Implementation of an ERP System: Case Cimson Koulutuspalvelut Oy
Abstract

It is crucial for business organizations to constantly find new ways to improve their procedures in order to maintain their position in the industry. One possible way to achieve more cost-effectiveness is to introduce an enterprise resource planning (ERP) system. An ERP system is business solution software that can bring a lot of value to a company by integrating different applications.

The main objective of this study was to improve the management of the human and material resources associated with the courses organized by Cimson Koulutuspalvelut Oy (Cimson) by implementing an ERP system that encompassed a resource management module that consisted of calendars collecting and displaying resource usage. The study was motivated by the emerging significance of ERP software among business organizations. Design science research was the utilized research method.

The main observation of this study was that the ERP implementation at Cimson was successful. The main contribution of this study was to give more insight into the mitigation of multi-site issues by implementing a browser-based system, reinforcing the social cohesion of the implementation team, and having a person of top management as a solid part of that implementation team.

Keywords
ERP, enterprise resource planning, Cimson Koulutuspalvelut Oy, browser-based system
Foreword

This Master’s Thesis was written between January and May, 2013, under the supervision of Adjunct Professor Raija Halonen, University of Oulu. Ben Li (PhD student) was the opponent.

The purpose of this Thesis was to improve the management of the human and material resources of the courses organized by Cimson Koulutuspalvelut Oy (Cimson). This Thesis was partly motivated by my urge to give a demonstration of my abilities in practice because this was my first real work project in this area.

I want to acknowledge Master of Science (Economics) Markku Kuuselo for introducing me to this project. In addition, I would like to acknowledge Cimson and especially Master of Science (Economics) Mikko Hannula for accepting me to be the main developer.

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Jesse Mikkola

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1. Introduction

Organizations implement information systems (IS) in order to enhance their performance and efficiency (Hevner et al., 2004). The main purpose of this study was to improve the management of the human and material resources related to the courses organized by Cimson Koulutuspalvelut Oy (Cimson) by implementing an enterprise resource planning (ERP) solution that encompassed a resource management module that consisted of calendars collecting and displaying resource usage. The implementation was carried out between February, 2012 and January, 2013, and only the resource management part of ERP was implemented. The situation is clarified in Figure 1.

Figure 1. An outline of the modules of an ERP system.

In Figure 1, the modular structure of an ERP system is roughly presented. The Resource Management component implemented at Cimson encompassed human and material resources associated with the courses the company organized. The component partly overlapped with the Supply Chain Management and Manufacturing modules. The motivation behind this study was the increasing importance of ERP solutions among business organizations. According to a study by Rajamäki and Ahtola (2011), three out of four Finnish companies are planning to extend their current ERP systems or implement new ones.

There are studies about successful ERP implementations (Berchet & Habchi, 2005; Chen et al., 2009; Mandal & Gunasekaran, 2003; Tchokogué et al., 2005) as well as unsuccessful implementation endeavors (Barker & Frolick, 2003; Chen et al., 2009; Xue et al., 2005). Umble et al. (2003) present nine critical success factors that can considerably impact the outcome of an ERP implementation. The ERP implementation at Cimson was evaluated against these essential success factors.

1 http://www.prlog.org/11982999-erp-solution.jpg
The research problem was that the human and material resources related to the courses organized by Cimson were not effectively enough managed which resulted in the necessity of having a tool to improve the management of these resources. The previous Excel-based system of the company did not meet the requirements of the current business activities of Cimson. The new system enabled the possibility, for example, to see every booking of a course room or a computer during one month rapidly and conveniently in one place. The old system contained the same data but the information was scattered due to the lack of a centralized database. It was time-consuming and challenging to gather and integrate data from many different sources in order, for instance, to follow the utilization rate of a course room or a car.

In addition, the ERP application made it possible to quickly and effortlessly generate different kinds of reports that presented data in a clearly structured and distinct way. The top management of Cimson especially appreciated the possibility to compose reports because they helped the company to plan its activities better by providing explicit information about the utilization of the human and material resources of the organization. It was not possible to create reports with the former system. Overall, the ERP solution automated many of the functionalities of the Excel-based system that required a lot of human involvement. As a result, the users of the new system could use their time more effectively.

The research question was: “What kind of ERP system is needed in order to improve the management of human and material resources related to courses?” Design science research was the utilized research method. The main contribution of this study was to give more insight into the mitigation of multi-site issues by implementing a browser-based system, reinforcing the social cohesion of the implementation team, and having a person of top management as a solid part of that implementation team.

The remainder of this study has the following structure: Section 2 will discuss the history of ERP, the success factors of an ERP implementation, and the social cohesion of a project group. Section 3 will define the employed research method. Section 4 will review Case Cimson. Section 5 will discuss the research implications. Finally, section 6 will draw conclusions based on the previous sections and suggest future research areas.
2. Earlier Research

In this section, the history of ERP is reviewed. Furthermore, the factors behind of a successful ERP implementation and the social cohesion of a project group are discussed.

2.1 History of ERP

In order to get a better understanding of the term ERP, the history should be reviewed. Figure 2 depicts the evolution timeline. ERP systems date back to the 1960s when the initial accounting and inventory systems were introduced (Elragal & Haddara, 2012). Expenses were the key competitive thrust in the 1960s. As a result, manufacturing strategies became more product-centered based on high-level volume production, the minimization of expenses, and presuming solid financial requisites. (Jacobs & Weston, 2007.) The necessities of manufacturing enterprises were meant to meet with customized software solutions such as reorder point system (ROP) (Gupta & Kohli, 2006). These systems supplied all the basic manufacturing planning and control (MPC) necessities of these enterprises (Jacobs & Weston, 2007).

![Figure 2. The history of ERP (Jacobs & Weston, 2007).](image)

In the 1970s, material requirements planning (MRP) solutions that were used for planning and managing manufacturing got more focus (Gupta & Kohli, 2006). The basic functionality of MRP is scheduling and releasing manufacturing work orders and purchase orders in a way that articles arrive at the assembly unit exactly as they are needed (Schroeder, 2003; Shankarnarayanan, 2000; Siriginidi, 2000). MRP was the precursor to and foundation of MRP II and ERP. The previous versions of computerized MPC software (e.g. “PICS”, production and inventory control system, by IBM) had used magnetic tape because it was the only large scale storage instrument obtainable. (Jacobs & Weston, 2007.)

Large size, rigidity, and a high price were the characteristics of early MRP systems. A vast amount of people with technical capabilities was called for to sustain the mainframe computers, for instance, the IBM7094 at first, and later 360s and 370s of IBM. A significant permitting technology for the developing of more integrated business IS was the developing of faster and higher capacity disk (random access) storage. The vocabulary did not contain the word “database” and software tools were primitive. (Jacobs & Weston, 2007.)
The key competitive thrust in the late 1970s was transition towards marketing. As a result, target market strategies centered on larger manufacturing integration and contemplation were embraced. (Jacobs & Weston, 2007.) By mitigating inventories, enhancing customer service, and improving both efficacy and performance, MRP solutions managed to answer that demand elegantly (Siriginidi, 2000). MRP solutions were employed by production companies to ease dealing with manufacturing and inventory planning procedures (Elragal & Haddara, 2012).

In the early 1980s, J.D. Edwards started to concentrate on writing software for the IBM System/38. This system offered a less expensive option for the mainframe computers: it provided adjustable disk drives with capabilities for small and medium sized enterprises. The phrase manufacturing resource planning began to be used instead of material requirements planning as the concept of MRP started to be applied to the increasingly comprehensive functions. (Jacobs & Weston, 2007.) Since the functionality grew larger and started to meet the requirements of manufacturing companies regarding other activities, the concept of manufacturing resource planning II (MRP II) was devised (Elragal & Haddara, 2012). Concurrently, with this transition in the scale of software applications, the production competitive thrust of the 1980s shifted to high-class with the emergence of the quality “gurus” such as Deming, Juran, and Ishikawa (Jacobs & Weston, 2007).

Gartner Group invented the term enterprise resource planning in the early 1990s (Wylie, 1990). It encompassed the next generation of solutions which are different from the previous systems in the domains of relational database management, graphical user interface, and client-server hardware architecture (Keller & Teufel, 1998; Koch et al., 1999). In 1992, SAP released a product called R/3. The most essential characteristic that separated the product from earlier ERP solutions was its utilization of client-server architecture. (Jacobs & Weston, 2007.)

According to Jacobs and Weston (2007), Y2K was probably the single case that signaled the maturing of the ERP manufacturing as well as the acknowledgement of big and small ERP suppliers. It took its time, but by 2002, and after the breakdown of technology and “dot-com” stocks starting in 2000, software businesses were searching for means to upgrade their product offerings and grow market share. Between the years 2000 and 2002 software businesses encountered with considerable pressure to reduce staff after their astonishing growth continuing all the way to 2000. (Jacobs & Weston, 2007.)

2.2 Success factors of ERP implementation

The implementation of an ERP system is a complicated and time-consuming process. There are studies about successful implementation endeavors (Berchet & Habchi, 2005; Chen et al., 2009; Mandal & Gunasekaran, 2003; Tchokogué et al., 2005) as well as failed implementation efforts (Barker & Frolick, 2003; Chen et al., 2009; Xue et al., 2005). The implementation costs and time of ERP solutions vary greatly. A study by Ross and Vitale (2000) suggests that the implementation costs varied from $2 million to $130 million among fifteen production companies. The implementation process took from one to five years from the signing of the agreement until the eventual “go-live”. The magnitude of these companies varied from $125 million in sales to over $25 billion (US). (Ross & Vitale, 2000.)
According to Umble et al. (2003), a collection of factors that can have a crucial impact on a successful ERP implementation has been recognized by several authors. Umble et al. (2003) have aggregated the most important factors identified by these authors. They continue that based on these factors, it is possible to determine if the implementation process will be successful. These nine essential factors are depicted in Figure 3.

**Figure 3.** The nine essential factors affecting a successful implementation of an ERP system (Umble et al., 2003).

*Clear understanding of strategic goals:* A necessity for an ERP implementation is that the key personnel of the entire company have a distinct, immersive image of the activities the company should exercise so that it can fulfill the needs of customers, empower workers, and facilitate a supply chain for the impending three to five years. Goals, expectancies, and products have to be explicitly recognized. (Umble et al., 2003.) Lastly, the reasons for implementing an ERP solution and what important organizational necessities the software will deal with need to be precisely specified (Krupp, 1998; Latamore, 1999; Schragenheim, 2000; Travis, 1999).

*Commitment by top management:* Top management must demonstrate solid leadership, commitment, and involvement in order to achieve a successful implementation (Bingi et al., 1999; Davis & Wilder, 1998; Laughlin, 1999; Oden et al., 1993; Sherrard, 1998). Due to the crucial input of top management when construing and revising current business procedures, there ought to be a top level administration planning board behind the implementation effort that is engaged with business integration, comprehends ERP, agrees with the costs completely, calls for return on investment, and advocates the project (Umble et al., 2003). Furthermore, there should be a greatly revered, top level project champion in charge of the implementation endeavor (“Crucial success factors in an ERP makeover”, 1999; Krupp, 1998; Maxwell, 1999).

*Excellent project management:* To successfully implement an ERP system, it is required that there is an exceptional framework for managing the project (Umble et al., 2003). This encompasses an explicit recognition of goals, developing of an action plan as well as an asset plan, and diligent control of the project plan (Davis & Wilder, 1998; Laughlin, 1999; Sherrard, 1998). The project timetable should be demanding, but reachable and instill and uphold a feeling of imminence (Laughlin, 1999). Project goals need to be distinctly specified in addition to having an explicit scheme to aid the organization in evading the well-known “scope creep” which can expand the ERP cost.
estimation, compromise the project advancement, and convolute the implementation process (Davis & Wilder, 1998; Laughlin, 1999; Minahan, 1998).

