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ANALYSIS OF DECISION MAKING FOR ENTERPRISE RESOURCE PLANNING (ERP) SYSTEM SELECTION AT SMALL AND MEDIUM-SIZED ENTERPRISES (SME) IN THE GERMAN SPEAKING REGION

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ANNOTATION

Mid-size companies are very important players in the German economy and understand their challenges in the global market. They need to focus on following their growth priorities while being confronted with an increasingly tough globally competitive environment. To remain in that new market situation they need to expand aggressively but profitably while growing organically. Therefore, especially mid-size companies have to take the chance and challenge to select a supporting ERP system.

This dissertation investigates in the strategic decision making process of small and medium-sized enterprises (SME) with the special focus on the selection of an ERP system. Analysing and reflecting the specifics of this approach, let to the extended research along the decision people, following a selection process structure and identifying the decision criteria. The aim is to prove the relation of the decision making process (the selection) of an ERP system with the satisfaction of the chosen ERP system along a set of criteria.

The theoretical part of the dissertation is based on a well-funded literature research in the area of organization and decision making theories, particularly emphasizing Nobel Prize Laureates H. A. Simon and D. Kahneman`s concepts of decision making efficiency outcomes, bounded rationality and prospect theory.[1]

Very detailed literature reviews have been executed focusing on selection and decision making models as well as detailed research on the success criteria. Using the results, a criteria based model has been developed, with the uniqueness of aligning the satisfaction of the ERP system with the quality of the selection process on a measureable basis.

The ERP life-cycle (selection, implementation & operation) is very complex and challenging to execute especially for SMEs which seldom use a structured implementation process.[2] Therefore it was a valid to start this research qualitatively executing a series of semi-structured interviews and company case studies. After this first qualitative verification of the hypothesis a quantitative research approach was taken. The execution of a quasi-field

[1] Simon H. A. 1978: Rational Decision-making in Business Organisations. Novel Memorial Lecture, Carnegie-Mellon University, Pittsburgh, Pennsylvania, USA, Economic Science, pp. 343-371
[2] cf. Verville, et al., 2003a, p. 585

experiment with ERP professionals followed by a detailed questionnaire supported the findings quantitatively.

The result of this research, being a positive relation between the quality of the execution process and the satisfaction with the ERP system, will be useful for many SME companies. The suggested model as well as the structured set of criteria will be a good starting point for further research as well as a basis for additional case companies.

CONTENT LIST

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List of Abbreviations

ANP	Analytic Network Process
BF/M	Betriebswirtschaftliches Forschungszentrum für Fragen der mittelständischen Wirtschaft e.V. an der Universität Bayreuth. Institute for SME at the University of Bayreuth, Germany
BPR	Business Process Reengineering
CEO	Chief Executive Officer
CIO	Chief Information Officer
CSF	Critical Success Factors
DM	Decision Making
DATEV	DATEV e.g. Company for IT Services
EIB	European Investment Bank
EIF	European Investment Funds
ERP	Enterprise Resource Planning
EU	European Union
IfM	Institut für Mittelstandsforschung, Bonn Institute for medium-sized company science in Bonn, Germany
IT	Information Technology
SDM	Strategic Decision Making
SME	Small and Medium-Sized Entities
USP	Unique Selling Point

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INTRODUCTION

Actuality of the topic

The advantages of using Enterprise Resource Planning (ERP) software have been well understood by the large and multinational businesses for a long time. The selection, implementation, and maintenance of standard enterprise resource planning (ERP) software, like the high-end enterprise packages of, e.g., SAP®, Oracle and Microsoft is more and more a commodity part of big enterprise businesses. The information technology (IT) employees of their departments are well trained with years of experience. The consultancies supporting them are preparing in very professional competence centers, e.g., industry solution departments for the different branches. The IT-methods are proven, many case studies are available and most of the time, there is a variety of relevant solutions available for nearly any given problem. This market is characterized by a profound stability since 2009.[3]

The area around the small and medium enterprises (SMEs) is significantly different. A lot of small, mainly local IT companies are implementing a large number of different ERP solutions according to a similar number of different methods. The trends are mainly driven by the requirements of the global market and the uniqueness of small companies.[4]

The business requirements for medium-size companies are changing rapidly. Hence, their need for a professional ERP system support is higher than ever. A study of the Centre for Enterprise Research of the University of Potsdam analysed 1300 SME companies and stated that about 70% of the companies are planning to invest in an ERP System implementation or are in the middle of the implementation process. A trend towards a decline of the significance of an ERP System specifically for SME is not noticeable.[5] There are significant trends where SME companies and ERP providers will have to work on for the next 5-10 years. Firstly, due to the high internationalisation, specifically of German SME companies, the ERP provider needs to invest in very specific industry solutions which can be integrated. In addition, the core functionality and processes have to improve even more. Secondly, technology and IT architecture are gaining importance. Finally, ERP has to provide mobile solutions in the years to come. The study claims that the current need for a new ERP System selection and implementation is under 50% but increasing. Similar to cloud computing where currently the companies are still hesitant on the one hand, but dependent on the technological details, more

3 cf. Casper, et al., 2013
4 cf. Rieger, et al., 2010
5 cf. Gronau, 2012

and more companies are interested in new solutions.[6]

Aim and Purpose

The main aim of the dissertation is to investigate whether there is a relationship between the conduct of a strategic decision making process concerning the selection of an ERP system and the satisfaction with the chosen alternative specifically for small and medium sized enterprises. The focus is on the Germany speaking region considering mainly production companies.

Tasks

This dissertation will focus on the decision making process i.e. the selection part of the ERP life-cycle (containing selection, implementation and operation) - and point out the specifics for SMEs showing all activities executed are aligned. Intensive literature research and review of existing models and processes, as well as their related selection and success criteria, were undertaken. The work completed with the case companies to test a proposed model and set of criteria was based on expert ratification. The model was tested quantitatively executing a field experiment and expert questionnaire.

Overall, a lot of detailed and diverse activities have been executed with the sole aim of identifying and proving the criteria based model for the selection of an ERP system at SMEs.

Subject

Strategic decision making for enterprise resource planning (ERP) system selection at small and medium-sized enterprises in the German speaking region in order to develop a real world decision making model including a detailed procedure, measures and indicators for the ERP selection.

Object

The object is small and medium sized enterprises to investigate whether there is a relationship between the conduct of a strategic decision making process concerning the selection of an ERP system and the satisfaction with the chosen alternative. The focus is on the Germany speaking region considering mainly production companies.

[6] cf. Gronau, 2013

Hypothesis and Research Questions

The key research question is: *"Is there a relation between the suggested selection process of an ERP system and the overall satisfaction with the ERP system at its final state i.e. up and running? And is there a basis for evaluation of selected outcome quality?"*

Meaning which model has to be followed during the selection phase to have a successful system in the end, used and maintained by satisfied employees. This research question leads to the *main hypothesis* driving the overall research:

The level of satisfaction with a selected ERP solution is strongly dependent on the execution of the decision making model.

Main thesis to defend

Aligned with the hypothesis mentioned above and the research question, additional propositions have been developed. These following three propositions have been the basis for all research and analysis and supported with the key results.

- Proposition1: The use of the suggested selection process has a positive impact on the satisfaction with the decision.
- Proposition2: The involvement of decision people has a positive impact on the satisfaction with the decision.
- Proposition3: The use of specific decision criteria has a positive impact on the satisfaction with the decision.

Used Methods

The ERP life-cycle (selection, implementation & operation) is very complex and challenging to execute, even for large organisations, but especially for SMEs who seldom use a structured implementation process[7]. Given that it is a rather new field of research and relevant interviewees were not responsive a qualitative research strategy was designed as a starting basis. The approach taken in this qualitative part of the research was to carry out a series of semi-structured interviews and company case studies. Later on the results have been challenged quantitatively involving professionals for a quasi-field experiment and challenge ERP professionals with a questionnaire.

[7] cf. Verville, et al., 2003a, p. 585

Semi-structured interviews with a subject matter business expert were firstly favored to simple questionnaires to ensure greater consistency in the presentation and interpretation of questions and their answers during the actual interviews. A questionnaire with eight topics was developed and used as the basis for each of the interviews. This approach led to more reliability in the subsequent comparison of the information and data collected. The research methods are used purely to achieve qualitative results, mainly due to the smaller sample size.

From the information collected during this series of semi-structured interviews a hypothetical ERP selection process (see Figure 3-7) was developed and then tested using two company case studies. The first company case study was used to initially create and test the developed "selection model" and a corresponding set of "selection decision criteria" in order to drive the suggested ERP selection process engaging the relevant decision people. In the end the study was used to measure satisfaction with the chosen system based on a set of defined criteria derived from literature and verified during the decision-making. The second company case study focused on a detailed execution along the suggested model, testing the "structured selection process" and "detailed selection criteria" with the involvement of the right team. This was developed based on literature, expert interviews and the input of the first company case study. The results of the semi-structured expert interviews provide a point of view on the theoretical research results and are tested with the company case studies. A multi-method approach was used to gain additional input due to the sample size. On the basis of the findings of the qualitative results a quasi-field experiment was executed with ERP professionals to support them. A questionnaire was developed in sync with the qualitative questionnaire used in the expert interviews. This questionnaire was distributed to a wider group (65) of ERP professionals supporting the results quantitatively.

Content of Dissertation

Chapter 1:"Theoretical foundation of decision making".

This chapter has been used to outline the associated theories. Very specifically focusing on the decision making theories which concentrate on models, related specifically to the strategic decision making approach. The different approaches of decision making are analysed in the framework of the selection of an ERP system at SME. In addition the theories of ERP system selection and buying behaviors and the specifics for SME have been considered. The models have been reviewed and summarised for further analysis.

SMEs lack critical human and technical capabilities' and spend a significant amount of money for an ERP system in comparison to their turnover (over 5%). To fail the ERP implementation

often results in bankruptcy of the company[8]. Therefore it has to be pointed out that the strategic decision of an ERP system for a SME is critical and that they need to consider in detail the people involved, the process followed and the criteria defined according to the business requirements. To summarize the chapter, the selection of an ERP system is a critical strategic decision making process with a long term impact on the organisation. It is a rational decision based on a model, which cannot be completely separated from irrational influences. The buying procedure – the acquisition itself, is the result of an intensive strategic decision making process finalised with the decision itself, the selection of the ERP system.

Chapter 2:"Review of specific research studies into ERP selection at SME".
This chapter illustrates in detail all aspects of specific research of ERP systems, ERP life-cycle and SME. The reviews in literature show that the subject of ERP selection and implementation is becoming more and more popular. Most of the literature included in this research was published in the last ten years. Firstly, reviewing many of the existing papers it was observed that the ERP selection is a topic which is rarely covered. "However, current ERP research has focused on the ERP implementation stage, post-implementation and other organisational issues, the issue of an acquisition process for ERP software is, for the most part, being ignored."[9] Secondly, the selection and acquisition process of SME companies and very specifically the purchasing of an ERP system is not part of a CEO's key business remit, so the subject in the context of SME companies is a very recent topic. Finally, when reviewing the literature that combines selection criteria and ERP software, most articles focus on the implementation not on the selection of the software. There are some detailed case studies available which evaluate the criteria sometimes called 'critical success factors' in literature.

Chapter 3:"Model development, research propositions and methodology"
The research question and main hypothesis of this thesis will focus very specifically on the decision making procedure i.e. the selection of an ERP for SMEs, and its influence on the overall satisfaction with the chosen system. The developed model and the identified variable e.g. decision criteria, cover a wide area but the supporting propositions and their conceivable validity will focus on the aforementioned scope, and relate specifically to SME companies. Designing the research strategy led to the analysis of relevant research methods. As a very recent topic the collection of representative quantitative data is complex and the return rates

[8] cf. Fisher et al., 2004, p.38
[9] Shehab et al., 2004, p.374

are very low. Due to the expertise and the very in-mature, new research area a qualitative method has been chosen firstly. The evaluation of the topic in current literature confirmed this and supported the use of a multi-method approach. Semi-structured interviews with business experts were used to confirm the findings of a detailed literature research followed by two case studies to test the developed, proposed model. In addition a quasi-field experiment was executed to add quantitative data and substantiate the first qualitative findings. Finally a questionnaire was distributed to ERP professionals to include a higher number of companies and get additional representative feedback.

Chapter 4:"Specification of applied research methods, findings and results".
This part illustrates in detail the research executed according to the aforementioned methods, pointing out the goals and threats as well as the qualitative and quantitative criteria for the study. It summarises all findings according to the main research question and hypothesis, as well as the results obtained from implementing the aligned propositions and research methods. Detailed literature review together with the results of the expert interviews foster the assumptions taken for the overall empirical research of this study. The case studies support more intensively and very detailed the overall model developed, specifically using and testing it, confirmed the research question positively. The quasi-field experiment and the questionnaire distributed to ERP professionals add some quantitative results to the detailed qualitative findings on a wider area of distribution.

Overall limitations taken in summary

The target group of this paper are small and mid-size companies with up to 250 employees located in Germany and Austria. The detailed research is limited geographically to the southern part of Germany, Bavaria and Tirol in Austria. For a concrete comparison, the industry covered is the production industry. Insurances, banks, governmental institutions, service companies are out of scope as well as natural resource companies. Due to the actuality of the topic the research considers a timeframe of the last 10-15 years (Year 2000 plus). The very specific focus is the fulfilment of decision criteria after go-live of an ERP system at small and mid-size companies and whether or not the entire organisation and business processes have been changed. The implementation is out of scope. The research covers neither the comparison of current software packages nor providers and their functionality and efficient use. The focus is on standard ERP software packages, not on any individual programming. The selection of hardware and its purchasing process is out of scope. The

quality of the execution of the expert interviews is related to the capabilities of the interviewer and interviewee not completely neglecting some subjective characteristics.

Main conclusions

A review of the literature pertaining to decision criteria for selection as well as different ERP decision making / selection models, and selection part of the life-cycle illustrated, indicates that there is a lack of research. The study undertook the task of examining the ERP selection part of the overall ERP life-cycle process and focused on SME companies. It developed and empirically tested a model which combined the selection of an ERP system with the overall satisfaction within the ERP life-cycle, along a defined set of criteria. The proposed model assumed a qualitative approach for execution i.e. the process used, the people involved and the criteria defined. The model was developed, expanded and tested with business experts. It was validated with mainly one very long company case study and a second very detailed company case study, focusing on the extensive analysis of the set of decision criteria. Finally all qualitative compiled results have been evaluated on a quantitative basis executing a quasi-field experiment and distributing a questionnaire to a higher number of ERP professionals.

Summarizing the main conclusions the author identified:

1. In the world of highly integrated business processes even very small companies are forced to use computer systems (e.g. ERP systems) to maintain their competitiveness.
   1.1 There is always a clear business trigger, a set of requirements, before a small or mid-size company starts the selection of an ERP System. The key triggers are: international growth, replacement of an old system and/or a merger/acquisition situation.
   1.2 Due to increasing need the ERP market for SMEs has a high growth potential. Surprisingly the existing market does not meet the specific needs of SMEs identified as high flexibility and an efficient approach to the execution of the ERP life-cycle. Instead the market is very diverse and no standardised methods or processes exist.
2. The research area of ERP and decision making theories is very recent and was found not to be very mature concerning the selection part of the ERP life-cycle process in general. In the existing studies of the small and mid-size production industry the selection part of the ERP life-cycle does not receive proper attention. The author found by retrospectively evaluating ERP life-cycles that the efficiency of the selection process is highly relevant for the satisfaction after implementation of the ERP system.

