Figure 4*).

The factor *requirements volatility*, i.e. how much the requirements change during the project, leads us further to the importance of well-organized requirements engineering. Requirements engineering is described by van Lamsweerde et al (1998) as the process in which high-level goals and user expectations are transferred into clear specifications. The process also includes assigning responsibility for the requirements to people and system components. Requirements engineering is surprisingly difficult (Brooks 1987 cited in Liu et al 2007) and inconsistencies are not unusual. Both van Lamsweerde et al (1998) and Liu et al (2007) discuss the problem of solving inconsistencies and detecting overlapping use cases. Both reports agree that this problem has to be solved sooner or later in the project – preferably sooner.

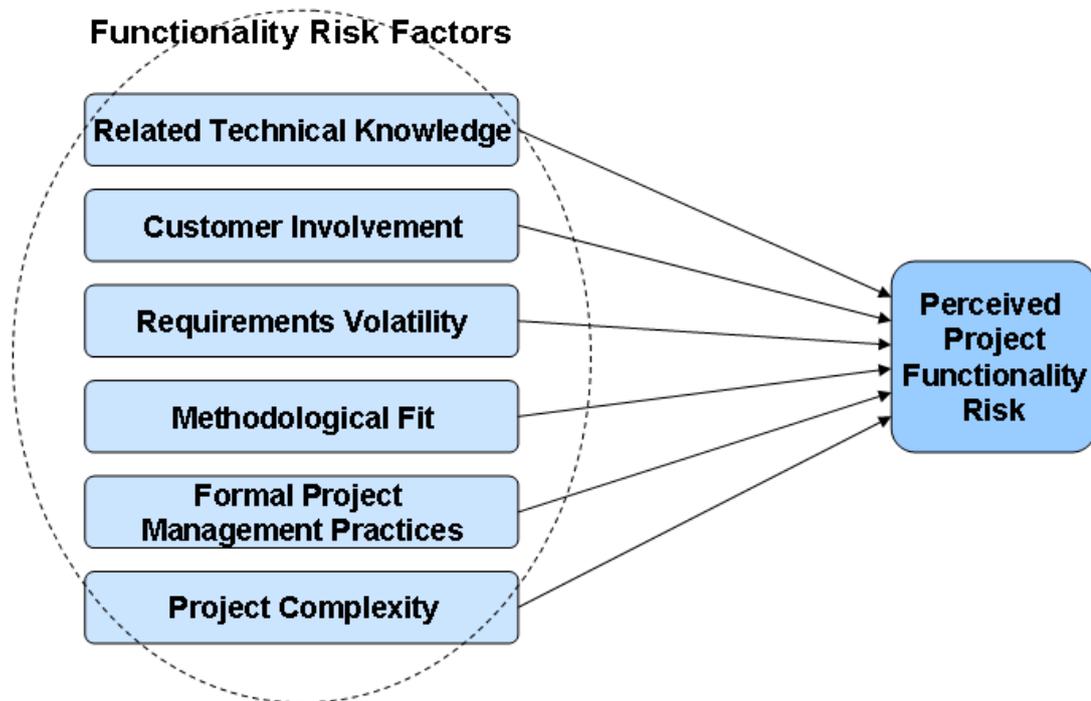


Figure 4. Model of functionality risk factors' influence on perceived project functionality risk. (source: Tiwana and Keil 2006)

Maiden (2008) present a theory of why requirements management often go wrong. He thinks that the two different types of requirements: user requirements and system requirements are treated as the same while they are actually very different. In software projects both types of requirements are needed but they need to be distinct from each other when creating, presenting, and using them. (Maiden 2008)

Jiang et al (2007) have made a thorough investigation into how the best requirements engineering technique should be chosen. While the research is focused on presenting a knowledge-based approach to selecting the best technique they also contribute by listing several different requirements engineering techniques. The presented approach itself is in a nutshell based on gathering knowledge from people involved and using an objective evaluation of the techniques' pros and cons.

It is important not to overlook the demands that existing technology puts on the new IS. The new system should be aligned and integrated with existing systems. The infrastructure issues should furthermore be managed with careful consideration. (Wognum et al 2004; Al-Mashari et al 2003; Loonam & McDonagh 2007; Soja 2006; Brown et al 2007). Legacy systems management includes not only the handling of the technological issues but also the organizational and process-related issues. Before embarking on a new implementation project, legacy systems and their role should be carefully analyzed. The system integration on the other hand should be planned with the future in mind as well, i.e. how will the new

system be integrated with even newer systems in the future? (Al-Mashari et al 2003). When implementing a PDM system in an organization with an ERP system in use the connection between these two systems need extra attention since the data in both systems are closely interconnected (Peltonen 2000).

Saeed and Abdinnour-Helm (2008) have found that the way how system integration is done – and perceived – has a direct influence on IS usefulness. Also information quality affects the usage of the IS. These are results worth noting in the technical part of system implementation. Partly on the same topic we can note that Loonam and McDonagh (2007) state that management should not let the vendor dictate the technical solution but take an active part in those decisions as well.

Al-Mashari et al (2003) also give system testing a critical position in the implementation and say that the functionalities need to be tested both alone and together with other (existing) technology. The testing should also confirm that the system is working according to business requirements. (Al-Mashari et al 2003.)

Other technological issues that are critical for implementation success are such as keeping in mind that the system is adjustable enough in possible future merger-situations (Loonam and McDonagh 2007) and assuring system reliability (Soja 2006). It is also pointed out that key technology issues should be handled early enough in the implementation project (Mabert et al 2003).

5 Product Data Management Systems

Crnkovic et al et al (2002, 19) offer a definition of product data management (PDM) which states that it “is the discipline of controlling the evolution of a product and providing other procedures and tools with the accurate product information at the right time in the right format during the entire product life cycle”. It is important to note that this is the definition of PDM as a discipline while a PDM system is the information infrastructure used for managing product information (Crnkovic et al et al 2002). PDM systems can be used to manage both the engineering data and the product development process (Smith 2004).

PDM systems are being developed in order to create a tool for mastering the continuously increasing amount of information in design environments and to meet the demand for fast creation of new products (Crnkovic et al et al 2002). PDM systems are used to manage files and database records related to the whole life cycle of a product. According to Peltonen (2000) almost all data in a manufacturing company could be regarded as product data – with the exception of financial data and human resource data. Nevertheless, PDM systems usually encompass only the actual engineering data and leave out data related to for example sales and delivery. The reason for this is simply that the systems have been originally created to deal with the engineering aspects of product development (Peltonen 2000). PDM systems are simply put needed because the structure of product data is often so complex that it cannot be handled in conventional databases (Katz 1990, Crnkovic et al et al 2002).

The version dimension: The system has to allow versioning of designs so that designs can be modified easily.
The views dimension: The system must allow representation of one product in multiple levels/views/representations.
The hierarchy dimension: It must be possible to present data in a hierarchical structure
The status dimension: It must be possible to give the design a status that describes what requirements are reached.
The variants dimension: The system must be able to handle different variants of a design.

Table 5. The five dimensions of PDM systems according to van den Hamer and Lepoeter (source: Van den Hamer & Lepoeter 1996)

Van den Hamer and Lepoeter (1996) have investigated what should be required out of a system supporting design data management, i.e. product data management. They have created a list with five fundamental dimensions. But they state that all dimensions cannot be met at the same time and hence they need to be prioritized according to specific needs. The dimensions are presented in *Table 1*.

PDM systems have been listed at the top of companies' IT investments list (Gott 1995) and many companies regard the implementation to be of strategic importance (Crnkovic et al et al 2004). PDM systems are furthermore believed to eliminate part of the problems related to barriers to accessibility of information in companies (Smith 2004). But as Peltonen (2000) concludes introducing a PDM system in a company is a large undertaking and although the system is believed to be increasingly important the exact benefits have been difficult to define and measure. Crnkovic et al et al (2002) note that PDM system projects have generally been marked by large amounts of problems and high costs. But as the industry's interest in PDM has grown so has the commitment to PDM projects and more successful implementations have been achieved (Crnkovic et al et al 2002). Furthermore, research does recommend the implementation of PDM systems and claim that faster time-to-market, better product configuration management, and product data integrity can be achieved with the help of a PDM system (Smith 2004). PDM has evolved into emphasizing information evolution, life cycle management, global access, control, and collaboration and hence, PDM systems are good tools for supporting distributed product development (Crnkovic et al et al 2002). The conclusion is still that the operational effects are easier to point out than effects on the company's business performance (Crnkovic et al et al 2002).

It is important to note that deploying a PDM system is much more than a technical endeavor. Knowledge about and analysis of the processes of the company is crucial. But there is not much research on this non-technical aspect of deploying PDM systems. It has been concluded though, that introducing the system in a phased manner is preferable and it is recommended to implement functionalities in steps. (Crnkovic et al et al 2002)

6 Research methods

The empirical part of this thesis is based on qualitative data collected primarily through interviews. Observations of the environment have also had impact on the conclusions and discussion of results. The findings of the interviews are compared to theories presented in the literature review. The aim of the interviews was to map Wärtsilä employees' views on what the most critical success factors in information system projects are as well as to gather experiences and lessons-learned.

The interview approach used here is called *the general interview guide approach* by Patton (2002). Hirsjärvi and Hurme (2000) have named the same approach “*interviewing according to theme*” (free translation from Finnish). The approach is a semi structured interview approach which means that the interviewer conducts the interview according to a pre-planned high-level structure. The structure outlines the issues that the interview is thought to cover but does not contain specific wording of questions. The purpose of the plan is to have a sort of checklist that will ensure that all the relevant topics are covered during the interview. The execution of interview can be quite similar to a normal discussion. This kind of interview is well suited to a situation where only the general topic of the research is known and where the interviewer does not want to restrict the topic too much in advance. This approach is therefore the best option for the interviews in this research since the aim is to map the interviewees' experiences, opinions, and views on the topic of information systems implementation projects. Furthermore, the interviewees' own prioritizing of topics is also valuable in this research. This kind of a semi-structured approach is also suitable because it is not known in advance what the interviewees' exact experiences are and whatever they mention can be valuable information. By using this approach it was furthermore possible to adjust the interview to match every person's individual role and experience.

All in all 16 Wärtsilä employees were interviewed. They were divided into two groups according to primary focus-area of the interview. The first group of interviewees was people with experience of various information systems projects at Wärtsilä – both bigger and smaller projects, as well as closed and on-going projects. The aim of these interviews was to map general experiences from information systems projects. The other group of interviewees all had a role in the on-going rather big PDM project (the project is presented in more detail in chapter 8.1). The focus of these interviews was specifically on the issues in the PDM project. The profile of the interviewees can be viewed in *Table 6*.

General focus of interview	Date	Role in the project	Title, if other than role in the project	Organisation (Information Management personnel or business division representative)	IS-project focused on in interview	Status of project
General IS-project experience	24.6.2008	Project Manager		IM	ERP	closed
General IS-project experience	3.7.2008	Application Manager		IM	CRM	on-going
General IS-project experience	3.7.2008	Project Manager		IM	Engineering application	closed
General IS-project experience	7.7.2008	N/A	General Manager, User Support	IM	N/A	N/A
General IS-project experience	14.7.2008	Project Manager		IM	Time reporting application	closed
General IS-project experience	15.9.2008	Project Manager	former Chief Information Officer	IM	ERP	closed
General IS-project experience	26.9.2008	Senior Counsellor	General Manager, Business Development	Business	CRM	on-going
PDM-project experiences	25.9.2008	Roll-In Manager		IM/Business	PDM	on-going
PDM-project experiences	1.10.2008	Process Expert		IM	PDM	on-going
PDM-project experiences	1.10.2008	Testing Expert		IM	PDM	on-going
PDM-project experiences	6.10.2008	Training Expert		IM	PDM	on-going
PDM-project experiences	7.10.2008	Team leader	Development Manager, Engineering Applications	IM	PDM	on-going
PDM-project experiences	8.10.2008	Project Manager	General Manager, Product Data Management	IM	PDM	on-going
PDM-project experiences	9.10.2008	Super Key User	Senior Product Engineer	Business	PDM	on-going
PDM-project experiences	30.10.2008	Roll-In Manager	Local IM Development Manager	IM/Business	PDM	on-going
PDM-project experiences	30.10.2008	Super Key User	Software Engineer	Business	PDM	on-going

Table 6. Profiles of interviewees.

In the process of preparing the interviews and selecting the interviewees another method of interviewing was also used; the questionnaire. This method of interviewing is well-suited when a large group of people are to be interviewed on some very specific topic. This approach was chosen because the aim was to among about 20 persons find such persons that could be interviewed (the questionnaire can be viewed in Appendix 1: Questionnaire). Furthermore an overview of what kind of experience could be found in the organization was sought for. On the basis of the answers to the questionnaire the interviewees for the general IM-interviews were chosen. The interviewees for the PDM project focused interviews were chosen on the basis of their area of responsibility and role in the project.

6.1 Execution of interviews and the analysis

The interviews were executed during a time period from June to October 2008. The aim was to execute the interviews which were focused on general IS project experience first

and after that the PDM-focused interviews. This was in order to keep focus on one area at a time. The aim was almost reached as the interview-rounds were over-lapping only by one. This also meant that the PDM-focused interviews were all executed after the literature review was done while the general IS project interviews were executed at the same time as the literature review. The interviews were executed in English or in Finnish.

The interviews were recorded with written notes. The analysis was done by first organizing the notes from all interviews into four main categories much aligned with how literature is categorizing the issues. The data was then organized into sub-categories following the idea of constant comparative method which meant that new sub-categories were created “along the road”. The idea of the constant comparative method is that new categories are created continuously during the analysis-process. The constant comparative method is one of the central theories of analysis according to grounded theory (Hirsjärvi & Hurme 2000) which is the method of analysis that has, in some extent, influenced the analysis in this research. Analysis of data according to the grounded theory is suitable for this research since the results of the research are developed during the whole research and influenced continuously by literature and findings in the interviews. Grounded theory is a commonly used method for qualitative analysis.

The categorized material was further analyzed in relation to literature and to common practice at Wärtsilä. The findings of the interviews are presented in chapter 7.2 and 8.2. The analysis is presented in chapter 9. The results are also presented in a shorter format in Appendix 4: *Recommendations in table* format. This list functions also as a summary of the findings and could be used in the development of Wärtsilä IM functions.

7 Information Systems Projects in Wärtsilä

7.1 Information Management at Wärtsilä

The responsibility of Wärtsilä's Information Management (IM) organization is to manage operations related to business information, processes, and information technology in the company. Wärtsilä IM is an internal service provider for other divisions of Wärtsilä.

Wärtsilä IM is a relatively young organization. The global IM organization was established in 2003. Previously the information (technology) related operations were handled separately by assigned persons in each business division. As the company has grown heavily during the last decade so has the IM organization. There is a need for global management of various applications and processes and thus IM's mission includes guarding that this global approach is kept and developed by providing global application management. IM also works for global streamlining of information related processes.

A considerable part of IM's functions revolve around the introduction of new information systems and the updating of legacy information systems. In 2002 the implementation of an ERP system, the WE SAP project, was kicked-off. The introduction of the ERP system in Wärtsilä was preceded by a thorough process modeling initiative involving all Wärtsilä divisions. Overall the WE SAP project was a large effort and project. The project was officially closed in 2007 (after that the system has still been implemented in new locations joint to Wärtsilä through e.g. acquisitions). The implementation of WE SAP was a true necessity and a milestone on the path to a truly integrated global company and made several other information related investments realizable, as the former Chief Information Officer noted. Another big information system project in Wärtsilä is the introduction of the CRM system for the sales function that started in 2007 and is planned to be closed in 2009. One has to note though, that the application has played a secondary role in the CRM project and the enhancement of sales functions in general, has been the main goal. A third big project is the Product Data Management system project which will be closely presented and discussed in this thesis (see chapter 8).

Several other smaller information systems projects have been conducted in Wärtsilä, and many are yet to come. There has been project guidelines developed in order to create a common policy for IM-related development projects. The guidelines are thought to help in succeeding in conducting the project and also to harmonize the development actions of IM. The project guidelines are also a mean in communicating best practices. The project guidelines include among other things the definition of phases of the project. These guidelines have not been used in the projects that the interviewees come from but will be used in all future IS projects. In order to further improve the ways of working in IM there is special effort called the Quality and Testing project which aims at refining the practices for requirements collection, processes for functional and architectural design, and testing in the whole organization.

It must be noted that the term deployment is used in Wärtsilä when referring to bringing the system to usage. The deployment phase is the last phase of the actual execution of an IS project according to the new Wärtsilä IM project guidelines.

7.2 Evaluation of Information Systems projects in Wärtsilä

Seven persons from Wärtsilä's IM organization were interviewed about their previous experiences of information system projects. Their answers and thoughts are summarized here while the conclusions drawn from the interview findings are presented in chapter 9. In this chapter also parts of the interviews held with people involved in the PDM project are reported, namely such comments that concern information system projects and IM functions in general. The comments that concern specifically the PDM project are reported in chapter 8.2.