When an ERP project is in a planning phase, the company must decide whether to implement a standardized ERP package and embrace the built-in functionality or to customize the software according to the company requirements (Holland & Light, 1999). It is imperative that the scale of the project is explicitly determined prior to the execution. Furthermore, the scope should recognize both the implementable modules and the business procedures that are concerned. If there is no need implement more than a basic version of an ERP solution with no notable modifications, the customization of the source code will be minimal. (Umble et al., 2003.) As a result, the intricacy of the project will be diminished and the implementation schedule is easier to follow (Sherrard, 1998).

Organizational change management: Many enterprises have existing organizational structure and procedures that are not in accordance with the structure, tools, and forms of data supplied by potential ERP solutions. No matter how adjustable the ERP system is, it still affects the strategy, organization, and culture of a company. (Umble et al., 2003.) Hence, main business procedures may need to be reengineered and/or new business procedures may need to be developed to uphold the organizational objectives in order to implement the ERP system (Jarrar et al., 2000; Minahan, 1998). Consequently, redesigned procedures have to be correspondingly adjusted in organizational control to maintain the performance of the reengineering endeavors. Most functional areas and several social practices within the organization are usually affected by this readjustment. As a result, organizational constructions, policies, procedures, and personnel may be considerably impacted. (Umble et al., 2003.)

Unfortunately, several top managers consider ERP only as a piece of software and the implementation process mainly as a technological challenge. They should come to understand that an ERP solution may substantially alter the operational means of the organization. This is seen as one of the problems when dealing with current ERP software. (Davenport, 1998; Umble et al., 2003.) Enhancing the business processes should be the eventual objective, not implementing a piece of software (Umble et al., 2003). Instead of having the IT department drive and direct the implementation process, it should be motivated by business and directed by business necessities (Chew et al., 1991; “Crucial success factors in an ERP makeover”, 1999; Minahan, 1998).

The implementation of an ERP system may alter corporate culture in a thorough way. Personnel should be fully aware of and ready for the immediate transformation in order to avoid denial, opposition, and turmoil caused by an unsuccessful implementation. If the organization employs appropriate transformation practices, it should be able to adopt the possibilities supplied by the new ERP software. Moreover, ERP enables the availability of larger amount of information and the possibility to have more improvements than originally seemed feasible. (Umble et al., 2003.) It is required that the company is resilient enough so that it can fully utilize these possibilities (“Crucial success factors in an ERP makeover”, 1999; Sherrard, 1998).

A great implementation team: Teams implementing ERP ought to consist of top-quality people who are skilled, productive, adaptable, and have a good reputation (Umble et al., 2003). These people should be empowered to make crucial decisions (“Crucial success factors in an ERP makeover”, 1999; Davis & Wilder, 1998; Laughlin, 1999; Minahan, 1998; Sherrard, 1998). There should be continuous information exchange between the management and the team, and the team should be able to make quick decisions
The team implementing the software has a significant role in creating the initial elaborate project scheme or overall timetable for the whole project, appointing obligations for several operations, and setting deadlines. In addition, the team ensures that there is no lack of resources. (Umble et al., 2003.)

**Data accuracy:** Data accuracy is an imperative characteristic of correctly operating ERP software. Since ERP is an integrated system, inputting a wrong kind of data can have a domino impact on the whole company. (Umble et al., 2003.) In order to avoid this, the significance of data accuracy and appropriate data input directives should have a high priority in an ERP implementation process (Steadman, 1999; Stein, 1999). In addition, it is imperative that all the staff in a company utilize the ERP software, not avoid it. The organization has to clearly show to the employees that it is dedicated to employing the new system, will completely shift to the new software, and will disallow further use of the legacy system. In order to strengthen this dedication, every old and unofficial system needs to be disposed of. (Umble et al., 2003.) If concurrent systems are kept on using in the organization, some employees will continue using the out-of-date systems (Hutchins, 1998).

**Extensive education and training:** Arguably, the most extensively identified critical success factor is education/training due to the pertinence of user comprehension and buy-in. A critical mass of expertise is needed by an ERP implementation in order to make it possible for the people to resolve complexities within the framework of the software. (Umble et al., 2003.) If the workers do not comprehend the functionality of a system, they will come up with their own procedures utilizing those parts of the system they are able to deal with (“Crucial success factors in an ERP makeover”, 1999; Hutchins, 1998; Laughlin, 1999; Ptak & Schragenheim, 2000; Sherrard, 1998).

End users must use ERP appropriately so that they can fully benefit from the software. In order to successfully train the people to use the system, the education process should start as soon as possible, preferably plenty of time before the start of the implementation. Often top management tends to drastically underestimate both the amount of education and training and the related costs needed to implement an ERP system successfully. Executives must demonstrate that they are entirely committed to provide sufficient amount of money on education as well as end user training and include it in the ERP cost estimate. (Umble et al., 2003.) Some have proposed that allocating 10-15% of the complete ERP implementation cost estimate for training/education will improve the odds of the organization by up to 80% to successfully implement the system (McCaskey & Okrent, 1999; Volwer, 1999).

Many times it is taken for granted that personnel can exploit the new system cogently only with their education and training, whereas the actual learning procedure takes place when the users use the system normally in practice. Hence, a certain person (preferably the project leader) should be appointed to maintain continuing contact with every system user and keep track of the use of and complexities with the new system. Training is also needed after the implementation process. (Umble et al., 2003.) Periodic meetings should be arranged in order for the system users to recognize issues with the software and invite them to share experiences gained from the use of the system (Krupp, 1998).

**Focused performance measures:** A delicate construction of performance measures to evaluate the effects of the new system is needed. These measures should be able to indicate how well the system performs. It must be taken into account when designing the measures that they stimulate desirable actions by every function and person. The
measures could encompass features like on time deliveries, sales margin, customer order-to-ship time, inventory turnovers, and dealer performance. (Umble et al., 2003.)

Assessment measures have to be incorporated into the project straight from the start. If there is no link between the implementation and the compensation, the project will not succeed. For instance, if every executive will get his or her bonus next year even though the system is not yet functional, a successful implementation is less probable. It is mandatory for executives, dealers, the implementation team, and the users to have a common, explicit comprehension of the objective. (Umble et al., 2003.)

If some individual has problems trying to achieve a previously set goal, he or she should either accept the offered help or be substituted. When previously set objectives are met, incentives ought to be distributed in a really apparent way. The project needs to be carefully observed until the implementation process is fulfilled. (Umble et al., 2003.)

Following the implementation, the system has to be observed and evaluated (Hutchins, 1998).

It is usually expected by management and other personnel that performance will start to improve straight from the moment the ERP software becomes functional. However, due to the intricate and challenging nature of the new system, companies have to be ready for the possibility that the productivity will decrease at first. As soon as the users begin to get acquainted with the new system, the productivity will improve. (Umble et al., 2003.) Therefore, it is important to distinctly bring forth the expectations regarding the performance with respect to time frames (Langenwalter, 2000; Oden et al., 1993).

Multi-site issues: There are special concerns with respect to multi-site implementations. The success of the ERP implementation may depend greatly on the ways these issues are dealt with. The extent of the autonomy of a single site can be a significant concern which depends on two factors: (1) the extent of procedure and deliverable integrity across the remote locations, and (2) the requirement or preference for centrally managed information, system specification, and usage. An ERP implementation may include a goal to achieve more centralized management by implementing unified procedures. It is also possible to implement the system in order to give the remote sites tools to specify their methods to their exquisite needs. (Umble et al., 2003.)

Also the culture of the remote site affects the implementation. Company standardization versus local optimization is the essential concern. Along with company standardization come simplified interfaces among diverse areas of the organization, capabilities to shift personnel and articles between different sites with only little interruption, and facilitation in distributing data through the whole company. It is also possible that local optimization efforts induce cost reduction by introducing more potent and efficient operations. (Umble et al., 2003.)

Executing the cutover plan is probably the most challenging matter regarding multi-site implementations. The company has to adopt one of the following implementation approaches: either the implementation is put in motion at the same time in every facility or a phased method by module, by production line, or by plant with a pilot implementation effort at one facility is employed. Having to invest a great amount of money in software, hardware, and the implementation team, the enterprise may prefer a simultaneous implementation in order to refund its expenses as swiftly as feasible. (Umble et al., 2003.)
Usually, a phased approach is seen as better when it comes to multi-site implementations. One of the reasons for this is the success or failure experienced in the initial implementation endeavor that commonly predicts the end result of the whole project. Hence, a pilot site with a great potential should be selected so that the success rate becomes higher. (Umble et al., 2003.) The experiences learned from the first phased implementation can mitigate the problems at later sites (Allen, 1997).

2.3 Social cohesion of a project group

It is essential for project groups implementing IS to have strong cohesion because the implementation of IS is a social construction procedure during which participants negotiate, accomplish, and develop a common comprehension through interaction, sense making, and collective learning (Boland & Tenkasi, 1995; Newell et al., 2004; Sahay & Robay, 1996). Cohesion means the tendency of a team to stay together and united when reaching for common goals and objectives (Carron, 1982; Carron et al., 2002; Langfred, 1998, 2000). According to the social capital theory, a direct source of group cohesion is the willingness of group members to subordinate their individual desires to group goals. Even though there are many participants involved in the implementation of IS, research has focused on user participation due to the fact that users are familiar with the organizational needs and determine system acceptance. (Wang et al., 2006.)

A shared comprehension between end users and other team members is increased by a willingness to take part. As a result of this increased collective comprehension, there is a larger pool of possibly beneficial mutual adjustments. Common comprehension and adjustment enable the possibility to settle disagreements faster and preempt the accumulation of grievances and grudges (Nelson, 1989), and consequently, improve the tendency of a group to stay together and united when reaching common goals and objectives. Cohesive teams have a higher chance to accomplish objectives because they are more familiar with their group members and have motivation to successfully carry out tasks. (Wang et al., 2006.)

According to Thompson et al. (1998), teams with high cohesion have a better chance to reach their goals and objectives. Hunton et al. (2001) observed that the cohesion of a group correlates positively with performance indicators. Typically, groups with high cohesion have a better possibility to accomplish common goals and objectives than low cohesion teams (Carron, 1982). A group with good cohesion has a strengthened group identity and is better committed to the common task (Goodman et al., 1987; Thompson et al., 1998).

However, there is no adequate certainty of how the cohesion of a group affects its performance (Wang et al., 2006). There may not be a linear correlation between group cohesion and outcome, and therefore, the outcome is not an adequate indicator of group cohesion (Hunton & Gibson, 1998; Klein & Mulvey, 1995). Collective user participation in comparison to individual user participation resulted in more advantages during the implementation of accounting IS (Hunton & Gibson, 1998, 1999). According to Aladwani et al. (2000), group participation affects both positively and directly the performance of groups implementing IS. Thompson et al. (1998) highlight that the amount of cohesion of a work group may impact on the sustainability of advantages gained from collective participation.
3. Research Method

A design science research approach was applied in this study. Design science originates from engineering and the sciences of the artificial (Simon, 1996). Ultimately, the paradigm is about problem-solving (Hevner et al., 2004). It aims at developing innovations that specify the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and the utilization of IS can be successfully achieved (Denning, 1997; Tsichritzis, 1997). These kinds of artifacts follow natural laws and behavior theories, and their creation resorts to existing kernel theories that are adapted, tested, altered, and expanded through the knowledge, creativeness, intuition, and problem-solving aptitudes of the research worker (Markus et al., 2002; Walls et al., 1992).

Design has a significant meaning in the IS literature (Glass, 1999; Winograd, 1996, 1998). It is suggested that the relevance of IS research goes hand in hand with its feasibility in design and proposed that the results of empirical IS research ought to be “implementable,...synthesize an existing body of research,...[or] stimulate critical thinking” among the practitioners in the field of IS (Benbasat & Zmud, 1999, p. 5). However, it is an intricate process to design useful artifacts because of the lack of creative advances in domain areas where there is a shortage of theory (Hevner et al., 2004). Increasing technical knowledge enables the possibility to apply IT to new application areas where IT support did not seem feasible before (Markus et al., 2002). The resulting IT artifacts expand the area of human problem solving and the capabilities of organizations by providing both computational and intellectual tools. These artifacts’ development and use will be followed by theories about their application and effect. (Hevner et al., 2004.)