3. Out of a pool of variables influencing the quality of the selection process of an ERP system three were extracted and specified in detail: a structured selection process, the involvement of significant decision people and the decision/ selection criteria.
    a. The use of the developed structured decision making model for the selection of an ERP system at SMEs leads to a higher and measureable satisfaction with the system due to a highly structured selection process.
    b. The leadership team in charge of the decision for an ERP system has to involve IT related knowledgeable decision people or improving their own IT/ERP affinity. This will lead to a better result at the decision making point in time.
    c. The detailed set of decision criteria included in the structured model for the ERP selection provides an efficient approach even for non IT/ERP related people, leading to a highly professional execution and a measurable result.
4. The pressure on a precise ERP implementation which covers all business and functional needs is rated very high for SME companies due to their small size, limited budget and limited resources.
    a. The flexibility and speed of the ERP life-cycle is rated much higher than the pure costs of the system.
    b. The price needs to be economic but is not rated as high as the first analysis would predict as long as the ERP system fits the needs of the company.
    c. To schedule sufficient time for the selection has a positive impact on the satisfaction with the chosen system.
5. Without a standardised approach the selection of the ERP system is threatened to be highly influenced by irrational factors. These influences are minimized by using the developed structured model which provides a predictable, profound and stable basis.
6. The interviewed and analysed companies confirmed that almost all of them did not use a defined, structured selection process or overall decision making model. By reviewing the suggested model with the interviewees they confirmed that this model would have been beneficial to them in making a structured decision, which would have led to a higher satisfaction with the ERP system.

Main suggestions

Suggestions to the executives of SME Companies:

1. SME Companies have to understand the selection of an ERP system as a strategic decision. Executives must be aware of the high business risk and that a wrong decision has a high impact even on a long term basis.

2. SME Companies in the position to select an ERP system should use the developed decision making model at the very beginning to structure the process and develop details as a starting point for the selection. They need to build awareness for the importance of the selection.
3. SME Organisations have to follow the proposed detailed, clear and structured selection process before starting the implementation of any of the systems.
4. The suggested decision making model enables even leadership and management with little or no IT/ ERP affinity to execute a professional selection process for a SME company.
5. SME companies should make a detailed analysis of their functional and business requirements at the beginning of the selection process. These factors have to be weighted and prioritised. Later on satisfaction can be measured in relation to their identified set of priorities.
6. The CEO'S and CIO's should be trained to make strategic ERP decisions along the suggested decision making model. This rationalization contributes to a higher competence independently of their previous IT/ERP personal knowledge.
7. CEO's should leverage the experience provided with this strategic decision making process, using the developed model and adapting the functional details for other strategic decisions.

Suggestions to ERP providers:

8. ERP providers can demonstrate that they understand the specific needs of SMEs by using the proposed decision model. Reusing the models of big global entities does not reflect an understanding of the SME market.
9. Using the structured selection process, ERP providers can position themselves and differentiate with an adapted process within a growth market.
10. ERP providers should use the set of decision criteria developed as a significant sales advantage to explain the benefits of their product.
11. Enlarging the set of decision criteria for their client's business, ERP providers will have a clear unique selling point, differentiating themselves from their competitors.

Suggestions to the scientific community:

12. The ERP market especially for SMEs is far away from saturation. Therefore the development of standardized templates for the structured selection process of an ERP

system developed to meet the needs of the target group (SME) is of high importance for further Research and Development.

13. The scientific community should use the results and interpretations as a basis to relate the mature decision making theory with further areas of operationalization. The model developed is very generic but the variables are specific to the topic of ERP.
14. The scientific community should consider the use of the model in relation to other fields of decision making which should be elaborated. They should consider the area of selection of an ERP system for SME companies as an important research field.

Used sources

The theoretical part of decision making was based on significant books and Nobel papers providing a basis. Given the actuality of ERP as a topic for decision making, there are some key researchers in this field but they established just in the last 10-15 years. Schlichter executed a relevant literature review in 2010 mentioning the key researchers in this field and publications,[10] which have been used. To point out recent ones, the key authors for business journals are J. Verville, A. Harlingten, T.M. Somers, M. Al-Mashari just to mention a few main ones.

Novelty

1. The author developed a model of decision making specifically related to ERP selection on the basis of existing theoretical models and expert opinions.
   - 1.1 The evolved model focuses respectively on the selection stage of the ERP life-cycle process in contrary to the existing ERP models that concentrate mainly on the implementation stage.
   - 1.2 In order to evaluate the decision, the model connects the beginning i.e. the selection with the outcome i.e. the satisfaction.
   - 1.3 The developed model applies especially to SMEs rather than large global companies as is the case with most of the existing models.

2. Out of numerous variables that influence the decision model of an ERP system three have been extracted by the author for the first time as the key driving factors: structured selection process executed, significant decision people involved and selection decision criteria defined. For each of these variables important details have been developed in order to guarantee a high level of applicability to the model.

[10] cf. Schlichter et al., 2010, p. 501

2.1 A comparable basis in order to analyse the efficiency of the *selection process structure* of an ERP system was created and the outcome of it defined by the author. The level of detail for this process is very precise, including the developed basis of specific templates which can be used by SME organisations.

2.2 For the first time, practical guidelines have been developed to support the involvement of *decision people* involving a knowledgeable team.

2.3 Out of the retrospectively defined set of *selection/ decision criteria* the author initialised practical guidelines in the form of specific templates which consider the needs of SMEs.

Approbation of the results of research

The main results have been provided to the scientific community for use and further research.

International Scientific Conferences:

International conferences, in which the results of the research have been reported on:

- Van der Vorst, C. (2014) 9th International Academic Conference, Istanbul, Turkey, IISES, *"Satisfaction with the Selection of an ERP System. Experts Opinions for SME",* Istanbul, Turkey, April, 13-16, 2014, International Institute of Social and Economic Science, Selcuk University, Turkey and University of Economics, Prague, Czech Republic.
- Van der Vorst C. (2014) 2nd Global Virtual Conference, *„ERP System selection for SME Companies."*, Online, April 7 - 11, 2014, Thomson Ltd. Slovakia, University of Zilina, Slovac Republic and Goce Delchev University of Macedonia.
- Van der Vorst C. (2013), International Scientific Forum, ISF 2013, "The level of satisfaction with an ERP system in relation to the decision making process", Tirana, Albania, December, 12-14, 2014, European Scientific Institute of University of Azores.
- Van der Vorst, C. (2013). *Theory of decision making for the effective analysis of ERP selection at SME.* International Scientific Conference "New Challenges of Economic and Business Development, Riga, Latvia, May 2013, University of Latvia.
- Van der Vorst, C. (2012): International Research Conference, "International Business and Economics Conference", *"Why do you need an ERP system as a SME company? How do you know which is the right one? Expert opinions."* Kufstein, Austria, August 2012, University of Applied Science, Kufstein, Tirol, Austria.
- Van der Vorst, C. (2012), International Scientific Conference. "New Challenges of Economic and Business Development", *"Approach for selecting ERP Software at mid-*

size companies reflecting critical success factors." Riga, Latvia, May, 2012, University of Latvia.

- Van der Vorst, C. (2011), International Research Conference, "Recent Developments in Business Management Research", *"Selection and Acquisition of an ERP Software at mid-size companies. Lessons Learned from experts."* Fulda, Germany, December, 2011, University of Applied Science, Fulda, Germany.
- Van der Vorst, C. (2011) International Research Conference, "Current Issues in Economic and Management Sciences", *"Strategic decision making at small and mid-size companies using the example of information technology acquisition."* Riga, Latvia, November, 2011, University of Latvia.
- Van der Vorst, C. (2011) International Research Conference, "Recent Developments in Business Management Research", *"Selection and Acquisition of an ERP Software at mid-size companies. Lessons Learned from experts."* Riga, Latvia, May 2011, University of Latvia.

Publications:

Papers have been published in combination with the conferences and in journals.

- Neuert, J., Van der Vorst, C. 2014, *"Success factors for the evaluation of an ERP System investment decision in SME's. Theoretical considerations and empirical findings",* JAABC Journal, ISSN 1540-1200.
- Van der Vorst, C. 2014, *"Satisfaction with the Selection of an ERP System. Experts Opinions for SME",* Conference proceedings, IISES Conference Istanbul, Turkey.
- Van der Vorst, C. 2014, *"ERP System selection for SME Companies. Expert Opinions",* Conference proceedings, GV Online conference, ISSN 1339-2778.
- Van der Vorst, C. 2013. *"The level of satisfaction with an ERP system in relation to the decision making process."* European Scientific Journal. ISSN 1857-7881 eJournal eISSN 1857-7431.
- Van der Vorst, C. 2013. *"Theory of decision making for the effective analysis of ERP selection at SME"*. Conference proceedings. ISBN 978-9984-45-715-4, pp. 634-644.
- Van der Vorst, C. 2013. *"Selection and Acquisition of an ERP Software at mid-size companies. Lessons Learned from experts."* Discussion Papers Vol.8, German National Library Database, ISSN 2194-7308.

- Van der Vorst, C. 2012. *"Approach for Selecting ERP Software at Mid-size Companies Reflecting Critical Success Factors."* Journal of US-China Public Administration, David Publishing Company, Vol.9 Nr. 9, pp. 1057-1068. ISSN 1548-6591.
- Van der Vorst, C. 2012. *"Approach for selecting ERP Software at mid-size companies reflecting critical success factors."* Conference proceedings. ISBN 978-9984-45-519-78, pp. 780-791.
- Van der Vorst, C. 2011. *"Strategic decision making at small and mid-size companies using the example of information technology acquisition."* Conference proceedings. ISBN 978-9984-45-417-7, pp. 677-687.
- Van der Vorst, C. 2011. *"Selecting an ERP Software at mid-size companies. An investigation of the decision making process."* Conference proceedings. ISBN 978-9984-45-348-4, pp. 847-858.

The content of the publications is in sync and part of this dissertation. Therefore these publications are not cited specifically.

1 THEORETICAL FOUNDATION OF DECISION MAKING

Decision making theories are a wide area in science. Even years after Neumann/Morgenstern published their theory of the axioms[11] there are many results published in this field of economics. The modern decision theory is not clearly definable and many areas of science concentrate on it. Reviewing the anomaly of decision making and all the findings for the very specific case of a software decision, many impacts should be considered. Klose[12] stated that there are the effects for the orientations of decision making considering all interdisciplinary relationships. The decision for an ERP system should be a rational decision based on multiple facts. The main theories in science for decision making should be considered. Rational theories are based on facts not considering soft facts or preliminary decisions. Klose concludes in his study that it is useful to make anomal decisions rather than wrong, incorrect decisions especially if there are not enough information for a rational decision. If the costs for failure can be calculated they should be compared with any second best / anomal decision[13]. The problem is that the costs for failure or no decision cannot be calculated. Therefore the question remains, whether the decision for an ERP system should be based on a rational approach or whether irrational behaviours related to it?

Business requirements are changing very rapidly specifically for small and medium-sized entities (SME) challenged to work in an international environment competing in the global market. Despite the decision for an ERP system is more and more commoditised for big global entities it is very new to SME. It is a strategic decision because it has a long term impact on the organisation. The risk associated with the selection and implementation, is much higher than for big enterprises. SMEs lack critical human and technical capabilities' and spend a significant amount of money for the ERP system in comparison to their turnover (over 5%). To fail the ERP implementation results often in bankruptcy of the company[14]. Therefore it has to be pointed out that the strategic decision of an ERP system at SME is critical and needs to consider in detail the people being involved, the method followed and the criteria defined according to the business requirements.

[11] cf. Neumann et al., 1944 – Theory of games and economic behavior.
[12] cf. Klose, 1994, p.6f
[13] cf. Klose, 1994, p.152f
[14] cf. Fisher et al., 2004, p.38

1.1 Theoretical Analysis of Decision Making

Decision Making Theory is part of Organisation Theory. Both developed very much aligned in the 20th century and were influenced and explored by the same theorists and researchers. The decision making theory is seen as part of the organisation theory. Organisations are interpreted and analysed as a system of decisions to be made; therefore the close link was confirmed. There are mainly two relations: organisational measures are just defined to control company decisions and vice versa defining clear and structured organisational measures require extensive decisions. Therefore even the basic factors (goals, information and capabilities) influencing organisations are related to decision making factors.[15]

The definition for an organisation can be differentiated into the different dimensions which are related as well to the three key differentiation areas of decision making. Whether an organisation is seen as a machine to accomplish goals, a small society or an organism are the key drives basically the analysis and definition. The key definition for organisation is the *rational system organisation* which was defined, developed and analysed mainly by Barnard, Simon and March. Gouldner focuses more on a natural system definition where the organisation is seen as a *natural system* structured according to behaviors. Challenging that an organisation is not a closed but an open system with heavy influences from outside, the next definition, the *open system* definition, was created focusing on the wider interest embedding all different interests. All three systems are valid approaches which influence all organisations and impact their decision making.[16]

1.1.1 History of Decision Making Theory

The history of decision making theories reaches back hundreds of years. With diverse and different focus on the various sciences and intellectually disciplines like mathematics, sociology, psychology, economics and political sciences just to name a few. The research into risk and organisational behavior has just the main desire to help to achieve better outcomes. Leaders of all kinds have been forced to make decision like e.g. the emperors in wars, but it wasn't until the seventeenth century before the humankinds understanding of numbers was up to calculate risk and decision making.

[15] cf. Laux et al., 2003, p. 23f
[16] cf. Scott et al., 2007, p. 27ff

Daniel Bernoulli, Friedrich Gauss and Francis Galton have been the ones before the 20th century to come up with studies of random events, normal distribution and concept of regression just to name some examples coming close to the economic study of risk analysis. Risk is an inescapable part of every decision; therefore it has to be considered.

In the 20th century the studies and interest of researchers in the management fields occur and new theories have been developed rapidly. After World War I the risk theory gained more interest. Frank Knight distinguished in 1921 between risk, as a calculable, possible outcome and uncertainty, when an outcome is not possible to determine or unknown. Chester Barnard separates personal from organisational decision making. Neumann and Morgenstern describe with their game theory the mathematical basis for economic decision making. Herbert Simon and James March shared the fascination of organisational behavior and Simon rejected the classical notion of rational decision making. IBM launched their mainframe system end of the 1960th and scientists were envisioning how new tools might improve human decision making. The use of technology influenced decision making and still does with endless information of the internet as well as supporting technologies to support any mathematical calculation to support decision making.

Henry Mintzberg positions decision making in the context of managerial work in the 1980ties. Followed by the knowledge and focus on group dynamics, the care and feeding teams which rapidly evolved. Victor Vroom and Philip Yetton analysed the circumstances under which group decision making is appropriate. The group dynamics continued to be very interesting for management decisions and many other scientists add to that field of research by analysing teams and their influence. Given the complexity and high volume of information and the speed of information changes the trend is towards group dynamics. Management decision like the mentioned selection of EPR system are very much supported by computer systems and the possibility to evaluate the different possibilities with statistics calculated by computer programs. In the case of ERP selection the group dynamics and the decision making team supporting the decider are highly relevant.

Amos Tversky and Danies Kahneman publishing the prospect theory, which demonstrates how people fail to make rational decisions in an areas of uncertainty and founded the area of behavioral economics. This field will be explained in much more detail in the following chapter 1.1.2 and 1.1.7.

The scientific field of decision making is getting mature the area of management decision making. The differentiation of rational and irrational decision making is a more recent field of research.[17]

1.1.2 Theoretical Decision Making Concepts

There are multiple possibilities to differentiate the various disciples of decision making. Common is the distinction between prescriptive (or normative) and descriptive (or positive) decision making which was developed and established end of the 20th century. According to history as elaborated in the previous chapter 1.1.1, the descriptive decision making is the most recent differentiation, so a lot of previous papers and books are just focusing on normative decision making. Decision making analysis has mainly the aim to gain descriptive or prescriptive (mandatory or normative) results. Therefore dependent on the main research objective the aligned theoretical approach is chosen.[18]

The overview of Laux shows in detail the distinction between the two main theories and in more detail that the prescriptive theory is underlined with tangible guidelines and models.