The seven persons that were interviewed about information system project experiences in general were asked to name three factors that they believe are the most critical for information system project success. Those factors are listed in *Table 7*.

Information systems projects are not easy and project success is not easily attained. All interviewees did either indirectly or directly express the view that information system projects are always full of challenges. It was stated that every information system project is unique. Budget overruns were also seen as very common. The cost estimation for the largest of Wärtsilä's information system projects did a large overrun compared to the original budget. This was thought to have happened because consultancy services and resource needs were underestimated.

Critical success factors that were mentioned (3 factors / interviewee)	Number of interviewees
Management support and commitment	5
Communication and organizational change management	3
Training	2
Mature and well-functioning system and intergration to other systems at go-live	2
Existence of clear targets and business benefits	1
Enough resources in the project	1
Involving the users in the project early enough	1
Project management	1
Commitment of the customer (In Wärtsilä: business divisions)	1
Skilled project personnel	1

Table 7. Critical success factors in information system projects according to the interviewees.

One thing that was thought to need more attention in Wärtsilä was the fact that an information system's life does not end when the implementation project ends. The IS will be developed throughout its life cycle. This is something that should be taken more into consideration in functions related to information systems in Wärtsilä. There should for example be a person assigned to manage the information system throughout its life cycle.

7.2.1 Project Management, Planning, and Project Progress

Good and structured project management was stated as a prerequisite for project success. It is worth noting that most interviewees seemed to view this as quite self-evident and would not have mentioned it if it would not have been explicitly asked about.

The knowledge about project management in information system projects was introduced in the company via the consultants in the ERP project (that started in 2002). The IM-organization's project management knowledge has since that increased notably though the organization is still thought of as being quite young and still developing heavily. Special project management guidelines for IS projects have been developed on the basis of the company's general internal project guidelines. Besides the rather obvious fact that project management guidelines result in better managed projects and hence, better quality of the deliverables, one interviewee also mentioned that the guidelines make the organization work in a consistent way and hence, the customers, i.e. the business divisions of Wärtsilä, learn how IS projects are executed.

The project guidelines also serve as a place to gather best practice and lessons-learned. But the collection and above all the communication of lessons-learned and knowledge gathered through project experience, was commonly thought to be important to improve in the organization. Some of the interviewees felt that lessons-learned might be written down but not properly transferred. The transfer happens in an organized way among the project managers but fact is that also other IM personnel would need to hear about previous experiences. It was noted that mistakes could have been avoided in many projects that have followed the big ERP project if lessons-learned from that project would have been taken into consideration. One of the experts wondered if the reluctance to use lessons-learned from the ERP project was due to the bad reputation of that project while in fact, concrete methods in for example configuration management would probably have helped in for example the PDM project. One of the project managers referred to Otto von Bismarck and stated that it is better to learn from others' mistakes than from own mistakes. The same project manager had gotten good feedback when openly sharing and talking about the problems of the project he was heading. Another of the interviewees stated that if there are no processes or practices written down there is no way to make the process better.

One interviewee felt that the knowledge about how to conduct specifically software development projects is simply missing in the organization. Other interviewees expressed the thought that surely the people in the ERP project must have learned a lot on that topic,

but that knowledge has not been transferred. It was commonly seen as a problem that most of the lessons-learned from the ERP project were left in the heads of the people participating in that particular project.

It was also mentioned that there is now an internal Quality and Testing project that aims at specifying practices for requirements collection, system build, and testing. This was thought to increase the success rate of the IS projects in Wärtsilä. Another element of general project management that was mentioned was document management and the importance of keeping documents in line and up to date. An IS project can produce a large amount of documents and there has to be a system for managing the documents. As discussed in chapter 8.2, document management has not been very good in the PDM project.

One interviewee also called for clearer internal working processes in IM in general. He felt that there is no immediate readiness to act on something where it is not pre-defined which team is responsible. Another interviewee thought that more knowledge sharing about what the bigger contracts with important partners really include would also be needed. Now there is a lot of time wasted on finding out what some contract really includes, e.g. the support contract.

The planning phase of the project was noted as crucial for project success. Several different issues related to planning were mentioned. All interviewees thought that if the planning is well done the chance to succeed is bigger. But it was also stated that the planning cannot go on forever, the actual project has to start at some point.

One mid-size project had failed mainly because the planning and the initiation of the project were not done thoroughly enough. This resulted in an unrealistic schedule which then led to a project where the focus was more on getting the project done rather than actually introducing a system that would work and make the daily work of engineers more effective. Furthermore the process of selecting the application was not done thoroughly enough which led to a somewhat questionable choice of application. A better standard way for selecting the application was called for by some of the interviewees.

The creation of unrealistic schedule was seen as a very common problem for IS projects, especially by interviewees representing the business divisions. It was speculated whether the creation of unrealistic schedules is a selling trick. This problem was seen as something that should definitely be remembered in coming projects; creating over-optimistic schedules is never a good idea. But as one interviewee mentioned IS projects should for financial reasons always be carried out as fast as possible; the trick is just to balance between fast execution and a properly executed project.

It was highlighted that the planning of an IS project should start with careful investigation of how people affected by the new system work at the starting point of the project. An analysis of how work processes will change with the introduction of the new system is

very important. Peoples' way of working should be in focus. The analysis should result in an understanding of what the transition from the as-is situation to the to-be situation actually means for all stakeholders. Workshops and interviews were noted to be good tools in conducting the analysis. Furthermore such analysis is important to conduct separately for each group of stakeholders and there has to be separate project plans for each unit.

Both representatives from business divisions and IM mentioned that the customer, i.e. the business divisions, should be engaged both earlier and in a greater extent in the planning phase of the project. It would be important to bring business divisions and IM closer to each other to create a better mutual understanding. One concrete method that was mentioned is to include more business people in the planning of the project. Because fact is, that only the customer can express the expectations on a system and the expectations need to be expressed so that the aim of the project should be clear from the very beginning. The relationship between IM and business divisions is discussed more thoroughly below.

The experience from one project was that it is important that the project tollgates of the IM project guidelines are fixed enough and the passing of each tollgate is not done carelessly. The tollgates should also get attention in the planning phase. Furthermore it was noted that in bigger projects it would be good if there is at least one person who's single task is to follow-up the project's progress - a sort of project controller – so that for example the project leaders can concentrate on getting things done and not checking and reminding people all the time. The tollgates are important to follow also from the point-of-view that when the system is transferred to production it is very important that all administrative things (licenses, servers etc.) are in order.

The hand-over to support after project closure has not always been smooth. From support point-of-view it would be good if the hand-over to support would happen earlier than it has done up until now. The hand-over should happen before roll-out, or at least the support organization and personnel should be involved earlier. A so called service transition template is under development in Wärtsilä. The template is thought to be a tool in ensuring that the information system is ready to be transferred to support. Furthermore it was noted that the technical go-live should happen before business go-live so that the system can be ensured to work properly also in the production environment.

Another “selling trick” that was criticized was to promise all kinds of financial savings as results of implementing big information systems. Those savings that are promised are seldom realized and as a result IM will be thought of as always promising too much. The interviewee thought that all bigger systems should be sold as strategic tools instead of cost savers.

The views on evaluation of IS project success were quite diverse. Most interviewees agreed that evaluation is difficult but it would be important to sort out what a successful IS project actually is. Three interviewees expressed the opinion that evaluation is very important. It was stated by one interviewee that Wärtsilä should start doing regular

evaluations of the system usage 2-3 months, 6 months and 12 months after go-live. One interviewee on the other hand thought it is simply impossible to evaluate IS project success. The evaluation is also more difficult after very big projects since the business environment might have changed a lot during the project.

7.2.2 Project Organization

The people in the project organization were thought to be a crucial factor in IS projects. Enough resources have to be assigned to a project in order to succeed. This is something that at least the steering committee has to be well aware of. In Wärtsilä one bigger project was given too little human resources and this was by some interviewees viewed as one of the reasons that the project was not that successful. It was stated that projects that do not get enough resources should never be allowed to start. But on the other hand, the interviewees from that particular project thought that such a small group of people was able to work very dynamically and in relation to the amount of personnel that particular project was thought to be successful.

But more important than the quantity of people is the quality of people. One interviewee even stated that there is only one critical success factor in IS projects and that is the knowledge and skills of the project personnel. Other interviewees thought that it is simply not realistic to gather such a group of people where everybody has enough experience etc. and hence proper task assignment and communication inside the project organization are more crucial issues. If the needed knowledge and resources cannot be found inside the company resources can always be found on the outside. It was noted by some of the interviewees that the knowledge and experience level among Wärtsilä IM-personnel is not yet on a sufficient level. Furthermore it was stated that this kind of knowledge can only be gathered through experience – not through training. All in all the whole organization will develop and learn only by doing.

In any case communication between team members, between project teams, and towards project management is always crucial. It is furthermore important that everyone understands the big picture and the aim of the project. The spirit of the project personnel is also crucial for project success.

The project manager is also in a crucial position. It was stated that it is the project manager's task to arrange the tasks so that the resources in the project are effectively used and people's individual competencies come to their rights. The project manager has to be a person who is good at administering projects in general. This is one of the reasons that IM has developed a project manager pool and it has proven to be quite a good arrangement. On the other hand it was stated the down-side of this arrangement is that the project manager often sits in a different location than the rest of the project personnel.

7.2.3 Cooperation with Partner Organizations

Wärtsilä uses consultants in practically all IS projects but the cooperation with the partner organization has not always been unproblematic. A common understanding among the interviewees is that a consultant cannot understand the company's way of working, the business, and the expectations unless they are clearly expressed. This is the main challenge; to be able to express expectations so that the partner organization understands. Furthermore, such work that is done outside the own organization has to be carefully monitored. One project manager of a project where the original vendor failed to complete the tasks noted that the hardest thing is to know when to "jump off the train". He feels that there is a need for distinct check points in both contract templates and project guidelines that can help in assuring that the partner does the work properly. It should be easier to prove for all stakeholders that the work of the partner is not proceeding as it should. Another comment was that continuous and careful follow-up of the outsourced work is important in all projects.

It was also mentioned that if the strategy is to use only the biggest and best partners in order to ensure quality Wärtsilä should also be better at demanding the very best from the partner. One opinion was also that the choice of partner should always be done through benchmarking – not to save money but to get the best competence. Another comment was that different partners can be used for different phases of the project.

Some concern related to the frequent outsourcing was raised as well. Two interviewees speculated about what the role of the IM organization actually is if all "real" work is outsourced. One interviewee thought that the continuous outsourcing is a bit dangerous since the result might be that no knowledge about and understanding of the applications can be found in-house in the future. His message was that Wärtsilä should follow the example of other companies that have decreased the outsourcing. He mentions one project where quite simple coding work was outsourced but the result was a system that did not meet Wärtsilä's need at all – that kind of simple coding could as well be done in-house. Another interviewee questions what the role of IM actually then is if for example all development work is outsourced. Then IM would be only a coordinator between business divisions and partners without enough understanding of either side. IM's role is also a bit questioned by one business representative who notes that it has been easier to communicate directly with the partner instead of via IM.

7.2.4 Relationship to Business Divisions

All but one of the interviewees felt that the relationship between IM and the business divisions is not as smooth as it could be. A clear majority felt that there is need for better mutual understanding. It is among other things crucial that IM understands what business divisions are expecting out of IS projects in order to succeed with the implementation. But

the view on what the core of the problem is varied between IM and business representatives as well as between managers and experts.

Some of the interviewees noted that IM would need more knowledge about the business divisions' way of working or that such knowledge is valuable in IS projects. This opinion was expressed by all interviewees who directly or indirectly represented the business divisions and by one IM project manager. It was noted that there is a difference in the way of thinking and talking. One business representative thought that IM is using such a vocabulary – a sort of 'IM-jargon' – that engineers in the business division do not understand. An IM manager said that IM is thinking too theoretically about the application and that the approach should be switched to a more practical approach focused on the usage of the applications. Another business representative claimed that most IM personnel do not know why the company even exists and what the core business is. Similarly the relationship suffers from the fact that IM does not experience the direct pressure from the market.

A common view was that IM's role is to support the business divisions. It was stated that IM is the supplier and the business divisions are the customers but also that in reality this relationship is not always remembered. It was also noted that the relationship between IM and the business division is a kind of "forced" customer-supplier relationship. This means that IM probably takes more responsibility than an external supplier would take but also that IM might do things a bit more carelessly than an external organization that is dependent on a contract. One IM manager felt that the business divisions sometimes forget that IM does what business divisions ask them to do and that IM needs resources for that. Some time ago the budget of IM was opened up and each expense was shown to business management. The strategy was to shift the budget discussion to a kind of 'okay, don't give us the money but then tell us which server to shut down'-discussion. This has proven to be a good strategy from IM perspective and the business management has now a better understanding for IM's functions.

As IM's role is to support the business divisions it is furthermore important that all systems that are introduced are such that the business divisions really need. It is therefore important that all parties are involved in deciding which systems should be introduced. It was thought to be a good thing that the prioritizing of improvement proposals related to IT in the company is done together with business divisions - although one interviewee from IM side called for more participation of business divisions in the overall prioritizing of projects in IM. But all in all, the relationship between business divisions and IM on a top management level in Wärtsilä was stated to be quite good and is all the time getting even better. But on lower levels in the company a need for better mutual understanding is still needed.

It was stated that in order for IM to understand the business divisions' way of working better, IM personnel should follow the work of business divisions more closely. One IM representative wanted to highlight the fact that there is no need for a special process to help in understanding what business is expecting from IM because that is simply the main task

of IM and all other functions should evolve around that. More informal interaction was generally thought to be needed. Hence, local IM organizations were thought to be valuable. One IM manager thought that IM's functions should not be more centralized than what they are now. And in addition to that IS project organizations should be situated closer to the organization that is going to use the new information system so that there would be more everyday interaction. But the advantages with a global IM organization were still understood by everyone. One IM representative thought that it is important that business divisions understand that it is not financially feasible to have a lot of local applications instead of global ones.

One view on the problem was also that business divisions do not really know how to express their expectations. One interviewee used the analogy "empty helpdesk-mails are being sent" to describe the situation in some cases. One IM expert also felt that it is unclear what the roles are and expressed a feeling of sometimes being the one dictating the requirements of the customer, i.e. the business divisions, instead of simply receiving and recording the requirements. Another thing that business divisions should become better at is to follow the progress of IS projects and be able to supervise it so that the result will meet the expectations. It is furthermore important that there are business representatives working fulltime for IS projects. This was thought to be the easiest way to ensure that business benefits are fulfilled.

More general communication from IM towards business divisions was also called for. For example the status of different projects and information of what improvement efforts are going on could be communicated towards the rest of the company. Similarly the benefits that are planned to be achieved with some new application should be clearly communicated. It was noted that this kind of information could enhance the trust towards IM because people would know that IM is actually all the time doing something to improve the IT-related things in the company. Especially in countries where there is no IM-organization this kind of communication would improve the relationship between business divisions and IM. Another thing that was called for was that more training in basic applications such as Outlook should be available. A business division representative in one project furthermore expressed the view that the outsourcing of the IT-support was understandable but it had also made the gap between IM-functions and business divisions bigger.

7.2.5 Customer and Management Commitment

Business commitment, i.e. commitment from the customer, was mentioned as an important issue in IS projects. One interviewee felt that it is very critical that the local organizations are committed and ready to take over the responsibility for some new system directly after roll-out. It was said that good preparation and clear motivations can secure the commitment from the customer.

According to the project manager of one project the project failed because the customer was not committed enough. There were two aspects mentioned in connection to this issue. First, it is critical that the expectations of the customer are clearly stated and understood by all parties. Commitment to those expectations, and later on requirements, is furthermore very important. Secondly, if the connection between assigning financial resources and the expectations/requirements is not understood by the customer the project might easily fail. In this particular case the full responsibility was in the end moved to the customer. This decision was said to have saved the situation as it made the project and the need for sufficient amount of resources more clear.

The customer's commitment and participation in defining needed processes and requirements was mentioned as very important by also other interviewees. In one project there had been an official signing of a paper ensuring the commitment to the defined processes. Such a practice was recommended also for other projects. Moreover the view on this particular issue differed somewhat depending on if the interviewee represented business divisions or IM. From IM side the tone was more a kind of; 'they should simply decide what they want' while business representatives were saying that IM does not understand what business divisions want. One business representative also noted that it is hard to find such persons in the business divisions who are really able to describe the requirements so that IM understands them.

All interviewees stated that management commitment is very important in order to succeed in IS projects. Interviewees thought that the commitment and support has to be found on all levels of managers; from top management down to line managers and team leaders. It was noted that the managers' attitudes have a direct impact on the users' attitudes towards the system. If the new system is something that creates an additional work task it is important that managers demand the usage of it and commit to demanding continuous usage of the system. One project manager mentioned a case from another company where the usage was motivated with tying it to the yearly bonus.

Another concrete reason for the need of management commitment is that managers are the ones that can allocate human resources to a project. Managers also need to give time for users to attend trainings and other events related to the introduction of the new system. Furthermore top management support is needed at the latest when there are problems in the project.