Complexity, artificialness, and intentional design are qualities of IS and the organizations supported by IS (Hevner et al., 2004). These systems encompass people, structures, technologies, and work systems (Alter, 2003; Bunge, 1985; Simon, 1996). Design is often in question in general (Boland, 2002) when it comes to the work performed by IS practitioners and managers. In this context, design means organizing resources purposefully to achieve an objective. (Hevner et al., 2004.) The fundamental alignments between business and IT strategies and between organizational and IS infrastructures are depicted in Figure 4 (Henderson & Venkatraman, 1993). In order to efficiently transfer strategy into infrastructure, comprehensive design activity is called for on both sides of the figure: organizational design for the purpose of creating an efficient organizational infrastructure and IS design for the purpose of creating an efficient information system infrastructure (Hevner et al., 2004).

These design activities are mutually dependent and essential to the IS discipline. Thus, it is imperative that IS research discusses the interaction among business strategy, IT strategy, organizational infrastructure, and IS infrastructure. (Hevner et al., 2004.) The role of this interaction is growing larger as information technologies enable the possibility to have business strategy and organizational infrastructure (Kalakota & Robinson, 2001; Orlikowski & Barley, 2001). The strategies that direct organizations are considerably based on existing and emergent IT capabilities (Hevner et al., 2004). State of the art IS make it feasible for organizations to undertake new forms and new
Design science as an IS research paradigm has to be divided into two categories in order to truly understand and value it (Hevner et al., 2004). Design is a procedure (series of actions) as well as a product (artifact): both a verb and a noun (Walls et al., 1992). In the world, the procedures represent actions and the artifacts represent something that can be sensed. A problem-solving paradigm that constantly changes a point of view between design processes and designed artifacts for the same difficult problem is endorsed by the Platonic view of design. (Hevner et al., 2004.)

The design procedure consists of expert actions that output an innovative article, that is, the design artifact. Feedback information and a better comprehension of the problem are provided by evaluating the artifact. This helps to enhance the quality of the article as well as the design procedure. (Hevner et al., 2004.) Prior to creating the ultimate design artifact, the build-and-evaluate loop is usually repeated many times (Markus et al., 2002). While using this creation procedure, the design science researcher has to take into account that the design procedure, as well as the design artifact, evolve as part of the research (Hevner et al., 2004). Hevner et al. (2004) have defined seven guidelines that should be followed during the research.

According to March and Smith (1995), design science research in IS has generated two design procedures and four design artifacts. Build and evaluate are the two procedures and constructs, models, methods, and instantiations are the four artifacts. In order to deal with unresolved problems, deliberate artifacts are developed. The artifacts are evaluated based on their applicability to solve those problems. (Hevner et al., 2004.) Problems and solutions are specified and reported using a language that constructs provide (Schön, 1983). Constructs are exploited by models to illustrate a real world circumstance: the design problem and its resolution space (Simon, 1996).

With the help of models, problems and resolutions are easier to understand. Moreover, models often stand for the link between problem and resolution components enabling the possibility to observe the impacts of design decisions and variations in the real world. The role of methods is to determine procedures. They improve problem-solving and assist in finding the correct solution. Methods can be, for instance, formal...
mathematical algorithms that specify the search procedure explicitly or informal, written depiction of “ultimate practice” approaches, or some kind of a composition. Instantiations are responsible for demonstrating that the implementation of constructs, models, or methods is feasible in an operational system. They provide the possibility to tangibly appraise the applicability of an artifact to its destined purpose. In addition, they help researchers to widen their knowledge about the real world, to understand how the artifact impacts it, and to see how users adapt it. (Hevner et al., 2004.)

In Figure 5, a conceptual framework for comprehending, implementing, and evaluating IS research conflating behavioral science and design science paradigms is demonstrated. The paradigms are located and compared using the framework. (Hevner et al., 2004.)

![Figure 5. IS Research Framework (Hevner et al., 2004).](image)

The phenomenon of interest is situated in the problem space determined by the environment (Hevner et al., 2004; Simon, 1996). In IS research, the environment encompasses people, (business) organizations, and the existing or contemplated technologies of these organizations (Silver et al., 1995). People within the organization observe business necessities specified by the goals, tasks, problems, and opportunities that are in the environment. Such an observation is based on the position, capabilities, and characteristics of a person within the organization. The assessment and evaluation of business necessities is conducted taking into account the organizational strategies, structure, culture, and existing business procedures. The necessities are with respect to the existing technology infrastructure, applications, communications architecture, and development capabilities. Within the context of these factors together, the business necessity or “issue” made by the research worker is specified. The relevance of research is achieved by harnessing research activities to address business necessities. (Hevner et al., 2004.)

There are two complementary stages in IS research: Behavioral science considers research with respect to developing and justifying theories that explicate or anticipate phenomena connected to the recognized business necessity. Design science considers
research with respect to building and evaluating artifacts designed to fulfill the recognized business necessity. Truth is the objective of behavioral science research: Behavioral science theories are principled explanations of phenomena. These theories are approximations and are based on many presumptions and prerequisites. They are appraised only after evaluation against truthful norms or declarative power and the arguments they make are substantiated in reality. (Hevner et al., 2004.)

Applicability is the objective of design science research. Truth and applicability cannot be separated. Design is guided by truth and theory is guided by applicability. Applicability can be found in an artifact because of some unfound truth. If a theory is advanced enough, its truth can be included in design. In each case, the assessment of research through the justification/evaluation actions can lead to finding out deficiencies in the theory or artifact and the necessity of refinement and reassessment. Generally, the procedure of refinement and reassessment is seen as a future research topic. (Hevner et al., 2004.)

The knowledge base contains the ingredients for achieving IS research. Foundations and methodologies comprise the knowledge base. When it comes to the development/building stage of a research study, earlier IS research and outcomes from reference disciplines supply foundational theories, frameworks, instruments, constructs, models, methods, and instantiations. Methodologies supply instructions exploited in the justification/evaluation stage. With a proper application of existing foundations and methodologies, rigor is accomplished. Methods applied in behavioral science are usually data collection and empirical analysis techniques. In design science, the evaluation of the quality and efficiency of an artifact is mainly done with computational and mathematical methodologies. In addition, the use of empirical techniques is also possible. (Hevner et al., 2004.)

In IS research, the appraisal of the inputs of behavioral science and design science is done when they are applied to the business necessity in a proper environment and when they contribute to the knowledge base for further research and praxis. Even though a theory is justified, if it is not beneficial for the environment, it is as useless as an artifact resolving a problem that does not exist. (Hevner et al., 2004.)

In design science research, it must be noted that routine design or system development differs from design research. The character of problems and solutions make the distinction. In routine design, existing knowledge is applied to organizational problems, such as building an accounting or publishing information system employing ultimate practice artifacts (constructs, models, methods, and instantiations that exist in the knowledge base). On the other hand, in design science, significant inexplicable problems are dealt with using unique or innovative ways or resolved problems are dealt with using more powerful ways. The explicit recognition of an addition to the archival knowledge base of foundations and methodologies is the main distinction between routine design and design research. (Hevner et al., 2004.)

When a discipline is in its initial stage or there are essential variations in the environment, every new artifact built for that discipline or environment is a trial that presents a question to nature (Newell & Simon, 1976). Existing knowledge is applied whenever it is possible but many times there is no earlier knowledge (Markus et al., 2002). The nature of such research endeavors counts on resorting to creativity and trial-and-error search. After the codification of design science research outcomes in the knowledge base, they get the best practice status. As a result, the routine application of the knowledge base to identified problems is system development. (Hevner et al., 2004.)
Design actions are a prevalent part of numerous crafts (Hevner et al., 2004). Especially, in the field of engineering, a remarkable amount of literature has been published (Dym, 1994; Pahl & Beitz, 1996; Petroski, 1996). Numerous design actions have been the topics of a significant amount of study and formalizations, and are becoming normal or routine in the context of IS discipline (Hevner et al., 2004). In IS, design science deals with so-called wicked problems (Brooks, 1987, 1996; Rittel & Webber, 1984). The nature of these problems is the following:

- requirements and restrictions are defined by unclear environmental contexts,
- the interplay between subcomponents of the problem and its resolution is intricate,
- they have innate flexibility to alter both design procedures and design artifacts,
- the production of powerful resolutions relies greatly upon human cognitive aptitudes (e.g., creativity) and human social aptitudes (e.g., teamwork), and
- the production of powerful resolutions relies greatly upon human social aptitudes (e.g., teamwork) (Hevner et al., 2004).

Hence, a theory of design in IS is in a perpetual state of changing out of necessity (Kuhn, 1996; Simon, 1996). Innovative and creative design science procedures enable technological advances. Such advances are considered at least arbitrary if not unpredictable (Brooks, 1987) taking into account business necessities and already existing knowledge. Database management systems, high-level languages, personal computers, software components, the Internet, and the World Wide Web are some of the innovations that have affected in a crucial and unplanned way on the comprehension, design, building, and management of IS. (Hevner et al., 2004.)
4. Case Cimson Koulutuspalvelut Oy

In this section, the history and background of Cimson Koulutuspalvelut Oy is discussed. In addition, the implementation process and the evaluation of the ERP system are addressed.

4.1 Company

Cimson Oy was established in 1990 in Jyväskylä (Cimson, 2013). The company has been providing training and consulting services as its main activity since 1992. Cimson Koulutuspalvelut Oy was founded in 2008 to continue offering these training and consulting services as a separate branch of the parent company. The customers of Cimson are people, companies, and communities. Furthermore, the company produces training and teaching material.

Cimson has decentralized its activities all over Finland. The company has regional offices in different parts of Finland in order to get a better understanding of the local activities and offer more suitable services. The regional offices are situated in Helsinki, Jyväskylä, Lahti, Oulu, Tampere, and Turku. Cimson organizes training services in close cooperation with regional Centres for Economic Development, Transport and the Environment; Employment and Economic Development Offices; Labour Service Centres; companies; and learning institutions.

There are around 50-100 people working at Cimson in different kinds of work, cooperation, training, and support positions. Annually, the amount of personnel varies regionally depending on the number of customer relationships. The business purpose of the company is to help people to get employed and succeed at work and entrepreneurship.

The previous system of Cimson that was used to manage human and material resources related to courses relied greatly on the communication among the staff members. As a result, the workers of the company got to effectively exercise their teamwork skills. The social cohesion of the staff of Cimson was supported by the active collaboration that was required to fulfill the daily tasks of the organization. The social cohesion was also supported by having common activities outside work because the company realized the benefit of good cooperation skills and improved trust among the staff.

4.2 Implementation of the ERP system

The implementation part of the ERP system was executed between February, 2012 and January, 2013. The kick-off meeting of the project was held on the 16th of February, 2012. This was also the first time for the researcher to meet the customer. The researcher had started to get familiar with the project material a few days earlier in order to better understand the project and to present valid questions at the first session. Everyone was in good spirits at the meeting and looking forward to the future as the project would proceed. The ERP system was almost completely planned, and now it was time to put the plan in motion.
Figure 6 illustrates the timeline of the implementation in months. Only the most important parts of the development process were incorporated into the timeline. The timeline does not present every important detail of these parts. It is only supposed to provide a rough description about the different phases of the project. Furthermore, the timeline is aligned with this chapter in order to improve understandability.

**Figure 6.** The implementation timeline of the ERP system.

As Figure 6 shows, there were seven primary phases during the project. The design of the layout was the first clear phase and the finish of the implementation was naturally the last phase of the project. The development of the Schedule section marked the midpoint of the implementation.

### 4.2.1 Layout

At first, the layout of the system had to be designed. The customer had a clear vision of what it should look like. They wanted the layout to be similar to the website of their own company. The front page of the website of Cimson is illustrated in Figure 7.

**Figure 7.** The front page of the website of Cimson².

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² [http://www.cimson.fi/](http://www.cimson.fi/)
The layout was designed using graphics editor called GIMP. The graphical elements were created one by one in separate layers and then they were positioned correctly. The layout was assessed as a whole and a screenshot was sent to the customer in order to get their opinion. The layout was not completely satisfactory. It was missing some small details: the straight corners were replaced with round corners and the selected tab had to be highlighted in order to help navigate the page. The customer provided some official color codes that were incorporated into the design. The small adjustments were made and a screenshot of the layout was sent to the customer again. This time, the composition was approved. Figure 8 presents the approved layout.