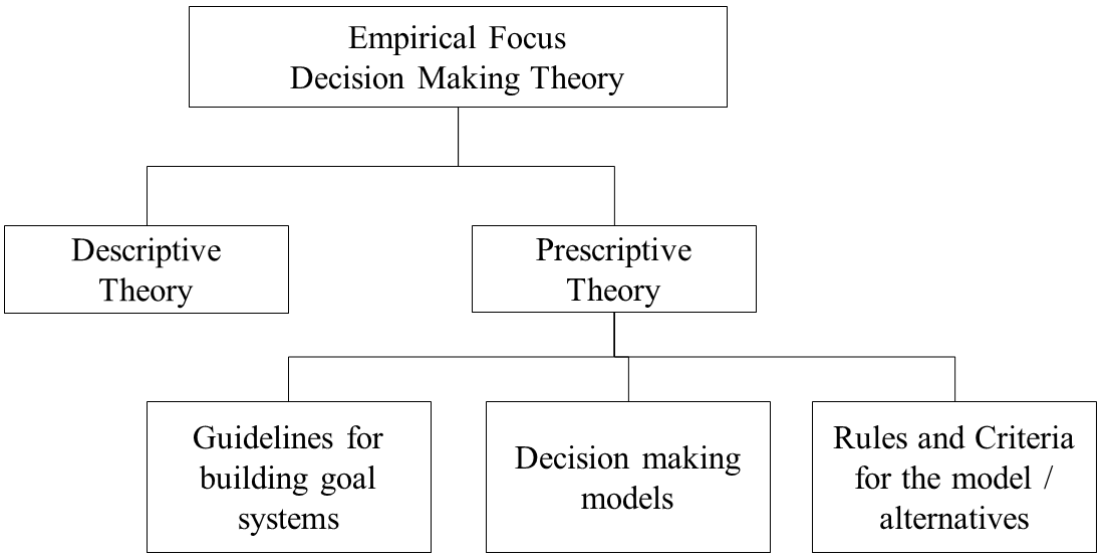


Figure 1-1: Main Theories, created by author according to Laux[19]

Descriptive decision making theory explains the reality of decision making and mainly why they are made in that specific way. Main goal is to analyse empirical hypotheses related to the

[17] cf. Buchanan et al., 2006
[18] cf. Laux, et al., 2003, p.32
[19] cf. Laux, 2007, p.13

habits of the decision maker and the possibility to predict the detailed result. Descriptive theories try to prove the evidence of the relation of two variables in reality. It should support the decision which alternatives are relevant, pointing out the consequences. The descriptive theory doesn't focus primarily on the decision problem and how to solve; it aims to describe the decision in reality. How the person made the decision and the influencing factors based on irrational acting.[20] The descriptive discipline aims to observe the different behaviors of the decision makers and the decision making people therefore the aim is as well to monitor situations and predict future decision making based on the findings. The basis for the descriptive decision making is founded as well in the behavioral and social science.[21]

As shown in Figure 1-1 the descriptive theory doesn't follow a series of models or a structured approach. It is a very recent theory and the empirical research is at the very beginning. To structure and compare the findings descriptive preference theories have been developed which try to describe the intuitive decision making e.g. Prospect-Theory, Disappointment-Theory, Regret-Theory, and others. These Theories are not elaborated in more detail because they are not relevant for the subject of ERP selection.[22]

Prescriptive (normative) decision making theory has the aim to provide an approach how decisions should be made on a rational basis according to defined guidelines, not how they are really made. It should provide guidance how to resolve decision making problems, so it reflects from all angles, all possibilities how the decision making person should act. All basic problems of a decision are analysed in detail as well as all related, eliminating activities excluded. Rational decisions can just be solved, if clear goals exist and the alternatives can be evaluated. All prescriptive decisions have to be evaluated and success of the final solution pointed out. The decider need to be questioned about the objective system which is the basis for a uniformed goal. Usually a decider needs support with a defined concept, structure and guidelines. Therefore the prescriptive decision making should follow a clear model, guidelines and criteria to evaluate the alternatives.[23]

The prescriptive theory would like to support the decision makers to make mainly rational decisions. There is not a clear definition of "rational" so far, very specifically in the context of decision making. Therefore a decision to be right or wrong can only be classified. A result is

[20] cf. Laux, 2007, p. 14f
[21] cf. Salinger, 1988, p. 1f
[22] cf. Eisenführ et al., 2003, p.357f
[23] cf. Laux, 2007, p. 15f

not rational or irrational usually it is in between it is “more or less” rational, and even this cannot be specified. It is very difficult to measure the success of a decision based on a clear rational approach.[24] Basic principles of the decision making need to be defined and evaluated further (e.g. like action alternative, goal setting, command variables, risk analysis, …). Most of these basis elements are covered in the description of the decision making models chapter 1.1.3 as much as they are relevant for this study.

Models which are developed on the basis of rational choice seem to lack practical applicability.[25] The so called “rational decision maker” does not satisfy the considered assumptions of human behavior. Historically decision making theory differentiated between decision making behavior into “open” and “closed” models.[26] Closed models can be seen independent of the environment. It is not distinguished how the cohesive system influence the decision making process, all premises are taken for granted and treated as constant factors. On the other hand open system consider interactions between the decision making process and its environment. The closed model represents typical rational choice, the “classical” / “neoclassical” view. Meaning the decision makers preference is on the maximization of benefits by choosing an alternative that promise the maximum outcome.[27] Kirsch[28] describes this case as the typical “homo oeconomicus” where people are capable of rational behavior, motivated by self-interests and get the highest return by using the given resources. The behavior of the “homo oeconomicus” is characterised by three main assumptions: 1.) the decision maker does have all information at any given point in time and is capable of leveraging all of them. 2.) the decision maker can indicate the best alternative and 3.) and is motivated to maximize the self-interest. Neuert stated the decision maker possesses a complete system of alternatives which allows him to choose. Just taking these implications into account to make rational decisions, seem to fall short. Human behavior never shows pure rationality in decision making. Rational is limited by individual and/or collective constrains, like insufficient cognitive competences, psychological predispositions, feelings and emotions, norms, rules, structures and values, etc.. In particular human behavior for any decision making has to be considered as a combination of intuitive and rational behavior. [29]

[24] cf. Eisenführ et al., 2003, p. 4
[25] cf. Bendoly, et al., 2006, p.737ff
[26] cf. Kirsch, 1970, p.25f
[27] cf. Roth, 2008, p. 111
[28] cf. Kirsch, 1970, p.27
[29] cf. Neuert, et al., 2014, p.3

The selection of one or multiple alternatives is the result of many thoughts in the beginning. Therefore decision making is not just the decision itself as a point in time; it is a process for problem solving. Opportunities are evaluated according to the various approaches. One process evaluated is a five step approach developed by Scalan and Heiden.[30] The steps are: definition of the problem, detailed goal setting, development of goal systems, selection of one opportunity and decision at start of realization. This is one systematic approach to follow for a solution. Bamberg divide the decision making process in three key areas to be evaluated the goal setting, the information and the selection process. The goal setting is defined by factors changing the goal categories and the real result. Information setting differentiates the information collection and the information building. The selection analysis differentiates between problem definition, standardised rules and the analysis of alternatives. This decision making approach is based on organisation decisions and should be considered for strategic decisions considering rational and irrational behaviors.[31]

To get more precise decision should follow a model or a structured approach both will be evaluated in detail in the next chapter.

There is a variety of identifications of the term decision. In science the term management decision making is very often synonymously treated with the preparation process, the selection and the decision itself. "Decision making comprises three principal phases: finding occasions for making a decision; finding possible courses of action and choosing among courses of action".[32] For the purpose of this paper decision making is illustrated as a process which is finalized with the decision itself in the end. This process needs a specific structure and unfolds over weeks and months, with management political power and role play to conclude in a final result, the event of a decision.[33]

The results of descriptive decision making can be relevant and influence the prescriptive decision making. Prescriptive theories provide guidelines (framework and model) to solve decision making problems. But these evaluations are just feasible if the person making the decision can obey it. The descriptive decision making investigates in the requirements and fulfilments of the person. Both theories are relevant to make significant decisions.[34]

[30] cf. Laux, 2003, p.32f
[31] cf. Bamberg, 2002, p.9
[32] Harrison, 1996, p.46
[33] see Garvin, 2001, p.110
[34] cf. Laux, 2007, p. 15

To summarize, most of the time decision making theories are focusing mainly on the prescriptive theory which is concentrating on identifying the best decision to take, assuming the ideal decision maker who is fully informed and able to calculate the risk to make a fully rational decision based on a structured approach. Therefore prescriptive decision making is always related on a predictable process on how people should make a rational decision. The descriptive decision making is the younger discipline focusing on the fact what people actually do and how decisions are really made. Therefore descriptive decision making is linked to the rather irrational approach of making decisions. Since the prescriptive, optimal decision making often created hypotheses for testing against the actual behavior the areas are very closely linked. For the purpose of this thesis both theories will be considered. The rational approach will be followed by the development of the structured decision making process, as well as for the detailed development and consideration of decision criteria. The irrational theory will be considered involving decision making people, the person making the decision and the supporting knowledgeable team. The satisfaction with the decision will be operationalised by the efficiency of the decision executed (see chapter 1.1.5). The irrational factors are very important given the human subjective evaluation of the result. In sum, both theories are a valid foundation for management decisions and this framework indicated that decision making is neither a totally rational nor an irrational process. More likely it seems that there are several degrees of decision making rationality.[35]

1.1.3 Theoretical Analysis of Strategic Decision Making

As decision making is such a crucial part of business management at all levels of the organization, it needs to be analysed in detail. Mainly three areas should be considered: Strategic decisions made by owners/ board members, tactical decisions made by managers and operational decisions made by employees[36]. Given this categorization, the example of ERP selection for SME is definitely part of the area of strategic decision making.

Strategic decision making has been a topic of interest in organisation theory and strategic management ever since. A myriad of research papers and theories foster that strategic decision making is highly complex because of a lot of dynamic variables. The decision types identified by Harrison[37] categorize the variables, but strongly support the notion that an ERP

[35] cf. Neuert, et al., 2014, p.5
[36] cf. Bowett, 2013
[37] cf. Harrision, 1996, p. 46

selection process is definitely a strategic decision. "The decision must be critically important to the long-term success of the total organisation." [38]

The term "strategic" indicates something long lasting, using the big picture. In history the term usually was connected to war and military. In the 19th century it became more related to strategic management. So, long term strategies run the businesses. "Eyes wide open" used strategic decision making for SME as a special art to combine strategic, tactical and operational decision making. Just looking at the strategic part it specifies that it focuses on the big picture, on the question "what?" "The focus of strategic decisions is typically external to the business and usually future oriented. Strategic decision-making created the forward thrust in the business."[39] The primary focus is on strategic decisions of top managers of a small, possible medium sized company.

The strategic view is important for this paper because the decision for an ERP system is a decision with a long term impact. The ERP systems are used for about 10-15 years, and often even longer. It is one of the most critical strategic decisions for an SME because it usually impacts the overall business processes and the organisational structure of the company.

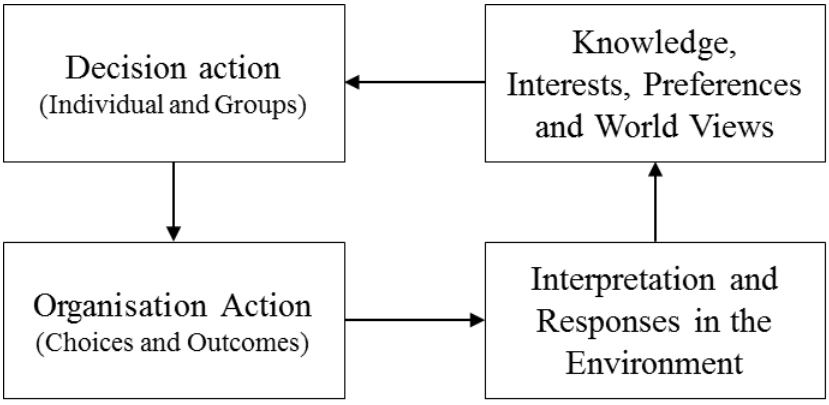


Figure 1-2: Strategic decision-making process Nutt adapt. from March, created by author 2013[40]

March identified and pointed out many of the key features of decision making and debated them in relation with strategic decision making. His approach is illustrated in Figure 1-2. As a basis, March taught to consider the assumptions of rational conduct in both areas, individually and organisationally. He added to that model later on that decisions are rule-based and choice-

[38] Harrison, 1996, p.46
[39] cf. eyes wide open, 6/2011 / http: //www.smallbusinesshq.com.au/factsheet/20305-tips-on-strategic-tactical-and-operational-decision-making.htm. Mon., 27.06.2011, 13.25h
[40] cf. Nutt et al., 2010, p.9 picture adapted from March J., 1994, a primer on decision making: How decision happen. New York, Free Press

based. Finally, March wanted to make the link between the organisation and decision making explicit. He argued that decision outcomes can either be attributed to the actions of autonomous actors in organisations, or can be the result of the specific traits of organisation as an interacting ecology.[41]

The question of decision making performance and outcomes eventually leads to the problem that usually researchers suffer from relatively poor measures of performance. The main dependent variable identified is the decision making performance in relation to the structure and the contents of the decision making process.[42]

In sum, as mentioned at the beginning of this sub-chapter business management decisions such as the selection of ERP systems are a very critical part of the business. The decision has an impact on all areas of the business on a long term basis therefore it is definitely a strategic decision. All levels of the organisation should be involved even if very often specifically at SME it is a decision executed just of the top management, owners and family members. [43]

1.1.4 Research based Models of Decision Making

Following the question on how to make decisions rather that how decisions been made, models have to be considered. An approach Mintzberg[44] analysed is the simple process of rational decision making. He quotes that decisions are always following the same structure in four steps: "Define – diagnose – design – decide." This is a very simple model but very often used. He added, to be more effective, companies should embrace intuitive or action oriented forms of decision making, so basically adding irrational decision making to a rational approach. None of the step-by-step approaches of rational decision making basically consider this. "PACED" is another model often used for teaching decision making, basically with the underlying assumption of rational decision making. "PACED" stands for: „Define the Problem, list Alternatives, list and rank Criteria, Evaluate alternatives using criteria, Decide best alternative." Following this model a rational decision could be supported. Others quote or define models to follow, but basically very similar just with some more details and focus on individual steps of the process.[45] Reviewing the methodology of decision making,

[41] cf. Nutt et al., 2010, p.8f
[42] cf. Nutt et al., 2010, p.631f
[43] cf. Bowett, 2013
[44] cf. Mintzberg et. al., 2001, p.89
[45] cf. Bowett, 2013, *Organisation – Decision-making in business.* [-Online] Available at: http://www.tutor2u.net [Accessed 25.02.2013 1.37 PM.]

Schwarber[46] points out that: "in terms of methodology, the elements that go into superior decision making never vary." These elements are objectives, alternatives and risk. Later in his study the person making it was involved, so he as well adds the irrational factor, the person and its behavior to the scope.

Harrison describes, the concept that a model for decision making representing a particular segment of the real world at a given time and place under various conditions. He state that: "models can also reduce the almost infinite number of complex variables in decision making to a small number of causal factors which are significant and understandable."[47] Even there is virtually no limit to the number of models and its categories, Harrison defines decision making models in four categories: the rational (classical), the organisational (neoclassical), the political (adaptive) and the process (managerial) decision making.[48]

Saliner briefly explains his vision of decision making models in a descriptive model and a technological model; where the first one covers three factors, goals, actions and external information. Where the descriptive model just explains the relations of all factors towards the situation, the technological model covers the relation between the information and the related goals.[49] This approach doesn't seem very practical and more theoretical not covering and analysing all available information.