7.2.6 Technical Issues and System Design

Technical problems in IS projects were thought to be inevitable and something that is always part of the challenge. It was furthermore noted that technical issues can influence the users' attitudes towards the system in some extent. In the ERP project it was noted that from an organizational change management perspective it is important to get a working system in one place, e.g. in the pilot. It was furthermore discussed that from a support

point-of-view is it important that the system is mature, i.e. that it works flawlessly and answers to expectations on the system, at the point of handing over the system to support.

One interviewee listed a well-functioning integration to other systems as one of the three most critical issues. The interviewee had participated in a large IS project where the system was not properly integrated with other systems at go-live and hence, the usage of the system was more than problematic. The reason for this failure was that the partner, who was thought to design the integration, did not have enough knowledge about the chosen technique. This inability to master the connections between all systems was also noted by another interviewee as an area where Wärtsilä IM should improve. The first step towards improvement has now been taken as there is an Integration Manager in Wärtsilä IM who is responsible for all the integration-related things at Wärtsilä IM.

It was also stated that testing is very important. It was noted that testing should happen also in the actual production environment and with data imported in the system to ensure that it is really working. Also the infrastructure should be tested. There was furthermore some critique expressed towards the very slow speed of some applications in some locations. It was thought to be an easily fixed problem by a business representative and it was not understood why nothing had been done to fix the problem.

As important as it is to create a system that works properly is it to have correct data in the system. But it is not easy and the topic of data migration was often met with a sigh. The cleaning of the data which would be important to do before migration, seem to have been a problem in most IS projects. As one of the interviewees expressed it, data cleaning is something that he has been nagging about for many years but still it is a job that creates problems in every project. All interviewees who were asked to share their thoughts on data migration issues stated that the work with cleaning the data should start early enough and get enough resources because it always takes more time than planned and is quite a boring task. Wärtsilä is furthermore an organization where information has accumulated under many years and hence, data cleaning is an even bigger challenge.

The important thing to keep in mind in system design is that the system should answer to users' expectations or else the IS project has not succeeded. The requirements collection is in a critical position in creating a system that answers to users' expectations. It was stated that one of the most critical issues is to have end users involved in specifying the requirements. Another important part of requirements collection is to freeze the requirements. This was not done in all Wärtsilä IS projects. Requirements collection in general, seems to be a challenge in the organization and it was something that was thought to need improvement. Hence, methods for requirements collection are included in the ongoing Quality and Testing project (presented in chapter 7.1) that aims at creating some new guidelines that will help in ensuring quality of the systems. It should also be remembered that the requirements have to be turned into functional specifications and that it is not an easy task either. The interviewees stated that it is better to keep the system as simple as possible and not take into account all of the nice-to-have functionalities. But

project experience shows that this is easier said than done, for example in the PDM project (as discussed in chapter 8.2).

Closely related to gathering the requirements is creating the processes related to the new system. One IM manager thought that the users often want to keep things the way they are, including ways of working. Hence, the possibility to improve ways of working by creating new processes when a new system is taken into use does not get enough attention. It can also be noted here that the word “process” is easily met with skepticism and thought to be part of the ‘IM-jargon’.

The striving towards a global way of working in the company in general is often part of the aim of an IS project. One IM manager stated that if wanting to do global business, global processes are needed and therefore global systems. Another IM manager thought that there is need for more commitment to decisions on global ways of working. A third IM representative noted that the work with defining global processes that preceded the implementation of the ERP system had a great positive impact on shifting people’s attitudes towards thinking about one global company. That process work was also a start of creating a sort of common vocabulary in the company. One IM manager on the other hand, was a bit skeptic towards creating absolutely similar ways of working and having exactly the same configuration of applications everywhere in the company. He thought that there are situations where it is inevitable to work in slightly different ways and therefore systems with some differentiations in configuration should be allowed.

In relation to the discussion about the creation of processes for working with different systems, one idea was presented by one IM expert. She thought that the process models could be used in a greater extent also internally in IM as a tool for better understanding the core business and everyday work of business divisions. At the moment the process models are just created in order to describe the company’s processes and as means in “selling” a system to business divisions. But the models could as well be used for bringing the documentation of processes, architecture, and other application-related things closer to each other.

On the question of whether the processes should change or the system should be customized to suit the existing processes varying answers were given. One IM manager stated that high class processes are simply needed in order to practice high class business. He speculated that commercial systems are probably created based on very high class processes and therefore it might be a good idea to align one’s own business with the processes of the new system. One business representative thought that whatever option that makes business more efficient should be chosen. Another business representative on the other hand thought that it is always better to change the processes since a largely customized system is always difficult to maintain. This view was shared by an IM representative responsible for training end users; he felt that after all, it is still easier to change people’s way of working than to change the system – although change resistance

will inevitably occur. A person responsible for the roll-in of the system in the business divisions said that these should meet in the middle somewhere.

One IM manager had a thought that the degree of customization is depending on the role of the information system; if the system is part of the core business and if a customization would contribute to some sort of competitive advantage, the system should be customized to fit the business. But on the other hand if the system is not more than a tool in some supporting function it should not be customized since it creates dependencies on external actors and makes updates etc. more complicated.

7.2.7 Organizational Change Management Issues

The most common reaction to the concept of organizational change management was a bit of skepticism and the comments were that it is such an abstract thing. But when the interviewees thought about it for a while and when they were asked to describe what change management in IS projects is in practice, quite some thoughts were shared. It was noted that this topic has slowly gotten more and more attention in the organization. Some interviewees thought that a bit more knowledge about change management, as it is presented in the books, would do no harm. Similarly more resources and attention in general would be good. Change management in general was mentioned as one of the three most important critical success factors and something that everybody involved in the project should take responsibility for.

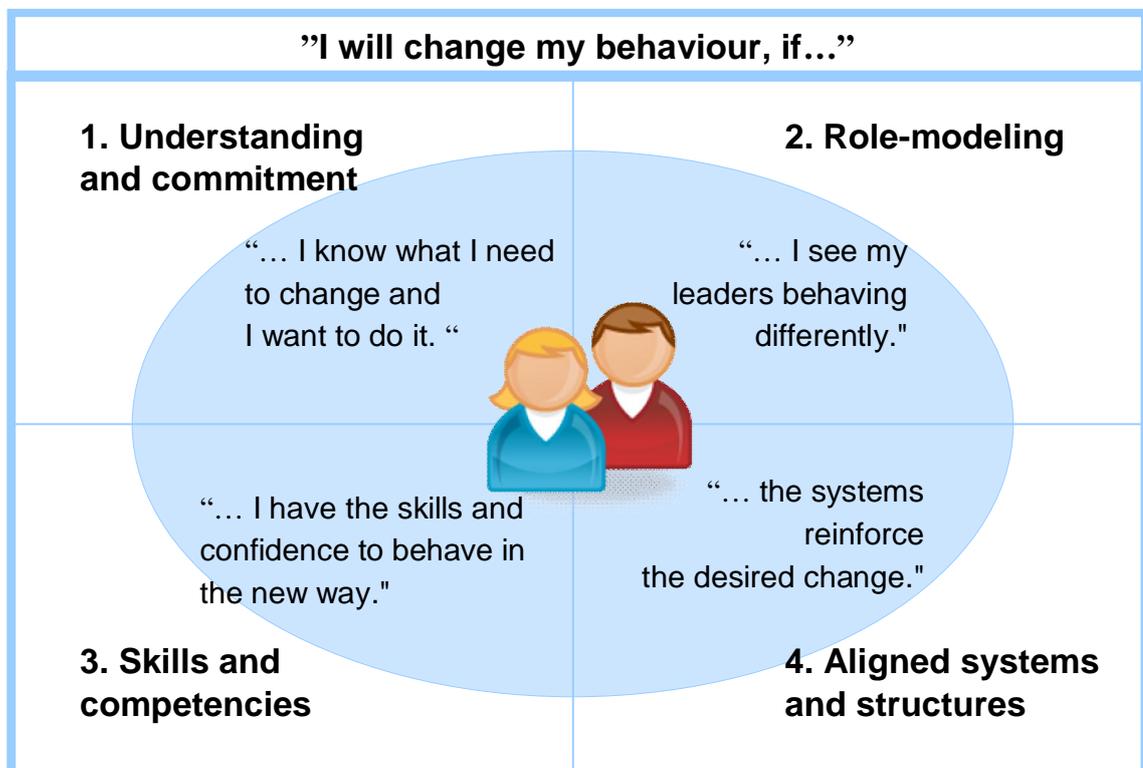


Figure 5. A model for approaching organizational change management.

One view to organizational change management was that it is simply about being with people; in face-to-face meetings the attitudes towards a new system or similar thing are easiest handled. One project manager presented a view that change can be obtained if four areas are covered, as modeled in *Figure 5*. The first is to get the user to understand what is about to change and to get the user to commit to that change. The second area is to have good role-models; i.e. the leaders have to behave in line with the change. The third point is to see that the users have enough skills and competencies to act in the new way. The fourth thing is to arrange so that systems and structures are aligned with the change. The project personnel furthermore need to understand the as-is situation on a very concrete level and from every role's point of view.

One project where attention has been put on the change management perspective is the CRM project. It was launched as specifically a *change* project and not an IT project. The CRM project furthermore started with workshops on the topic of how the sales functions could be improved and hence, the end users were involved in creating the motivation and the basic ideas for the project. The experience from other projects also showed that an important part of organizational change management is to involve the end users in laying the ground for the project for example when selecting the application. One IM manager also commented that the business divisions in Wärtsilä have started seeing IS projects as more than just a system implementation; i.e. that it is not only about the technology.

Both informal communication and formal communication was frequently mentioned as important parts of organizational change management and in general as a critical factor for succeeding in IS projects. While it was stated that continuous communication is important and that it is not possible to communicate too much it was also noted that the right things have to be communicated in the right places and to the right stakeholders. Communication just for the sake of communicating something is often not a good idea. Some of the interviewees also reminded of the importance to have two-way-communication; there has to be a feedback-channel as well. Communication face-to-face was said to be most important in the beginning of the project; the belief in the project has to be created through personal communication and then maintained with continuous communication.

Organizational change management in general is something that has to be customized according to stakeholders. Different methods can be used in influencing different groups. One example from the ERP project was that a group of people that was under the threat of lay-offs were motivated by saying that knowledge in using the application is a good thing to have on ones résumé. Another tip was to tightly engage the worst critics in the project.

Change resistance was viewed as something that is inevitable and will always occur when something new is introduced somewhere. But it was generally noted that when the end users see clear advantages and benefits in using the system the system will be easily welcomed. It might also be that some unit will welcome the system more when they know

that other units are using the system already. This kind of a “pull-effect” was evident towards the end of the ERP project.

The training of end users was mentioned as one of the three most critical factors by about one third of the interviewees. Training was furthermore thought to be a considerable part of organizational change management. It was noted that the person who is giving the end user training is in a critical position since that person’s attitude towards the system directly influences the training and the users. And similarly, the managers influence this by allowing or not allowing people to participate in the training. One interviewee reminded that training should be thought about as a deliverable that will live as long as the system is in use. Furthermore, language and culture have to be taken into consideration when planning and executing the training.

The focus of the training should be to get the user from thinking in the as-is way to thinking in the to-be way of ways of working. In addition to that it was mentioned that the aim of the training should also be to get the user to see the benefits of the new system. Thus, it was stated that the actual application-training should be preceded by a process-training. It was also stated that in general in IS projects should the working processes have a higher priority than the technical application. Additionally, it was underlined that training should have a clear approach stating that ‘this is now the new way to do things’ instead of presenting several alternative ways. In one project an experiment to arrange training and testing on the same time was done. But the experiment did not prove to be particularly successful.

The training sessions were also thought of as important parts of the informal communication. One IM manager stated that such informal communication stands for 20% of the IS project success, the remaining 80% can be handled with good project management, planning, system build etc.

8 Deployment of Product Data Management System in Wärtsilä

8.1 The Product Data Management System Project in Wärtsilä

The Product Data Management (PDM) system is introduced in all Wärtsilä in four different projects according to business division and geographical location. The first project, PDM Project Alpha, started in 2007 and will be finalized in 2009. The second project, Beta, will start in 2009. The two last projects, Gamma and Delta, will be executed in 2010 and 2011, respectively. All in all the system will have 5600 end users.

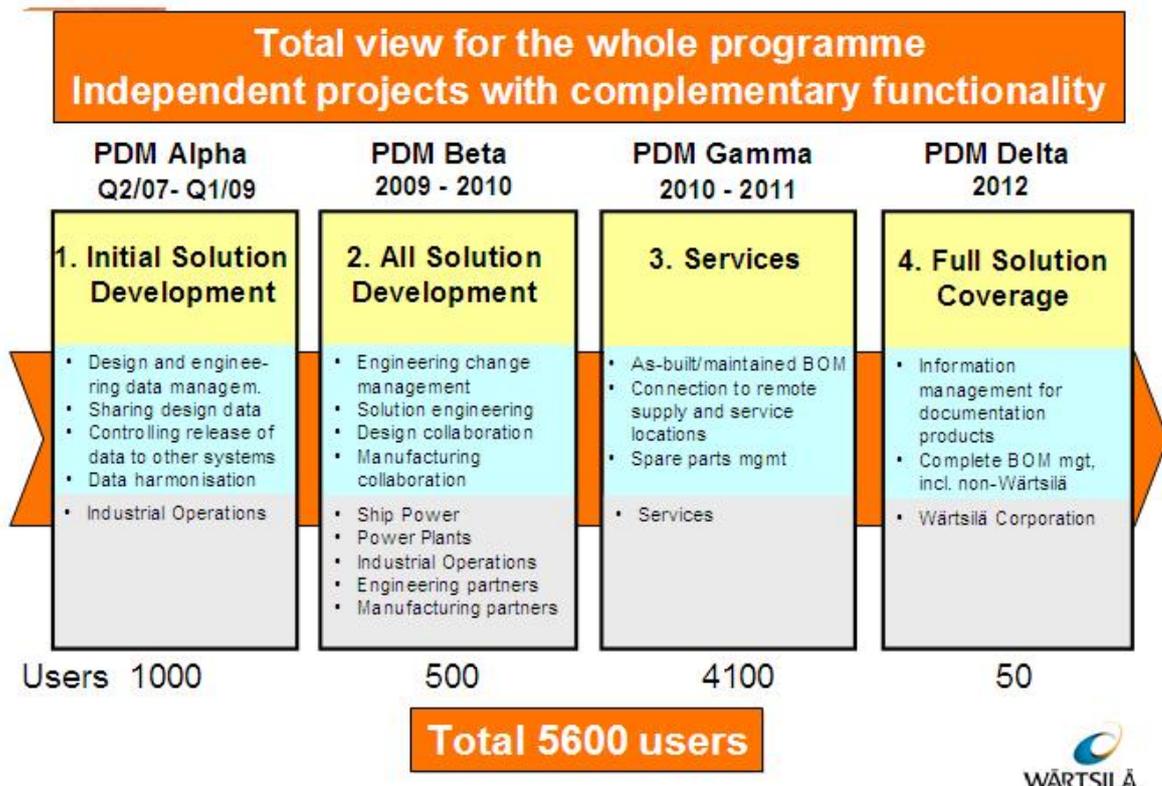


Figure 6. Overview of the PDM projects in Wärtsilä

By taking a global PDM system into use Wärtsilä is hoping to be able to capitalize its knowledge and improve business agility. The purpose is also to lower costs. The vision is furthermore that when the system is in use it will be easier to grasp the product structure throughout the life cycle. Knowledge sharing and information flow between the divisions will also be enhanced.

The PDM system that Wärtsilä has chosen is Teamcenter. Teamcenter is a product from Siemens PLM Software Inc. Teamcenter has previously been used in one Wärtsilä division; Wärtsilä Propulsion but the global solution has been configured specifically according to the global requirements.

8.2 Evaluation of the PDM System Project

Nine persons were interviewed about the issues in the PDM project so far. Their views on particularly the PDM project, are reported here while their views on general IM-matters and IS project related things are reported in chapter 7.2. The interviewees were among other things asked to list one to four issues that they thought had been the biggest issues in the projects. Such issues are here called 'big issues'.

8.2.1 Project Startup, Planning, and Progress

Three interviewees thought that the start-up of the PDM Project Alpha went quite well. It was noted that the launching event was appreciated and that it was good that top management was present at that event. Another interviewee thought that the objectives of the project should have been more concrete at the start-up. Also the project tollgates should have gotten attention directly in the beginning and they should have been decided upon.

It was noted that other than technical issues should have gotten more attention when planning the project. The approach was that the new system will simply replace the legacy systems and it was not noticed that the new system would actually also mean quite remarkable changes in the ways or working. Some of these changes were noted in the beginning but not all. For example was the process when a person inserts information from one of the legacy system to another not analyzed enough. Too late was it realized that that person does an intelligent check of the information before completing the transfer. This miss would later in the project come to have implications on the project from an organizational change management point of view.

