The ERP Project Risk Assessment – A case study

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Abstract—**Information and communication (ICT) technology related projects, such as enterprise resource planning (ERP) projects have a high failure rate. Planned and systematically adopted risk management procedure is crucial to keep projects on time and within budget with all requirements fulfilled. In this paper, we have analysed the critical risks of ERP projects through the case study of three manufacturing small and medium size enterprises (SMEs). First, by using company-specific risk analysis method, the critical risks of the ERP projects have been identified and assessed. Second, by using characteristics analysis method, the recommendations of how to divide the ERP projects into manageable sub projects have been given.**

Index Terms—**Enterprise resource planning, risk analysis method, characteristics analysis method, small and medium sized enterprise.**

I. INTRODUCTION

Enterprise resource planning (ERP) systems, when successfully implemented, links all functions of an organisation including order management, manufacturing, human resources, financial systems, and distribution with external suppliers and customers into a tight integrated system with shared data and visibility [1]. The primary motive for ERP implementation is the potential for enhancing the firm's competitiveness. ERP systems provide significant benefits, and companies adopted them with the goal of replacing inefficient stand-alone legacy systems, increasing communications between business functions, increasing information processing efficiencies, improving customer relations, and improving overall decision making [2].

Despite the significant benefits that ERP systems provide, the Statistics show that under 30 % of ERP implementations are successful [3], which means that projects are completed on time and on budget, with all features and functions originally specified. ERP projects are major and risky exercises for any size of company. The average implementation time of ERP system is between 6 months and 2 years [4] and the average cost is between US$1,3M and US$70M [5], and they require disruptive organisational change [4]. ERP implementation requires the allocation of special competences, and a number of financial and human resources. Also, the implementation is usually carried out concurrently with the daily business, which already ties up the available resources [5]. Especially in small and medium size enterprises (SMEs), which employ less than 250 persons and an annual turnover is not exceeding 50 M€ and/or an annual balance sheet total is not exceeding 43 M€ scarce

resources are badly needed in the daily business operations.

Risks are part and parcel of ERP projects, but a planned and systematically adopted risk management procedure throughout the implementation project reduces the possibility of risks occurring. The risks are higher for SMEs as the cost overruns during implementation may put financial strain on the firm and thus substantially impact firm performance [2]. In addition, SMEs have less of a chance of recovering from a failed ERP implementation attempt than large enterprises [6].

Several standardised tools and methods have been developed to help companies to better manage their ERP projects. In this study, we present experiences of company-specific risk analysis method (RAM) and characteristics analysis method (CAM) through the case study of three manufacturing SMEs. First, by using RAM, the critical risks of the ERP projects are identified and assessed. Second, by using CAM, the recommendations of how to divide the ERP projects into manageable sub projects are given.

II. RISK ASSESSMENT

A. ERP project risks

Several research studies have investigated the ERP risks and have attempted to classify them in various ways. Six main dimensions of risk in ERP implementation have been identified by [7], namely, 1) organizational, 2) business-related, 3) technological, 4) entrepreneurial, 5) contractual and 6) financial risks. Organizational risk derives from the environment in which the system is adopted. Business-related risk derives from the enterprise's post-implementation models, artifacts, and processes with respect to their internal and external consistency. Technological risk is related to the information processing technologies required to operate the ERP system – for example the operating system, database management system, client/server technology and network. Entrepreneurial or managerial risk is related to the attitude of the owner-manager or management team, while contractual risk derives from relations with partners and financial risk from cash-flow difficulties, resulting in an inability to pay license fees or upgrading costs, for example. [7] In the research of [8], following six risk categories have been presented: 1) organizational fit, i.e. failure to redesign business processes, 2) skill mix, i.e. insufficient training and reskilling, 3) management structure and strategy, i.e. lack of top management support, 4) software systems design, i.e. lack of integration, 5) user involvement and training, i.e. ineffective communication, and 6) technology planning/integration, i.e. inability to avoid technological bottlenecks. Later, [9] develop the risk identification list based on the category of [8].