Most of the daily decisions seem very heterogeneous, but according to Laux they can be related back to a main decision making model, covering standard functions. Independent of the decision making subject the basic elements remains the same.[50]

[46] cf. Schwarber, 2005, p.1087
[47] cf. Harrison, 1993, p.27
[48] cf. Harrison, 1993, p.28
[49] cf. Salinger, 1988, p.2ff
[50] cf. Laux, 2007, p. 19ff

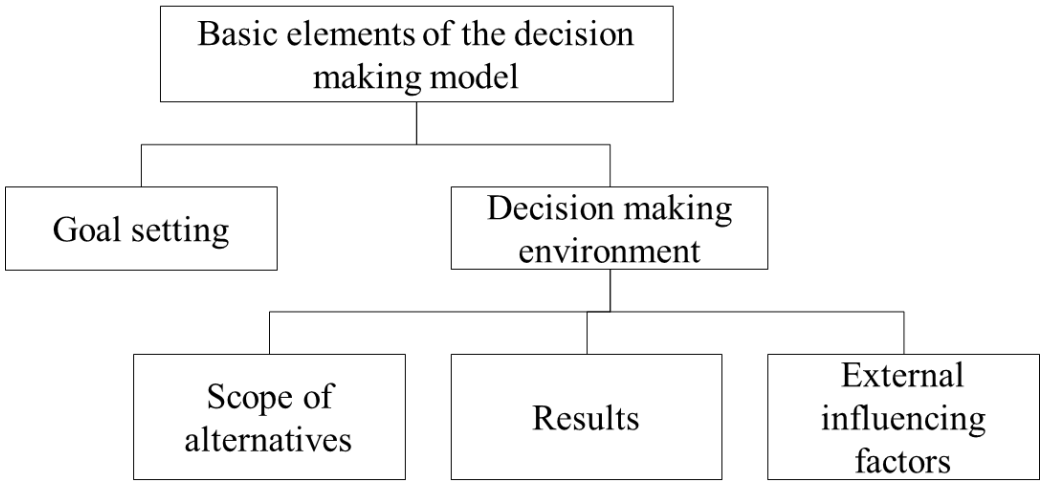


Figure 1-3: Basic elements of DM Model, created by author 2013 according to Laux[51]

This type of decision making model is called A-Model because they should be able to used generally or universal independent of the individual decision making model. Nevertheless the model has a very rational basis not considering the decider himself.[52] As a secondary determent in a more detailed analysis, Laux add the key characteristics of a decision maker; mainly the character and the environment of the person, where the character is divided into the motivation, the qualification and the strategic motion of the decision making person. Adding these elements to the basic model (see Figure 1-3) the new model considers even the descriptive elements of decision making.

According to Rehkugler, the main model of decision making, subordinates normative decision making and an ideal process. The decision making person has to evaluate all possible solutions and base them on criteria. Main goal is to evaluate the different alternatives before actual decision making.

[51] cf. Laux, 2007, p. 20
[52] cf. Laux et al., 2003, p. 36f

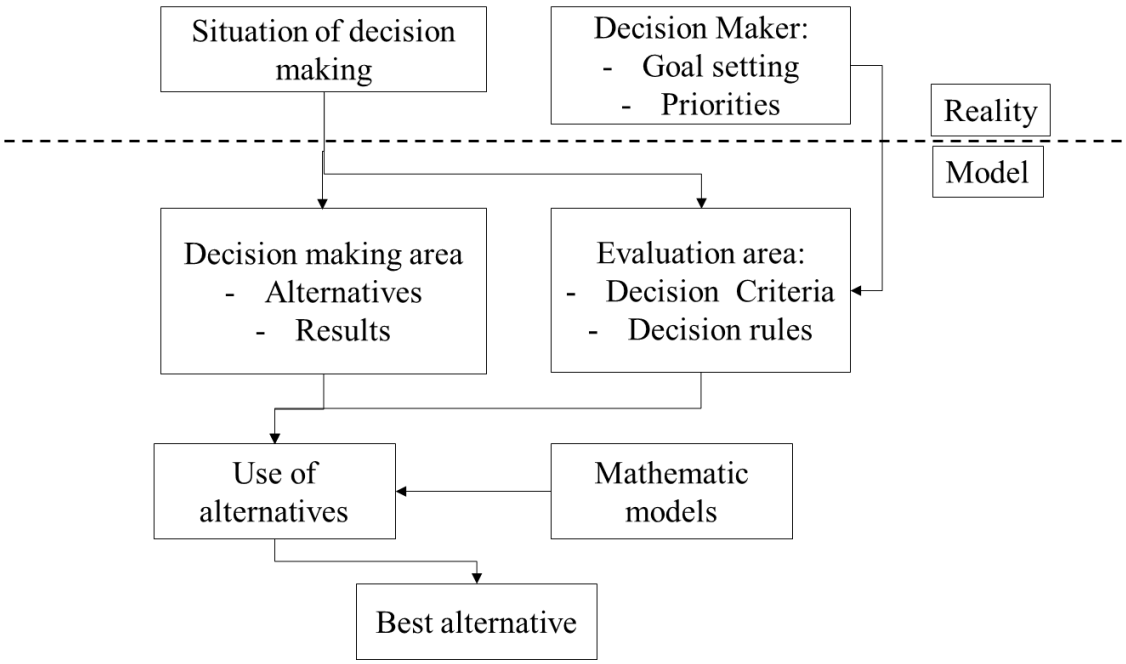


Figure 1-4: Main model of normative DM, created by author according to Rehkugler et al.[53]

The figure shows the input of real life situations on a decision making model. Some aspects should be considered; the best alternative is only optimal in relation to the model and the value system of the decision making person. There are three phases to be considered: the definition of the situation, the evaluation of alternatives and the selection of the best possible alternative.[54] Even it is a rational model it tends to include some irrational approaches like the priorities of the decision maker.

These are some examples of valid decision making models mainly supporting a rational approach. Bamberg summarized as well that there are so many different models out there, he didn't create his own model but tried to classify the existing ones. His first and very high level classification is, if a model should follow one or multiple goals. The second stage contains the level of information and knowledge of the decision maker, differentiated in security, risk and uncertainty. The third and fourth stage covers the decision making environment with uncertain factors and the individual the decision maker. The final level of decision making models differentiates between static and dynamic model. Even using this classification doesn't lead to the one right model to use for the individual decision.[55]

[53] cf. Rehkugler et al., 1989, p.21
[54] cf. Rehkugler et al., 1989, p. 21
[55] cf. Bamberg et al., 2002, p. 41

In summary, there are multiple different decision making models available which cannot be compared on a lower level and none could be seen as the *one right model* to be used for all decisions. Overall, reviewing the different theories, the identified field of research fits in the area of strategic decision making mainly focusing on rational decision making processes and models. The irrational more descriptive part has definitely an impact but the level considered so far couldn't specify any detail. The suggested model developed by the author later on, considers this theoretical part but considers the business requirements of ERP selection as well. It follows a mainly rational basis. Irrational models have not been found in literature but this would contradict the irrational approach. Basically rational models are the basis supported by the human factor.

Most of the overall conceptual models presented are compatible with the decision making approaches elaborated in chapter 1.1.2. These three theoretical orientations: Prescriptive, descriptive and naturalistic suggest the following relations: 1.) characteristics should predict the process used 2.) types of decision and processes should be paired and 3.) personal and organisational characteristics affect the decision process and outcome. It was stressed that previous research has stated some findings of the relationship of decision process and decision outcome but there are still many areas for future research to point out the relationships of and within models.[56]

For the purpose of this research study a structured, pragmatic model was developed based on the main elements of the relevant decision making heuristics describes above and aligned with the basis of the described model of normative decision making Figure 1-4. This pragmatic model emphasis the following characteristics of a decision making process as essential for desirable outcomes of the decision performed:

- Formal precise execution of the stages of the decision making process (further labeled "structured process")
- Inclusion of competent, relevant decision makers (further labeled "decision people")
- Awareness and application of the decision making criteria (further labeled "decision criteria").

This model, suggested by the author as the 'ideal' model, is described and outlined in detail in the chapters 1.2.3, 3.2, 3.3. The detailed outline especially focuses on the operationalization of the above mentioned independent variables of the research question.

[56] cf. Nutt et al., 2010, p.536f

1.1.5 Theoretical Analysis of Decision Making Efficiency

The term efficiency should be clarified in the context of decision making. It is essential to understand the expected result in terms of the selection therefore the term should be defined and used in a clearly defined way. Very generically the term can be defined as following:
Efficiency in general describes the extent to which time or effort is well executed for the intended task or purpose. It is often used with the specific intent of relaying the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or unnecessary effort. "Efficiency" has widely varying meanings in different disciplines.

As stated it has varying meanings in the different disciplines, the efficiency of decision making needs to be defined in more detail. The definition Neuert came up with for planning fits very well for the selection and decision making as it is part of the planning process of the ERP life-cycle[57]. According to many scientists, the term efficiency is defined by him in a wider context. Any economic action implies the necessity for the judgement of the consequences. The consequence is the result which needs to be measured, so the quality has to be reviewed in proportion to the achievement. The efficiency of the decision making process is measured in the quality of the results. Both, the decision as well as the result needs to be specified by indicators and criteria to be measured. The terms “efficiency”, “success” and “worth” can firstly be used equally in this context.[58] For the evaluation whether the decision is efficient or not, ‘critical success factors’ will be defined as criteria to be weight and measured (see chapter 2.7).

The author defines the term efficiency in relation to the definition of Welge/ Fessmann, where the focus is highly on the satisfaction with the final result in a problem solving environment indicated by factors. This mainly result oriented definition does not contradict with the main indicator of efficiency, the degree of fulfilment in relation to the defined goals. It just agrees to an early or upfront definition of requirements as an evaluation of the results. In summary the definition of Welge/ Fessmann is taking a basis for this research; the basic applicability of a method or procedure to achieve a defined goal.[59]

[57] cf. Neuert, 1987
[58] cf. Neuert, 1987, p. 109ff
[59] cf. Welge et al., 1980, p.577f

For the matter of the ERP selection a lot of elements have to be considered and specified generically but it does not allow measuring the result, it helps to structure this specific decision at the very beginning:

- The decision is an exception; as it is a strategic decision done once or twice in an executive's life time.
- There is very little knowledge about it so the framework and more details need to be preconceived.
- This is one of the key points – all specifications need to be considered and based on facts a rational decision should be prepared.
- The implementation execution needs to be observed as one 'critical success factor'.
- All criteria need to be prioritised and reviewed during the course of the decision making process. The decision making process is key to a successful decision, however it is measured.

In comparison to efficiency the term effectiveness is very often used in the same context. But according to the more detailed definition efficiency can express the result in more detail, meaning efficiency can be calculated and the result can be compared with what could ideally be expected.

The concept of decision making efficiency has to be stated more precisely according to Neuert[60] and Gzuk[61] it is necessary to create a purpose and/or aim, a realised output or result, and an input respective the use of resources. According to the studies efficiency can just be achieved if there is a ratio between input and output and a decision must provide results which ensure that the aspired objectives will be achieved.[62] According to both authors it is key to operationalise all input and output results which then allow measuring the "total" efficiency of a decision outcome. To ensure high quality of the decision making result it is stated that for each dimension there should be more than one indicator. Multiple variables or operationalised measured will enhance the model reliability and lower the errors. According to Neuert, efficiency can be seen as the "quality level" of results within the decision making process.[63]

So, for the current case of the decision of an ERP system for a SME company, the author decided to use measurable 'critical success factors' to prove the hypothesis (see as well

[60] cf. Neuert et al., 2014, p.6f
[61] cf. Gzuk, 1975, p. 40f
[62] cf. Gzuk, 1975, p. 5
[63] cf. Neuert et al., 2014, p.6

chapter 2.7.). The above mentioned fulfilment of the independent variables leads to higher degree of the decision making efficiency. In the author's model, the dependent variable 'efficiency' is measured by the indicator 'subjective degree of satisfaction' of the decision maker with the final decision. Also this operationalization of the dependent variables is described in detail in chapter 4.2 and Figure 4-4.

The author was influenced positively by a study of Dean and Sharfman[64], that for the development of the model the decision making process has to be considered as one element. So, there is a small overlap in the use of terminology and there is not a very hard and precise distinction. According to all mentioned definitions analysed the term "efficiency" is the one used for the evaluation of satisfaction with an ERP system.

1.1.6 Theoretical Analysis of Decision Making Mistakes and Failures

The term strategic indicate something long lasting, using the big picture. In history the term usually was connected to war where winning and failure are clearly defined. For an ERP system selection even failure is only vaguely defined. The very clear cases, that the software is de-installed, the business is not able to run or deliver or the company is bankrupt, are the very extreme cases and the failure is obvious. Many of the system implementations are failures but they are still used. According to Barker half of all ERP efforts result in failures.[65] Given the success of the system is hardly measured; the failure is neither measured at all, nor are the criteria for success or failure documented. Usually it is just a gut feel, "it is not the system and functionality we expected", "it is more effort", "more expensive" or "we do not like it" these are just some arguments used.

In literature, there is not a common definition about an incorrect decision or failure. Geissler[66] specified that in economics all definitions about decision making are based on rational behaviour. To conclude that all incorrect decisions are based on irrational behaviour is be too easy and incorrect. The habits of the deciders are the key for failure or success, so if a decider uses the following model of behaviour there will be a high likely hood for failure.

- Ignorant action, the decision is based on mistakes in facts and omission of available, relevant facts.

[64] Dean et al., 1996, p.389
[65] cf. Barker et al., 2003
[66] cf. Geissler, 1986

- Illogical action, the decision is based on erroneous deductions or predictions, and erroneous application of normative criteria.
- Blind action
- Rash action[67]

Geissler states that these facts are just one aspect of the definition. It needs to be considered that more precise characters need to be looked at. Key questions need to be answered:

- What are the criteria for measuring the results?
- What is the right time to measure the result?
- Which person / people are capable of measuring the results?[68]

He concludes, a possible definition after reviewing the results of many researchers: Incorrect decisions have been done if at a defined point in time the achieved results missed the defined goals in a serious magnitude and a correction is impossible or the time and effort to change is too high.[69]

In strategic decision making the area of decision failure or not proceeded decisions remain relatively under-researched but should get equal attention. Organisational size needs to be considered because it does matter as well as for example, big companies harder go bankrupt.[70]

Respecting the fact of incorrect decisions it is even more necessary for the selection of ERP systems to define measurable success factors at the very beginning of the process and decide when the results of the decision for a package should be measured against these criteria. The main criteria have been analysed in literature and a set of most sensible criteria defined (see chapter 2.7).

In summary, the area of decision making in the field of organisation theory is very mature. Nevertheless it is a very agile research field which is rapidly changing; very specifically the area of descriptive decision making is rather young research field. Including the studies of behaviors, in decision making there is still a lot of potential for further research. The combination of rather small and medium size companies and the focus on ERP acquisition have not been found.

[67] cf. Geissler, 1986, p. 44f
[68] cf. Geissler, 1986, p.62
[69] cf. Geissler, 1986, p. 125
[70] cf. Nutt, 2010, p.633

1.1.7 Theoretical Particularities of Investment and Industrial Goods Acquisition Processes

"While consumer satisfaction has recently attracted a lot of attention among academics and practitioners, most academic research on this construct has focused on consumer goods using the individual consumer as the unit of analysis. Customer satisfaction in industrial markets in an under-researched area so far."[71]

The object of the underlying research question of this dissertation, namely the investigation of the determining factors of ERP Systems selection and their outcomes, clearly deals with an investment decision rather than a private consumer decision.[72] According to Homburg et al. decision making processes into investment goods selection differ significantly from the decision making processes concerning consumer goods.[73]

In the above mentioned article, Homburg and Rudolph develop a seven dimensional structure of industrial consumers' satisfaction, encompassing the dimensions products, sales, people, technical fit, product related information, complaint handling and internal personnel.[74] Those dimensions are similar to the author's satisfaction criteria in the quantitative questionnaire which were supposed to measure potential industrial goods, customer satisfaction as a success element of the decision making process outcomes (see Appendix 13 - Questionnaire with ERP Professionals of the Alpine Region:).