Five out of nine interviewees mentioned the problems related to the schedule and the planning in general as one of the biggest issues in the project. The situation was that the original planned duration was nine months while the estimated duration was now extended to approximately two years. The interviewees representing the end users thought that the original timetable was simply unrealistic and was of the opinion that there were people who should have noted this directly in the beginning and could have questioned the schedule already at that point. It was stated that people from the business divisions clearly saw that the schedule was unrealistic because they knew how very different the ways or working were in the different design locations. One of the business representatives furthermore stated that they would have much rather waited a bit longer to get a system that really works instead of getting a poorly and hurriedly designed system. Also project personnel were of the opinion that the schedule was simply too optimistic. A general comment on the creation of the schedule for an IS project was that the amount of time needed to reach consensus about requirements between different sites is often underestimated.

It was noted that Wärtsilä had put all trust on the partner to do the planning, handle project management (including methods for managing configuration, documents, requirements etc.), and to prepare the schedule. The reality was though that the partner did not have skills or methods to manage a project of this size. Wärtsilä's idea was to ask the partner to take the responsibility of everything from system build to training. But as two of the interviewees noted, the partner seemed to have had another view on the matter and was actually only interested in doing the configuration of the system and delivering the software package. The rest of the discussion about the relationship to the vendor will be presented below. But the outcome of this difference in views was that the plan prepared by the partner proved (too late) to be unrealistic and lacking many important tracks. The interviewees' comments on why such a schedule was even accepted were mainly of two types. One analysis was that this situation could have been prevented if more experts from Wärtsilä side would have been involved in the planning or if there would have been more knowledge of this kind of projects in the IM organization. The other analysis was simply that the wrong partner was chosen.

Besides the opinion that the original schedule was simply unrealistic, various analyses on why there had been such a considerable delay were presented. The two most common views focused on the partner and the project-internal ways of working. Two of the interviewees felt that the problems have entirely to do with the fact that the original partner did not complete the agreed-on tasks. Two interviewees put half of the blame on the partner's inability to deliver and the other half on the constant adding of functionality to the original scope or on Wärtsilä's inability to clearly express what was expected from the system. Two of the project's experts felt that the reason for delay was that there was a significant lack of internal ways of working and knowledge about how these kinds of software development projects should be conducted in Wärtsilä. Another interviewee thought that there should have been more time and expertise put on the planning in order to create a better common understanding of the scope and the size of the project. One additional view was that there would also have been need for some sort of a project controller whose fulltime job would have been to follow up the progress of the project.

The fact that the project schedule has constantly changed has created troubles for among other things the planning of the end user training. All interviewees agreed that the constant delay has had a negative impact on the reputation of the project. It was noted that at times there had been too little communication towards the end users simply because there was nothing else to say than that the project is delayed – again. One interviewee furthermore believed that there is a feeling that the project has been going on forever and that has affected the general attitudes towards the system.

Some worried voices were raised on the fact that a “what if”-planning is missing in the project. Similarly there was a concern that the lessons learned from the Alpha project are not taken enough into consideration in the planning of the Beta project – or more specifically that there will be no time to do a thorough evaluation of the Alpha project before getting too far into the Beta project. One interviewee also felt that it would have

been good to learn about how things were done in the ERP project already during the planning of the PDM project.

8.2.2 Cooperation with the Partner Organization

According to three of the interviewees the single biggest issue in the project has been the problems in the cooperation with the partner. Two interviewees thought that those problems have more or less lead to all the other problems. All interviewees but the ones representing the end users, i.e. the ones with least project-internal information, thought that the problems with the partner was the root cause for most of the problems in the project.

The central criteria when selecting the application was that a world-leading application that would be supported by more than one support organization was wanted. Wärtsilä set out to seek a partner that would provide the whole; everything from project management to testing and training. In addition to that there was a bit of a hurry to get the project started. The owner of the application was chosen as partner since it was thought that that organization would handle the delivery of the application the best. Contract negotiations with the partner were described as thorough and Wärtsilä had a feeling that everything was under control. All in all, Wärtsilä truly believed that the partner would do the job well. One of the interviewees thought that the fact that Wärtsilä had to sort of convince the partner to enter a contract that would include all project actions, should have been seen as a warning signal.

When the project had been going on for about three months the first concrete signs that the partner did not have the situation under control were noted by Wärtsilä. Four months from that the steering committee felt that the situation was close to catastrophic; the partner had not succeeded to deliver anything according to the schedule and the configuration that existed was full of bugs. In addition to that it was evident that the partner had assigned too few resources to the project and did for example not even update the project plan according to changes. But still at that point the partner would not admit that the situation was not under control. The decision taken at that time was to narrow the scope of that partner so that they would only handle the technical configuration and Wärtsilä would look for another partner to handle the training, testing etc. But still after that decision the partner did not handle the configuration on a satisfactory level and about one year after the start-up of the project the original partner was entirely excluded from the project and a new partner took over also the configuration work. During the period of slowly noticing that the partner did not handle the project the project manager thought that the most difficult thing was to know when to actually “jump off the train” and break the contract with the partner. This issue is discussed in chapter 7.2.

The project manager noted that in that sense the decision to go for an application that was supported by several consultancy companies proved to have been very wise. The choice of

application was also somewhat criticized by project personnel since that it was thought to be too complicated and heavy for Wärtsilä's need.

Most interviewees concluded that the partner did simply not have enough experience or knowledge to handle this kind of a project. Another frequently mentioned issue was that one consultant got a too crucial role and thus too much was depending on one person. One interviewee also thought that the big issue was that the proposed set-up of the application did not actually suit Wärtsilä's way of doing business and was developed too far from practice. The final decision to change partner was thought to be good but also time consuming. Although the cooperation with the new partner was thought to be quite good one interviewee noted that it would do no harm to create a better mutual trust in order to be spared from some of the bureaucracy e.g. around the change request handling. At the latest at go-live a less bureaucratic and a more smooth process of handling incidents would be needed. There were two interviewees who felt that there is still a risk in the fact that Wärtsilä's own people have too little knowledge about the actual configuration and hence, the dependency on the consultants might be too great.

Some of the interviewees were wondering why the partner even presented such a tight schedule in the beginning. Thoughts on that matter included one speculating that maybe it was a selling trick. And naturally a customer is always interested in getting something delivered as fast as possible so Wärtsilä simply accepted the schedule. Another theory was that maybe the long ERP project had created a feeling that projects that take for ever have to be avoided. It was later realized that the partner had made the schedule by only taking into account the technical build which was estimated to 1 month/site – such things as negotiations about requirements of system, training and validation testing were not considered.

Beside the comments that the original partner was not able to handle the project most of the interviewees also felt that there was reason to also be a bit self-critical. It was highlighted that Wärtsilä's expectations were not communicated well enough to the partner. And as mentioned, the view was also that knowledge to really examine e.g. the proposal for solution was not found inside Wärtsilä.

8.2.3 Project Organization and Project-Internal Processes

The internal communication in the project was subject for some critique. Three out of five of the interviewees from IM thought that the communication between sub-teams and between individuals has not been as smooth as it could. The fact that there has been no meeting for the whole project was for example questioned. One reason for the bad internal communication was thought to be the fact that the project personnel are located in a few different locations. Another explanation offered was the lack of project-internal work processes and unclear roles and responsibilities. There was also the view that more proactive people and more people taking responsibility for the whole would be good. The

channel for feedback towards project management on the other hand was said to be well-functioning.

Two out of four interviewees who were nominated to the project from business divisions felt that the communication from the project towards them should have been better. The other two had nothing to complain about. Among this critique there were also comments on the geographical distance and on the tight and suddenly changing schedules which created pressure on delivering some information to the project teams.

Most of the people working for the project were new to this sort of project at the point of launching it and therefore the methods have been developed along the way as the knowledge base has evolved. One of the interviewees actually felt that the biggest issue has been that there was not enough knowledge about these kinds of projects found in Wärtsilä; not in IM, nor in the business divisions. And as the original partner did not master these kinds of projects either, the result was that no one really knew what kind of information was needed in order to build the system that was sought for. In addition to that no one even knew what could be demanded from the system and hence, already the requirements collection was quite a mess. One interviewee also pointed out that the situation will be different when the Beta project starts as project personnel will have much more experience at that point.

Other interviewees also noted that personal skills and experiences impact the level of success of a project a lot. When asked about what has been good in the project, six out of nine interviewees mentioned the project organization, the people and their attitudes, and the positive feeling inside the project. Although most people were new to software development projects the skills have developed remarkably and the spirit has all the time been a kind of “let’s do it!”- spirit.

But it was also noted that part of the personnel is already now working overtime and really pushing themselves to get things done in time – while some are not as motivated. There was a bit of worry expressed about what will happen at go-live when even more effort will be needed. Two of interviewees felt that it is anyway not realistic to ask for more resources to the project since it is already taking up quite some resources both from IM and business divisions. The project manager furthermore believed that it is always better to ask for part-time resources from the customer, i.e. the business divisions, since then it is actually possible to get the “best” people and those who really know the business. That also increases the chances of getting such business division representatives that have a good reputation among the colleagues and can help in creating a good attitude towards the system. It is also important that such key users understand and are really interested in the project. It was also noted that some sort of a project controller would have been needed in the project, i.e. a person whose fulltime task would have been to follow-up the progress of different teams’ tasks.

One interviewee felt that the thing that has messed up the project the most has been the lack of clear project-internal work process and clear roles and responsibilities. It was stated that with clearer procedures the project work would have been more efficient. The fact that the partner was expected to suggest the project procedures is one part of the reason. But the interviewee also felt that Wärtsilä should have taken a more active role in creating the procedures.

Three other interviewees also felt that the lack of methods has affected the project. For example the requirements collection, which will be discussed more in chapter 8.2.4, was described as quite chaotic. Other areas where methods were lacking were incident management and configuration management. The incident management had for example been created so that the tool for managing the incidents was first chosen and after that the process was designed – which now afterwards was thought to be the wrong way to go.

Two interviewees felt that the document management should have been better arranged. There was an opinion that the vast amount of documents could have been anticipated and a way of handling them could have been planned. It was noted that there are now a lot of documents and the purpose of all those documents was never defined. Additionally there are too many documents e-mailed back and forth and stored on people's computers instead of in the company's document management database.

Representatives from business divisions were a bit concerned about the support arrangements for the system. First of all was it stated that more understanding from IM would have been appreciated regarding the fact that this system needs special arrangements for support. The opinion was that the partner handling the IT-support does not know enough about the system and furthermore, it would be important to gather knowledge about the system inside the company. Hence, there is now a special organization prepared for the support. But still there was some skepticism towards those plans since it was believed that e.g. users in Finland would not be happy with the support being in China because there would be language problems.

8.2.4 System Design and Technical Issues

All interviewees felt that the requirements collection and the related tasks were not very successfully conducted. It was again expected that the partner would provide the methods for gathering the requirements but the methods they applied were not suitable for a project of this size. In a nutshell Wärtsilä was given a blank paper to fill in without any guidance on what kind of information was even needed. There should have been a clearer way of working with preparing the specification of the system and the process should have been laid out in advance. It was also stated that more time should have been planned for this task.

The work started with modeling the processes starting from the company's key processes. One business representative stated that the work started very good while another business representative thought that it was too abstract to start from the key processes. One of the project's experts stated that it is good to start from modeling the processes in order to understand what the system should actually do but it should be remembered that processes are not enough for good requirements. The expert felt that the processes, if they would have been modeled properly and on a detailed enough level in the beginning, could have been used as a very good basis for all specifications etc. Also other interviewees agreed somewhat to this comment. But the work with modeling the processes and doing a thorough requirements collection was, according to one interviewee, interrupted by a hurry to quickly get at least some functionality into the system.

One business representative stated that the requirements collection should have started with interviews or workshops where the project people would have been introduced to how the end users work with the legacy systems. Another interviewee expressed the view that the business representatives did not quite know what to say in order to describe their requirements and expectations – it was expected that IM would know what to ask about. All this led to the situation that additional requirements have been popping up during the project. The end user representatives thought that this was simply because it is impossible to come up with everything at once and also because the requirements collection phase was thought to be too short. It was furthermore pointed out that there should have been more end user representatives involved in the work with the requirements.

The project personnel seemed to be a bit irritated over the fact that the gathered requirements never seemed to match the "actual" requirements and new functionality demands have kept on appearing. One of the managers stated that in the future it is definitely important to get the customer to commit to the requirements and to freeze the requirements at some point. It had also been noted that there was a surprisingly big difference between the requirements stated by top management in the project's preparation phase and the requirements expressed later on in the project.

The fact that the scope has constantly increased and changed was seen as a reason for project delay as well. Two interviewees expressed the view that the opportunity to improve Wärtsilä's design process by exploring the possibilities that the application offers were not used. One comment was that the application should have been studied in more detail before deciding on requirements etc. Another comment was that the scope of the first release should have been kept at its original size with only basic functions so that some users could have first gotten a bit familiar with the application and all the ways it is possible to work with it.

Although the modeling of the processes had started very well a fact was that the process models were of no use in the actual configuration of the system. For that purpose use cases were created. But the problem was that the use cases were actually of no use; they were too theoretical to explain how the system would be used and they were too abstract to be used

in the configuration. This was again a result of Wärtsilä's *and* the partner's lack of knowledge about how to conduct a software development project of this size. The problem with the non-usable use cases was mentioned by five interviewees. Then, in order to create some sort of an easily understandable description of how the system was to be used so called business scenarios were created. The business scenarios were thought to be quite good but one interviewee mentioned that also these were created on a too tight schedule and hence, things were left out. Other comments on the matter were saying that the business scenarios were created too late. All in all this whole process was thought to be quite a mess by most interviewees. It was noted that there was a lot of redundant documentation and also a lot of specifications without actual connection to practice.

One interviewee also noted that the application is actually not a process-oriented application so the whole approach of starting with process modeling might have been the wrong approach in this case. The idea that the processes are the basis had come from the ERP world. It was furthermore noted that the proximity between the application and the CAD systems was not thought about enough. One of the end user representatives underlined that it should have been noticed that the new application will have an effect also on how the product designers work with the CAD systems. The problem was deepened by the fact that there existed no common way of working with the CAD systems. This problem has been noticed now and there is an effort in the PDM function to start harmonizing the instructions for the work with the CAD systems.

All in all, the configuration of the application has been everything but smooth and the amount of bugs has been unbelievable, as one interviewee described it. It was noticed that it must have affected people's attitude towards the system – but in different extent in different locations. One interviewee representing the end users said that the users do understand that there are always problems in a software configuration. It was furthermore noticed that the same bugs have been occurring again and again and hence, the quality of configuration management was doubted about. One interviewee was very skeptic towards the quality of the configuration work done by the original partner and questioned whether there was even any sort of unit testing done.

The testing (arrangements, test cases) arranged by Wärtsilä was thought to be good. It was for example thought to be very good to collect testers to one location so that they could discuss with each other while testing. And it was noted that it is indeed important to test thoroughly. The possibility to do some automatic testing on parts of the application was thought to be something worth investigating a bit more. One business representative did criticize the fact that the system has not been very stable during testing and hence, he felt that there has not (until that time) been any real possibility to test the system.

The biggest concern with regard to testing was that there had not yet been and there was not in sight at that time, any possibility to test with real migrated data in the system (later on it was reported about the proposed arrangements for business divisions' representatives to test the migrated data). The work needed for the data cleaning and migration was stated

to have been underestimated. Furthermore, an extensive enough plan and proposal for methods for data migration had not been done. It was noted that the data that was to be inserted in the system was quite a vast amount and included a lot of redundancies. There was some disagreement on why the data cleaning was taking so long. Some business representatives thought that there was not enough time allocated for the work while project personnel felt that business divisions had not realized the amount of manual work needed to clean the data and not reserved enough resources or time for that. In addition to that it was mentioned that there had been no extensive plan for how to manage the migration.

One of the business divisions had earlier been using the same application and therefore it was believed that the data migration for that division would not take long. But it had not been realized how different the data models of the old division-specific version and the new global version were and hence, the amount of effort needed was underestimated. One expert noted that there should have been a more thorough analysis of what was demanded of the data inserted in the system before making any plans for the migration. Another interviewee furthermore noted that the new application puts more demand on the quality of the data since some procedures get automated and hence, the data cleaning is indeed quite an extensive task. It was also reminded that the data cleaning is more than a technical issue since it is closely connected to work procedures. Furthermore was the lack of data in the system at e.g. testing and training events seen as bad from a change management perspective; it is easier to learn and accept a system if the data in the system can be recognized.

One interviewee mentioned another possible data-related issue in the future. An important part of the new global application is to have a global way of defining product parts. This quality of the system was even used as an argument for introducing a PDM system. But the standardization of material names etc. has taken a long time. If it is not finished at go-live the situation can become quite chaotic as users might start inventing own names instead of using the global standard names.

The representatives of the division that had previously been using the application saw a potential issue in the fact that the handling of 2D and 3D designs had been split. It was noted that this split will need to be carefully presented to the end users of that division so that it is understood. Secondly this split has made the technical solution more difficult to implement. But it was anyway thought to be a good decision to split the designs.

There were two additional issues that had made the work for the technical teams of the project difficult. The cooperation with the server team of IM should have been closer and the content of the outsourced IT-support contract should have been more familiar. It was concluded that these difficulties should get some attention generally in IM.