The following ERP risk factors are summarised by [4]: 1) inadequate ERP selection, 2) poor project team skills, 3) low top management involvement, 4) ineffective communication system, 5) low key user involvement, 6) inadequate training and instruction, 7) complex architecture and high numbers of modules, 8) inadequate business processes, 9) bad managerial conduct, 10) ineffective project management techniques, 11) inadequate change management, 12) inadequate legacy system management, 13) ineffective consulting services experiences, 14) poor leadership, 15) inadequate ICT system issues, 16) inadequate ICT system manutenibility, 17) inadequate ICT supplier stability and performances, 18) ineffective strategic thinking and planning, 19) inadequate financial management.

Instead of using abovementioned ready-made risk lists, a company might consider identifying their own, company-specific ERP implementation risk list. These risks could be complemented by common risk lists.

To minimize the risk of the ERP project, [10] have recommended the application of a risk management plan at different ERP implementation project stages; selection, implementation, and usage. A planned and systematically adopted risk management procedure throughout the ERP project reduces the possibility to risks occurring. Consequently, [11] suggest that major mistakes are made in the early stages of the ERP project, even prior to the implementation process. [12], however, emphasizes the efficiency of risk management when it is introduced at the earliest possible opportunity in the life cycle of the system in question, when planning issues are most important and the criteria for system selection are determined.

This research has been carried out as a case study of three manufacturing SMEs. The case SMEs are in different phases of the ERP project. Company A is still contemplating the ERP implementation, Company B is in the selection phase, and Company C is already in the usage phase. In practice, this study has been carried out during 1.1.–30.12.2008.

B. Risk analysis method

Risk analysis method (RAM) identifies the most essential risks and their probability in the company context. The risk list for the case study has been formed based on the risk list of [5]. In this paper, the risk list is formed out of 63 questions or statements dealing with the ERP selection, implementation, and usage. The basic aim is to identify the ERP risks arising from the company's reality and therefore the employees from various levels of organisation have been interviewed and observed. The company-specific risk list has been filled in close interaction with company personnel. Risk assessment for the risk list is done by evaluating each risk's probability and effect in a scale from one to five. The number one means very small probability and effect, and number five means high probability and catastrophic effect. Then, the risk multiplication as an indicator of risk significance has been used. It is calculated as multiplying the value of the probability by the value of the effect. Range of this value is from one to twenty-one. [5]

C. Characteristics analysis method

Characteristics analysis method (CAM) is a tool to ensure that the information and technology (ICT) project is manageable and consistent by its different goals content and development approaches. The result of the CAM is a recommendation of how to split the large and complex ICT project into manageable sub projects. Further, the inputs of the CAM are the project proposition document, the knowledge and experience from prior development projects, and the requirements of the of the project portfolio. [13]

In this paper, the CAM analysis is formed out of 90 questions dealing with the ICT project. The basic aim is to find out the manageable size of the ERP project of the case company. Also, CAM provides recommendations what management aspects should be put more attention to successfully manage ERP project (management of a project as a whole, management of integration, project scope management, time management, cost management, quality management, human resource management, management of communication, risk management, management of purchase). The questions are either positive or negative statements for which their applicability to the project will be evaluated (0 = fault, not true, 5 = exactly right; N/A = don't know). The tool has been implemented as an MS Excel worksheet with automatic tabulation based on decision rule sets. The result can also be illustrated graphically (see figures 1 and 2). [13]

III. CASE STUDY

A. Case 1: Company A

Company A develops blast cleaning technology and manufactures automated blast cleaning machines and robots (turnover about 1,2 M€ and number of personnel approximately 20). Company A has not an ERP system, but is contemplating the ERP implementation in near future. The need for the new ERP system has grown internally because of the problems in the current ICT system. Today, the company is using an excel-based ICT system, which includes e.g. the following ERP functions: customer relationship management (CRM), product data management (PDM), purchase and order management, and product lifespan management. The problem of the current system is how to manage over 100 different versions and variations of Excel, Word, and AutoCAD documents. Main problems occur in the tendering and purchase processes, and in the production capacity planning. The purpose of company A is to adopt an ERP system, which helps production capacity planning and control so that the scheduling and resource allocation for different projects can be planned in detail before the project is started. Furthermore, the new system should include warehouse and stock management functions, and it have to support purchase process.