Whereas consumer good decision theory focuses on the purchase behaviour of private people, often determined by impulsive actions, which frequently are not subject to a "planned process", investment and industrial goods decisions are made by organisations respective their representatives. [75] Those kinds of decisions are mostly characterised by a deliberate screening and scrutiny of the investment goods alternatives, simply because those kinds of decisions usually require a huge amount of investment capital and induce long term effects on a company's development and success. ERP systems can clearly be assigned to the category of investment goods.[76] One main criterion is the high investment, required for the implementation of an ERP system. Also ERP systems are supposed to deliver long term usability for the company. ERP system selection usually requires a very high standardised and

[71] Homburg et al., 1999, p.15
[72] cf. Backhaus et al., 2010, p.39f
[73] cf. Homburg et al., 1999, p. 15
[74] cf. Homburg et al., 1999, p.15
[75] cf. Kroeber-Riel et al., 2009, p.444ff
[76] cf. Oberstebrink, 2014, p. 11f

formal purchasing process, high rationality, deliberate decision criteria, extensive services and individual knowledge requirements, involvement of buying centres and many different business requirements. All these criteria are very important for an investment decision, like buying an ERP system.[77] This assertion consequently leads to the author's theoretical and empirical efforts, treating the underlying ERP selection process research as an investment good decision for which the analysis of investment goods customer satisfaction theories have to be emphasised. This is why the author particularly refers to the papers of Homburg and Backhaus.

In addition, relevant literature concerning customer and consumer satisfaction have been analysed, in particular to gain a general understanding of buyers' satisfaction dimensions as a seminal element of decision making efficiency.

Consumer and customer satisfaction has been researched by a number of authors, who especially investigated potential cause-effect-relations between the independent variables of consumer behaviour determination and the dependent variable of consumer satisfaction with buying processes outcomes. Also the measurement of consumer and customer satisfaction has been in the centre of those kinds of consumer satisfaction research efforts. In the following the author provides an overview of a selected number of articles and monographs, dealing with that issue:

- Oliver and Swan analyse the factor "structure of equity" and "disconfirmation measures" within the satisfaction process. They point out that "theoretical and empirical approaches to understand the consumer satisfaction process have combined elements of equity and disconfirmation theory. Fundamental to this view is the argument that satisfaction is a product of both: disconfirmation and the marketers' fairness."[78] This dissertation also refers to the individual perception of ERP system acquiring companies in terms of their satisfaction with their purchased ERP software.

- Peyton, Pitts and Kamery provide a review of consumer satisfaction and dissatisfaction literature, especially pointing out the basic notion of consumer satisfaction and potential theories which determine consumer satisfaction or dissatisfaction. They refer to assimilation theory respective Festingers' dissonance

[77] cf. Backhaus et al., 2010, p. 45ff
[78] cf. Swan et al., 1984, p. 2

theory, contrast theory and negativity theory. They conclude that "researchers have defined satisfaction in terms of need fulfilment, pleasure / displeasure, cognitive state attribute or benefit evaluation, and subjective evaluation of experience. … (S)atisfaction is viewed as an emotional response to a product experience." [79] Again, this concept is similar to the author's approach of satisfaction measurement (see Chapter 4).

- Yüksel and Yüksel also develop a critical review of consumer satisfaction theories. Among others (dissonance theory, contrast theory.) They particular refer to the Expectancy-Disconfimation Paradigm (EDP). In contrast to the earlier theories of consumer satisfaction, this model "implies that consumers purchase goods and services with pre-purchase expectation about the anticipated performance. … If the outcome matches the expectation, confirmation occurs. Disconfirmation occurs where there is a difference between the expectations and outcomes."[80] The author used this concept in her empirical design, measuring the satisfaction with the ERP system acquisition in terms of satisfaction and dis-satisfaction with the acquired product.

- Also, attribution theory, primarily developed by Weiner, Frieze and Kukla has been analysed. According to this model, "consumers are regarded as rational processors of information who seek out reasons to explain why a purchase outcome, for example dissatisfaction, has occurred."[81] The dissertation also refers to the satisfaction of the buyers as a result of the purchase outcome.

- Consumer satisfaction is part of various overviews of theories. According to these papers, "satisfaction can be determined by subjective (e.g. customer needs emotions) and objective factors (e.g. product and service features)."[82] This definition of satisfaction has been put in the context of simulation theory, disconfirmation theory, cognitive dissonance theory and adaptation-level theory. It strongly refers to the dissertation approach, emphasising subjective and objective elements of decision maker satisfaction.

[79] Peyton et al., 2003, p. 41f
[80] cf. Yüksel et al., 2008, p.70f
[81] Folkes, 1984, p.399
[82] No author, Indian ETD Repository, p. 91f

- In addition, multi-factor theory has to be mentioned in the context of decision making determinants and decision making efficiency. In this context, Thorndike's multi-factor theory should be mentioned. It distinguishes between four attributes of intelligence, contributing to the solution of difficult problems. Those attributes decompose the level, the range, the area and the speed in which and by what difficult problems, e.g. purchase decisions, can be solved. [83]

- Finally, the author analysed literature concerning utility theory. Classical utility theory goes back to Bernoulli, dealing with probability and uncertainty. More recent theories deal with the notion of the so called subjective of expected utility (SEU).[84] The SEU theory deals with individual expectations with decision making outcomes under uncertainty and emphasises the notion of subjective benefits of the decision maker with the decision.[85] Subjective Expected Utility Theory also leads to Kahneman's and Tverksky's Prospect Theory. Prospect Theory refers distinguishly to individual acceptance or dissatisfaction with decision making outcomes, especially emphasising psychological constraints and biases of human beings in decision making processes.[86] This approach is in line with the author's notion of individual satisfaction or dissatisfaction with the ERP decision making outcomes.

- Particular emphasis in terms of the dissertation's research question concerning the efficiency outcomes of the process was placed on Nobel Prize Laureate Herbert Simon's concept of bounded rationality. (H. A. Simon, Nobel Memorial lecture, 1978: Rational decision making in business organisations).[87] According to Simon, a rational decision making process is comprised of three steps: "the listing of all possible behavioural alternatives; the determination of all the consequences … and the comparison of the alternatives that should be evaluated by the sets of consequences. …"[88] However, according to Simon, human decisions are not made in complete rationality but rather based on "bounded rationality". Bounded rationality "is consistent with our knowledge of actual human choice behaviour, (and) assumes that the decision maker must search for alternatives, has egregiously incomplete and inaccurate knowledge about the consequences of actions, and chooses actions that are

[83] cf. Pal et al., 2004, p.182f
[84] cf. Quiggen, 1993, p.9f
[85] cf. Quiggen, 1993, p.10f
[86] cf. Kahneman et al., 1979
[87] cf. Simon, 1978
[88] cf. Barros, 2010, p.457

expected to be satisfactory."[89] The most important element in Simon´s "Theory of Bounded Rationality" is the **satisficing** hypothesis. According to this hypothesis "decision makers, instead of trying to maximise values in a given choice aim at satisficing: they search for alternatives that are good enough according to some pre-established criteria. ….The decision maker satisfices, if he or she chooses an alternative that attends or exceeds a set of minimal acceptability criteria. … (T)he satisficing hypothesis is accomplished by search processes for alternatives as well as … by (limited) information." [90]

In some decision making theories, human beings and of organisations the aim at satisfactory results, rather than the optimal solution is emphasised. This is because aiming for the optimal solution may necessitate needless expenditure of time and resources. The term of "satisficing" was coined by Herbert Simon, combining the terms satisfying and suffice." [91]
This dissertation especially uses Herbert Simon's concept of decision making satisficing in order to determine the efficiency of the ERP selection process as an individually felt degree of satisfaction or dissatisfaction with the decision making results.

1.2 Selection of an ERP System as the Central Research Topic with Focus on SME

The review in literature shows that the subject "decision making" is exhaustive and especially "strategic decision making" is getting more and more popular recently. The aspect of strategic decision making in the context of small and mid-size companies add a very specific focus on the behavioural aspect, given smaller companies do not have an intensive organisation structure and the decider of any strategic decisions is usually the owner. The selection of an ERP system is a main strategic decision where the decider usually lacks experience. This example will be elaborated further reviewing existing literature and current statements and results could be considered for any strategic decision of a SME.

1.2.1 Strategic Decision Making and Buying Behaviour at SME Companies

The term strategic decision making in management has been discussed just in the 20th century. The foundation of the study of managerial decision making suggests strongly to

[89] Simon H. A., 1997, p.17
[90] Barros G., 2010, p. 461f
[91] cf. Simon H. A., 1957, p. 129ff

move away from the traditional approach and to consider aspects of psychologies, economists, sociologists, organisational theorists, statisticians, philosophers and others. Theorists as Barnard, James March, Herbert Simon, and Henry Mintzberg laid the foundation for the study of managerial decision making. The awareness of a dependency on culture, economy and politic has resulted in a movement away from the traditional approach to consider all aspects of psychologies, economists, sociologists, organisational theorists, statisticians, philosophers and others. Risk is an inescapable part of making a decision, especially a strategic decision, meaning the implications might be enormous.[92] [93]

trategic decision making processes for small and medium-size entities (SME) are more relevant than ever given the managerial needs for globalization. Mid-size companies understand their challenges in the global market. They need to focus on following their growth priorities while they find themselves squeezed in by the effects of an increasingly tough global competitive environment[94]. Due to the historical approach and set up of these companies, business processes even for these very critical areas are often not structured and elaborated. Especially the question of "who makes the decision, why and how?" has rarely been analysed. It still follows the same established approach that the owner, CEO or head of the family business decides.
"Selecting the best ERP system is a strategic decision process." [95] It is often a one-off strategic decision, especially concerning the use of decision making 'instruments' with which the decider has little or no experience. The acquisition of an ERP System is a fundamental cost factor. In a lot of industries for mid-size companies it is above 5 % of the annual turnover.[96] The decision for one specific ERP package defines not just the IT framework with hard- and software, but the selected system is also the backbone for all business processes.

"The term "acquisition" in the content of decision making refers to all the stages from buying, introducing, applying, adopting, adapting, localizing, and developing through to diffusion."[97]
For the purpose of this paper the term "acquisition" should be limited to its original meaning the procurement of the ERP system. The basic procurement process is containing the information gathering, supplier contact, background review, negotiation, and contract finalization.

[92] cf. Buchanan et al., 2006, p.33
[93] cf. Harrison, 1993, p.27
[94] cf. Jacoby, 2006, p.2f
[95] Percin, 2008, p.644
[96] cf. Biermann, 2005, p.110ff
[97] Rahardjo, 2006

The structures of a purchasing department or a structured process for the acquisition of an ERP system are the specific needs for a mid-size organisation. The question, which information is required for a sustainable purchasing process is not covered by researchers in much detail. Knowledge about the buying behaviour is highly important; especially for the sales people and the optimization of the system acquisition is a short term goal. A detailed analysis of relevant cause effect relations did not take place so far. Empirical studies analysed the importance of buying centers at SME companies and resulted that the importance of it are related to the size of the company. The bigger the company the more important is the use of buying-centres with companies or cross entities.[98] Catrin Hinkel, Senior Executive of Accenture GmbH Germany, confirmed this statement and added that internet purchasing platforms, auctions and buying centers are used for general purchasing at SME but rather at mid-size companies than at small companies.[99]

1.2.2 The Relevance and Importance of an ERP system for SME Companies

Managers of mid-size companies know that profitable growth in a global environment is dependent on very efficient business processes and a strong, supporting ERP/IT environment. A recent study shows that 68% of the managers are absolutely aware that their success and growth are dependent on a powerful IT, and even more than 72% believe that flexibility during growth is dependent on the IT landscape.[100]

The decision for one specific ERP package defines not just the IT framework with hard- and software, but the selected system is crucial for all the business processes. Especially small and mid-size companies will not invest in any system architecture in parallel to the ERP system. An average ERP system remains for 10-15 years of utilization.

Thus, the selection of an ERP system is not the responsibility just of the IT department but for any manager in a leading position of a company.[101]

"The current focus on organisational buying behavior continues to be the same, largely ignoring the advent of IT".[102] Especially for mid-size companies the buying process and a successful implementation and later on service management cannot be decoupled.

[98] cf. Schmitz et al., 2007, p.243f
[99] Hinkel, Interview, 21.12.2009, Accenture Kronberg
[100] cf. SAP, 2008, p.4
[101] cf. Jacob et al., 1998, p.23ff

In the area of purchasing ERP, there is no commonly defined, standardised, professional process for the selection of the system or a common basis to gain information.

Firstly, especially SMEs with the focus on smaller entities are using the input of friends, customers and suppliers in a rather unprofessional way to gain there decision making basis.

Secondly, the selection process of ERP systems is not part of their key business, even less, it is a decision taken, most of the time, once in many years. Given the investment, which is usually very high, the decision is fostered by the C-Level and signed off there.[103] A lot of attention is directed to the implementation and organisational issues but the acquisition is mostly being ignored. It is difficult for practitioners and researchers to examine all dimensions and implications of one buying decision prior to the commitment of a formidable amount of resources. The challenge is to ascertain the correlation of acquisition and implementation without any practical experience. So it is a critical part in a longer journey.[104]

Thirdly, the selection decision has a long term impact on the organisation, and especially for SMEs the risk, associated with the selection and implementation, is much higher than for big enterprises. SMEs lack critical human and technical capabilities and spend a significant amount of money in comparison to their turnover (over 5%). The business case is stretched to all limits. Hence, the failure of the ERP implementation often results in bankruptcy of the company. [105]

To sum it up, the selection process for an ERP system is very critical, cost intensive and risky for a SME.

1.2.3 Criteria Based Approach as a Suggested Model for Decision Making

As mentioned in the previous sections a very critical and special ‘event’ for any company is the process of an ERP selection and acquisition. It is a strategic decision process within adequate instruments has to be used in order to overcome the problem that often the decider has little or no experience and the costs are immense for SME. In a lot of industries the cost volume exceeds 5% of the yearly turnover of mid-size companies.[106] Interviews with industry

[102] Verville et al, 2003a, p. 585
[103] cf. Schmitz et al., 2007
[104] cf. Verville et al., 2002b, p. 207
[105] cf. Fisher et al., 2004
[106] cf. Biermann, 2005, p.104

experts provide a clear overview of the current practice and support the theories that the problem at senior management level from the very beginning would lead to successful long-term decisions. A clear and structured approach should be followed as well as experience from large entities should be utilized for SME's, still considering their specifics. Mainly the relevant decision making theories and the knowledge of ERP processes led to further analyses and to the development of an adequate decision making model.

The very critical part of this strategic decision making model can be divided into three key areas: the selection process itself, the people making the decision and the goal oriented decision criteria to be evaluated.

The *selection process* itself usually follows a certain structure. But this is not necessarily an overall generic structure each company often comes up with its own ideas. The main difference between the adequate execution of the selection process and its intensity depends mostly on the size of the company.

Big global multinationals follow a similarly structured RFP/RFQ (Request for proposal /quotation) acquisition process as for any other strategic purchase. They narrow the ERP vendors from a long list to a short list. A very detailed definition of the characteristics and evaluation follows the course of this chapter. Participants have clearly defined roles and responsibilities in this process.[107] Small and medium-size companies might not have a purchasing department or / nor an IT department, so they do not have the capacity to execute or copy this long, structured selection process. These companies follow a financial or non-financial approach and try to assess tangible and intangible benefits. They evaluate all possible business processes and compare them with software functionality. But even small companies try to limit the number of ERP packages to find the one they want to buy, because it seems to fit their business needs.[108] [109]

The literature summarises that there are a lot of similarities for the execution of the acquisition process itself. For the purpose of this paper the process is taken as a multi-stage process with reference to all mentioned authors. The 4, 5 and 6 stage processes usually cover the same activities just describing a different level of detail. These key stages are taken for the purpose of this paper: planning, the information search, the (pre-) selection, the evaluation,

[107] cf. Verville et al., 2002b, p.210
[108] cf. Verville et al., 2002b, p.211
[109] cf. Perera et al., 2008, p.9

the choice and the negotiation stage.[110] Mainly these criteria have been taken for the development of a detailed selection process. The need to use a process as one element was identified in a detailed study by Dean (see chapter 1.1.5)[111]

Looking specifically at the ***decision makers – the people***, there is a significant difference between small and mid-size companies, mainly driven by the organisation structures. Small production companies rarely have an IT-department or purchasing department, in addition administrative and management functions are usually combined. Mid-size companies act much more like big companies due to their organisation structure and the availability of an IT and / or purchasing department. Reviewing the literature according to this topic, there are many opinions presented but just in recent papers.