8.2.5 Attitudes towards the Project and Relationship to Business Divisions

Interviewees from IM as well as from business divisions thought that the PDM project was generally believed to be needed and important by business divisions; both managers and employees. It was noted that the legacy systems had to be substituted and introducing the PDM system was also seen as an important step towards being one global organization with one global way of working. Furthermore it was stated that the PDM system will enhance the internal communication which is important since Wärtsilä's solutions are often made up of many products designed in various places.

One interviewee from IM repeatedly pointed out the fact that the system is developed too much from a theoretical point of view and that the connection to practice is too weak. This could have been avoided with more involvement from business divisions; both end users and managers. Three other interviewees also felt that there should have been more involvement from business divisions. One business representative admitted that maybe business divisions should have simply *taken* a bigger role in e.g. writing the specifications.

One of the project's experts thought that due to the project delay and large amount of bugs in the system the expectations must have been lowered and confidence in the system decreased. Also other interviewees agreed and it was argued that the fact that the key user no longer want to conduct the training is evidence that no one wants to be the "face of the system". It was also speculated whether business divisions maybe expect the new system to solve *all* possible problems – which is not a realistic expectation. A business division representative sort of confirmed this by saying that the feeling is now that the PDM system will not solve all the problems – as was expected of it. Two of the managers commented that the systems should be viewed as a strategic tool and the focus should not be put on calculating which savings it will create, as discussed in chapter 7.2. One of the managers noted that the main benefit of the PDM system will be the improvement in information quality.

The comments on the communication between the project organization and the business managers and end users were quite varying. It was stated that the communication around requirements etc. is much easier if all parties understand the as-is processes – which was not always the case in the PDM project and hence, effort had to first be put on getting to understand the work of the end users. One business representative anyway said that the effort to communicate was better from project side than from business divisions' side. It was stated that business divisions just want a system that works but are not really interested in taking part in shaping the system and creating new ways of working with the possibilities that the system offers. Another business representative on the other hand thought that the communication between project people and the end users is quite bad and that they talk "different languages". He also stated that the feedback-channel is not always working. Another general comment was that the first official decision to implement the PDM system should have been better communicated to all divisions' end users. But it was also noted that communication problems inevitably exist in every big organization.

One manager representing one of the business divisions in the project but who is also part of the IM-organization thought that the communication related to the project inside that business division had been very bad. The managers had not taken enough interest in the project and had not wanted to present the project to the end users; instead the interviewee had to present the project. He felt that the information about the project should have definitely been presented by the top management of that division. The low interest in the project can also be questioned from the point of view that it is quite an expensive project for the business divisions.

Project personnel was also expressing the view that it seems as though business managers and end users do not see that the development of the application does not end with the first release and hence, the adding of new requirements seem to never end. It was stated that new requirements presented by end users etc. have been a bit too easily accepted by the project organization. But as one IM-manager stated, it is the customer who is paying and hence, all demands are to be taken into account although that means that the scope has swollen quite a lot from the original.

Another comment was that end users and other representatives from the business divisions do not see the background work that IM does for every change in every system. An IM-expert speculated that maybe there is a feeling that every small change takes unreasonably long to implement since the requester does not see the analysis that must be done for every change. Therefore a button in the system can be seen as a small change by the users while in fact, such a change always demands some analysis.

One of the IM representatives also said that it is important for IM to remember that the normal work of the business division does not end just because a new system is to be introduced. Therefore business division representatives are not available for project-related questions all the time. Also, if the business is booming at the time of starting the project it will be more difficult to get resources and time from business divisions. This was the case at the start of both the CRM and PDM project.

8.2.6 Management Commitment

All interviewees agreed that top management support is of importance also in the PDM project. Three of the interviewees representing business divisions thought that the commitment of the business divisions' line and top managers could be better in their respective divisions. It was also noted that in some other divisions the commitment was much better. The fact that the top management of one of the division did not present the project to the engineers of that division is quite descriptive for the lack of commitment from management. The top managers of one of the locations were said to see only the cost of the project and not what the project is actually aiming at. In those locations the end users are less happy with the project than in other locations. The project personnel on the other

hand were mostly content with the support and commitment found in the project. The only thing that was wished for was that there would have been more reactions on how to cope with the delay in the project.

It was noted that it has been evident in the project that the choice of roll-in managers has quite an impact on the user's attitudes towards the new system. Not all roll-in managers have enough authority and influence. Also, there are roll-in managers and key users who's negative attitude have affected the end users' attitudes as well. An interviewee heavily involved in the trainings noted that such trainings were a top or line manager is present in the beginning and takes an active role in creating a positive feeling in the training sessions have been more successful than those were the manager takes a passive and negative stand.

Five of the interviewees mentioned the Commissioning Team (ComTeam) as a very good thing in the project. It is a team made up by middle management from business divisions with the purpose of ensuring that the divisions are ready to take the system into use. The issues discussed vary from detailed questions about data to other more general issues. It has been noted that the managers get to understand the users better through the ComTeam and the managers' support for the project gets concrete and visible. The leader of the ComTeam was said to be good at communicating and presenting things and that was appreciated by the end users. It was stated that the team should have been formed directly in the beginning of the project. One problem in the work of the ComTeam has been to find a balance for how detailed issues should be presented and discussed in the team.

8.2.7 Organizational Change Management Issues

Organizational change management seems to have gotten quite little focus in the PDM project. The planning was said to be good but the realization was not thought to be especially good and all in all quite random. The answers the interviewees gave on the question of how much effort was put on organizational change management signaled a feeling that the effort had been a bit random and that the concept of organizational change management was not very familiar, nor easily understood. One thought was that change management got so little attention in this project because the PDM system was thought to induce less change than the ERP system. As mentioned in chapter 8.2.1 perhaps the biggest mistake related to organizational change management was to fail to see how much the technical change would actually affect the way of working.

All those IM-interviewees that were not working directly with the end user did not have much to say about this topic and felt that everything was "quite okay". It was generally stated that the trainers and the roll-in managers, i.e. such persons who are in direct contact with the end users, get to handle the most of the organizational change management issues. One roll-in manager said that a large part of his job is simply to try to convince people that the new system is a good change.

When the interviewees were asked to mention the concrete methods of change management communication was mentioned frequently. It was stated that explaining the change and how it will affect the ways of working for the users was essential. In order to successfully communicate around the change is it necessary to understand the as-is situation and how the new procedures will differ from those of today. It was also stated that it has to be explained why the new system is introduced. One interviewee thought that all in all it is about creating a positive feeling around the system. Another interviewee noted that it is all about handling people's reaction to the change. Not only the end users should be targets for change management efforts, the attitudes of line managers and other managers have to be handled as well. It was also said that some people in the project are much better at handling these kinds of issues than other, i.e. that the success of change management efforts is much dependent on personal qualities.

One of the business division representatives thought that there should have been more face-to-face communication in the PDM project. Also another business representative thought that more effort could have been put on communication. One interviewee noted that although it is important with face-to-face communication as part of the change management effort this cannot be realized in a project of this size. There are simply too many end users so it is not possible to meet everyone. Therefore the "human filters" have to be taken into consideration when spreading some message.

Comments from the project personnel included a statement that all the communication channels recommended to be used by IM were used in the PDM project but the fact that the schedule has all the time been changing has affected the quality of the communication. Also, as reported earlier, the big delay in the project has affected the communication; there is a limit for how many times it can be stated that the project is delayed – again.

The training was said to be in a very critical position. The end user training in the project was at the time of the interviews still ahead. One end user representative felt that the part of the training that explains *why* the system is being introduced is still missing. Another interviewee representing end users thought that the material explaining the whole solution and the whole idea with the PDM system is important and should have been spread earlier. Representatives from the project personnel also mentioned the importance of getting people to focus on the overall idea behind introducing a PDM system rather than focusing on every small change that will happen in the working procedures – this was felt to be the case at the moment; focus is not on the "big picture". There was also a comment that the system change request raised in the project show that the users would actually want the new system to work in exactly the same way as the old systems.

It was also noted that if the users see advantages with the new system it will be easier accepted. Hence, there was a comment that the users of the divisions where the legacy systems do not work very well will accept the new system much easier. A somewhat opposite thought was that the users in the division where the application is already in use

(though it is a different version) do not see as much advantages with the new version of the same application.

One interviewee stated that training is the most important element of organizational change management. Also the majority of interviewees highlighted the importance of training if wanting to succeed in the project. At the time of the interviews only the key user had been trained so the end user trainings were only planned and not yet executed. But the existing plans and the persons responsible for training got good feedback from the interviewees representing the business divisions and project management.

Three interviewees noted that it might have been good to have postponed the very first training sessions in the project because there had been quite some questions that the project personnel had not been ready to answer at that point. The project personnel did at that time not yet have enough knowledge about the system and about the ways or working with the product data. In addition to that the system did not quite work when it was demonstrated. Therefore, the key users attending the first training did maybe not get the best picture of the training.

There was also some doubt about the length of the training. It was thought that the planned two days long classroom training sessions would not be enough to get the users familiar enough with both the new processes and the application. But a remark to that was that the training is not only given in the classroom session but also through e-learning modules etc. Another interviewee thought that the training is spread over a too long time-period and wondered if the end users will remember and know how to use the system at go-live.

But the reality is that the training arrangements are very much dependent on resources and timetable and it was noted that both of these are quite restrained in the PDM project. As one of the experts commented, go-live will not be postponed just because of the training schedule and hence there is a lot of pressure put on effective execution of the training. Furthermore the original thought was that key users would train the end users but now the key users have stated that they do not know how to use the system well enough and do not want to give the training. Also, project management has promised business divisions that everyone will get the training from experts as a sort of consolation for the project delay. This means that there are now seven persons who are giving the training to more than 1000 users. Besides the fact that this puts pressure on the schedule there is also the risk that if one of the trainers misinterprets something, 1/7 of the end users will get the wrong training. Another problem was that there had been popping up requests for training in all kinds of different languages at that is simply not possible if the experts are to give all the training sessions. One of the interviewees concluded that these risks must at least be acknowledged. Similarly the important role the training plays for project success must be given attention. The training expert who was interviewed also stated that it would be good if the trainers would know more about the users' work to be able to better answer questions and plan the training. It would furthermore have been good if the trainers would have been participating already in the requirements collection.

From the training perspective the overall project delay has been very bad. Since training is the last event in the project it is dependent on everything that happens before that and because of the project delay and other problems the training has had to be re-planned several times. It has also led to a need for special effort on maintaining the knowledge of the key users who got their first training quite some time ago.

During the project the overall project budget has shifted from giving much weight to license and other technical costs towards prioritizing costs that are related to people and time. This illustrates how also the people-related issues such as training, communication, and thinking about the implications on the ways of working in practice have gotten more attention. As stated before, the project was in the beginning almost only focused on the technical implementation.

9 Discussion

This chapter is a synthesis of theory and empirical findings. Such findings that are thought to be valuable are discussed and conclusions are presented as the discussion goes along. The conclusions listed are believed to contribute to the general knowledge of how IS projects should be conducted. The recommendations listed in chapter 9.2 are improvement proposals for the case company Wärtsilä. The recommendations are introduced also as part of the discussion in chapter 9.1.

The research questions of this study are answered as follows:

First research question: *What are the critical success factors in IS projects according to previous research / Wärtsilä IT professionals?*

Chapter 4 presented and discussed the success factors that are critical for project success according to previous research. Critical success factors that were mentioned by Wärtsilä IT professionals are presented in the report of interview findings (chapters 7.2 and 8.2) and in particular in *Table 7* which presents the CSFs that interviewees listed. From the conclusions discussed below especially conclusions 2-16 and 18-20 corresponds to this research question.

Second research question: *How does the view on IS project challenges in literature correspond to the views of IT professionals in Wärtsilä?*

The discussion below shows that in general do the ideas of what factors are critical for IS project success correspond quite well. But that the methods that could be used in practice to handle some CSF are not very well known among IT professionals. This study does also contribute to this field of research with some new input to what is critical for project success; especially conclusions 10, 14, and 20 are worth noting.

Third research question: *What are the characteristics of information systems?*

The answers to this question can be found in chapter 2.

Fourth research question: *What are the attitudes towards IS projects?*

As conclusions 1 below shows are IS projects thought to be difficult and challenging – both according to literature and the interviews. Conclusions 2 and 4 also concern this research questions. In general this question is answered in the report of interview findings in chapters 7.2 and 8.2.

Fifth research question: *How do IT professionals view the concept of organizational change management and what are the concrete ways of including it in IS projects?*

Chapter 3 lay out the ground for answering this question and the interviews give material for answering the question. Conclusions 16 and 17 relate to this question.

Sixth research question: *How could Wärtsilä improve the quality of their IS projects? And in particular, what areas should be given extra attention in the future PDM projects?*

The answers to this question are the recommendations that are listed in chapter 9.2. The recommendations are also discussed in chapter 9.1.

9.1 Conclusions

The general conclusion in this study is not very different from the general findings in literature; information system projects are full of challenges and the methods and best practices are still being developed. The findings of the first survey executed in this study showed that when investigating the success of information system projects the real question is not *whether* there were problems but rather *what* the problems were. This is the situation at most companies –also at Wärtsilä. It can also be concluded that, as a whole, this study brings forwards the same critical success factors as previous research. Thus,

Conclusion 1: Information systems projects are very challenging.

It was noted that the Information Management function at Wärtsilä is still quite new and the processes and methods are not fully developed. But as one of the IM managers noted the organization and the working methods have developed notably during the last years. It was stated that via the ERP project quite a lot of know-how was created in the organization. The observation is furthermore that the organization has not fully realized that research and literature on how IS projects are best conducted is easily available and that such guidance could be consulted at a greater extent instead of putting time on testing and trying different methods.

It is often mentioned in literature that it is important that an IS project gets support and commitment from all stakeholders. The analysis of the interviews indicates that the need for cooperation between IM and business divisions has indeed been acknowledged at Wärtsilä but there are still occasional problems in the actual cooperation. The conclusion is therefore in line with the findings of itSMF Finland's research (2008); the importance of mutual understanding between the IT department and the business organization is understood but there are still challenges in creating concrete and well-functioning processes for improving the relationship in practice. Furthermore, it was noted that the communication has to be improved between the two parties. There were, however, few concrete ideas about how this could be done. Thus,

Conclusion 2: Companies do recognize the criticality of mutual understanding between IT departments and business divisions but do not know how to tackle the problem in practice. Concrete methods and practical tips are needed.

The statement that people from IM and business divisions do not even understand each other should be acknowledged as a fundamental problem. Interviewees even feel that the

two organizations speak different languages. This is proven by the fact that some issues in the PDM project have become unreasonably complex in the discussion among the business divisions' line managers simply because the issues have been presented on a too detailed and technical level by someone from the project organization. A lot could be achieved if IT professionals and business professionals, respectively, would acknowledge this risk for misunderstandings and simply drop such professional jargon that creates these misunderstandings.

This research also shows that the existence of local IT people is very important for the relationship between IT departments and business divisions - above all from an organizational change management perspective. Previous research (Kim & Oh 2000) states that information systems need to be managed on a global level – something that is also supported by the findings of this research. The conclusion here is that it is first and foremost important to keep this global approach, but it is likewise important to execute as much as possible of IT efforts close to the end users. This means that IS project organizations must be flexible and ready to travel and spend time close to the end users. Closely related to this is the statement that the outsourcing of IT support in Wärtsilä has created a wider gap between IM and business divisions. This fact must also be taken into account and remembered when discussing possible future outsourcing. Thus,

Conclusion 3: A global approach to the management of information systems is needed but likewise a face-to-face contact with the end users need to be maintained. Therefore the IT organization needs to be flexible and ready to travel.

The recommendation is furthermore that the IM organization should think about its own role in, for example the system development work. The findings in this research indicate that the IM organization's knowledge base is rather weak as there is not enough knowledge about the business of the company or about the applications. The risk is now that the organization solely turns into a mediator between the business divisions and outside partners. This study argues that it is clear that the IM organization is very much needed in the company but that the role should be made clear and knowledge should be strengthened in some areas. A mutual understanding of IM's role should be created together with the business management. The role of the organization should furthermore be known by everyone in the organization – not only managers – and especially those working at the interface between the IT organization and the business divisions or external partners.

As stated in the literature review, it is believed to be utterly important that the information technology supports the business of a company. Thus, decisions that concern investments in IT applications cannot be taken solely by the IT department. Therefore, IT departments have to collaborate with the business divisions when deciding on the prioritizing of IT efforts (e.g. IS projects). The change in the discussion about the budget, i.e. to open up the IM-budget so that business managers would see directly where the resources go, that was carried out some years ago at Wärtsilä has proven to be very beneficial in the strive

towards mutual understanding. This practice can be recommended for other organizations as well. Thus,

Conclusion 4: Business management and IT management should together and openly discuss the prioritizing of IT efforts as well as the IT budget.