The risk list has been filled with company personnel and the effect and probability of risks have been assessed. In the *ERP selection phase*, the most critical risks which may be realised in company A are: misunderstanding between buyer and customer (12), system not flexible enough under processes' exceptional circumstances (12), and special needs of a company not defined (10). In the *ERP installation phase*, the most critical risks are: company's project manager is not a full time PM (20), data transfers from old to new system is difficult (16), connecting system to other systems creates

problems (16), and supplier is not committed enough to system implementation (15). In the *ERP usage phase*, the most critical risks are: system not felt as helping the business (12) and the system supplier does not develop the system in the future (10).

Company A is just contemplating to acquire an ERP system. In the RAM results, in every phase (selection, implementation, usage), the crucial factors are depended on the decision of the ERP system itself and the ERP supplier. The technical and functional factors related to the system, and the factors related the chosen system supplier, are considered the most critical. Even a company A has very few employees (under 20), the lack of resource, skills and expertise, and other factors related personnel have - surprisingly – not aroused as a potential risk in this analysis.
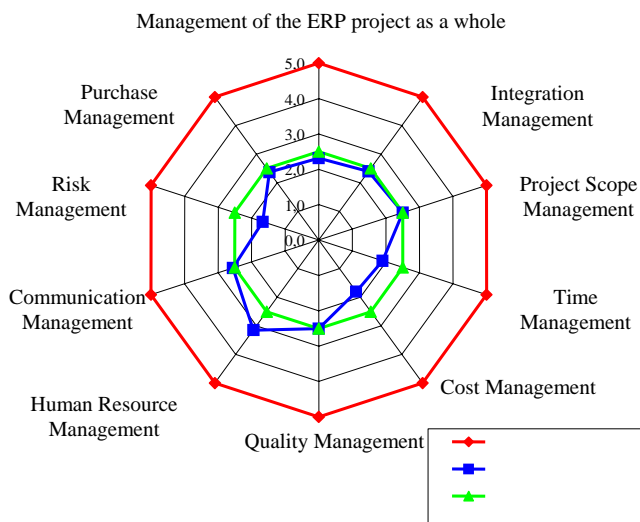
The results analysed by CAM is presented in Figure 1.

Figure 1. CAM diagram of the company A

According to CAM, Human Resource Management is the management/leadership field that clearly exceeds the critical level. Company A should direct special attention to this factor in ERP project management. In addition, several other management/leadership fields, such as 'Communications Management', 'Purchase Management', 'The project as a whole', 'Integration Management', 'Project Scope Management' and 'Quality Management' are right at the critical level. Only 'Cost Management' and 'Time Management' and 'Risk Management' are clearly under critical level. According to CAM, factors connected with personnel training and increasing personnel skills and knowledge require more from managing the ERP project, although they are not considered to be amongst the most potential risk factors according to RAM. On the basis of the CAM, it can be deduct that Company A has a clear view of the costs caused by the ERP project, the time spent for it, as well as the technical and operational risks involved.

B. Case 2: Company B

Company B provides demanding sheet metal work, welding, and heavy metal works, specialising in steel, paper, chemistry, and ship manufacturing related machinery and equipment. In addition, the company manufactures offshore equipment and ship propellers. The company, founded in 1974, currently employs ca. 150 people.

Company B is in the selection phase of the ERP project. The company has interviewed several ERP suppliers. The company has already gone through more detailed discussions with two potential suppliers. The company has made a preliminary requirement specification, a type of demand list, through which they are able to limit their ERP suppliers to two options. Also, some consultants have worked for the company. Company B is very aware that the existing ICT systems are already in the end of their life cycle, and they had to invest in a new ERP system.

The risk list has been filled with company personnel and the effect and probability of risks have been assessed. In the *ERP selection phase*, the most critical risks which may be realised in company B are: system is poor compromise for all parties (12), choosing poor project manager or project group, and misunderstandings between buyer and customer (10), choosing improper ERP system (10). In the *ERP installation phase*, the most critical risks are: normal business disturbs ERP project activities (20), ERP project disturbs normal business (16), timetable falls behind schedule (16), Software configuration and testing don't function swiftly (16), disciplined use of the system (data entry is not achieved) (16).

In the *ERP usage phase*, the most critical risks are: ERP system not used in a disciplined manner (12), and only part of the system used and benefits realized (12).