Shiau confirmed in his study the hypothesis that "Possession of rich IS (ERP) knowledge by the CEO has a strong and positive relationship with ERP adoption." "With regard to investment decisions, the CEO of small and medium-size businesses takes most of the critical decisions? Previous research had also concluded that CEOs affected IS adoption."[112]

Focusing more on mid-size companies, Schmitz stated that during all phases of the selection process of an ERP system the CEO, owner or board are significantly involved[113]. According to Deep[114] it is most important to define the value-adding process up front in much detail. Therefore the decision needs to be a team decision of the end users, functional experts and management. Reference visits are much more important than the demonstrations of functionality.

Reviewing literature and positive examples from companies making successful decisions provide the insight that there is a clear trend towards group decisions. Even if the CEO of a smaller company makes the final call, a lot of key users should be involved to provide professional input and a steering committee should be set up. Discussing the decision making process in view of all aspects of potential decision making failures due to personalities and backgrounds need to be considered. [115] [116] Laux et al. identified that the decision maker, the person and its qualifications are key for the decision success. They evaluated with the

[110] cf. Verville et al., 2005, p.667
[111] cf. Dean, et al., 1996, p.389
[112] Shiau et al., 2009, p.105
[113] cf. Schmitz et al., 2007, p.248
[114] cf. Deep et al., 2008, p.433
[115] cf. Klose, 1994, p.152
[116] Mai et al., 2011, p.197

development of their decision model even multiple elements to be considered, the qualification, the motivation, the strategic motion and the environment.[117].

In sum; the decision making person is a key influencer for the selection of the ERP software package. The decision is influenced by the technical affinity and background, relationships to consultants, colleagues and competitors, as well as the advice and experience of friends, other managers or CEO's.

According to many researchers, more important than the process and the people is the requirement oriented criteria based approach, chosen to evaluate the ERP system. The best fit of these decision criteria, its evaluation and impact on the system selection is essential for a measurable, successful implementation. The biggest challenge for the selection of information technology is the definition of all requirements for the expected solution. [118]

Considering the goal oriented decision criteria has to be clarified as one of the key factors to define the requirements of an ERP system. According to the Oxford Online Dictionary a criterion is "a principle or standard by which something may be judged or decided."[119] The term will be used summarising and referring to all business requirements for the selection of an ERP system. Given the discussion about a successful ERP system or the successful selection of the system, many papers refer to it as critical success factors (CSF). Just for clarification purpose these term is defined as well, because so many papers are using the term. Critical success factors (CSF) are elements that are vital for a strategy to be successful. A critical success factor drives the strategy forward it "makes or breaks" the success of the strategy, hence "critical". To avoid confusion, the term 'critical success factor' is only used if it is used in the literature, referencing other papers.
Summarizing, there is a need to point out a set of success oriented decision criteria at the beginning of the selection process as an indicator for all requirements and later on to measure the selection process success against it. Literature covers many of the aspects of relevant decision criteria. Looking at the diversity of company organisational structures, industry groups, business areas and their sizes, it is obvious that there is not the one right set of criteria. Even for a defined subject like ERP selection there are many sets and many diverse individual

[117] cf. Laux et al., 2003, p.67
[118] cf. Schmitz et al., 2007, p.260
[119] Oxford Online Dictionary, term ‚criteria', online, 03.12.2012, 9.30 PM

factors to be reviewed and considered.[120] It is very important that a most relevant set of criteria is reviewed at the beginning and prioritised individually.

The influence and need of efficiency criteria is analysed and evaluated by Laux et al. with the development of the decision making model. They confirm that there should be an orientation on decision making criteria, but it is also critical to consider the prioritisation and weight of each individual influencing factor to reduce complexity. It needs to be evaluated which impact each criterion has with its weight on the decision and how it impacts the different alternatives.[121]

There are multiple studies containing literature comparisons of the influencing criteria for the ERP selection. Each list has a slightly different research background as well as completely different hypotheses as a basis. Shiau [122] focuses with his list on measurable critical success factors to validate the criteria of the ERP acquisition. Shehab [123] lists various papers to provide an overview of the criteria used for SME and large companies. Rahardjo created a list of success factors and factors for failure.[124] All his criteria for failure have been used, but in a positive way, as success factors, e.g. "lack of management capability" is used as a success criterion "high management capability".

To summarize this section, the selection of an ERP system is a critical strategic decision making process with a long term impact on the organisation. The buying process - the acquisition itself - is just the result of an intensive strategic decision making process. Therefore all elements of decision making have to be considered in detail, the decision making people involved, the structured process followed and the criteria set up in accordance with the selection requirements.

In particular, one aspect of decision making should be taken into further consideration: Rational decision making addresses *how a decision should be made* rather than how decisions are made. [125] Strategic decision making is a conglomerate of many research disciplines. This paper focuses on managerial decision making where Barnard and later theorists like James March, Herbert Simon and Henry Mintzberg laid the foundations for. To make successful

[120] cf. Jacob, et al., 1998, p.39ff
[121] cf. Laux et al., 2003, p. 59f
[122] cf. Shiau et al., 2009, p.105f
[123] cf. Shehab et al., 2004, p.372
[124] cf. Rahardjo, 2006, p.5
[125] cf. Harrison, 1996, p.46

choices, companies must be able to calculate and manage the risks as well.[126] Decision making is seen as a functional view driven by rational behaviour.[127] Strategic decision making is a non-routine process with long-term consequences.[128]

The software acquisition of an ERP package covers a wide range of internal and external factors and actors that engage in the strategic decision-making process. Looking at the first part of this very complex strategic process, the selection, the process structure and the evaluation criteria chosen, are the key factors which will be considered for this research.

Focussing on small and medium-sized companies and the selection of an ERP system is pointing out, that there are still areas where profound theories are not much developed. The complexity of this strategic decision indicates that there are still areas for further research.

[126] cf. Buchanan et al., 2006, p.40
[127] cf. Melé, 2010, p.637
[128] cf. Hedelin et al., 2002, p.125

2 REVIEW OF SPECIFIC RESEARCH STUDIES INTO ERP SELECTION AT SME

Reviewing literature for the specific subject of IT and ERP decision making shows that ERP selection (and implementation) is getting more and more popular recently. Multiple cases have been analysed[129], and many different approaches have been reviewed.[130] [131] The management topic is mainly covered by reviewing the different organisation structures, decision-making processes, and political, behavioural, and procedural specifics by Violino, Hong, Snider, Sumner, Trimi and Zabjek, just to name a few. The specific combination of successful acquisition of ERP systems at SME companies are available in papers covered by e.g. Biermann, Caruso, Dwivedi, Jacob, Jacoby, Jutras, Laukkanen Schmitz and Shiau. It is generally a new topic and research results have been edited only recently.

Ensuring the right scope and terminology of ERP followed by the specifics of SME determines an approach for further research. To ensure exact comparability the limitations to the research will be compiled and analysed. Considering the details of strategic decision making in this context, key drivers need to be compared in literature for the purpose of further study as well as the basis for the individual fields of research.

In this chapter key *terminology* used throughout this paper is contextually outlined. It is worth mentioning that some of the terminology is widely used in other literature and published research and is not always consistent.

2.1 Actuality of the Overall Theme, Selection of an ERP system at SME Companies

The selection, implementation, and maintenance of standard enterprise resource planning (ERP) software, like the high-end enterprise packages of, e.g., SAP®, Oracle and Microsoft is more and more a commodity part of big enterprise businesses. The information technology (IT) employees of their departments are well trained with years and years of experience. The consultancies supporting them are preparing in very professional competence centers, e.g., industry solution departments for the different branches. The IT-methods are proven, many case studies are available and most of the time, there is a variety of relevant solutions available for nearly any given problem. This market is characterized by a profound stability

[129] cf. Verville et al., 2002a, 2002b
[130] cf. Verville et al., 2003a, 2003b & 2005
[131] cf. Palanisamy et al., 2010

since 2009.[132]

The area around the small and medium enterprises (SMEs) is significantly different. A lot of small, mainly local IT companies are implementing a large number of different ERP solutions according to a similar number of different methods. The trends are mainly driven by the requirements of the global market and the uniqueness of small companies.[133]

During the past years the number of larger entities buying and implementing new ERP systems has reached saturation. They are currently rather consolidating existing systems and upgrading new releases. ERP developers are seeking new markets among small and medium-sized enterprises (SME).[134] With the opening up of all economy SME companies are forced to adapt their business model and approach according to practices and software adopted by big companies.[135]

The business requirements for medium-size companies are changing rapidly. Hence, their need for a professional ERP system support is higher than ever. A study of the Centre for Enterprise Research of the University of Potsdam analysed 1300 SME companies and stated that about 70% of the companies are planning to invest in an ERP System implementation or are in the middle of the implementation process. A trend towards a decline of the significance of an ERP System specifically for SME is not noticeable.[136] There are significant trends where SME companies and ERP providers will have to work on for the next 5-10 years. Firstly, due to the high internationalisation, specifically of German/ Austrian SME companies, the ERP provider needs to invest in very specific industry solutions which can be integrated. In addition, the core functionality and processes have to improve even more. Secondly, technology and IT architecture are gaining importance. Finally, ERP has to provide mobile solutions in the years to come. The study claims that the current need for a new ERP System selection and implementation is under 50% but increasing. Similar to cloud computing where currently the companies are still hesitant on the one hand, but dependent on the technological details, more and more companies are interested in new solutions.[137]

[132] cf. Casper et al., 2013
[133] cf. Rieger, et al., 2010
[134] cf. Deep et al., 2008, p. 430
[135] cf. Shehab et al., 2004, p. 359
[136] cf. Gronau, 2012
[137] cf. Gronau, 2013

Following this, current challenges to be considered are:

Globalization is important. Markets are wide open and the competition is tough. Even mid-size companies produce and deal around the globe. As they open up subsidiaries' outside Europe and face the same business challenges as large enterprises.

Market consolidation is the day to day business. Companies are constantly merging. Enormous flexibility and high competitive ability are a must. High performing companies reduce prices, keep the quality and invest in their IT systems.

All companies face the challenge to fulfill new legal requirements and global standards. All companies dealing and producing in foreign countries, especially outside Europe have to fulfill all legal and tax requirements according to the global standards. Large entities employ legal departments; SMEs rely either on either a transparent ERP system or consultants.

The competition for resources around the globe is emerging. The severe global rivalry limits all kinds of resources – people, money and material. The market is not just dominated by giant entities any more, inaugurating a new field for SMES.

Companies are forced to accelerate innovation. The product life-cycle is much faster in a global than in a national market, so all participants need to be very innovative and flexible. Especially mid-size companies need to define a clear USP.[138]

A very recent study from the institute of medium-size companies in Germany identified the main criteria establishing a successful company. Looking at the numbers of the most successful companies they can be nominated according to quantitative factors. Reviewing the qualitative factors explains more "why" they have been so successful, leading, innovative companies. The key criteria driving a SME to a success are: internationalisation, specific and deep know-how, differentiation focus on service and quality and staying competitive in a nice market.[139]

The most successful SME companies are technology oriented with a strong internationalisation.[140] All enterprises have a different trigger why they are considering the

[138] cf. SAP, 2008, p.5f
[139] cf. IFM Bonn, 2011, p.1ff
[140] cf. Schilling, 2011, p. 9f

ERP implementation. But they have in common that they all expect benefits of a certain kind from this enormous effort. The main benefits can be differentiated between functionality versus cost benefit and tangible versus intangible benefits. Key benefits are listed by Shiau like:

- cost savings from reducing the inventory, workforce, travel and communication costs
- increased returns from financial assets
- integration of several functional areas for faster retrieval or delivery of information and reports
- improving the accuracy or reliability of information
- speeding up transactions and shorten product cycles
- enhancing employee productivity or business efficiency
- improving customer relations
- provide new or better products or services to the customers[141]

To summarize, as the ERP market is more and more a commodity market for big global companies the ERP providers discovered the smaller and medium-sized companies as a target to penetrate. This market is different according to companies' diversity of the companies and the more flexible needs. But literature and journals provide alarming stories about the ERP system implementations, cost and time overruns, trouble with business processes and the high risk of failure. The acquisition decision presents the greatest challenges for many organisations because it can affect the organisation even to the point of jeopardizing the existence.[142]

The author's conclusion of the relevance and the importance of the ERP market especially for SME are the threefold:

- In view of the ever increasing and improving information and communication technology development, no business can survive without implementing a single instance (e.g. SCM) or integrated ERP system.
- ERP systems are essential for outcome oriented management processes in a holistic manner.
- Functioning ERP systems are especially an instrument for SME to successful competition against big companies.

[141] cf. Shiau et al., 2009, p.105f
[142] cf. Verville et al., 2010, p.36

2.2 Delimitation of Small and Medium-Sized Entities (SME)

In Germany the medium-sized companies, the so called "Mittelstand", are very important for the economy given that about 99% of the companies are small and mid-size companies depended on industry and definition[143] and 70% of the positions and 83% of all apprenticeship training position in Germany are held by these companies.[144]

In Austria the situation is almost identical. About 99.7% of the companies are medium-sized companies in all industries. They are the backbone of the Economy. The overall report of SME Austria stresses, that only the SME in Austria and Germany have been able to fulfil all requirements of the European 'small business act' where the given gross value and employment factor have been reached.[145]

However the interpretation of SME (small and medium-sized entities) or mid-size companies is not consistent throughout literature. In the following sections some comparative, qualitative and quantitative factors are analysed and stated.

2.2.1 Common Delimitation of SME

Quantitative Factors

The quantitative, comparative factors to be analysed relate to company size, specifically to the number of employees and turnover.

The most relevant definitions are from the EU commission and the IfM Bonn. But even these are different given a different focus. The EU focus on Europe, where the number of medium-sized family businesses is rather small in comparison to Germany, which is the focus of the IfM Bonn. The definition of the EU commission is optional for all members but will be used by the European Investment Bank (EIB) and the European Investment Funds (EIF).

[143] cf. Wallau, 2011, p.3
[144] cf. Ifm Bonn, 2011
[145] cf. Oschischnig, 2013, p.73ff

Definition of the EU-Commission as of 01.01.2005 Article 2

SME - Quantitative threshold values of the EU since 01.01.2005[146]

Company Size	**Number of employees (FTE)**	**and**	**Turnover €/ p.a.**	**or**	**Total assets amount of balace sheet €/p.a.**
Very small businesses	Up to 9		Up to 2 million		Up to 2 million
Small businesses	Up to 49		Up to 10 million		Up to 10 million
Medium-size businesses	Up to 249		Up to 50 million		Up to 43 million

Table 2-1: "Numbers of the EU for SME" EU Commission, 2005

The institute for the research of mid-size companies in Bonn, Germany, (ifm, 2011) defined:

Quantitative definition of SME – IfM Bonn since launch of EURO –Currency 01.01.2001[147]

Company Size	**Number of employees (FTE)**	**Turnover €/ p.a.**
Small businesses	Up to 9	Less 1 million
Medium-size businesses	0-499	1 up to 50 million
Big businesses	500 and up	50 million and up

Table 2-2: "Numbers of the IfM for SME" IFM Bonn, 2011

Comparing the different papers which are covering the subject IT Systems / ERP Systems and SME and white papers from software providers, show the modified numbers again. Schmitz and Biermann define the numbers differently for their studies to both of the above definitions. They just focus on numbers of employees and neglect companies under 50 employees explaining that below this, the companies do not have the financial capacity for an ERP implementation. Believing the definition rather needs to be functional than a "right"

[146] EU Commission Paper, 2005
[147] IfM Bonn, Statictics 2011, www.ifm-bonn.org

definition.[148] They used an older Swiss standard selecting medium-sized companies between 50-499 employees.

A very specific ERP Study using as well the number of employees as the main indicator defined the numbers again slightly differently:

- Very small Companies up to 49 employees
- Small Companies 50-99 employees
- Medium-sized Companies 100-499 employees
- Big Companies over 500 employees[149]

In conclusion the definition needs to be specified based on the criteria and subject to analyse. For the matter of the ERP selection and implementation the number of employees is much more relevant than the turnover. As a basis for this paper, all so called small and medium-sized companies with up to 250 employees are the target companies. Big entities with more than 250 employees are out of scope for the dissertation.