![Figure 8. The layout of the ERP system.](image)

As Figure 8 demonstrates, there is a big red banner on top of the page with the logo and the name of the company on it. Below the banner, there is the menu bar. Unselected tabs have a dark background and the selected tab has a light grey background to visualize it better. In the middle of the layout, there is the main content area. All the main information is presented in this area, so it is basically the core of the layout. The small grey bar below the menu bar was added to separate the menu from the main content area more clearly.

In Figure 8, the white bar on bottom of the layout is reserved mainly for a copyright statement. The background of the page is dark grey and its idea is to give a sense of calmness as the opposite of the white main content area. As a whole, the view is simple and clear. Since the system was only for the inside use of the company, there was no need to achieve a more complicated and graphical result.

### 4.2.2 Main structure

On the 24th of February, the customer confirmed the continuation of the project. This was foreseen because everything went so well right from the kick-off meeting. As the project continued, it was time to get familiar with what the application should contain. The number of different main sections of the system was a bit vague at first, so it was difficult not knowing how much the layout had to be altered during the implementation. In the end, the number of different tabs ended up being seven. A mind map and design documents describing the ERP system helped during the process of deciding how many separate main sections the system had to have.

The next project meeting was on the 14th of March. It was time to discuss the progress and demonstrate the done work by providing a brief presentation of the functionality of
the ERP application under development. Since the system was not yet on a server, it had to be demonstrated on a local computer. This caused a little bit trouble because all the correct versions of different applications had to be installed in order to get the system working properly. After resolving all the complications, the ready-made functionality of the system was presented. Even though there was not much to present yet, the customer was satisfied and the atmosphere at the meeting was excited. The project was heading to the right direction.

It was time to upload the application under development to a server in order to make its demonstration easier and to enable the possibility for the customer to test the software anytime from anywhere. It took quite a while to get the system working properly on the server. The server environment was Linux-based and the ERP system was being implemented in the C# language developed by Microsoft for .NET programming. Since Linux is a quite different environment compared to Microsoft Windows, the Windows-based application did not work at all on the Linux-based server. The same exact versions of the needed applications were installed on the computer that the system was being developed as the server had. Despite this, the system would not work on the server. The server settings were modified many times but there was no luck.

It was time to try a Windows-based server. Everything worked well almost straight from the beginning. Only the server software had to be updated. The Linux-based server environment was considered more stable than the Windows-based server but there was no other option due to the unknown problems. The server environment was controlled by a third party, so it was impossible to take a closer look at the problems at that end. However, the ERP application worked smoothly on the Windows-based server, so it was time to move on.

A project meeting was held on the 23rd of March. The main topic of the meeting was to clarify the contents of the different sections of the system. The meeting was important especially because the researcher was uncertain to which direction the application should be developed. If the researcher had developed the application on his own without any clear knowledge of the wishes of the customer, he could have done unnecessary work if the customer did not find the result satisfactory. It was a little frustrating not knowing how to continue the implementation but luckily the meeting helped to clarify the most important obscurities regarding the project at that time.

A database was used to save all the user entered data of the ERP software. It was time to modify this database. Even though the database was already designed, the design had to be modified in order to make the database to meet the current requirements. The structure of the database was altered numerous times during the implementation process. Since no one had a definite technical vision of the final version of the system, this was only natural. The development process was flexible, so it did not take a lot of effort to make changes wherever and whenever they were called for. One could even say that the process had some similarities with the agile software development methods.

The use of the system relied heavily on forms. The design of the different forms took a lot of time. The researcher would make a form and then its layout, understandability, and usability were evaluated by the customer. For example, the customer wanted some words to be rephrased to meet their quality criteria or to add more information on a form to enhance understandability. The forms varied in different sections of the system.

All the forms throughout the browser-based ERP system had the same basic design but they were customized in order to meet the requirements of the different sections of the
application. Besides the forms, every part of the application had the same basic design in order to improve understandability and integrity. The graphical design was largely based on the vision of the researcher but it was complemented with the ideas of the customer. This kind of work distribution was productive.

The understandability of every form was emphasized. For example, if a form had to be filled in, there would be a separate guidance text in addition to the name of an input field. The guidance text would pop up unobtrusively as soon as the user moved the mouse cursor over the fillable field. Some parts of the forms were automatically filled in for the user in order to expedite the use of the software. For instance, if the user’s regional office was set to Oulu in his or her user settings, the default regional office of a course was automatically set to Oulu when the user was creating a new course (see Fig. 9). Furthermore, numerous kinds of input validation mechanisms were programmed to prevent any kind of misuse of the system. Besides these fill in forms, there were also forms that were already filled in consisting of the information that had already been given.

Figure 9. The form used to create a new course.

Figure 9 presents an example about the process of creating a new course. As the picture proposes, the cursor is over the field where the user is supposed to input the abbreviation of the course name. Since the cursor is over the field, the guidance text has popped up in order to give the user more information about the proper use of the field. With the help of the guidance text, it was easier for the user to input the correct information without having to contemplate so much what kind of text the input field should contain. Some input fields of the application contained only a simple guidance text due to the simplicity and unambiguousness of the title of the input field.

As Figure 9 demonstrates, there are red stars after the input fields indicating that the user must provide the input field at least with some information. The obligatory fields had to be incorporated into the software so that there were fewer opportunities to abuse the system. The fields ensured that at least the basic information was provided. They were utilized in the system to a great extent. The last field with a grey background in Figure 9 shows the timespan of the two date fields above in a number of days. The course timespan was automatically calculated as soon as the dates were selected by the user. The small calendar icons after the date fields (see Fig. 9) were used to select the appropriate time period for a course.
4.2.3 Calendar

At the time of the research, the resource management at Cimson was carried out by using Excel-based calendar sheets. The idea was to make a similar-looking calendar view on the ERP software. This was probably the most difficult part of the system to implement. This was partly because the researcher did not have a clear enough picture how dynamic the calendar should be, but mainly because the researcher did not know at the time how well the technical environment would support this kind of element. In order to manage the development of the component, the process had to be carried out carefully.

At first, it seemed that the ASP.NET Calendar control was the correct component for developing the needed calendar view. The ASP.NET Calendar control is presented in Figure 10. However, as the extensibility of the component was examined more closely, it became clear that this component was not the solution for the problem. The customer required, for instance, that the calendar should have spacious day cells that could contain a good amount of information. Since the Calendar component was nowhere near the functionality the customer wanted, the situation became more complicated. Some kind of new approach had to be tried.

Figure 10. The ASP.NET Calendar control.

As Figure 10 shows, the calendar seems quite limited on the outside. The appearance of the component pretty much reveals how much extensibility this calendar offers. The calendar could be handy if it was used only as a calendar with no other information in the day cells. Since the calendar was a ready built component by Microsoft, the basic functionality was difficult to extend because of the vendor restrictions. After the customer turned down this calendar option, the situation became problematic because this component seemed to be the only feasible way to implement the calendar view at that time.

A few viable calendar options were found in the Internet but the best ones were commercial. Probably the most interesting example of these calendars was JavaScript-based DHTMLXScheduler (Scheduler) by DHTMLX\(^3\). The calendar is presented in Figure 11. This calendar option was presented to the customer. Since the customer found the view of the calendar satisfactory, the idea was to incorporate this calendar into the ERP application even though it was not free of charge. However, the structure of the database of Scheduler differed so much from the database of the ERP system that Scheduler was discarded.

\(^3\) http://dhtmlx.com/
The calendar in Figure 11 gives a good demonstration of what the view can look like. For example, if an event lasts more than one day, the event bar is stretched over all the days. In the Excel calendar, the structure of the course markings was similar. The layout of the Excel calendar is presented in Figure 12. Since the customer wanted a calendar with a month view, the Month view of Scheduler was under examination. Once the customer saw this calendar and found the appearance desirable, the researcher knew exactly what kind of result he should look for. One part of the calendar problem was solved. The next thing to do was to try to come up with a feasible technical solution.

There were also a few free calendar components but the database architecture of these components did not fit into the technical environment well enough either, so also they were discarded. The incompatibility with the structure of the database of the ERP software was the problem with all the commercial calendars also besides the price. However, the search for a better calendar component gave new ideas on how to resolve the calendar problem. The found calendars showed what kind of solutions could be developed even though they were meant mainly for a different kind of technical environment. Every available ready-made calendar had such database architecture that its incorporation into the ERP system would have demanded a fundamental revision of the structure of the main software. This option was not considered.

The only option left for the researcher was to build the calendar component by himself. The free JavaScript library, jQuery, was used to develop the calendar. The calendar was programmed in jQuery because it was well supported by different browsers. It took

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Figure 11. The JavaScript-based Scheduler

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Figure 12. The structure of the Excel-based calendar.

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4 http://dhtmlx.com/docs/products/dhtmlxScheduler/sample_basic.shtml
quite a while to make the calendar look exactly like the one the customer had in mind. There was a free jQuery code sample in the Internet that was used as a base. Even though the base was ready, the modification of the code took a while.

After the main functionality of the jQuery calendar had been implemented, it was noticed that jQuery did not sit well enough with the Microsoft-based C# environment. Especially, querying the information from the database to a jQuery-based calendar did not work as expected. As a result, it had to be concluded once again that there was still no solution to the calendar problem. The situation called for some innovative thinking.

The possibility of building the calendar in C# was considered next. A calendar developed in C# would be a perfect solution only if it was not too difficult to implement. At first, the basic functionality was developed. The code of the jQuery calendar was exploited. The jQuery code provided the guidelines for developing the basic functionality for the C# calendar. After the basic functionality had been programmed, it was time to figure out how the data could be fluently and efficiently fetched from the database.

The purpose of the calendar component was to show day-specific bookings. The calendar was the core element of the whole ERP system, so it had to be carefully developed. The calendar had a month view and every time a month was changed, the month-specific data was queried from the database and the calendar view was rendered containing the booking information. The default month of the calendar was the current month. The final version of the calendar programmed in C# is introduced in Figure 13.

![Calendar View](image-url)

**Figure 13.** The final version of the calendar programmed in C#.

The calendar view in Figure 13 is from the Courses section of the ERP system. It shows all the courses during the selected month. It was also feasible to view one course at a time. This came in handy when there were a lot of different courses during a month and the view became too unclear. The current date was visible on top of the calendar. Furthermore, the name of the calendar month was presented separately. As the day cell of the 20th of February shows, the current date is bolded in its calendar cell (see Fig.
The calendar could be navigated using the three buttons in the top right corner. The left arrow button showed a previous month and the right arrow button showed a next month. In addition, there was a third button that simply changed the view back to the current month.

The calendar view was from Monday to Friday (see Fig. 13) because these were the most essential days the customer wanted to incorporate into the calendar. If there had been also Saturday and Sunday, the readability of the view would have suffered due to smaller calendar day cells. As Figure 13 suggests, there is more than one calendar color option. For example, if there were markings of five different courses in one day cell and all the course markings were in different color, the readability was better than with only one color option. The user got more information about a certain calendar marking by taking the mouse cursor over it. Furthermore, a new window containing all the information regarding the course was opened once the user clicked the marking. There were also many other menu options that helped the user to separate the courses from each other.

Designing and implementing the calendar element took quite a lot effort because it had to be thought so thoroughly. At times it seemed that there was no viable solution for the problem. Through trial and error the calendar component was built a bit by bit. Altogether, solving the calendar view problem took a few days and it was the most complex problem to resolve during the whole project as well as the most educational.

There was a project meeting on the 15th of August. It was not a regular project meeting because the people at the meeting consisted of the key figures of Cimson, including the chief executive officer. The ERP system was demonstrated and after the presentation, relevant questions and ideas were expressed. The feasible ideas were later incorporated into the software. Since the audience consisted of the end users, their ideas were greatly valued because they knew the best what kind of system they wanted to have.