Company B is in the selection phase of the ERP project. In the RAM results, the crucial factors are mostly depended on the personnel (including project manager/team and top management level) behavior, skills, and experience. Company B is also worried of the changes what the new ERP system will affect to the company's normal business, and in opposite, how the normal business hinders the ERP project progress.

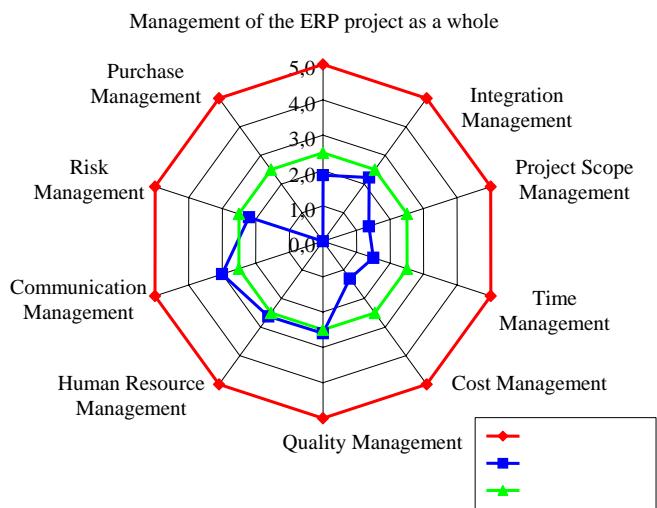The results analysed by CAM; is presented in the figure 2.

Figue 2. CAM diagram of the company B

According to RAM, Communications Management is the management/leadership field that clearly exceeds the critical level. Company B should direct special attention to the factor considered people skills, knowledge and expertise. In

addition, 'Human Resource Management' and 'Quality Management' are right at the critical level. To manage ERP project successfully, the company should pay attention to these three management/leadership factors.

C. Case 3: Company C

Company C has implemented an ERP system a few years ago but only part of the system was functioned complete. Company C is going to continue the ERP project and adopt several new functions of the ERP system in use. The risk list has been filled with company personnel and the effect and probability of risks have been assessed. The risk analysis has been done focusing on the main risks considered the new modules adoption. Also, because the company C already has the ERP system in use, the selection phase was skipped.

In the *ERP installation phase*, the most critical risks which may be realised in company C are: normal business disturbs ERP project activities (25), cost rise compared to initial estimations (25), supplier is not committed enough to system implementation (25), software configuration and testing don't function swiftly (25), company is not important customer for supplier and don't get the best effort (25), and supplier don't understood the customer needs (25). In the *ERP usage phase*, the most critical risks are: all needed information is not entered into the system (15), only part of the system used and benefits realized (12), and system not felt as helping the business (12).

Company B estimates several risks and their probability with maximum rates. This estimate is possibly coloured by the partial failure of their old ERP project, and the communication difficulties they experienced with their ERP supplier. Company B also has few employees (under 20), and when the contact person of the system supplier disappeared in the middle of the project, the risks came true.

The CAM was not carried out in the company B, since they were already at the usage phase of their ERP project. Main usage phase problems occur because of the poor requirements specification phase, and lack of documentations in the implementation phase related to configuration and parameterisation. Also, the key person of the ERP vendor shifted to another company middle of the project.

IV. Discussion

The ERP project should not be viewed merely as a project of acquiring and implementing a new ICT system but as a framework project for the company's all business processes. According to [14], twofold approaches should be taken for ERP projects: 1) Change the business processes to fit the software with minimal customisation. On one hand, fewer modifications to the software application should reduce errors and help to take advantage of newer versions and releases On the other hand, this choice could mean changes in long-established ways of doing business (that often provide competitive advantage), and could shake up important people roles and responsibilities; and 2) modify the software to fit the processes. This choice would slow down the project, could affect the stability and correctness of the software application and could increase the difficulty of managing future releases, because the customizations could need to be torn apart and rewritten to work with the newer version. Conversely, it implies less organizational changes, because it does not require dramatically changing the company best practices, and therefore the way people work.

SME companies usually have great difficulties in their ERP through. The most common risk that may entail project failure is the ubiquitous lack of resources and IT skills or the company personnel [2]. ERP systems are typically designed for large companies, and the ERP suppliers do not necessarily understand the special characteristics and operational processes of small companies [11]. The success of an ERP project also largely depends on how well SMEs can manage changes in their business and how well personnel can adopt new way of operations. This change process is best to start already in the early phase of the ERP project, because many risks can be eliminated before the ERP project system starts. The SMEs can e.g. hire temporary staff to perform the routine operations so the key persons get more time to concentrate on the ERP system characteristics and new work practices.