An additional recommendation for general IM functions is to try to see about that information systems are available with fast enough connections so that it is pleasant to work with the systems. The interviews show that these kinds of problems easily have an impact on users' attitudes towards the IT functions of the company. This is partly because a layman finds these kinds of problems as something that should be easy to fix. Consequently, if the problem persists the user might grow unhappy with the IT department. A similar phenomenon is that users feel that changes in some systems take too long to implement only because they do not see the background work. This also has a direct impact on the relationship between the IT-department and the customer organizations. This point-of-view should also be considered when contemplating the mutual understanding in general.

The literature review and the interviews both underline the importance of understanding the as-is situation before introducing a new information systems. The approach should thus be that IS project personnel should first learn about the end users' way of working and try to understand their daily work before starting the actual requirements collection. One way to do this is to sit with the users and follow their daily work for some time. Only after such understanding is in place should the customer be asked to explain the requirements and expectations. The approach should not be to simply ask the customer what their requirements are because, as seen in the PDM project, the users do not necessarily know how to answer such questions. Furthermore, there is a risk that part of the requirements are forgotten since they are thought to be self-evident to the end users.

Literature and interviewees agree on the fact that requirements collection in general is difficult – even surprisingly much so. In the PDM project the requirements collection was not thought to be successful at all and a lot of additional and corrective work has had to be done on specifying the requirements. The fact that the requirements were never frozen and have been changed throughout the project has made everything from system configuration to creation of training material and test case more complicated and resulted in a lot of redundant work. The argument is hence that problems with the requirements collection will result in project delay. Furthermore, this research argues that requirements collection is a crucial action since if failing to collect accurate requirements the system that is built will not answer to user expectations – something that is important to strive to according to both literature and interviews. Thus,

Conclusion 5: Requirements collection is one of the most crucial actions in an IS project and need careful preparations and clear methods.

When analyzing the requirements collection in the PDM project with the help of Tiwana and Keil's (2006) model on functionality risk shown in *Figure 4*, it can be stated that the functionality risk in the PDM project has been quite high. The interviews show that the related technical knowledge was low in the internal project organization, the customer involvement was low in the first phases of the project, the requirement volatility has been high, and the project management practices were not fully under control. The system and project were furthermore rather complex. It is therefore evident that the functionality risk has been high and it is motivated to put attention on lowering this risk in future projects by focusing on lowering some of the functionality risk factors.

It is furthermore worth underlining that the situation would have been different if clear methods for the requirements collection had been created in advance. But as the partner in the PDM project did not understand that the project was of such a size that simple system requirements cannot be written down immediately and as Wärtsilä personnel did not question the partner's approach the result was a rather complicated requirements collection process. Maiden's theory (2008) on why requirements collection go wrong; that the difference between system requirements and user requirements is not understood, would suit this situation as well. In the PDM project case the use cases were surely thought of as material for system requirements but as there was no format for the user requirements the use cases had to play also that role. But it must be noted that an effort to improve the requirements collection is part of the ongoing Quality and Testing project at Wärtsilä IM. The recommendation is though that the most urgent thing to get in order is a practice for freezing the requirements in the future PDM projects.

Overall the interview findings in relation to theory indicate that there is a need for an effort to create generic guidelines and improve methods for several project internal processes. Among these are also testing, system build, and requirements collection which are already targets for improvement in the ongoing Quality and Testing project. But there are still other processes and areas that would need clear methods, for example configuration and incident management. The interviews show that especially the document management methods should be improved. In the general interviews it was stated that IS projects produce quite a lot of documents and it is important to keep track of all documents. The PDM project focused interviews show that the documents of that project have not been managed very well and there have been a lot of documents created without clear purposes. There is thus a need for more organized document management in future big projects.

The IM organization should furthermore not forget its role as a filter between the system builder and the users when it comes to deciding what requirements are wise to implement at which stage of the system development. It is first of all important to keep decisions about configuration that affects the functionality close to people who understand how the system will be used in practice. The interviews further show that it is recommendable to try to keep the system as simple as possible and the scope of the functionality manageable. Thus,

Conclusion 6: Managing and restricting the functionality scope for the application is of great importance for project success.

The interviews also show that the possibility to improve some business processes by adopting the way of working the application suggests should not be overlooked. This is a valuable possibility in an IS project and therefore, the project should be planned with this in mind. End user representatives should be given the possibility to familiarize themselves with the possibilities the new application offers. In practice it might be necessary to force the users to try out the new system but as noted in the literature review forcing people to adapt to some change is not all bad. Thus,

Conclusion 7: Situations where end user representatives can try out the new application should be created so that possible superior ways of working that the application allows are tried out. In this way, the quality of the business processes could be changed and improved.

Literature on the topic of whether it is preferable to customize the system to fit the existing business processes or to change the processes to fit the system is divided into two. The finding in this research is slightly leaning towards the standpoint that changing the processes is preferable. Both the literature review and the interviews show that customization of a system is thought to be expensive and create unwanted dependency. This study argues that customization should always be carefully considered and done only on such systems that support the core business and are thought to be of strategic importance. An additional observation is that the term 'processes' is clear for IT-professionals but not necessarily among for example end users. This should be noted when contemplating the communication between IM and business divisions. Thus,

Conclusion 8: Only such information systems that support the core business and are thought to be strategically important should be customized

The PDM project was marked by two bigger issues; the problems with the partner and the lack of clear working methods. The discussion about the latter often involves statements such as that the methods should simply have been created in advance. This research thus agrees with previous research in highlighting the importance of the planning phase. The planning of IS projects in Wärtsilä IM should take into consideration some of the recommendations related to project planning listed in the literature review in chapter 4.5. This research adds one notice to those recommendations; a need to include the customer and the representatives of the end users in the project already in the planning phase. This research furthermore shows that project management in general was thought to be self-evidently important by information management professionals. Thus,

Conclusion 9: A thorough enough planning phase is critical for project success. Every possible impact that the system could have on the whole organization should be analyzed as part of the planning.

This research has shown that a common problem in information system projects seem to be the creation of overoptimistic schedules. It is clear that there are far more disadvantages of too optimistic planning than there are advantages and this creates frustration among the end users. The conclusion is hence, that although the timetable has to be limited somehow it is very important that the approved timetable is realizable. It is worth remembering that if given promises cannot be met it is often better not to promise anything. Thus,

Conclusion 10: Overoptimistic schedules are too often accepted and can cause a lot of problems in an IS project.

There is an evident need to improve the transfer of lessons learned at Wärtsilä IM; this is backed up by both the literature review and the interviews. There are two reasons for this; on one hand it can be quite expensive to repeat the same mistakes as previous projects. On the other hand it is important to share such ideas and methods that have proven to be successful. At Wärtsilä, a mechanism for sharing lessons learned with other project managers has been established but it is important that lessons learned are communicated to the whole project personnel. And as literature states; the know-how level among the project personnel is a critical success factor. This would be especially important before launching any bigger IS project. The observation is furthermore that lessons learned are best transferred face-to-face and not via written manuals or similar. But other concrete ideas for how the transfer of knowledge should happen are not found in this research. Additionally the boundaries that seem to exist between projects and teams in the IM-organization would need to be removed. The organization should work on creating a climate where also a project that has not been fully successful is believed to contain valuable lessons learned. Therefore the fact that the problems of the PDM project have been openly communicated is a step in the right direction.

The PDM-focused interviews include a descriptive example of the need for better transfer of lessons learned. Quite a few problems have arisen due to the lack of clear project-internal work processes and divisions of responsibility for everything from configuration management to requirements collection. And while part of the blame can be put on problems with the partner many of the problems could have been avoided if a more thorough investigation of the methods used in the latter part of the ERP project would have been conducted. That would for example have given Wärtsilä project personnel better chances to question the methods the partner presented – or rather to react on the lack of methods at an early enough stage. It was speculated that the ERP project had a bad reputation and thus, there was reluctance to copy working methods from that project. But the fact is that towards the end of the ERP implementation the people involved knew exactly what they were doing and their knowledge should have been better transferred to all people of the PDM project. Now as the second PDM project is starting there should be time devoted to analyzing the first project and writing down lessons learned instead of running head over heels into the next project. But it should also be noted that the people in the project are no longer as new to the system – and to the IM functions or to the business

of Wärtsilä – as they were when launching the first project. Thus, the Beta project will probably quite automatically be more successful.

As in all projects the competence of the personnel is a critical factor also in IS projects. But the reality is that it is impossible to create such a project organization where everyone has enough experience or knowledge. Therefore there has to be enough training possibilities and other knowledge transfer mechanisms – as well as the above mentioned sharing of experience. This research argues that the IM organization would surely benefit from arranging more training in for example software development project management for all personnel. Additionally, it would be beneficial to work on reducing attitudes such as people can only know as much as their experience has taught them. Because in practice the project personnel will consist of both more experienced and less experienced people but all personnel should contribute as much as possible. The conclusion is hence, that such factors as the commitment of the people and the assignment of suitable tasks to each person are more critical than previous experience in real life situations. With one remark; when project personnel meets representatives of the customer organization it is very important that the personnel have enough knowledge to be able to answer all possible questions. This has a profound impact on the attitudes towards the system and it is important from an organizational change management perspective. This kind of management of project personnel competencies should also get attention in the project plan. Thus,

Conclusion 11: In practice training and maintenance of commitment among the project personnel is more crucial than the level of previous experience of the personnel.

The interviews show that the people working fulltime in the PDM project do not think that the communication between teams has been good enough. (But on the other hand people who are representing business divisions and are not in the core project organization have felt that the communication has been good.) The recommendation is thus that the internal work processes are made clearer and the roles and responsibilities looked over in order to create more clear communication patterns. Furthermore the internal communication should be enhanced by for example arranging more informational meetings for the whole project personnel. The fact that the project people are divided into two locations has also had an impact on the internal communication. Additionally, the general IM interviews show that the arrangement that the project manager sits in another location than the rest of the project team has created some problems in some projects. Thus,

Conclusion 12: Geographically divided project organizations face more challenges than conventional organizations.

The efforts to evaluate the success of IS projects have been very random at Wärtsilä. Evaluation is thought to be very difficult or even impossible. Previous research also shows that evaluation is difficult but argues for the importance of developing ways to evaluate also IT-investments. When considering the situation from a general business perspective, it is easily understood that not evaluating such big investments as information systems is not

feasible. But the problem is the lack of evaluation methods and measures for evaluation. This problem is faced by most companies and concrete methods are wished for. Thus,

Conclusion 13: Evaluation is important but concrete measures and methods for evaluation are needed.

It can also be concluded that in practice, a common understanding of what project success actually is, is first of all needed and then, methods to measure the success can be sought after. This is the case at Wärtsilä and also, according to literature, in general in the field of IS implementation. The first step would be to create a mutual understanding of what kind of investments information systems are. The interviews show that IM professionals would rather talk about big information system investments as strategic investments since it has been noted that promising financial savings is often to promise too much. It might on the other hand be easier to argue for some investment by promising financial benefits. This study also argues that some kind of evaluation of IS investments is important from the perspective of gaining the respect of the business divisions since the benefits of the IS investment can then be proven.

The view in this study is that both tangible and intangible benefits (as presented in Al-Mashari et al 2003) need to be evaluated. Furthermore, every project is unique and when planning a project it has to be separately agreed on how the outcome of that particular project will be evaluated. Lastly is it important to remember that different stakeholders are interested in different aspects of IS-project success. The framework for IS evaluation process that Hallikainen (2003) presents is recommended. The framework argues that IS-project success evaluation should be done for three different processes which corresponds to three different outcomes; IS investment success, IS functionality success, and IS project success. This is presented in *Figure 1*. The reader is also directed to chapter 2.6 for more discussion on this topic.

On the more technical side of project success it is found that work related to data cleaning and migration has been a frequent problem in IS projects at Wärtsilä. The conclusion is that the amount of time and other resources reserved for that work has been heavily underestimated. This study does not include a literature review on this specific topic. The observation is rather that data migration issues have not been listed among critical factors in literature while the finding here is that these issues can have great implications on project success. Thus,

Conclusion 14: Work related to data cleaning and migration is a critical success factor in IS projects.

Management support and management commitment was the most often mentioned CSF in the interviews. Hence, this research supports the findings of previous research presented in the literature review where management support was the most often mentioned CSF. It must be noted that while literature stresses that *top* management support is most critical the

interviews underlined the fact that *all* levels of management have to be committed and engaged. This might be because the support from top management has been fairly good in all projects in Wärtsilä and the problems related to this issue have stemmed mostly from situations where middle management was not committed enough. This has meant that the role-modeling part of change management as shown in *Figure 5* has suffered in many projects. It was also mentioned that the customer's, i.e. Wärtsilä's business divisions' commitment is crucial but since that in practice means that the managers of the business division have to be committed these two viewpoints are here thought to be closely connected. Furthermore, this research supports previous arguments that the personality and authority of business leaders and key users involved in IS projects have an impact on the success of the project. Thus,

Conclusion 15: Management commitment should be found on all levels of management and is the most critical success factor in information system projects.

This study shows that the concept of organizational change management is not very concrete for people working with information system projects. The term was familiar but it was not quite clear how change management should be conducted in practice. It must be noted though, that when the interviewees were asked to describe change management in practice most of the things discussed in literature were actually mentioned. The recommendation is hence that organizational change management as a concept should be made more concrete for IT professionals through some sort of training. The connection between the thought behind organizational change management and the concrete methods need to be communicated to IT professionals. This study therefore argues that organizational change management as a whole should get more attention in IS projects and that training, communication, and management support should be seen both as important individual actions and as parts of overall change management. The model in *Figure 5* describes the most important four tasks of change management; get the user to understand and commit, get the leaders to commit and be role-models of the change, see that the users get training, and to align the systems with the change. This model could be used as a tool in IS projects.

It can furthermore be concluded that change management has not received attention in all projects but only in such projects where the change in people's way of working has been evident. The CRM project was actually launched and presented as specifically a change project and not as an IS project. But the PDM project on the other hand was thought of as simply a technical endeavor and the impact that the introduction of a new system would have on users' way of working was not noticed. This created some challenges later on in the project. Thus,

Conclusion 16: Organizational change management should be given more attention in IS projects.

Conclusion 17: The concept of organizational change management is known by IT professionals but what change management is in practice and how it should be conducted is not familiar enough.

This study also confirms the importance of training in IS projects. Training and communication were furthermore the concrete elements of organizational change management that were most often mentioned in the interviews. When it comes to arranging the training, the Wärtsilä IM professionals have a clear understanding that the end users first need to understand the big picture and then familiarize themselves with the actual application. This part of organizational change management thus seems to be quite well understood in companies. This research also shows that the trainer has a crucial role in project success. It was also noted that the managers' support for the IS project becomes concrete when it comes to allowing or not allowing end users to participate in the training. Thus,

Conclusion 18: Training is a critical success factor in IS projects and seen as a concrete part of organizational change management.

Communication was the other concrete area of organizational change management that was mentioned in the interviews. Communication was thought to be crucial for IS project success. This study concludes that the most important thing is yet again to understand where the end users are coming from in order to be able to successfully communicate about the change. It was frequently highlighted that the message should always be customized depending on the recipient and that communication should happen in two ways. Although it was stated that all possible channels are used for communication about IM functions at Wärtsilä this study argues that there is still room for more communication; such communication that would actually reach the end users. It is furthermore recommended that there would be more information given about IM functions in general. This study also notes that the end users seem to forget that they themselves have to take an active role in order to receive the messages. Hence, the situation might be that communication is already in place but the intended recipients are not ready to take it in.

Conclusion 19: Communication is a critical success factor in IS projects and seen as a concrete part of organizational change management.

One of the biggest challenges Wärtsilä has faced in IS projects seems to be the cooperation with partners. Both the CRM project and the PDM project have had problems with the partner. The core of the problem is that the wrong partner was chosen. The chosen partners were for example lacking knowledge about the technology or about IS project management in general. The conclusion is thus that the methods for selecting a partner and for inspecting the partner's ability to deliver what is expected should be developed. As Wärtsilä's approach is to use the biggest and the best partners there should be knowledge within the organization on how to really demand the best out of the partner and to be able to evaluate whether the partner is working according to expectations. There should also be

more tools for handling situations where the cooperation with the partner is not working and for general follow-up of the progress of out-sourced tasks. Overall, it can be noted that vendor management is something that should be a future topic of interest also in IT organizations.

Conclusion 20: Well-functioning cooperation with external partners should be acknowledged as a critical success factor in IS projects.

All in all this study concludes that Wäertsilä's recent information system projects have been challenging or even failed due to lack of knowledge about best practices in IS projects in the IM organization. The analysis is that all the big issues that were mentioned in the interviews can be traced down to lack of know-how. There is need for more knowledge about IS projects' challenges and CSFs so that it is known what is important to plan and analyze during the planning phase. More knowledge about how best practices in IS projects will also help in choosing the right partner and monitoring the work of the partner. It must be noted that the IM organization has already developed a lot and that it is clear that the organizations' knowledge is all the time increasing. The argument here is furthermore not that every IM professional should possess this kind of knowledge themselves but that the needed knowledge, if found within the organization, should be shared. It is quite clear that there are already now people in the organization with experience of all kinds of project issues but the transferring of lessons learned should be increased. In addition to this, external training is recommended.