The project was in the halfway point. Since the basic functionality of the calendar was ready, it was time to figure out how the booking data could be inserted into the database in a form that was easy to fetch. The form should be logical and readable if someone other than the researcher had to modify the data directly using a database management tool. For example, in some problem cases, a database administrator might have to alter the database because the ERP software provided only limited modification possibilities. As the application consisted of the different views showing the calendar markings queried from the database, the data was standardized as much as possible. It was made sure to a feasible extent that the data worked together fluently and efficiently in the different sections of the application.

Courses were the main section of the whole software. This part of the system was also under implementation the longest time. At first, the user added a course and then the course information was shown on the calendar view as long as the correct month was selected. Every course day was a separate item. For instance, if a course lasted for two weeks, there could be a different trainer, room, other resources, and textual description for every day. This kind of functionality demanded a lot of dynamicity because there could be so many different variations consisting of the entities that composed the overall content of a course day. When the implementation of the ERP software was started, the researcher was unaware that the software should be so dynamic because he was not familiar enough with the requirements of the customer.
4.2.4 Schedule section

During the development process, the researcher realized before long that the current version of the system would not meet the needs regarding flexibility: there was no possibility to have a course schedule that would consist of days containing different kinds of compositions of trainers, rooms, and other resources. As a result, the system had to be made more dynamic. Since the software was originally being built to provide only little dynamicity, it was a challenging task to rethink the architecture of the application because the current version did not take into account the possibility to have a multifaceted course schedule.

Some parts of the database were redesigned in order to support the required dynamicity. The database and source code were modified together so that it would be easier make them work together seamlessly. Increasing the dynamicity of the software was not an easy task. The researcher had to widen his concept of the system and considerably alter his mindset to achieve the new goals. Even though it was clear that the architecture had to be changed, it took some time for the researcher to align his thoughts with the new architecture.

In the application, every course had its own separate schedule that showed the detailed information about course days in a month view. The Excel-based schedule of Cimson presented the detailed information in a week view. Because the basic calendar view in the ERP system was month-based, it was a logical choice to make the separate schedule view to be month-based also. It was easier for the user to interpret the information when it was presented in the same format in every calendar of the system. The structure of the Excel-based schedule is illustrated in Figure 14 and the schedule view from the software is presented in Figure 15.

![Figure 14. The structure of the Excel-based schedule.](image-url)
As can be seen in Figure 14, the schedule of a course is in a week-based format. The name of a course is in the top left corner and the location text of a course is on top also. No Saturdays and Sundays were included in the schedule because the activities of Cimson happened mainly on business days. Every course day had its own cell. In the cell, there could be information regarding the topic and the trainer of the day. The cells with a blue background were web study days (see Fig. 14). The length of a course could vary greatly; it could be from few weeks to over a year.

![Figure 15. The schedule view from the application.](image)

As Figure 15 demonstrates, the schedule view of a course is in a month-based format. The name, the location, and the date of the course were also displayed in this view even though they are not to be seen in the figure. With the arrow buttons the user could navigate months like in the calendar in Figure 13. In addition, there was a button that changed the calendar month to the month when the course started and a button that changed the calendar month to the month when the course ended. These quick navigation buttons were useful especially when the course lasted more than a few months.

The course day cell displayed the textual description, the trainer, and the room. For example, in Figure 15, in the cell of the 18th of February, there is the description of the day, the name of the trainer, and the room where the activity takes place. The detailed information for a course day was set by clicking the link in the course day cell. If there was no trainer set for a course day, there was an exclamation mark before the abbreviation of the name of the course. Similarly, if there was no room set for a course day, there was an exclamation mark after the abbreviation of the name of the course. For instance, there is an exclamation mark before and after the abbreviation in the cell of the 20th of February (see Fig. 15). The exclamation marks provided the user valuable information rapidly.

Every trainer, room, and other resource was a separate entity in the system and each one of these entities had its own calendar view that showed all the bookings regarding different courses or other activities. Every time a trainer, a room, or other resource was
added to a course, a link was set between the entity and the course. Similarly, when an entity was first added and then removed from a course, the link between the entity and the course was destroyed. The schedule view could be printed out in order to help the distribution of the course information.

4.2.5 Reports section

After the course schedule entity was implemented, it was time to start developing the Reports section of the ERP system. The content of different reports was unclear to the researcher at first even though the customer had already defined the content. However, as the Reports section was being developed, the better the researcher got to understand what kind of content the separate report types should have. The customer wanted to have graphical data supporting the textual content of the reports wherever it was beneficial and feasible. The problem was that the researcher was not familiar with what kind of graphical possibilities the C# environment offers.

After doing a little research, the researcher found out that the ASP.NET Chart component could be the perfect tool for the job. In order to get a confirmation from the customer that the Chart control could be used, a quick example was composed and sent to the customer. The example presented some information in a graphical form. The customer found the example satisfactory, and the Chart component was put to use. Presenting the data also in a graphical form was seen beneficial especially from the point of view of the management. By just taking a quick glance at the chart, the big picture was easier to understand and to improve the planning of the forthcoming activities of the company. A piece of a report is represented in Figure 16.

![Figure 16. A piece of a report with a bar chart illustrating the number of courses.](image)

The search terms have been excluded from Figure 16. They were used to define what kind of reports the software should display. For example, it was feasible to select all the regional offices at once and check how many courses had been held, for instance, between August, 2012 and February, 2013. Furthermore, there were also some other search terms that could narrow down the search results. The more detailed information the system was able to provide, the better the company could take that information into account when optimizing the organizational functions. As with the course schedules, the reports could also be printed out so that the sharing of the data became more convenient.

4.2.6 Access rights

The Reports section was the second-to-last portion of the ERP system to implement. Finally, it was time to modify the ERP application in a way that the level of the user
was considered when the user logged into the software. So far every user of the system had had full access rights. The purpose of the openness of the software was to encourage the employees of Cimson to use the application as much as feasible in order to find possible bugs and to enhance the implementation process.

Since the ERP application was extensive and sophisticated software, it required a lot of testing. Incorporating the users into the development process as testers straight from the beginning was a great way for them to get comfortable with the system as well as to make them see the implementation process more from the point of view of the researcher and give more pertinent feedback. The testing was done by simulating real use by entering made-up data to the system and seeing how the system responded. The researcher collected feedback from the users several times during the implementation and modified the ERP software according to this feedback, for example, by fixing bugs or changing the text of a button.

Since everyone had full access rights to the system at the time, it was time to add some restrictions to the lower level users. The rights of the highest level users remained intact. Modifying the access rights was a complicated task because there were so many little things that had to be taken into account. For instance, if a user with inadequate access rights was trying to access some higher level information, the user was automatically logged out of the system. This forced logout was added to decrease the pleasantness of misusing the system. The setting of the rights was a time-consuming process but it had to be done as thoroughly and cautiously as possible so that unwanted situations could be effectively avoided. Restricting the access rights depending on the user level was the final, bigger portion of the ERP system to implement. The project was now finished except for some minor adjustment efforts.

As the application was made only for the inside use of Cimson, security was a great concern. Straight from the beginning of the implementation, the matters regarding security were given close attention. In every part of the system, security was emphasized. Since the security issues were considered in every part of the development of the application, the software contained security mechanisms in many different layers. The purpose of these mechanisms was to diminish the possibility to abuse the ERP system. It was recognized that the user himself or herself would be the most prominent security risk.

### 4.2.7 Communication

Information exchange during the project was carried out in many different ways. Face-to-face meetings were the main form of communication. There were around ten formal and five informal face-to-face meetings during the whole implementation project. The formal meetings were mainly in the morning on the premises of Cimson and lasted about three hours. An outline of the typical meeting room setup is illustrated in Figure 17.

During the face-to-face meetings, the researcher would demonstrate the latest development efforts and then the people present at the meeting discussed the next steps of the project. Besides the fact that people were always in good spirits at the meetings, at every meeting there were refreshments that further supported the atmosphere. The great atmosphere encouraged the participants to have better and more productive discussions. As a result, the development process became more rapid and efficient.
The informal meetings had a big role in addition to the formal meetings. An informal meeting differed from a formal meeting in that there was no official agenda or meeting minutes. The location of informal meetings varied greatly. The informal meetings improved the feeling of social cohesion and made people see their co-workers also as friends. As a result, the researcher wanted to put more effort into the software development so that these friends’ necessities would also be met regarding the application. For example, the researcher would try to find ways to improve the original requirement of the customer. Then he would present his addition to the original requirement and make the needed changes according to the feedback from the customer.

The communication was executed also by sending emails and having phone conversations (including text messages). In addition, one Skype discussion was carried out. Dropbox was also used for the information exchange as a document warehouse. For example, the meeting minutes were shared mainly using Dropbox. The best method of communication was chosen based on the situation at that time. For example, when it was impossible to have a meeting with key figures at present, email was used instead. The key figures of the project team consisted of the researcher, the project manager, and the regional manager of Cimson. However, as the meetings were the most important form of communication, they were held as often as possible. The other means of information exchange were primarily supporting the matters addressed at the meetings. The ways of communication are depicted in Figure 18.
As presented in Figure 18, the information exchange was carried out using several means. The size of each ellipse depicts the relevance of the way to communicate. The relevance was measured based on the variety of matters that were discussed. Especially, the spatial possibilities of face-to-face meetings improved the effectiveness because they enabled the possibility to use more tools to support the discussion. Since the face-to-face meetings provided the best basis for the information exchange, the Face-to-face meeting ellipse is the largest one. Similarly, the Skype ellipse is the smallest one because there was only one Skype conversation. Even though there were more than three hundred emails sent, the Email ellipse is still smaller than the Face-to-face meeting ellipse simply because emails were not as efficient a tool for communication.

4.2.8 Process

The implementation was an iterative process by its nature. It was perfectly possible to return to some already developed part of the software and refine it further. For example, the appearance and functionality of the forms were modified numerous times during the project. Since both the researcher and the customer had their own subjective views about the application, it was only natural that the same things were undergone over and over. Once a part of the software was seen as ready, it was forgotten for the time being. However, if the finished part was not aligned with some newly developed functionality, it was altered again in order to secure the operability of the system.

The implementation was a complex and time-consuming process. The most essential problem during the process was that at times the researcher did not have a clear enough image of how to technically fulfill the requirements of the customer because the requirements analysis (RA) was not detailed enough. However, as the project progressed, the image became more accurate. Even though there were various kinds of documents supporting the development, the implementation was still challenging. However, this did not come as a surprise because the documents were only tentative. The development was carried out in small steps just to ensure that everything would be done according to the requirements of the customer. The preliminary plans of the project altered numerous times during the development.

4.3 Evaluation of the ERP system

The system was evaluated constantly during the whole project. In addition, the application was assessed separately after the implementation process. The evaluation was carried out by the customer and the evaluation tools were the RA, face-to-face meetings, emails, and phone conversations (including text messages). The evaluation methods are depicted in Table 1.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements analysis</td>
<td>Contained rough characteristics of the system and provided approximate guidelines on how to carry out the implementation.</td>
</tr>
<tr>
<td>Face-to-face meeting</td>
<td>Were mainly held in the morning and lasted usually around three hours. The composition of the people varied.</td>
</tr>
<tr>
<td>Email</td>
<td>Were typically used when it was not possible to have a face-to-face meeting. It was feasible to send emails at any time.</td>
</tr>
<tr>
<td>Phone</td>
<td>Was usually used when there was an urgent need to have feedback regarding the development of the system.</td>
</tr>
</tbody>
</table>
The RA was composed before the implementation in order to steer the development in the right direction straight from the beginning. However, since the RA document was not nearly as detailed as it should have been, the evaluation of the software against it was not comprehensive. It merely provided requirements regarding some parts of the system and did not contain enough in-depth information to carry out the implementation more effectively.

4.3.1 Layout

Since the layout (see Fig. 8) was the first item to be produced, it was the first item to assess. According to the customer, the layout was clear and it did not require much effort to quickly perceive the purpose of the different graphical elements. Since the nature of the system was to be articulate and informative, it was important that no unnecessary elements were incorporated into the visual design to confuse the users. Since the layout of the ERP system had several similar characteristics to the layout of the website of Cimson (see Fig. 7), the customer felt that it was easier and more comfortable to get familiar with the new system.