Qualitative Factors

For a detailed depiction of SME, the review of the qualitative factors is very helpful because SME companies cannot just be differentiated and defined by numbers. Most important for this consideration are the leading personnel working for the company being closely related to it. The key examples, mainly for Germany, are the historically grown family businesses. Often strategic and/or management decisions, viewed from the perspective of a families ownership and relationships, can override or contradict those that would be made from a pure economic or management perspective. The impact of these contradictions is visible in many areas e.g. financing, product policy, use of IT, use of economic measures and in innovation. The qualitative factors are very difficult to measure but have a very high impact on decisions and can often hold more significance than quantitative measures.[150]

The differentiation of SME towards large entities is easier using quantitative measures e.g. numbers of employees. To define a company which acts like a SME company, independent of their quantitative factors, the following areas need to be reviewed:

- Review of organisational structure and decision making process

[148] cf. Schmitz et al., 2007
[149] cf. Stegemann, 2011, p.16f
[150] cf. Wallau, 2006, p.13ff

- The association and impact of the owner and his family in the business
- Little use of modern management techniques
- The number of employees is rather low
- Position in the market
- Research & Development as well as innovation is very high.[151]

For the purpose of this paper very lean organisation structure, owner domination, employees are closely related to the company, a very strong focus on R&D and production are the key qualitative factors characterising the SME companies relevant for this dissertation.

2.2.2 Specific Characteristics of SME Companies in Germany/Austria

SMEs operating in the free market economy in Germany/Austria face multiple intangible challenges that are very specific to them and not obviously comparable with large global entities. Multiple functions within a small company operate very differently and a wide variety of very specific characteristics have to be considered.[152] Lanninger identified eight different groups of characteristics which relate to SMEs using intangible definitions.[153] Focussing on strategic decision making and acquisition these characteristics have been investigated in more detail.

Pointing out the **organisation structure of a typical SME** company leads to the finding that SMEs are very different in their organisation and management styles. Three characteristics are often apparent.

- Owner executives tend to be very dominant
- Entrepreneurs are personally involved very closely with the company operations
- Organisation Structures are very simple and flexible

SMEs are often combining the management and ownership of the company. The influence of the owners / executives on all decision making processes is very high and the entire company is very much dependent on it. Family members generally work in the company. The smaller the company, the more family members are supporting it. Very often it is a task for life. Therefore the owner / founder has to be involved in every decision, very specifically in strategic decisions. The hierarchy is very flat. Usually there is the board or management,

[151] cf. Lanninger, 2009, p.39
[152] cf. Fritz, 2007, p. 18f
[153] cf. Lanninger, 2009, p.38ff

rarely a middle management. Decisions can be taken very quickly with the involvement of the top executive and their predisposition to the subject concerned. Little or no further communication will be required because, usually, there will be no additional layers of management. The owners are usually completely involved in the day to day business therefore often strategic planning is less focussed on. There are frequently deficiencies in collecting and providing information because of a lack of time and capacity (i.e. people). Market dynamics and changes are not monitored or analysed in very much detail and strategic plans (if they exists in the first place) or decisions are not re-appraised or altered accordingly. The use of general accepted modern management methods is still in its infancy.[154]

At SME companies the structure, roles and responsibilities are not defined in much detail. Specialists have their specific area of responsibility as well as managers. All administrative functions are covered mostly randomly by various people. External contractors or consultants are utilised much less frequently than they are at large, resource rich companies with an abundance of people available to cover the daily business whilst tackling large projects. Particularly for ERP systems selection and implementations large companies tend to make heavy use of external resources. By contrast, SMEs are very short of both the financial and human resources that may typically be deployed for an ERP system selection or implementation.[155]

In addition, many SMEs are **family businesses**, so this term and their specific structure need to be defined as well. But the clear focus of this paper is SME companies whether or not it is a family business. Many definitions are available. A commonly accepted one is from Finland; by the Finnish Working Group on Family Entrepreneurship (set up by the Ministry of Trade and Industry of Finland in 2006).

"The proposed definition reads as follows: A firm, of any size, is a family business, if:

(1) The majority of decision-making rights are in the possession of the natural person(s) who established the firm, or in the possession of the natural person(s) who has/have acquired the share capital of the firm, or in the possession of their spouses, parents, child or children's direct heirs.

(2) The majority of decision-making rights are indirect or direct.

(3) At least one representative of the family or kin is formally involved in the governance of the firm.

[154] cf. Lanninger, 2009, p. 42ff
[155] cf. Lanninger, 2009, p.78f

(4) Listed companies meet the definition of family enterprise if the person who established or acquired the firm (share capital) or their families or descendants possess 25 per cent of the decision-making rights mandated by their share capital."[156]

This explanation clearly points out the specifics of a family business and the key characteristics for it. In line with these specifics the key challenges for this important business with such high impact on the overall society needs be pointed out.

"Many of the challenges faced by family businesses also concern SMEs in general. However, some affect family firms more specifically, and others are exclusive to them. These challenges either stem from the environment, are inherent to the family firm or are related to educational issues. The notion of ownership is considered to be fundamental to understanding the challenges faced by family business. Family firms (and most SMEs) are independently and self-reliably owned by actual persons. Ownership is visible, personified by individuals who can accept responsibility and are accountable for the activities of their companies. This creates consequences in terms of both time and ownership. Most family businesses are not started, nor owned/managed to be sold, but to be continued to the next generation. Ownership goes beyond the capital, and financial decisions and operations are 'merely' a method of financing, not the primary mean to make profits. The understanding of the ownership dimension and how it affects the business behavior of family firms should also be improved. Member States and other countries participating in the project should support specialized research."[157]

Ownership and the actual managing of the company are key facts for family businesses. Even more in family businesses as in SME companies this influences the decision making process.

Innovation and Investment opportunities for SME. SME companies are usually very much specialised e.g. in one industry. Therefore they need to ensure constant further development and to follow future trends. Bigger entities support very strongly new innovations but SME companies should not be underestimated. Especially due to the flat hierarchy and deep knowledge in a niche market, a lot of innovations are from SME companies.[158] Innovations at SME companies are characterised according to flexibility, speed and functionality. They do

[156] No author, European Commission, 2003, p.10f
[157] No author, European Commission, 2003, p.22f
[158] cf. Fritz, 2007, p.25f

not do basic research – they do very quick and reliable R&D projects which are usually linked to a specific problem of one client.[159]

Raising capital and finance for larger investments is usually a problem for SME companies. More than 80% of the companies have a one-man business / sole proprietorship as a legal structure, so public funds are not available to these companies. They have a big disadvantage getting debt capital to finance a bigger project, development or new innovation. Therefore management mistakes are very critical for them. In comparison to big entities they are not able to cover temporary losses with gains of other businesses units. During crisis the financial support from the government is very rare. There is definitely a disadvantage for SME in terms of external financing. Therefore the ERP system implementation can be a big support and advantage to run the business avoiding big management mistakes. However the project itself needs to be financed and successfully implemented first.[160]

2.3 Delimitation of Enterprise Resource Planning (ERP) systems

Enterprise Resource Planning (ERP) is a very specific term. The author would like to avoid any confusion about this term therefore it is specified and analysed in detail. Given that there are many definitions the author will not come up with a new definition of the term, just pointing out the specifics of existing ones.

2.3.1 Term and Classification of ERP

The term stands for "Enterprise Resource Planning" a confusing term to express a very simple concept, managing all areas of your business efficiently. The confusion is mainly driven by the high number of different explanations which are based on the impression of software providers, scholars and researchers. Mainly the software providers try to use the term according to their product and adapt the concept according to it. Instead of coming up with an additional expression and usage of the term the author prefers to compare the existing ones and point out the key characteristics of the product. There are a lot of suggestions and definitions about the term available in literature; in the following some examples are quoted:

"The term "Enterprise Resource Planning" was first used by the research and analysis firm Gartner Group in 1990 as an extension of MRP (Material Requirements Planning; later,

[159] cf. Lanniger, 2009, p.87f
[160] cf. Lanniger, 2009, p.79ff

Manufacturing Resource Planning) and CIM (Computer Integrated Manufacturing). While not supplanting these terms, it has come to represent a larger whole" Definition: "Enterprise resource planning (ERP) is an *integrated* computer-based system used *to manage internal and external resources*, including tangible assets, financial resources, materials, and human resources."[161] This definition seems very much related on the history including just some areas of functionality. The stress on integration of functionality seems right but not complete for a definition.

"ERP Software is a strategic tool that unifies and manages the *core process* of a business to improve client and supplier interactions as well as equipping the business with well-defined and controlled processes."[162] This definition was mainly used by the author at conference to stress very simply a complete picture of the covered scope. It doesn't point out the integration aspect as well as not the IT complexity, but this is only a minor aspect for this definition.

"Enterprise resource planning (ERP) software systems *integrate* the *main business and management processes* within and beyond a firm's boundary. They support most commercial activities, including purchasing, sales , finance, human resources, and manufacturing resource planning (MRP) in the enterprise. Enterprise resource planning software systems provide a multitude of benefits to businesses, such as inventory reduction, data integration and cost reduction."[163] Holsapple and Buonanno support this definition as well.[164] [165] The fact of adding inventory reduction is added by Sumner.[166] The author prefers this definition to others due to its completeness of scope, but doesn't like the stressing on core production functionality.

"An ERP system is an information system that *integrates all enterprise functions*. It provides services to all departments in an organisation. It provides the enterprise with the capacity to plan and manage its resources based on an integrated approach."[167] This is a nice but incomplete attempt of Garcia-Sanchez to come up with something simple.

Barker and Teltumbde stress as well the historical approach in their very long variations. "Enterprise Resource Planning (ERP), created to conquer the shortcomings of MRP II

[161] cf. http://www.managingautomation.com/techmatch/erp-buyers-guide.aspx 06.12.2011 – 13.37h
[162] Dwivedi, 2007, p.27
[163] Shiau et al., 2009
[164] Holsapple et al., 2003
[165] Buonanno et al., 2005
[166] Sumner, 2000
[167] Garcia-Sanchez et al., 2007

(manufacturing resource planning), is a system that involved the planning and managing of the entire organisation's resources in the most efficient, productive, and profitable manner. Unlike an MRP structure, ERP systems are information systems that allow an organisation to run a *synchronized configuration that strategically connects all aspects of a business.* ERP allows an organisation to gain competitive advantages by saving resources and responding to the ever-changing business environment."[168] "Enterprise Resource Planning (ERP) is a generic term for *integrated systems* for corporate computing that supersedes concepts such as Materials Requirement Planning (MRP) of the 1970s and, later, Manufacturing Resources Planning (MRP II) of the 1980s. ERP projects basically represent the implementation of these systems. These systems are embodied in ERP software, which provides a set of functional capabilities in terms of process options that can be chosen to fit one' s preferred business model, on a specific technological platform. ERP software thus largely profiles ERP projects. However, their specific capabilities and limitations in the organisational context unfold during their implementation, which determines the delivery of ultimate value. Therefore, evaluation of ERP projects essentially encompasses the evaluation of ERP software as well as its implementation."[169]

Business functions and processes are the key focus of the ERP definitions of Dempsay, Lotto and Perera. They stress the functionality and integration less the technical advantages. There definitions cover the same scope but them all stress different areas.

Dempsay stated: "The ultimate in integrated systems is the single vendor Enterprise Resource Planning (ERP) system. An ERP system is a standard consolidated software package integrating all the functional modules of your business (Finance, Production, Sales, Human Resources, Marketing, etc.) which sit on a common database. Thus ERP systems can provide up-to-date real time information to their users."[170]

Lotto pointed out that: "Enterprise resource planning (ERP) software can assist an organisation with its business critical functions such as inventory and order management, forecasting and planning. Although these are the core functions of an ERP system, enterprise software providers also offer a host of applications designed to increase profitability, improve productivity and effectively manage the distribution channel, such as customer relationship

[168] Barker et al., 2003
[169] Teltumbde, 2000
[170] Dempsay et al., 2007

management, business intelligence, supply chain management, logistics and warehouse management."[171]

Perera focus on this definition: "ENTERPRISE Resource Planning (ERP) system is a software system for business management encompassing modules that support the functional areas such as planning, manufacturing, marketing, distribution, accounting, finance, human resource management, inventory management, service and maintenance, transportation and e-business. ERP system helps various parts of an organisation to share data and knowledge, reduce costs and improve the management of business processes."[172]

In summary, using all mentioned very valuable interpretation from scientists. The author does not want to come up with something new. The key quality criteria to specify what is meant by an ERP system are; firstly, it is a software package which covers standardised best practice business processes for the entire enterprise in one system. Secondly, on the basis of system modules all important areas of a business are covered in an integrated system. Finally, all business functions are covering actual data real time for the best steering and controlling of the company

Mainly, for classification purposes only, additional aligned terms are specified in more detail to avoid any confusion. To differentiate ERP from other definitions like IT, Software and Hardware the definitions of the other terms are presented on very high level.

The abbreviation "IT" means *Information Technology*. This term covers a much wider and more technical scope including hardware in comparison to ERP. IT is the area of managing technology and spans wide variety of areas that include but are not limited to things such as computer software, information systems, computer hardware, programming languages, and data constructs. In short, anything that renders data, information or perceived knowledge in any visual format whatsoever, via any multimedia distribution mechanism, is considered part of the IT domain.

Personal computer hardware are component devices which are typically installed into or peripheral to a computer case to create a personal computer upon which system software is installed including a firmware interface such as an operating system which supports application software that performs the operator's desired functions. Operating systems usually

[171] Lotto, 2006, p.54
[172] Perera et al., 2008, p.2

communicate with devices through hardware buses by using software device drivers. Hardware in combination with a personal computer is as well the mouse, the printer, the key board just to name some pieces. Hardware is completely out of scope for this research.

Hessler created a good overview to differentiate all terms.[173] The author summarized all information in one picture to classify the term ERP even further:

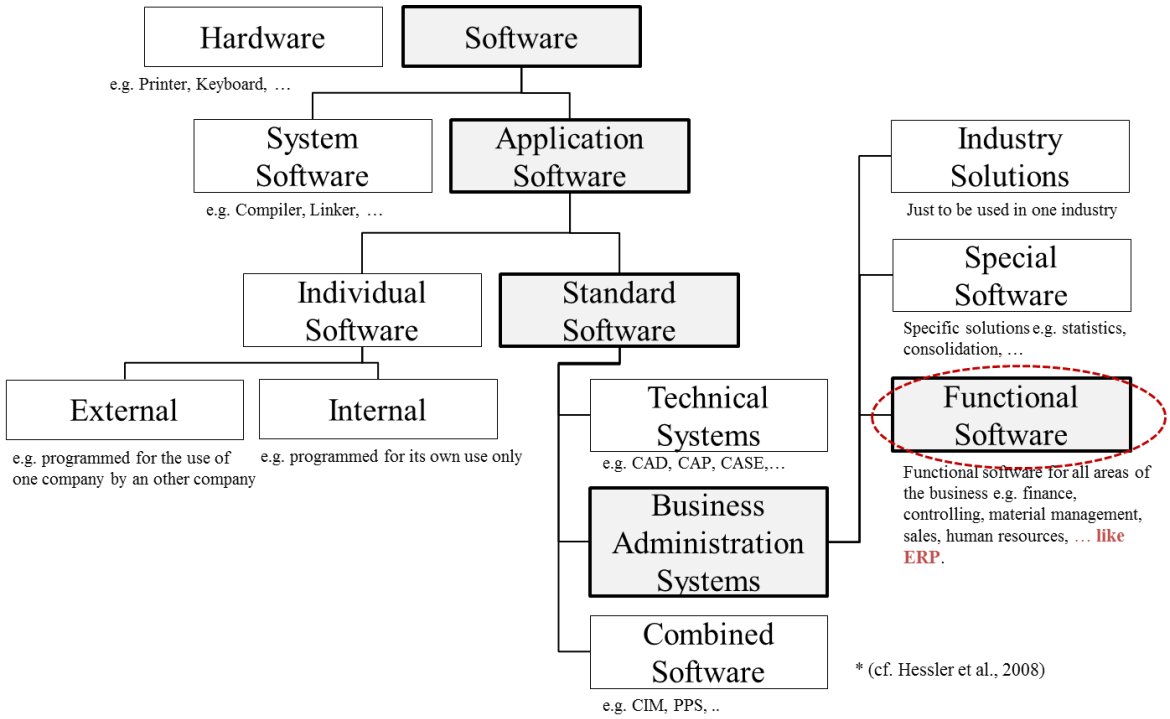


Figure 2-1: Author summarized from Hessler[174]

Summarizing the difference between IT and ERP the created picture specified that ERP systems are part of functional software under business administration systems. Limiting the scope to software and not hardware and very specifically to standard software characterise the area of ERP from top down.