The most potential risks can be divided in the following categories: the ERP supplier, the ERP system, and the customer company. The most potential risk related to the ERP supplier, is simple to choose the wrong supplier, which doesn't understand the company's special demands, or are not interested enough to committed to the ERP project of small customer. Also, the high potential risk is that the ERP supplier chosen ends the development and/or support of the system. Most potential risks related to the ERP system are depended on its technical and functional performance and features; how well the system can be implemented, configured, parameterised, and integrated.

Most potential risks related to the company are connected with the factors of company personnel and company top management; their skills, knowledge, and experience. Also, resistance to change is a typical potential risk factor. Personnel may not see the benefits of the system in their own work and, thus, are not committed to the new business model, and don't use the system in a disciplined manner. Normal business also disturbs the ERP implementation, and personnel may be unwilling to put time or effort to the development work. Top management support to the project is the most important success factor for the ERP project [15]. The second success factor is the proper project manager [4].

According to the CAM, the biggest investments in terms of bringing the ERP project to the finish line should be directed at Human Resource Management and Communications Management. In such a large change project the challenge is to make the employees stand behind the change. The acquisition of an ERP system includes within it changes for the company modes of operation and processes. For this reason the commitment of staff should be strong, so that new operational models are taken into use and the system can therefore be exploited to its full potential. The risk of sticking to old ways of doing things after system implementation is often high. People are experts at finding reasons why there is no need to change things or why it is better to stick to the old way of doing things, when they do not fully understand the purpose for the change. The change process is as a ground rule condemned to failure if people do not understand the need for change. For this reason it is important to create a

clear vision of the desired change and to communicate this really actively to the people involved in the change. In a long ERP project it is also important to obtain short-term successes so that people do not lose interest in the change process and the final aims are reached. Hence, it is good to divide the project into smaller part projects. It is typical for change processes that a process is declared a success too soon, at a stage when the first goals of the process are reached. For example, in the case of ERP projects it is erroneous to proclaim the project a success at the stage when the system they have has managed to run the system successfully and they have just started using it. Only when the system can be fully exploited and the original goals have been achieved can you consider the project to have succeeded. It is possible to enhance staff commitment to the process and the new operational model by communicating the change and by training staff. It is very typical that the need for communication and training is underestimated. The importance of communication can also be seen in the fact that communications enhance the commitment of the management level in the process. It also pays off to communicate issues during the project that are not being done. In this way you can diminish the potential of misunderstandings and to be in control of expectations. At the beginning of the ERP process it is recommended that a communications plan be drawn up, in which target groups, means and timing are outlined. In the case that everything possible in the project is outsourced the company staff will not consider the operational model to be their own.

V. CONCLUSION

This study presents experiences that are obtained in case studies in which three SME companies were drawn an ERP project risk analysis and characteristics analysis. The case companies considered both of the methods as good tools; they forced the company to think of the potential risks that might go off at the different stages of the ERP project, whether these risks had to do with the technical and functional characteristics of the system itself, or with the expertise and commitment of the staff, top management or ERP system vendor. The RAM presents risks in a form and language that is understandable, because the analysis have been done in the company context. As negative aspect of this RAM is that it requires a significant amount of work, and also help from external experts. The CAM helped the case companies in dividing their ERP project into manageable entities and provided them with recommendations on what leadership/management aspects they should devote special attention to. The CAM also showed inadequacies in the fields of management and leadership that the implementation of an ERP system causes in companies.

Cooperation with the research group provided the companies with new skills and the drive to continue in their own ERP project. Company A will take the next step in their ERP project and is faced with an extensive requirement specification process with the objective of mapping out the suitable ERP solutions for their company and to choose their ERP in 2009. Company B aims at enhancing the system they already have in use and to adopt new modules in 2009. Company B has initiated new contacts with their system integrator/provider and commenced the change requirement specification phase of adjusting their system. Company C made their decision on which ERP system they will choose at the end stage of this research. Implementation will commence in 2009.

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