The RA called for the possibility to use the browser-based system also on a mobile device such as cell phone. The customer observed that the visual design of the ERP system was clear and easy to comprehend also on a mobile phone. However, they recognized that the design could have been more optimized for mobile devices in order to expedite the usage. For a mobile phone user, it took more time to navigate the system because the scaling of the layout was not in line with the size of a cell phone screen. On the other hand, the customer considered the missing scaling optimization to give more freedom to the user while he or she was navigating the application.

4.3.2 Main structure

The system was browser-based, optimized for Mozilla Firefox, and used a database to store data as the RA required. Since the RA document did not demand that the system should work as well in other browsers as in Firefox, the software was tested in other browsers only to some extent. For example, some of the functionalities programmed in JavaScript did not work correctly in Internet Explorer but the customer approved this because it was early recognized that Firefox would be the main browser to use the system.

The RA specified that the system should consist of tabs to navigate between the main sections of the application. These tabs were created as the RA document demanded. The tab-based structure reminded the user of the structure of the website of Cimson (see Fig. 7). The customer found the same kind of navigation structure to be easy to adopt because of the familiarity and clarity. They felt that if the system had similar kind of navigation structure as their company website, the users would be more open to exploit the software.

When a user was, for example, creating a user account, it was required of him or her to save the given data in the end of the process. In order to clearly confirm the success of the registration, a dialog box popped up and thanked the user for the registration (see Fig. 19). The customer considered this popup confirmation box a feature that enhanced the system by giving more feedback of the usage of the system to the user. Cimson recognized that the user was better guided to use the application in a right way when he or she got explicit feedback of the correct use of the system. The popup confirmation
dialog boxes were incorporated into the whole software because they simply made it easier to use the system, considered the customer.

![Figure 19](image)

**Figure 19.** A popup dialog box thanking the user for registering to the application.

There were guidance texts all over the application (see Fig. 20) to facilitate the correct use of the system. The customer felt that this was a necessary and good feature because there were many kinds of people working at Cimson and some of those people were not as good with technology as the others. Therefore, it was important to take into consideration also the least-skilled users so that they could use the system appropriately. The customer recognized that if a user was not able to use the system correctly, there was a chance that he or she would start to avoid the application.

![Figure 20](image)

**Figure 20.** An example guidance text.

Besides the guidance texts, there were also information texts that would pop up as soon as a user moved the mouse cursor, for instance, over an input field (see Fig. 21). The customer found this feature compact and useful because it enabled the possibility to have a lot of vital information about the use of the system in an unobtrusive form. Since these popup guidance texts were utilized all over the software, the understandability and usability of the browser-based system were clearly improved according to the customer.

![Figure 21](image)

**Figure 21.** A popup version of a guidance text.

Popup windows were employed throughout the whole ERP software. The customer considered the popup windows a good way to clarify the structure of the system: the main window was in the background and a popup window was a clearly separate continuum of that main view. For example, if a user was in the Courses section of the system, it was possible to add a new course while seeing the other courses in the background at the same time (see Fig. 22). This was seen as a good way to visualize the bigger picture.
Figure 22. Adding a new course in a popup window while having the Courses view in the background.

However, the popup windows included a tradeoff: Even though it could have been possible to update the background view from a popup window, this possibility was not utilized because some parts of the ERP application did not work appropriately when the background view was updated from a popup window. Therefore, the main window had to be updated separately in the background view. Customer acknowledged that this could confuse some users but they understood that the technical restrictions did not allow a better solution. There were guidance texts all over the system in order to emphasize the meaning of separately updating a view. This kind of compromise solution was found satisfactory by the customer.

There was also another problem with popup windows because there should have been a dialog box popping up confirming the closing of a window. There was a built-in safety mechanism in the Mozilla Firefox browser (the main browser used for testing the ERP system) that prevented hiding the window closing button in the top right corner (see Fig. 23). In addition to this built-in closing button, there was a separate closing button on bottom of a popup window.

Figure 23. The adjustments buttons of a browser window.

According to the customer, the confirmation dialog box was seen necessary since there was a possibility that once in a while a user might close the popup window accidentally without saving the entered data. It was possible to utilize this confirmation dialog box but since it did not work smoothly enough with the popup windows because of the technical constraints of these windows, the dialog box was discarded. As a result, no feasible solution was found to ensure the saving of the inputted data in case of accidentally closing a window. However, the people at Cimson approved this since there was not any convenient solution available.
Because Cimson had regional offices in different parts of Finland, it was important to clearly inform the user of the ERP application about which office’s courses, trainers, rooms, or other resources he or she was viewing at the time. The availability of the data depended on the user level. The currently selected regional office was shown on a dropdown list (see Fig. 24). Naturally, all the other regional office options were also available on the list. Data regarding different area became available as soon as the user selected a different regional office. The customer found the dropdown list solution effortless and functional.

![Image](image.png)

**Figure 24.** The dropdown list containing the regional offices.

In the Rooms section of the ERP system, available and unavailable rooms were separated into two different dropdown lists: available rooms were on top and unavailable rooms below. The user could enable the below dropdown list simply by activating the radio button (see Fig. 25). According to the customer, the separation of course rooms based on their availability was a good feature that helped in finding relevant information faster. Since the categorization based on the availability was employed in every resource section of the software, the customer observed that the system directed the users to utilize the system more appropriately.

![Image](image.png)

**Figure 25.** The two dropdown lists that categorize course rooms based on their availability.

When a user wanted to add himself or herself, for example, to a meeting on his or her calendar, at first it was required to input the meeting data, then the data had to be added to a dropdown list (see Fig. 26), and finally the data had to be saved by clicking a save button. The customer found this three-step solution to be a little rigid. A more convenient solution would have been that the process had been saved as soon as the data was added to or deleted from the dropdown list. This kind of functionality would have streamlined the use of the system, evaluated the customer.

![Image](image.png)

**Figure 26.** The dropdown list containing meeting data.

However, the downside with the two-step solution was that it did not contain any kind of backup mechanism of returning the data deleted from the dropdown list. The customer acknowledged the importance of the mechanism that came with the three-step function and accepted the tradeoff that came with the solution. Since this data backup mechanism was utilized all over the system, the customer observed that the data persistency of the application was better.
Figure 26. The form used to add events.

When a user added, for example, a personal activity such as dentist visit to his or her calendar, the user was informed with a popup dialog box (see Fig. 27) if he or she already had some other engagement such as course training or meeting on the same day. According to the customer, this feature kept the user better aware of his or her activities and helped to reduce the chance of overbooking.

Figure 27. A popup dialog box informing the user of an overlapping event.

Moreover, since this same feature was also incorporated, for instance, into the section where trainers, rooms, and other resources were set on a course, the possibility to have too many overlapping links between different courses and the actors added to these courses was reduced, considered the customer. This popup dialog box feature was utilized through the entire ERP system because the customer acknowledged that it considerably helped the users to understand the results of their software-related actions better.

4.3.3 Calendar

The original requirement of the customer was to have a horizontal calendar that would grow wider as days went by. This was due to the fact that their original, Excel-based calendar had this kind of view (see Fig. 12). Since the calendar of the ERP solution (see Fig. 13) did not function like this, the requirement was not met. Primarily, there were
technical restrictions that prevented from doing the horizontal calendar. However, the customer became soon to realize that the implemented calendar solution was also operational. In addition, they identified that the month navigation buttons made browsing the calendar easy and swift.

The customer wanted the calendar to show only days from Monday to Friday. This requirement was met. The customer assessed that observing the calendar was easier because it did not contain weekends. Had the calendar also included weekends, the readability would have suffered due to the more complicated look, stated the customer. By including only workdays, the calendar did not contain any unnecessary information and it was easier for a user to follow.

The size of a calendar cell was a bit of a problem. Depending on the amount of course markings in a calendar cell, the readability varied. According to the customer, the size of a cell could not be big because it would affect the entire view in a negative way and make it look clumsy. On the other hand, a bigger calendar cell would improve the readability of the calendar in case of numerous course markings. A calendar cell had automatic scroll bars that emerged as soon as the amount of information in the cell exceeded a critical point. The customer found this solution acceptable and recognized the fact that this was a better way to enhance the size of the cells.

The possibility to choose a calendar color for a course was a feature that enhanced the readability, observed the customer. The color option feature was also mentioned in the RA document. The feature was fulfilled according to the initial requirements. However, the customer wanted more colors to choose from but this requirement was not met due to the fact that there were only a few, different enough color alternatives that worked well together with a dark text. This tradeoff was acknowledged and approved by the customer because they wanted to emphasize readability.

The exclamation marks in the abbreviation of a course name indicating something urgent regarding the content of that specific course day (see Fig. 28) were a great way to quickly provide the user with important information, considered the customer. They observed that these exclamation marks were a good way to emphasize the importance of the presented information due to the urgent nature of exclamation marks.

Figure 28. Exclamation marks in the abbreviation of a course name indicated urgent matters.

The customer acknowledged that giving the user explicit information about a missing trainer and/or course room by taking a quick glance at the calendar was a good feature because it gave crucial information right away. Since this feature was incorporated into every calendar of the software, the customer felt that the value of the ERP system improved due to the critical nature of the information.

4.3.4 Schedule section

The month navigation buttons that showed the first and the last course month (see Fig. 15) were appreciated by the customer. This was due to the possibility to quickly navigate between the beginning month and the ending month of a course. If course lasted, for example, over a year, the buttons made it plausible to access the last course month faster than by using the button that was used to proceed only one month at a
time. This was a great feature that saved a lot of time because it required only one button press instead of several presses that would have cumulated the use of time, identified the customer.

One of the most important requirements regarding the schedule of a course (see Fig. 15) was to be able to print it. This requirement was met. According to the customer, the possibility to print a course schedule improved the distribution of the information to the people who were participating in the course in question. It was convenient to have a course schedule also in a paper version because the paper version was quicker and easier to access than the electronic version of the schedule, observed the customer.

According to the customer, the paper version of a schedule was simple to read due to the fact that it did not contain the redundant graphical elements that were needed in the browser view. In addition, they found the spacious day cells (see Fig. 29) to be useful because they allowed a lot of information. The customer evaluated that the paper version of a course schedule was compact and informative. The paper version of a course schedule met the basic needs that the people at Cimson required.

Figure 29. A piece of the PDF version of a course schedule.

Content for a course day was specified by clicking the name of the course in an appropriate day cell. This was a good way to clearly indicate the user of which day’s content he or she was setting, assessed the customer. They observed that this kind of functionality explicitly decreased the possibility to accidentally set the content for a wrong course day. The user was informed about the date of a course day distinctly by presenting the specific date on top of the page that was used to set the day-specific content (see Fig. 30). According to the customer, this enhanced understandability.

Figure 30. A date is presented on top of the page used to set the day-specific content.
As Figure 30 illustrates, a date is clearly displayed on top of the page. Also the name of the course is explicitly presented. Both the date and the name were bolded because the customer felt that this enhanced the distinctiveness from the basic text. The bolded text feature was applied all over the software because the customer assessed that it helped the users to find out the most critical information faster and more easily.

4.3.5 Reports section

The possibility to create and print paper reports was required by the RA document. Creating and printing reports had an essential meaning especially to the top management of Cimson because they made it easier to visualize the big picture. The possibility to generate and print reports was implemented as required. The customer considered creating and printing them effortless. The graphical elements incorporated into the Reports section were greatly valued because they supported the textual data by clearly demonstrating the data in a graphical form. Just by taking a quick glance at a report containing a bar chart helped to understand the data quicker, considered the customer.