Some previous IS projects have been challenging due to the fact that the size of the project and its importance has not been acknowledged in the company overall. But now the support for IS projects among top management is very good and hence, the commitment from business divisions is greater. All in all, it can be, on the basis of the literature review and the interviews, stated that the importance, magnitude, and special characteristics of IS projects are being realized already but knowledge about how to manage the various areas of the project is still missing in Wäertsilä. According to previous research the situation is similar in other companies (see e.g. itSMF Finland 2008).

This study also concludes that there are still many areas related to IS projects that could be researched and developed. Furthermore, literature on this topic is still quite far from being usable in practice. The conclusions that have been presented here contribute to the knowledge about what is critical in IS projects and how companies' IT organizations experience the challenges of IS projects. In order to summarize the discussion can it be stated that IS projects are unique as well as challenging. Organizations still have a lot to learn and best practices to share among each other but the overall knowledge keeps on increasing.

9.2 Recommendations

Recommendations that are given to Wärtsilä IM on the basis of the literature review and the interview findings are listed here below. The recommendations are found in table format in Appendix 4: *Recommendations in table* format.

The reader must be informed that **these recommendations are given specifically on the basis of the material collected for this thesis**. The new project model and guidelines that Wärtsilä IM has developed and recently taken into use have not been followed in the projects that the interviewees have experience of. Hence the changes in project management etc. that the new project guidelines will bring along have not been taken into consideration. Therefore it must be noted that Wärtsilä has already launched improvement efforts that relate to some of the recommendations. Consequently the recommendations here should in some cases not be taken as improvement suggestions but rather as reminders of the importance to put attention on the specific issue.

9.2.1 Improved sharing of lessons-learned

The literature review shows that the sharing of lessons-learned is important. The interviews show that there is a procedure in Wärtsilä IM for sharing lessons-learned with other project managers after project closure. But this procedure should be changed to include transfer of lessons-learned to *all* IM professionals. The organization would also benefit from creating an atmosphere that would encourage the sharing of both positive and negative experiences in a greater extent. It is also recommended that the first PDM project is thoroughly enough evaluated before launching the next project.

9.2.2 Project schedules should be carefully prepared

The literature review shows that careful planning of the project is important. The experience of the interviewees show that over-optimistic schedules have been very common and have caused quite some problems in IS projects. The recommendation is hence to carefully evaluate proposed plans and avoid accepting over-optimistic plans in the future. On this topic Wärtsilä's own experienced IM professionals should always be consulted.

9.2.3 There should be attention put on how the application is selected

The literature review shows that it is crucial to select such an application or software that fits the company. The interviews show that there are no common guidelines for the process of deciding about the application in Wärtsilä. The recommendation is hence to give some attention to the process of selecting the application.

9.2.4 Requirement collection methods need to be developed

The literature review shows that it is crucial to design a system that answers to users' needs and expectations therefore the work with collecting the requirements is crucial. Interviews show that knowledge about how to execute the requirements collection need to be increased in Wärtsilä. Clear guidelines and best practices need to be created. It is also recommended that requirements get frozen at some point. The Quality and Testing project in Wärtsilä already focuses on part of this work.

9.2.5 Methods for monitoring project progress need to be improved

The literature review shows that close monitoring of the project progress is critical for project success. The experience of the PDM project is that this monitoring work should be improved and that there should be a person with the single task to follow-up the progress of various tracks and tasks. In the ERP project this work was done by the partner but those methods for monitoring progress in big IS projects were not transferred to Wärtsilä people at that time and hence the knowledge was not in-housed.

9.2.6 Project-internal processes in IS projects need to be improved

Research shows that good project management and in relation to that clear project internal processes and division of responsibility are crucial for project success. The interviews show that lack of clear project-internal processes can be devastating for a project. This concerns areas such as document management, requirements management, configuration management, incident management etc. The interviews show that in future IS projects it would be important to decide about these processes already in the planning phase of the project. Wärtsilä IM would benefit from creating generic process templates that could be used as basis for the internal processes of various IS projects. It also seems as though there is a general lack of knowledge about best practices which could be improved for example through trainings in the software development areas. This is also important when remembering that project personnel's competencies are crucial for project success. This recommendation especially concerns the future PDM projects.

9.2.7 Work related to the data migration should get more attention

The interviews show that all IS projects have run into problems due to the fact that too few resources have been assigned to the work with the data cleaning and migration. The recommendation is hence, that the vast amount of work that is often needed for the data migration should be acknowledged and given more resources especially if the quality of the data in the system is crucial.

9.2.8 The evaluation of project success should be agreed upon in the planning phase

There is research showing that cost savings *can* be achieved through the introduction of some information system but that the savings are difficult to measure and evaluate. Therefore, operational efficiency and similar improvements should be focused on. And if an information system is thought to be a strategic investment it should be regarded primarily as such. This is in line with findings in the interviews. It was said that financial benefits are seldom proven to be achieved in big IS projects and hence, extraordinary financial savings should not be promised because it might only hurt IM's reputation. Financial benefits should only be promised if ways how to measure them have been carefully agreed upon before launching the IS project. IM should together with business divisions list specific expectations – both tangible and intangible - on IS projects *before* launching the project and the project outcome should furthermore be evaluated after project closure. Chapter 2.6 gives further guidance on this topic and especially Hallikainen's framework (2003) in *Figure 1* is worth studying. Overall it is recommended that the attitude that it is simply impossible to evaluate IS project success is altered.

9.2.9 Projects with too little resources should not be launched

Previous research says that any IS project should be carefully analyzed before launching it which also means that the size of the project should be known. Hence, a suitable amount of resources should be assigned to the project and if there are not enough resources the project should not be launched. Experience in Wärtsilä says that such a mistake should not be repeated.

9.2.10 More weight on the planning phase

Previous research lists planning of the project among the most important critical success factors. As noted in point 9.2.6 several projects have failed on some areas because there has not been thorough enough planning of the project-internal ways of working and division of responsibility. The interviews further show that the customer would rather wait a little longer for some application instead of getting a badly and hastily implemented one. Hence, the recommendation is to put more attention on the importance of the planning phase.

9.2.11 Hand-over to support should happen before go-live

Interviews show that it would be important to remember to include the support organization in the IS project well in time before go-live. The knowledge transfer to the support organization as well as the actual hand-over should happen before go-live.

9.2.12 Guidelines for evaluating possible partner's competencies should be developed

The interviews show that selecting the wrong partner has been devastating for some IS projects. This fact should be acknowledged in the IM organization and practices for how to evaluate some proposed partner's competencies should be developed. It should be remembered that external audits or similar could also be used. Since Wärtsilä's strategy is to use the biggest and best partners the organization should be prepared to demand high-quality work as well.

9.2.13 Need for best practices for monitoring the progress of the work performed by the partner

The interviews also show that there is uncertainty on how to actually monitor the progress of the tasks the partner is performing. Related lessons-learned and knowledge that could be found both inside the organization and in literature could be gathered and shared at least among project managers. There should be some kind of vendor management strategy developed. As noted in point 9.2.5 literature also highlights the need for monitoring project progress and this includes also outsourced tasks.

9.2.14 Need for more knowledge about organizational change management

This research argues that an important part of IS projects is the organizational change management. The attention to this area in IS projects in Wärtsilä has been marginal. The knowledge about this area would hence need to be increased – especially the concrete contents and methods of change management should become more familiar. The recommendation in this thesis is that by making all IM professionals more familiar with the area of change management these issues will get more attention in future IS projects. The models presented in chapter 7.2.7 could be used as a first step towards making change management more concrete. Project managers should give also this topic attention when setting up the project organization and when analyzing the impacts of the new application.

9.2.15 The mutual understanding between IM and business divisions should be enhanced

Previous research shows that it is very important that there is mutual understanding between IT departments and business divisions. As discussed in the previous chapter this relationship should also be improved in Wärtsilä. The prioritizing of IM efforts should for example happen together with business divisions. The reader is directed to chapter 9.1 (Conclusion 2) for a more thorough discussion on this topic.

9.2.16 The integration of all information systems need to be improved

The literature review shows that it is important to manage all information systems as a whole. Hence, the connection between information systems is of great importance. The

interviews show that there is need for improvement in managing the integration of systems and more focus on the whole that all the applications form. This need is already somewhat answered to as there is an integration manager assigned.

9.2.17 Increased usage of process models

The literature review shows that it is utterly important for the IT department to be familiar with the business divisions' way of working. Hence, the idea presented in the interviews that the process models could be used also inside the IM organization is given as a recommendation here. The process models could be used for better understanding the business divisions' work and as a basis for functional specifications etc. In this way the process models would also be used in a greater extent.

9.2.18 Responsibility for the whole life cycle of an application

Interviews signal that the IM functions would benefit from giving the whole life cycle of an application more attention. This could be realized for example by assigning the responsibility of an application to an application manager directly when launching the implementation project and keeping the ultimate responsibility there throughout the life cycle.

9.2.19 Readiness to work over team boundaries

It was noted in the interviews that the IM organization should be able to swifter arrange temporary organizations to handle such issues that involve expertise from different IM functions and IM teams. A first step towards this would be more internal knowledge sharing about what the different IM functions work with. It was also noted that the contents of the big IM-contracts, e.g. the support contract, should be more known in the whole IM organization.

9.2.20 Need to put attention on what the IM organization's role is

The interviews show that the IM organization should put some focus on determining its own role in relation both the business divisions and the external IT partners. The interviews show that the IM managers have a clear idea about the organization's role but that the rest of the IM personnel, especially those who are in direct contact with business representatives, do consider the role a bit indistinct.

9.3 Limitations of the study

As it can be noted already from the table of contents the topic of this study is quite diverse and contains various subtopics. Therefore, it must be noted that the ambition of this study is not to discuss, for example, every critical success factor in detail. The aim is to give an

overview of what the challenges in an IS project are and pinpoint the extra critical ones. Similarly, when it comes to the recommendations given to Wärtsilä every recommendation is not discussed in full detail and practical methods are not always suggested. Future research could thus focus on some of the critical success factors and deepen the discussion on these.

It must also be noted that the interviews of this research gave room for free discussion about every issue that the interviewees thought were related to IS projects. Therefore, all issues were not discussed in all interviews and not every interviewee's opinion about some issue is recorded. The reader is also reminded about the fact that only one company's practices have been investigated in this study.

When contemplating the conclusions and recommendations of this thesis must it be kept in mind that Wärtsilä has already launched several efforts to increase the quality of the IS projects. The most important of these are the new IM project guidelines. But since these improvements are newly launched the effects of these have not yet been seen and none of the projects that were subject for this study have been conducted according to new practices. The reader is thus asked to remember the fact that the recommendations and conclusions of this thesis are done solely on the basis of the research material. An interesting future topic for a similar study would be the outcome of these improvements efforts.

10 References

- Abdolvand, N., Albadvi, A. & Ferdowsi, Z. 2008, "Assessing readiness for business process reengineering", *Business Process Management Journal*, vol. 14, no. 4, pp. 497-511.
- Aladwani, A.M. 2001, "Change management strategies for successful ERP implementation", *Business Process Management Journal*, vol. 7, no. 3, pp. 266-275.
- Al-Mashari, M., Al-Mudimigh, A. & Zairi, M. 2003, "Enterprise resource planning: A taxonomy of critical factors", *European Journal of Operational Research*, vol. 146, no. 2, pp. 352.
- Austin, J. & Currie, B. 2003, "Changing organisations for a knowledge economy: The theory and practice of change management", *Journal of Facilities Management*, vol. 2, no. 3, pp. 229-243.
- Biehl, M. 2007, "Success Factors for Implementing Global Information Systems", *Communications of the ACM*, vol. 50, no. 1, pp. 53.
- Brown, S.A., Chervany, N.L. & Reinicke, B.A. 2007, "What matters when introducing new information technology", *Communications of the ACM*, vol. 50, no. 9, pp. 91.
- Buhanist, P. 2000, *Organisational Change, Development Efforts, and Action Research*, Helsinki University of Technology, Department of Industrial Engineering and Management.
- Burnes, B. 1997, "Organizational choice and organizational change", *Management Decision*, vol. 35, no. 10, pp. 753.
- Burnes, B. 1996, "No such thing as ... a "one best way" to manage organizational change", *Management Decision*, vol. 34, no. 10, pp. 11-18.
- Cameron, E. & Green, M. (eds) 2004, *Making sense of change management a complete guide to the models, tools & techniques of organizational change*, Kogan Page, London.
- Collins, J.C. & Porras, J.I. 1996, "Building your company's vision", *Harvard business review*, vol. 74, no. 5, pp. 65-&.
- Committee on national security systems 2006, *National information assurance glossary*, Ft Meade, MD, USA.

Cook, S. 2004, *Change management excellence using the four intelligences for successful organizational change*, Kogan Page, London.

Crnkovic, I., Askund, U. & Persson, A. 2002, *Implementing and Integrating Product Data Management and Software Configuration Management*, Artech House, Norwood, MA, USA.

Daniels, S. 1998, "The strategic use of information systems", *Work Study*, vol. 47, no. 5, pp. 167-171.

Davenport, T.H. 1998, "Putting the enterprise into the enterprise system", *Harvard business review*, vol. 76, no. 4, pp. 121.

Dehning, B. & Richardson, V.J. 2002, "Returns on Investments in Information Technology: A Research Synthesis", *Journal of Information Systems*, vol. 16, no. 1, pp. 7.

DeLone, W.H. & McLean, E.R. 2003, "The DeLone and McLean model of information systems success: A ten-year update", *Journal of management information systems*, vol. 19, no. 4, pp. 9.

Dewett, T. & Jones, G.R. 2001, "The role of information technology in the organization: a review, model, and assessment", *Journal of Management*, vol. 27, no. 3, pp. 313.

Duck, J.D. 1993, "Managing change - the art of balancing", *Harvard business review*, vol. 71, no. 6, pp. 109-118.

Eurostat 2007, 27.11.2007-last update, *Information technology expenditure in millions of euro and as a percentage of GDP* [Homepage of European Commission], [Online]. Available: <http://epp.eurostat.ec.europa.eu> [2008, 13.08.2008].

Fisher, B. & Kenny, R. 2000, "Introducing a Business Information System into an Engineering Company", *Information Knowledge Systems Management*, vol. 2, no. 2, pp. 207.

Gott, B. 1995, "The product data management market", *World Class Design to Manufacture*, vol. 2, no. 4, pp. 18-22.

Hallikainen, P. 2003, *Evaluation of Information System Investments*.

Hamlin, B., Keep, J. & Ash, K. 2001, *Organizational change and development a reflective guide to managers, trainers and developers*, 1st edn, Pearson Education.

Hirsjärvi, S. & Hurme, H. 2000, *Tutkimushaastattelu : teemahaastattelun teoria ja käytäntö*, Yliopistopaino, Helsinki.

Ho, L.T. & Lin, G.C.I. 2004, "Critical success factor framework for the implementation of integrated-enterprise systems in the manufacturing environment", *International Journal of Production Research*, vol. 42, no. 17, pp. 3731.

itSMF Finland & Kuopio University 2008, *IT service management survey*, itSMF Finland.

Jiang, L., Eberlein, A. & Far, B.H. 2008, "A case study validation of a knowledge-based approach for the selection of requirements engineering techniques", *Requirements engineering*, vol. 13, no. 2, pp. 117-146.

Joshi, K. 1991, "A Model of Users' Perspective on Change: The Case of Information Systems Technology Implementation", *MIS Quarterly*, vol. 15, no. 2, pp. 229-242.

Kadiyala, R. 2005, "New developments concerning business information systems", *Management Research News*, vol. 28, no. 11, pp. 164-170.

Katz, R.H. 1990, "Toward a Unified Framework for Version Modeling in Engineering Databases", *ACM Computing Surveys*, vol. 22, no. 4, pp. 375-408.

Kim, B. & Oh, H. 2000, "An exploratory inquiry into the perceived effectiveness of a global information system", *Information Management and Computer Security*, vol. 8, no. 3, pp. 144-153.

Kitchen, P.J. & Daly, F. 2002, "Internal communication during change management", *Corporate Communications: An International Journal*, vol. 7, no. 1, pp. 46-53.

Klein, G. & Jiang, J.J. 2001, "Seeking consonance in information systems", *The Journal of Systems and Software*, vol. 56, no. 2, pp. 195.

Kotter, J.P. 1995, "Leading Change: Why Transformation Efforts Fail", *Harvard business review*, vol. 73, no. 2, pp. 59.

Lanning, H. 2001, *Planning and Implementing Change in Organisations - a Construct for Managing Change Projects*, Helsinki University of Technology, Department for Industrial Engineering and Management, Espoo, Finland.

Lee, O., Banerjee, P., Lim, K.H., Kumar, K., Van Hillegersberg, J. & Wei, K.K. 2006, "Aligning IT components to achieve wgility in globally distributed system development", *Communications of the ACM*, vol. 49, no. 10, pp. 48.

Leidner, D.E. & Kayworth, T. 2006, "A review of culture in information systems research: toward a theory of information technology culture conflict", *MIS Quarterly*, vol. 30, no. 2, pp. 357.