![Figure 31. A report demonstrating the usage data of a computer.](image)

The way the reports presented the data was satisfactory. The customer found that there was a lot of significant information available in an explicit form. No extra effort was needed to understand the generated information, evaluated the customer. Also the possibility to have detailed information, for example, about the usage of a computer (see Fig. 31) was a good achievement. According to the customer, the Reports section enabled the possibility to observe the activities of the organization more in-depth to a great extent. The report options offered the company a great way to monitor their operations from many different viewpoints.
As can be seen in Figure 31, the report about the computer usage provides distinct information. It was possible, for example, to separately see how many times a resource for booked during one week and how many times it was booked during one day. Especially, this feature was praised by the customer due to the possibility to have such detailed data. It was important for the customer to be able to compare the resource usage between resources more distinctly so that they could assess their resource necessity better.

4.3.6 Overall

As a whole, the customer found that the ERP system clearly supported their operations by making it more convenient to monitor the main activities of Cimson. Following the courses in different areas was now a lot easier than with the previous, Excel-based system. The data regarding the activities was much easily accessible than with the former system. The Excel-based solution depended considerably more on people when the new ERP system distinctly mitigated the amount of human activity needed by automating functionality. As a result, the users of the software were able to spend more time with more important matters. For example, now it was feasible for a top management user to follow the activities of all regional offices only by changing the regional office on the dropdown list (see Fig. 24). Earlier the data regarding, for instance, the courses of some other regional office than the user’s had to be requested separately from someone else.

The system enabled the possibility to easily follow the calendars of the different trainers of Cimson all over Finland. Furthermore, the monitoring of rooms and other resources became handier. As a result, it was easier for the organization to plan its courses because all the course-related information was available so easily. As a whole, the tracking of the personnel’s activities and the usage of course rooms and other resources such as cars and computers, was much better coordinated with the ERP application, observed the customer. The company was now able to follow the activities of its workers and the use of its rooms and other resources a lot more effectively and precisely which resulted in improved cost-effectiveness. According to the customer, the software also enhanced their information sharing capabilities.
5. Discussion

The main goal of this study was to improve the management of the human and material resources related to the courses organized by Cimson by implementing an ERP system that encompassed a resource management module that consisted of calendars collecting and displaying resource usage. The applied research method was design science research. In this section, Case Cimson is evaluated against the nine essential success factors introduced by Umble et al. (2003). In addition, the implications of this evaluation are discussed.

5.1 Clear understanding of strategic goals

ERP implementation requires that the key figures of the company clearly define the objectives, expectations, and deliverables of the business organization (Umble et al., 2003). At Cimson, the goals, expectations, and deliverables of the company were specified in a way that the benefits of the ERP system were taken into account. It was clearly identified that the ERP software would have a fundamental meaning to the company. It would support the basic activities of the organization by introducing a more effective way to carry out these activities.

Cimson clearly recognized that the former Excel-based system did not meet the current needs of the company. Resource management and coordination was not as fast and effective as the current market conditions required. Cimson decided to implement ERP software in order to enhance their resource management capabilities so that they could better maintain their competitive edge in today’s business environment. Overall, the rationale behind the implementation and the needs the ERP system would fulfill were explicitly identified as it is required (Krupp, 1998; Latamore, 1999; Schragenheim, 2000; Travis, 1999).

5.2 Commitment by top management

The case with Cimson was that the ERP implementation was widely supported by the top level management. This support was interpreted as a sign of commitment which met the requirement of showing complete commitment to executing the implementation (Bingi et al., 1999; Davis & Wilder, 1998; Laughlin, 1999; Oden et al., 1993; Sherrard, 1998). By demonstrating the commitment, the top management ensured that the entire staff of the company was more convinced that the ERP system would benefit the organization.

The implementation at Cimson was led by an external project manager. The project manager had over twenty years of experience in the IT industry and he had a Master’s Degree in Economics. His value was recognized due to his wide experience in the IT industry. However, he did not have extensive experience in managing a project but his comprehension of the basic needs of a project was satisfactory. Despite some lack of project management skills, the project manager was appreciated and his vision of the implementation was respected. It is suggested that the implementation effort should be led by a highly valued, executive level master ("Crucial success factors in an ERP
makeover”, 1999; Krupp, 1998; Maxwell, 1999) but in Case Cimson this did not completely actualize.

There should be an administration planning board consisting of executives that comprehend business integration and the nature of ERP and support the project (Umble et al., 2003). At Cimson, the top management acknowledged the value ERP could give. In addition, they explicitly identified their current business segments that could be integrated and incorporated into the ERP system. The top management understood how ERP could improve their business processes and endorsed the implementation project by agreeing with the execution plan and expenses.

5.3 Excellent project management

The case with Cimson was that there was a clear recognition of project goals. However, the exact technical means to achieve these goals were not explicitly recognized. The implementation plan only provided rough guidelines on how to carry out the project. A successful implementation requires that project objectives are clearly identified. Furthermore, there must be both an execution plan and an asset plan, and the project plan needs to be carefully followed. (Davis & Wilder, 1998; Laughlin, 1999; Sherrard, 1998.) At Cimson, these requirements were not completely fulfilled.

In Case Cimson, the project timetable was too demanding due to tight deadlines. Some of these deadlines were not met because some unforeseen issues were encountered during the implementation. This was not consistent with the requirement that the project schedule should be exigent and feasible (Laughlin, 1999). However, it was recognized that the schedule of the project was not definite because of several unprecedented factors that could affect the timetable. When the schedule was devised, it was taken into account that there should be enough leeway in order to better react to the issues that could emerge during the implementation but which were not considered when the project timetable was composed.

Due to the not clearly enough identified technical means to achieve the project goals, the ERP implementation at Cimson took longer than expected. The scale of the project grew more than was anticipated. The costs were not an issue because the programming of the software was done by only the researcher and the staff of Cimson could continue their main activities normally even though the project was still in progress. Even though the technical means to fulfill the objectives of the implementation were not clearly recognized in order to better control the expenses and scope of the project as it is demanded (Davis & Wilder, 1998; Laughlin, 1999; Minahan, 1998), the implementation was not critically impeded.

During the planning stage of a project, the organization has to choose between a standardized ERP package and a customized version of the software (Holland & Light, 1999). It is crucial to explicitly define the project scope before the execution (Umble et al., 2003). In Case Cimson, it was clear from the beginning that the organization wanted the ERP system to be customized according to their needs precisely. Since the other ERP solutions in the market did not meet the requirements of the company well enough, Cimson decided to have an own system built from scratch. It was identified that by having a system explicitly customized to their specific needs, it would demand a lot of active participation from the personnel of Cimson in order to achieve a desired result.
5.4 Organizational change management

At Cimson, a particular implementation team was established to facilitate the development of the ERP system. This was in line with the possible need to reengineer primary business processes and/or to build new processes to suit the needs of the company when implementing ERP (Jarrar et al., 2000; Minahan, 1998). Otherwise the main business operations of the company were normally carried out. However, as the development of the ERP system progressed, the company began to take the new software better into account by starting to fit their current business procedures to the application little by little.

The case with Cimson was that the significance of ERP was clearly identified by the executives as a successful ERP implementation demands (Davenport, 1998; Umble et al., 2003). They anticipated the need for change beforehand and informed the entire staff about their plans to implement an ERP system. The organization also educated its employees about how carrying out the activities of Cimson would change as the new system would replace the old one. As a result, it was easier for the workers to prepare themselves for the new system. They had more time to get familiar with the thought of having a new system that would affect the current business processes of the organization fundamentally.

At Cimson, the implementation endeavor was motivated by business and it was specifically directed by business requirements. This was clearly consistent with the necessity that the implementation should be driven by business and steered by business requirements, not by the IT department of a company (Chew et al., 1991; “Crucial success factors in an ERP makeover”, 1999; Minahan, 1998). It was identified that ERP is a piece of software but since it would clearly change the way of carrying out the business processes of the company, the implementation effort was strongly business-oriented. The business aspect was reinforced by partly composing the project team with people who were closely involved in the essential business activities of Cimson: person A was in charge of the operations and training activities in Oulu, person B was responsible for the practical arrangements of courses, and person C was responsible for the management of courses, teaching, and supervising students.

A company can access a greater amount of information and enable the possibility to have more improvements than initially seemed plausible when utilizing ERP (Umble et al., 2003). Cimson was able to alter its activities in a way that suited the ERP application. The organization was aware of the benefits the system could offer and made needed changes so that they could take advantage of the software to a greater extent. The company understood the need to adapt to the situation of having a new system in order to entirely utilize it (“Crucial success factors in an ERP makeover”, 1999; Sherrard, 1998). They realized that the automated nature of the system would help them to access a more comprehensive amount of data and have the data clearly structured in order to enhance its understanding.

5.5 A great implementation team

An ERP implementation team should be composed of people who are experienced, efficient, adaptable, and respected among fellow workers (Umble et al., 2003). In Case Cimson, the implementation team consisted of people who were familiar with their professional fields. However, the researcher could have been more experienced because there were some technology-related issues along the project that hindered the progress
due to the lack of familiarity with those areas. In addition, the other thing that clearly delayed the progress was that the employees of Cimson were sometimes so busy that they did not have enough time to test the software and give feedback to the researcher. As a result, the researcher got a little frustrated at times because he did not want to lose touch with the development process. However, the researcher acknowledged the fact that the people at Cimson had to take care of their normal work routines despite being a part of the implementation team.

There were several situations during the project that demanded the ability to rethink the situation. Especially, the researcher encountered many programming-related matters that called for adaptability. He needed to be able to find feasible solutions to problems that at first seemed overwhelming. Cimson also had to rethink the implementation at times due to the technical constraints that did not allow fulfilling their every requirement. All the members of the implementation team knew there would be unforeseen problem situations along the project. Therefore, they were prepared for these situations to some extent.

There was all-round trust and respect between the people of the implementation team. The researcher and the external project manager were accepted as a solid part of the team. They earned trust by demonstrating good group work skills and expertise in their professional fields. The team members had common activities also outside the work. This helped them to get better acquainted with each other and trust them and their judgment more. Due to the improved social cohesion among the implementation team, the matters regarding the development of the ERP system were easier and faster to negotiate. Studies also support the observation of reinforcing group cohesion because the implementation of IS is a social construction process (Boland & Tenkasi, 1995; Newell et al., 2004; Sahay & Robay, 1996).

The implementation team was able to make significant decisions. This was consistent with the requirement that the project team has to have the authority to make critical decisions (“Crucial success factors in an ERP makeover”, 1999; Davis & Wilder, 1998; Laughlin, 1999; Minahan, 1998; Sherrard, 1998). The team members felt that they were empowered because they had specifically been chosen to carry out the implementation. However, the team members had to reach a consensus among themselves in order to make the crucial decisions. Some decisions required the attention of the top management of Cimson. After the top management had given its opinion, it was explicitly taken into account.

The management and the implementation team should communicate continuously, and the team should have the ability to make decisions promptly (Sherrard, 1998). At Cimson, one of the ERP project members was also a part of the top management of the organization. This clearly made the development work more rapid because he could swiftly give his managerial opinion on the implementation. He was also well aware of the ideas the other executive people of Cimson had. Having an intermediate between the project members and the top management in the implementation team made the other team members to regard the development process more justifiable.

The case with Cimson was that the original project plan was not detailed. It only contained inexact information about the ERP system. The organization had a clear vision of the functionalities of the final system but the project plan lacked specific details which resulted in having to contemplate the details several times during the implementation phase. This slowed the progress of the project and increased the possibility of not reaching deadlines. The original timetable of the project was delayed
four and a half months. Overall, the implementation team did not meet the requirement of generating a detailed initial plan or an all-encompassing schedule for the entire project (Umble et al., 2003).

There was no lack of resources in Case Cimson because the most part of the implementation consisted of programming and the researcher had the necessary equipment to fulfill the needs regarding the programming. Otherwise Cimson provided the needed resources, including the database of the ERP software. For example, all the project meetings were held on the premises of Cimson. In addition to this, they provided the required equipment to effectively discuss the phases of the project. The requirement of having an adequate amount of resources was met by the project team as it is required (Umble et al., 2003).

5.6 Data accuracy

It is crucial that the data entered in an ERP application is in a correct form because the system is utilized by the entire company and erroneous data can cause serious malfunctions (Umble et al., 2003). Data accuracy and correct data input guidelines need to be emphasized during an implementation process (Steadman, 1999; Stein, 1999). When ERP was implemented for Cimson, it was explicitly taken into account that a user should not be able to enter data that could jeopardize the functionality of the system. It was recognized that even a small amount of wrong kind of data could seriously affect the operability of the software. During the implementation, it was regularly discussed what kind of limitations the data input mechanisms of the system should have in order to prevent any kind of misuse of the system.

During the implementation, it was emphasized that all the employees of Cimson should be encouraged to use the system. The company identified the explicit need to have all their workers utilizing the system which is in line with the requirement that every employee has to use the ERP system instead of avoiding it (Umble et al., 2003). It was emphasized that the ERP software should be as user friendly as possible. Cimson clearly identified that the workers should accept the system so that the company could fully benefit from it. They wanted to incorporate as many features from the previous resource management solution into the new software as feasible to reinforce its acceptability.

The staff of the company must be distinctly shown that the organization is committed to using the new software, will entirely switch to the new system, and will not permit to continue using the old system (Umble et al., 2003). At Cimson, the key figures such as chief executive officer and chief regional officers considered the new system beneficial and useful. By endorsing the ERP application, they indicated that the new system clearly had a place in the organization.

The key figures were the vanguard that helped the fellow workers to realize the benefits of the new system. They ensured that everyone at Cimson clearly understood that the former, Excel-based solution did not meet the current requirements of the company and that it was time to move on. The company identified that there was a chance that some employees would continue employing the older solution if it was not decommissioned while the new ERP system was in use. This was consistent with the demand for closing down the out-of-date systems so that they cannot be used while the new system is in use (Hutchins, 1998).
5.7 Extensive education and training

At Cimson, it was taken into consideration that unless the staff comprehends the system, they would not use the system to its full extent. It was recognized that the workers should be properly trained in order for them to accept the system and realize its benefits. This was in harmony with the requirement for educating/training users in order to help them to understand and endorse the system (Umble et al., 2003).

If workers do not understand how a system operates, they will only exploit those parts of the system they comprehend ("Crucial success factors in an ERP makeover", 1999; Hutchins, 1998; Laughlin, 1999; Ptak & Schragenheim, 2000; Sherrard, 1998). During the implementation process at Cimson, a lot of attention was paid to the fact that the system should be informative and guide the end users to exploit it correctly. It was observed that the ERP software must have a user manual to reinforce the learning process and mitigate the acceptance problems. The company wanted everyone to entirely commit to the system so that the activities of Cimson could be carried out more effectively.

The top management of Cimson identified the need to inform the employees before the implementation that the company would replace their Excel-based resource management system with a new ERP solution that would encompass a resource management module. By briefing their staff early enough, Cimson encouraged the workers to educate themselves about ERP and how it could enhance and speed up the current processes of the company. This was in line with the need for beginning the education process regarding a new system long before the implementation starts so that it is easier for the personnel to successfully learn to use the system (Umble et al., 2003).

Management has to demonstrate that they are committed to covering the education and end user training expenses and incorporate these costs into the ERP budget (Umble et al., 2003). At Cimson, the requirement for a proper education and end user training was acknowledged. The company realized that in order to enable the staff to fully utilize the ERP system, they need to be appropriately educated and trained to use it. Cimson identified the possibility that by neglecting the education/training process, acceptance issues would arise and the performance of the company could decrease.

The case with Cimson was that the project manager was officially appointed to instruct the workers of the entire company to utilize the system in a right way. The project manager was already educated as a trainer, so he had qualities to effectively guide the end users to use the new software appropriately. It was acknowledged that since he was the project manager, he was also the intermediate between the researcher and Cimson. Therefore, he better understood the project from the viewpoint of the researcher as well as from the aspect of the organization. By assigning the project manager to instruct the staff, the requirement of having a particular person such as project manager maintaining ongoing communication with all the workers using the system was met (Umble et al., 2003).

It is advisable to continue training even though the system is already implemented (Umble et al., 2003). There should be intermittent meetings held so that the end users can identify problems related to the system and share their experiences with each other (Krupp, 1998). It was agreed that Cimson could contact either the project manager and/or the researcher if they encountered issues during the use of the ERP application. Instead of periodic meetings, it was decided that meetings would be held in case there was a need. The need for further training was clearly recognized because it was pretty
much impossible to experience every possible use case during the implementation phase.

5.8 Focused performance measures

At Cimson, there was not any particular performance measures built which fails to meet the necessity of constructing subtle capacity measures so that the impact of the new software can be assessed (Umble et al., 2003). However, since the ERP application was tested during the implementation, it was feasible to compare the new system to the former one. For example, in the new system, data was presented in a more structured way. In addition, it was observed that the ERP system expedited carrying out the daily activities of the company.

In case some project team member encounters issues trying to reach an earlier determined objective, he or she ought to either accept the given help or be replaced by someone else (Umble et al., 2003). During the implementation at Cimson, the project atmosphere was supportive and productive. Whenever problems were encountered, they were discussed together. Everyone was free and encouraged to express their opinion if they perceived any problems related to the development process.

In Case Cimson, if a team member came up with a useful and great idea or otherwise demonstrated productive activity, he or she was explicitly praised and given an incentive. This was consistent with the requirement of distributing incentives in a way that truly catches the attention if an earlier determined objective is achieved (Umble et al., 2003). By clearly acknowledging a prominent work effort, the team members were encouraged to work more effectively because they explicitly knew that their work effort was appreciated. The rewarding atmosphere was one of the most important characteristics of the project.

Once the system is implemented, it has to be monitored and assessed indefinitely (Hutchins, 1998). It was recognized that the ERP system had to be continuously monitored and evaluated in order to prevent possible problems in the future. Since the long-term functionality of the software was not known, it was required to actively follow the operability of the system so that it would be easier to resolve the possible functionality issues that might arise in the future.

It must be recognized that the productivity of a company may decrease at first due to the complex and difficult nature of the new software (Umble et al., 2003). Consequently, it is advisable to clearly introduce the performance expectations taking time frames into account (Langenwalter, 2000; Oden et al., 1993). Cimson identified that the running in period might affect its productivity but they felt this was a necessary evil. A timetable was devised in order to help the organization to phase the deployment of the ERP application. Cimson observed that by setting clear time frames, the company could better plan their future activities. When the deployment schedule was composed, it was taken into consideration that there was enough leeway in case of unexpected problems.

5.9 Multi-site issues

At Cimson, there were not multi-site issues because the company was operating only in Finland and the different regional offices followed similar operational processes. Due to having same kind of operational processes, it was easier for the employees at different
offices to get used to the new system because they already shared the same kind of procedures. The ERP system was made to follow these procedures as much as possible. Furthermore, despite the fact that the company was already employing identical processes all over Finland, by implementing the ERP solution, they wanted to standardize these processes even more. This was clearly in line with the objective of implementing ERP in order to enhance the concentration of management by implementing consistent processes (Umble et al., 2003).

A relevant issue is company standardization against local optimization (Umble et al., 2003). The case with Cimson was that basic structure of their operations was similar all over the organization. However, for example, resource naming conventions differed in different areas. This was acknowledged and approved because the foundation of their main processes was identical in every area.

The business organization may go with a simultaneous implementation so that it can gain back its expenses as quickly as feasible (Umble et al., 2003). Since the ERP system developed for Cimson was browser-based, it was not required to implement it more than once. This clearly mitigated the problems related to multi-site implementations. The deployment of the system was executed in a way that the Oulu site started to gradually utilize the new system in their daily activities.

Since the implementation of the ERP system was carried out at the Oulu site, it was rational that the staff at this site would deploy the system first. They had the best comprehension of the system and could later help with the problems at other sites when deploying the software. Cimson planned to have a nationwide deployment of the implemented ERP system in August. One significant characteristic of the Oulu site was that the person responsible for ensuring that the quality criteria of Cimson were followed was working there. He supervised that the software was developed explicitly according to the quality standards of the organization.

5.10 Implications

After evaluating Case Cimson against the critical success factors presented by Umble et al. (2003), some theoretical implications could be pointed out: It was clear that the major part of the implementation at Cimson was executed according to the required actions. Even though the implementation did not completely follow these required actions, it can be considered successful. However, since some of the success factors carry more value than the others, it can be assumed that at least the most important factors have to be paid close attention in order to achieve a successful ERP implementation.

Some methodological and empirical considerations were also observed: Human and material resource management associated with courses was improved by implementing browser-based ERP software that encompassed a resource management module that consisted of calendars collecting and displaying resource usage. A browser-based solution should be considered if an organization is about to implement ERP. It does not limit or hinder the daily activities of the organization nearly as much as a solution that must be implemented separately at all sites. The browser-based system also facilitates the possibility for all the workers of the company to test and get familiar with the software while it is being developed. Therefore, it is easier for the workers to start to utilize the software in their daily activities when the deployment phase takes place.
Since the implementation of ERP is a complicated and challenging process, the implementation team should find ways to reinforce their social cohesion during the implementation in order to enhance the trust between them and improve the team spirit. In Case Cimson, this was clearly one of the most essential factors that enhanced the probability to accomplish a successful outcome. It should be also drawn close attention to the fact that after demonstrating prominent activities, the team members should be distinctly praised in order to improve the atmosphere among the project team and increase productivity. At Cimson, the rewarding work environment was one of the cornerstones of the success.

Probably the most significant managerial implication was that there should be a person from top management in the project team. At Cimson, this clearly improved the communication between the top management and the implementation team. Decision making was faster and easier and the project team felt more empowered. As a result, the implementation became more effective and the other members of the project team regarded the development process more justified when the progress was constantly monitored and evaluated by a member of the top management.
The main purpose of this study was to enhance the management of the human and material resources related to the courses organized by Cimson by implementing an ERP solution. Design science research was the employed research method. The research question was: “What kind of ERP system is needed in order to improve the management of human and material resources related to courses?” The answer to that question was: “Browser-based ERP software that encompassed a resource management module that consisted of calendars collecting and displaying resource usage.” The characteristics of the ERP implementation were assessed against the crucial success factors introduced by Umble et al. (2003). After the assessment, it can be concluded that the ERP implementation at Cimson was successful even though every success factor was not followed. The most significant factors that depicted the ERP endeavor at Cimson are illustrated in Figure 32.

![Figure 32. The nine most prominent factors that characterized the implementation at Cimson.](image)

Figure 32 summarizes the most essential factors that depicted the implementation endeavor at Cimson. These factors are presented with respect to the crucial success factors presented by Umble et al. (2003). As Figure 32 suggests, the implementation did not completely follow these success factors (see Fig. 3). Some of the characteristics of the implementation effort at Cimson compensated for the lack of appropriately adhering to every success factor introduced by Umble et al. (2003).

The main contribution of this study was to give more insight into the mitigation of multi-site issues by implementing a browser-based system that has to be implemented only once but can be accessed from anywhere. At Cimson, the browser-based system had to be implemented only once and it enabled the possibility to get familiar with and test the software anytime from anywhere during the development phase. Also the importance of improved social cohesion of a project team trying to achieve intricate and challenging objectives was clarified. In Case Cimson, the project group had common free time activities that clearly reinforced group cohesion. Moreover, the importance of having a top management person in a project team was addressed. At Cimson, the top
management person expedited the communication between the implementation team and the top management which resulted in a faster and more effective implementation.

Because Cimson is a business organization, the availability of research data was limited. This affected the description of the implementation and the evaluation of the ERP software as well as the assessment of the system against the success factors presented by Umble et al. (2003). For example, the security issues of the new system were discussed only on a superficial level. On the other hand, security mechanisms of any system should never be exposed to the public in order to diminish the possibility to abuse the system.

In future, the benefits of providing end users access to a system while it is under development should be studied further. In Case Cimson, it was possible to test and get familiar with the browser-based ERP system anytime from anywhere which resulted in more rapid and better controlled implementation. For example, large scale healthcare systems could benefit from the possibility of allowing users to access the system while it is under development. The implementation process would be better monitored which could decrease the expenses by decreasing the need to modify the system afterwards.
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