- Liu, H., Shao, W.Z., Zhang, L. & Ma, Z.Y. 2007, "Detecting overlapping use cases", *IET Software*, vol. 1, no. 1, pp. 29.
- Loo, R. 2003, "A multi-level causal model for best practices in project management", *Benchmarking*, vol. 10, no. 1, pp. 29.
- Loonam, J. & McDonagh, J. 2007, "Implementing Enterprise Systems: A Review of Critical Success Factors" in *Handbook of information technology in organizations and electronic markets*, eds. A.J. Salazar & S. Sawyer, World Scientific, , pp. 93-112.
- Mabert, V.A., Soni, A. & Venkataramanan, M.A. 2003, "Enterprise resource planning: Managing the implementation process", *European Journal of Operational Research*, vol. 146, no. 2, pp. 302-314.
- Maiden, N. 2008, "User Requirements and System Requirements", *IEEE Software*, vol. 25, no. 2, pp. 90.
- Marjanovic, O. 2000, "Supporting the “soft” side of business process reengineering", *Business Process Management Journal*, vol. 6, no. 1, pp. 43-55.
- Markus, M.L. 2004, "Technochange management: using IT to drive organizational change", *Journal of Information Technology*, vol. 19, no. 1, pp. 4-20.
- Middleton, P. & Harper, K. 2004, "Organizational alignment: a precondition for information systems success?", *Journal of Change Management*, vol. 4, no. 4, pp. 327.
- Miles 2007, "Foreword" in *Handbook of Information Technology in Organizations and Electronic Markets*, eds. A.J. Salazar & S. Sawyer, World Scientific, .
- Molokken, K. & Jorgensen, M. 2003, "A review of software surveys on software effort estimation", *Proceedings of the 2003 International Symposium on Empirical Software Engineering* IEEE Computer Society, Los Alamitos, CA, USA, pp. 223.
- Mukherji, A. 2002, "The evolution of information systems: Their impact on organizations and structures", *Management Decision*, vol. 40, no. 5, pp. 497-507.
- Nickerson, R.C. 2000, *Business and information systems*, Prentice Hall.
- Oh, W. & Pinsonneault, A. 2007, "On the assessment of the strategic value of information technologies: conceptual and analytical approaches", *MIS Quarterly*, vol. 31, no. 2, pp. 239-265.
- Patton, M.Q. 2002, *Qualitative research & evaluation methods*, Sage, Thousand Oaks, CA.

Peltonen, H. 2000, *Concepts and an implementation for product data management*, Finnish Academies of Technology.

Piccoli, G. & Ives, B. 2005, "IT-dependent strategic initiatives and sustained competitive advantage: A review and synthesis of the literature", *MIS Quarterly*, vol. 29, no. 4, pp. 747-776.

Pozzebon, M., Titah, R. & Pinsonneault, A. 2006, "Combining social shaping of technology and communicative action theory for understanding rhetorical closure in IT", *Information Technology & People*, vol. 19, no. 3, pp. 244.

Reich, B.H. 1996, "Measuring the Linkage Between Business and Information Technology Objectives", *MIS Quarterly*, vol. 20, no. 1, pp. 55.

Roy, V., Bernier, C. & Leveille, L. 2006, "The high wire balancing act of the IS project director", *The Database for Advances in Information Systems*, vol. 37, no. 1, pp. 8.

Ruuska, I. & Vartainen, M. 2003, "Critical project competences - a case study", *Journal of Workplace Learning*, vol. 15, no. 7, pp. 307.

Saeed, K.A. & Abdinnour-Helm, S. 2008, "Examining the effects of information system characteristics and perceived usefulness on post adoption usage of information systems", *Information & Management*, vol. 45, no. 6, pp. 376.

Salazar, A.J. & Sawyer, S. 2007, "Introduction" in *Handbook of information technology in organizations and electronic markets*, eds. A.J. Salazar & S. Sawyer, World Scientific, , pp. 1-12.

Salminen, A. 2000, *Implementing Organizational and Operational Change - Critical Success Factors of Change Management*, The Finnish Academy of Technology, Espoo, Finland.

Seddon, P.B., Graeser, V. & Willcocks, L.P. 2002, "Measuring organizational IS effectiveness: An overview and update of senior management perspectives", *Database for Advances in Information Systems*, vol. 33, no. 2, pp. 11.

Sharma, R. & Yetton, P. 2007, "The contingent effects of training, technical complexity, and task interdependence on successful information systems implementation", *MIS Quarterly*, vol. 31, no. 2, pp. 219.

Sharma, R. & Yetton, P. 2003, "The contingent effects of management support and task interdependence on successful information systems implementation", *MIS Quarterly*, vol. 27, no. 4, pp. 533.

- Sharma, R., Yetton, P.W. & Zmud, R.W. 2008, "Implementation costs of IS-enabled organizational change", *Information and Organization*, vol. 18, no. 2, pp. 73.
- Sherer, S.A., Kohli, R. & Baron, A. 2003, "Complementary investment in change management and IT investment payoff", *Information Systems Frontiers*, vol. 5, no. 3, pp. 321-333.
- Shupe, C. & Behling, R. 2006, "Developing and Implementing a Strategy for Technology Deployment", *Information Management Journal*, vol. 40, no. 4, pp. 52.
- Siddiqui, Q.A., Burns, N.D. & Backhouse, C.J. 2004, "Implementing product data management the first time", *International Journal of Computer Integrated Manufacturing*, vol. 17, no. 6, pp. 520.
- Smith, A.D. 2004, "Empirical exploration for a product data management (PDA) system at a major telecommunications firm", *Industrial Management + Data Systems*, vol. 104, no. 5, pp. 513.
- Soja, P. 2006, "Success factors in ERP systems implementations: Lessons from practice", *Journal of Enterprise Information Management*, vol. 19, no. 4, pp. 418.
- Standards Coordinating Committee of the Computer Society of the IEEE 1990, *IEEE Standard Glossary of Software Engineering Terminology*, The Institute of Electrical and Electronics Engineers, New York City, NY, USA.
- Strebel, P. 1996, "Why do employees resist change?", *Harvard business review*, vol. 74, no. 3, pp. 86-&.
- Teo, T.S.H. & Ang, J.S.K. 2001, "An examination of major IS planning problems", *International Journal of Information Management*, vol. 21, no. 6, pp. 457.
- Teo, T.S.H. & King, W.R. 1996, "Assessing the impact of integrating business planning and IS planning", *Information & Management*, vol. 30, no. 6, pp. 309.
- The Finnish Centre for Technical Terminology (TSK) 1993, , *TEPA* [Homepage of The Finnish Centre for Technical Terminology (TSK)], [Online]. Available: <http://www.tsk.fi/tepa/> [2008, 20.7.2008].
- Tiwana, A. & Keil, M. 2006, "Functionality Risk in Information Systems Development: An Empirical Investigation", *IEEE Transactions on Engineering Management*, vol. 53, no. 3, pp. 412.

van de Ven, Andrew H. & Poole, M.S. (eds) 2004, *Handbook of organizational change and innovation*, Oxford University Press.

van den Hamer, P. & Lepoeter, K. 1996, "Managing design data: The five dimensions of CAD frameworks, configuration management, and product data management", *Proceedings of the IEEE*, vol. 84, no. 1, pp. 42-56.

van Everdingen, Y., Van Hillegersberg, J. & Waarts, E. 2000, "ERP adoption by European midsize companies", *Communications of the ACM*, vol. 43, no. 4, pp. 27.

van Lamsweerde, A., Darimont, R. & Letier, E. 1998, "Managing Conflicts in Goal-Driven Requirements Engineering", *IEEE Transactions on Software Engineering*, vol. 24, no. 11, pp. 908.

Ward, J., Hemingway, C. & Daniel, E. 2005, "A framework for addressing the organisational issues of enterprise systems implementation", *The Journal of Strategic Information Systems*, vol. 14, no. 2, pp. 97.

Williams, M.D. & Williams, J. 2007, "A change management approach to evaluating ICT investment initiatives", *Journal of Enterprise Information Management*, vol. 20, no. 1, pp. 32-50.

Wognum, P.M., Krabbendam, J.J., Buhl, H., Ma, X. & Kenett, R. 2004, "Improving enterprise system support-a case-based approach", *Advanced Engineering Informatics*, vol. 18, no. 4, pp. 241.

Yeo, K.T. 2002, "Critical failure factors in information system projects", *International Journal of Project Management*, vol. 20, no. 3, pp. 241.

Yetton, P., Sharma, R. & Southon, G. 1999, "Successful IS innovation: the contingent contributions of innovation characteristics and implementation process", *Journal of Information Technology*, vol. 14, no. 1, pp. 53.

Appendices

Appendix 1: Questionnaire

Aim: to get basic information about the person's experience of IS deployment. On the basis of the information from question 1-6 persons that will be interviewed will be chosen. Questions 7-9 function as initial opening to the interview.

1. Your name and current position:
2. General information of the IS project in question.
 - a. Name of the system in question:
 - b. Duration of the project:
 - c. Number of end users:
 - d. Number of legal units in the project:
 - e. List of the business divisions that were included in the scope:
 - f. Amount of people in the project
 - i. Wärtsilä-personnel:
 - ii. Consultants:
3. Describe your role and area of responsibility in the IS project:
4. Which were the phases of the IS project (if not all) that you were involved in? Please, refer to phases in the Wärtsilä IM project guidelines that can be found here: <https://fiidm01.wnsd.com/kronodoc/SIM/DBAA186319> and also in the picture below this questionnaire.
5. What was the number of legal units where **you** took part in the actual deployment of the IS?
6. Describe the deployment task at 1-3 different legal units by answering the questions below. You can choose the units freely but please try to choose heterogeneous cases of deployment and such, where you participated in the actual preparation of the deployment. (If the deployment was done simultaneously and in exactly the same way in all units you can fill in one chapter that covers all units but in that case, please mention it here below.)

*Please give also **additional comments** and explanations to your answer on the questions where you are asked to place your answer on a [scale](#).*

Name of legal unit 1:

- a. The "level of complexity" of the deployment in the legal unit.
 - i. Number of end users in the legal unit:
 - ii. Short description of the end users' general IT skills (How confident IT-users were they? Did they use a computer in their daily work? Was their experience limited to only certain programs or were they e.g. "IT-pros"?):

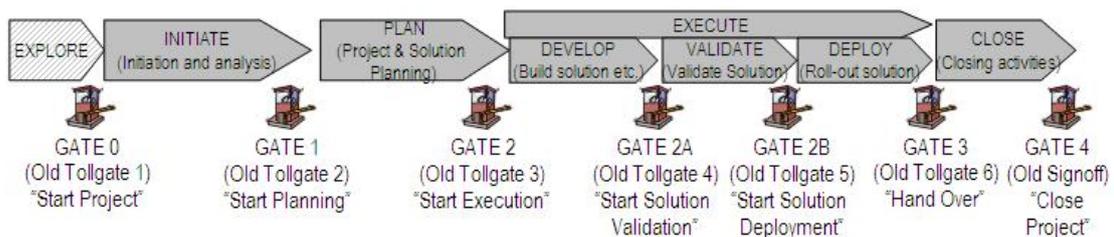
- iii. Short description of the end users' previous experience of the information system in question (Was the system completely new or already familiar in the unit?):
- iv. If this system replaced one or several systems previously in use in the unit, which were the systems?
- v. Your estimate of the amount of change in the WOWs that the IS brought about on the scale:
 very much change – some change – almost no change
- vi. Your estimate of the amount of change resistance on the scale:
 very much resistance – some resistance – almost no resistance

b. The success-rate of the deployment in the unit.

- i. Your estimate of the acceptance rate of the new IS:
 very accepted – accepted – moderately accepted – not accepted
- ii. How well did the deployment follow the time schedule?
- iii. How well did the deployment follow the budget?
- iv. Your estimate of the overall success on the scale:
 very successful – successful – moderately successful – not successful

c. Freely give additional comments about how you experience the deployment at this particular legal unit: e.g. the amount of problems, the working spirit, and the amount of change it brought about...

- 7. What are, in your opinion, the 3 most critical success factors when deploying an IS? Why?
- 8. Mention one or a few areas of IS deployment where Wäertsilä, in your opinion, should improve the practices the most? Why?
- 9. Additional comments or thoughts on the subject of this survey?



Appendix 2: Template for interviews focused on general IS project experience

Note: The template varied depending on the interviewees' experience and the characteristics of the IS project.

1. Which IS projects did you participate in and what was your role in the projects?
2. What is your experience with regard to the chosen* IS's deployment?
(*the IS project that the interview is focused on)
3. Other project specific question based on answers to questionnaire.
4. **Critical success factors** / biggest risks / most probable failure areas on a general level in IS deployment? How did it work in this project?
 - a. You mentioned:
 - ...
 - ...
 - ...
 - b. In what concrete ways does the CSF get realized? In what way does it show that it matters? (What is the risk if it is not handled?) How important is this area (very critical – critical – not that critical) and why? The reality in WE SAP project? And Wärtsilä in general?
5. The interviewees view on the importance of and issues related to
 - Project management
 - Change management and communication
What does CM mean for you and in general for people in Wärtsilä IM? How do you think this area could be done more concrete?
 - Top management support and management support
 - Alignment with business (see also 8)
 1. What is the attitude in Wärtsilä: make software fit the processes or make processes fit the software?
 - Business commitment
 1. Does business give enough resources/time for this?
 2. During project / after sign-off
 - Requirements collection
 - IS projects are more than just the introduction of an application.
 - Technological issues.
 1. How much do you think this matters overall for the project success?

(Go through such issues that were not mentioned before)
6. Evaluation of project success.
 - a. Is it done in Wärtsilä?
 - b. Should it be done? How could it be done?
7. How do you feel that the connection between Information Management and the business divisions of Wärtsilä functions?
8. What needs improvement in Wärtsilä IM functions?

Appendix 3: Template for interviews focused on the PDM project

1. What is your responsibility in the PDM project and in what parts of the project have you participated?
2. Have you been involved in other information systems projects before (at Wärtsilä or in other organizations)?
3. Question only to business: how important do you feel that this IS project is for business? Why?
4. What are, according to you, the biggest issues in the PDM-project? Such that have influenced specifically your work/responsibility but also general ones. (1-4 issues)
 - a. ...
 - b. ...
 - c. ...
 - d. ...
5. What is the reason behind? How were these issues handled? How could they have been prevented? How could Wärtsilä overall evolve in this area? Should guidelines and more structured ways to handle the issues be developed?
6. Which things in the PDM project have been handled well?
7. Comments on the following areas (if not mentioned in the answers on previous questions):
 - a. The start-up of the project. Were there clear targets? And clearly spelled business benefits?
 - b. People-issues (see also question 8)
 - i. Communication
 - ii. Motivation
 - iii. Training (preparation)
 - iv. Etc.
 - c. Project management
 - i. Would the general project management need revising at some point?
 - ii. The selection of the application
 - iii. Scheduling issues
 - d. Top management support
 - i. How important?
 - ii. What is the best way to concretise the support?
 - e. Requirements collection and writing of specifications
 - f. Work with the processes (redesign etc.)
 - i. How was it done?
 - ii. IS vs existing processes – how do you see it?

- g. Relationship between customer and supplier i.e. IM and Business
 - i. In PDM-project (business involvement, customer involved in early stage?)
 - ii. On a general level
 - iii. Commitment from Business side? What could have been done differently to get business to commit more? (IM-people....)
 - h. Project resources (both IM and business side)
 - i. Skills
 - ii. Amount
 - i. Information and data issues
 - i. Data migration (preparation?)
 - j. Technological issues
 - i. System build
 - ii. Incident management
 - iii. Testing
 - iv. Infrastructure
8. What does organizational change management mean to you?
9. Which are the things related to information system projects that Wärtsilä IM should focus the most on developing methods/structures/instructions for according to you?

Appendix 4: Recommendations in table format

Recommendation		Area
1	The sharing of lessons-learned need to be improved	IS projects
2	Project schedules should be carefully prepared	IS projects
3	There should be attention put on how the application is selected	IS projects
4	Requirement collection methods need to be developed	IS projects
5	Methods for monitoring project progress need to be improved	IS projects
6	Project-internal processes in IS projects should be improved	IS projects
7	Work related to the data migration should get more attention	IS projects
8	The evaluation of project success should be agreed upon in the planning phase	IS projects
9	Projects with too little resources should not be launched	IS projects
10	More weight should be put on the planning phase	IS projects
11	Hand-over to support should happen before go-live	IS projects
12	Guidelines for evaluating possible partners' competencies should be developed	IS project partners
13	There is a need for best practices for monitoring the progress of the work performed by the partner	IS project partners
14	There is a need for more knowledge about organizational change management	Change Management
15	The mutual understanding between IM and business divisions should be enhanced	IS projects / IM general
16	The integration of all information systems need to improved	IM general
17	<u>U</u> sage of process models should be increased	IM general
18	More wholesome responsibility for the life cycle of an application	IM general
19	The readiness to work over team boundaries need to be thought about	IM general
20	Need to put attention on what the IM organization's role is	IM general