2.3.2 ERP Systems – Development and Detail

The idea of an ERP system was probably born by the development of the first SAP System in the 80ties when five former IBM employees founded a new company called SAP AG and programmed a common software cross departments based on the need of the finance department. A lot of other individual solutions have been connected ever since based on a

[173] cf. Hessler et al., 2008, p. 6-15
[174] cf. Hessler et al., 2008, p. 6-15

joined history. A picture was developed by the author with input of papers from Shehab[175] and Teltumbde[176], to show the history and the connection of standard application systems.

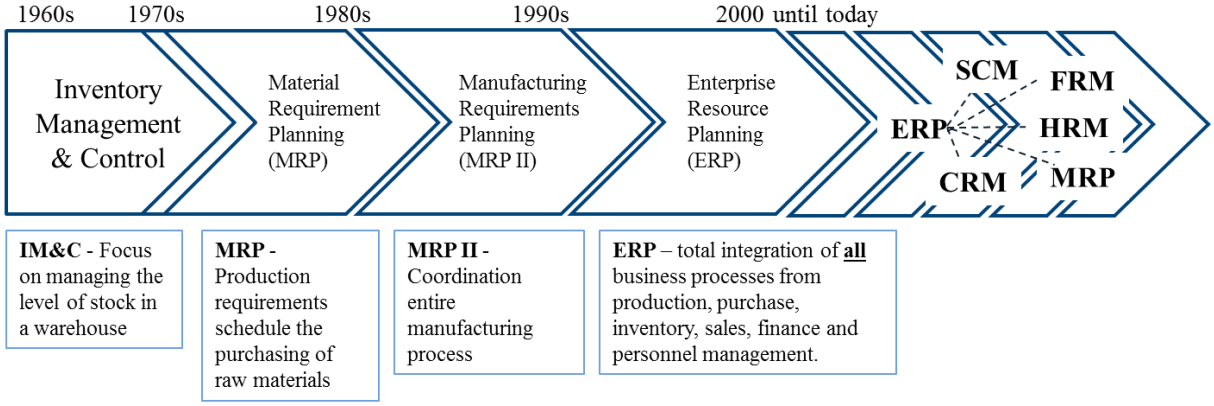


Figure 2-2: History of ERP development, created by author 2011

Starting with IM&C, extended to MRP and MRP II the development of ERP, Enterprise Resource Planning, was basically in sync with the development of the Computer Systems (Personal Computers) and scope was enlarged rapidly. Approximately since the year 2000 this term was even specified and expanded mainly to the areas of SCM (Supply Chain Management) and CRM (Customer Relationship Management).

"Sales of ERP systems grew significantly in the mid-1990s as companies faced the infamous Y2K problem in their legacy systems. Many manufacturers took this opportunity to replace legacy systems with ERP systems. In the early 2000s, the term "ERPII" was coined to describe the next generation of ERP software. This new generation of software is web-based and allows employees, suppliers, and customer's real-time access to the system's data. The implementation of an ERP system is a mission-critical, strategic investment for most manufacturers. Buying the right system and choosing the best vendor partner is critical for success." [177] The term ERP II was introduced just after the Y2K to differentiate from the previous software packages but didn't last. All packages are called ERP until now whether they are hosted or web-based.

An ERP system as it is defined means the scope and functionality of all business processes or all departments. The description of functionality developed over time. At the end of the 90ths the scope of the system was described in functions, later in the 2000s in business processes.

[175] cf. Shehab et al., 2004
[176] cf. Teltumbde, 2000
[177] http://www.managingautomation.com/techmatch/erp-buyers-guide.aspx 06.12.2011 – 13.37h.

Depending on the level of detail it can be a short list of all functional modules or a long list of all business processes. For the matter of comparison the list of functional modules will be used further.

ERP software is bundled with the following basic functional modules which are closely related to the department structure and overall business processes. Very general Purchasing, Inventory Management, Production Planning, Production, Sales and Marketing and Accounting, Finance and Controlling are covered. The area of Human Resources is usually part of the functional processes covered but due to the complexity and need for regular legal updated it is very often more difficult to implement and it does play a specific role.[178]

"As of 1998, according to Loizos, there were five leading ERP vendors that accounted for 62 percent of the market: SAP of Germany; Oracle; J.D. Edwards; People Soft; and Baan of the Netherlands. For the most part, these vendors focused on large business clients and concentrated on automating manufacturing, distribution, human resources, and financial systems. The remaining 38 percent of the ERP applications market was comprised of numerous smaller vendors which served smaller business clients and focused on niche applications."[179]

The situation didn't change much the past 10-15 years. The big ERP providers, SAP, Oracle (including People Soft, JD Edwards and Siebel Systems) and Infor (Baan) merged into three big players due to the acquisitions of Oracle, but they are still in the market targeting their peer big global players (fortune global 500 companies). Due to mergers and acquisitions as well the ERP sector of Microsoft grew much so it can be compared with the big Providers with their Microsoft Dynamics NAV and AX solution.[180]

The small and medium-sized companies are still penetrated by a large number of small and mid-size ERP providers. But even in this sector the market gets a bit more stable the past 10 years. The start-up mentality of the 2000s is over and the ERP providers develop in nice areas. The requirements for SME companies are still different in comparison to big global enterprises. SME companies require more flexibility, more specific functionality for lower costs with a local support.

[178] cf. http://www.managingautomation.com/techmatch/erp-buyers-guide.aspx 12.12.2011, 13.15 PM
[179] cf. Loizos, 1998 and http://www.answers.com/topic/enterprise-resource-planning#ixzz1fl4ztjGA, 13.12.2011, 11.57 PM).
[180] All these are names for ERP products which are mainly dominating the market for big global entities cf. as well Stegmann, 2011

Just looking at ERP systems with full functionality and without a specific industry solution, the top providers for SME companies (up to 250 users) are the following:
Microsoft Dynamics Nav, SAP Business One / SAP Business by Design, proAlpha, Sage ERP Solution, AP plus, Abas Business Software, Epicor, PSIpenta, Oxaion, IFS applications, FOSS, CSB-System, eEvolution , Fepa, Semiramis , ams.[181]

2.4 Influencing Factors for the Selection of an ERP System at SMEs

A review of the literature shows that the subject of ERP systems including selection and implementation is getting more and more popular in the recent years. In Germany, the Centre for Enterprise Research of the University of Potsdam is a leading institution covering significant researches in the area of ERP implementation and around all ERP system specifics especially for SME.[182] Importantly in the USA at the International University of Texas, Laredo, in the department of Management Information Systems & Decision Science professor Jacques Verville and the consultant Alannah Halingten are covering topics about ERP implementation in much detail. Multiple cases have been analysed[183] and many different approaches reviewed.[184] [185] Jacques Verville moved to the University of British Columbia, Vancouver, Canada in 2010 and build up an institute successfully covering the same topics. The scientific results from these researchers could be considered as relevant given their research companies used are very often headquartered in Western Europe and North America.

Other researchers cover the type of problems arising from the implementation of ERP systems range from Business Process Reengineering, Outsourcing, Internet Technology as well as to all stages of an implementation from selection, prototyping, implementation and service support. The management topic is mainly covered reviewing the different organisation structures, decision making processes, political, behavioral, procedural specifics. Important researchers in this new field are Buonanno, King, Posh, Scheer, Snider, Somers, Al-Mashari, Hong, Sumner, Trimi, Violino, Wu and Zabjek with their studies and publications mainly starting from 2005 onwards.

[181] cf. Stegemann, 2011, p.24f
[182] cf. Gronau, 2012
[183] cf. Verville et al., 2002a, 2002b
[184] cf. Verville et al., 2003a, 2003b, 2005
[185] cf. Palanisamy et al., 2010

Other interesting topics for research in the ERP areas include the soft or intangible factors like user buy-in, ERP adoption, leadership, organisational culture, business process modeling, ERP development or functional process issues, communication, training, etc.. These topics are mainly covered with publications of Verville, Everdingen, Lee and Soh in recent papers.

In addition to the science papers a lot of the software providers like SAP, Oracle, Sage, Microsoft, etc. create white papers about their products presenting business processes and the advantages and structure executed with their systems.

According to the literature that combines decision criteria and ERP software it is mostly focused on the implementation not on the selection part of the software, for example Al-Mashari and Hong pointed that out.[186] [187]

For the very specific combination of the successful acquisition of ERP systems for small – medium size companies only few papers are available. Some of the same already mentioned authors leading even this specific part of research like Caruso, Dwivedi, Jacob, Jacoby, Jutras, Laukannen, Schmitz and Shiau just to name some of the few. But it is generally a new topic and the papers are mainly very recent.

Small and mid-size companies are getting more and more attention in the past and problems around these businesses are covered in many magazines for instance CIO Insight, Harvard Business manager, ZfKE, MBT magazine, Economist Intelligence Unit etc. concentrating on their specific problems. Small and medium-sized enterprises (SME) are especially important for Germany, as mentioned before (see chapter 2.2). These magazines mainly cover all business questions. Anyhow, the IT / ERP issues are hardly included although they are currently widely discussed by the selling software providers. The standard university databases provide a very good overview of documents for this sector. Especially in the past 3-5 years many papers were published in related areas, markets and geographies and the number is increasing.

Moreover, institutes like the IFA in Bonn, the BF/M in Bayreuth and e.g. the University of Sankt Gallen are doing research on all operational fields of SMEs. Some universities e.g. the University Sankt Gallen have even established their own faculty just around family – or mid-

[186] cf. Al-Mashari, 2003
[187] cf. Hong et al., 2002

size businesses. Although relevant papers are available in this research field, the field of buying and implementing ERP Systems in mid-size companies is rarely covered so far.

Schlichter analysed the wide area of ERP publications over the past 10 years. He covered all authors, journals, topics and methods. There have been about 885 journal articles with a decreasing rate in the end. Most of the authors published just once. So, this confirms it is still a very new research field with diverse series of topics. The topic of ERP selection and critical success factors is a sub-topic of ERP implementation among many others.

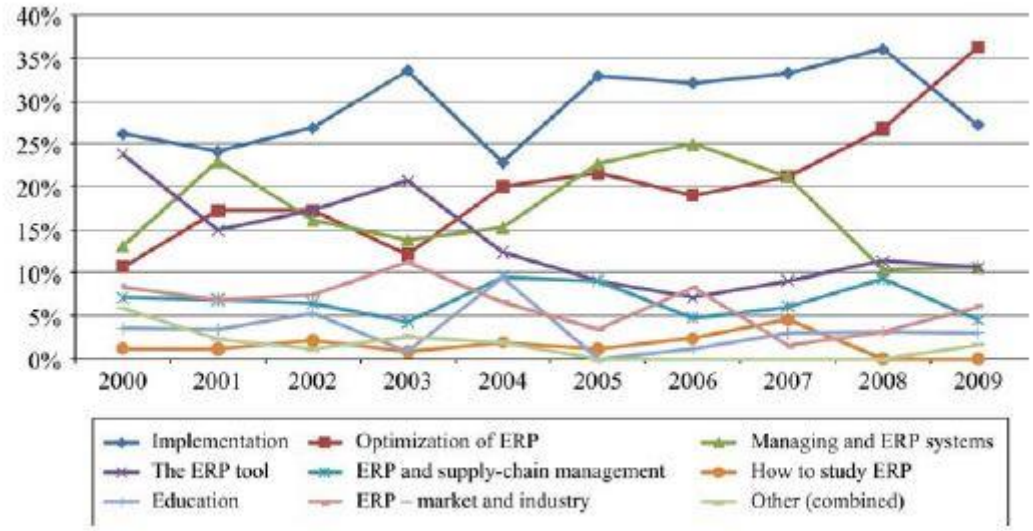


Figure 2-3: ERP Publications in journals by topic according to Schlichter[188]

Considering many published papers around that subject there are three main impacting areas which have been identified by the author need to be analysed in more detail. These areas seem to be simple but are very important specifically for the selection of ERP and are therefore been analysed in detail. For a successful selection of an ERP System the structure of the selection ***process structure*** is very important. So, available literatures are reviewed further (see 2.5). Another very important factor is the ***person*** responsible for making the decision (decision people). The background, personality, position and the involvement of other key people is also reviewed in literature (see 2.6). In addition all requirements for the system, the intention why a system is needed should be analysed and defined in a ***set of decision criteria***. These criteria based approach is specified in more detail and relevant literature reviewed (see 2.7). This defined set of criteria can be taken to measure the success and satisfactions with the ERP system after go live. In literature these set of criteria is very often call critical success

[188] Schlichter, 2010, p.504

factors, even if this term doesn't cover the full meaning and scope of this research, but for a comparison in literature the critical success factors should be considered.

2.5 Consideration of a Process Structure to Execute the Selection (Process Approach)

In comparison to chapter 1.1.4 where theoretical decision making models are reviewed and analysed, in this chapter the operational models of ERP selection and implementation process are considered, reviewed and evaluated in the context of ERP selection.

The IT acquisition strategy should follow the company's overall business strategy, so core competencies, criteria, feasibility studies and further specific information should be aligned by lead managers and related acquisition and implementation methods understood.[189] The strategy and method are more related to the approach taken, the selection process itself which usually follows a similar structure. The main difference between the execution of the process and its intensity depends mostly on the size of the company. According to the findings of a research study conducted by Infinedo, the organisational size is positively related to ERP success, due to some findings with respect to IT budget size, staff and department size.[190]
Big global multinationals usually follow a clear structured RFI/RFP/RFQ (Request for information /proposal /quotation) acquisition process to narrow the ERP vendors from a long list to a short list. They have large purchasing departments which are supporting the selection with structure and tools. A very detailed definition of the criteria and evaluation follows. People have clear defined roles and responsibilities in this process. Big global companies usually engage an IT consultant company to execute the selection and sometimes even the implementation of the ERP system.[191] But this is a very cost intensive process which could not be considered for SME.

Small and medium-size companies might not have a purchasing department or / nor an IT department so they do not have the capacity or money to execute a fixed, long, structured process or develop complex evaluation methods. These companies follow a financial or non-financial approach and analyse tangible and intangible benefits. In the best of all ways, they try to review and validate all possible business processes and compare them with software functionality, but sometimes even small companies follow a selection process to limit the

[189] cf. Rahardjo, 2006
[190] cf. Infinedo, 2007
[191] cf. Verville et al., 2002b

number of ERP packages to the one they want to buy and which perfectly fit their business.[192] [193] More often specifically SME just buy the software package like a piece of hardware e.g. a printer because the sales agent or IT representative told them to. This might cause a lot of long term problems.

In literature a lot of methods to execute a strategic decision making process are defined and researchers are constantly working on developing new ones. Harrison (1996) designed the concept of strategic gaps and continued with the development of the managerial and strategic decision making process. E.g. the managerial decision making process:

- Setting managerial objectives
- Searching for alternatives
- Comparing and evaluating alternatives
- The act of choice
- Implementing decision
- Follow-up and control[194]

The steps taken are similar to the steps defined by the researchers very specifically considering the strategic decision for selecting the best ERP system therefore the proposed methods are the basis for further consideration (see as well Chapter 1.1.4).
The existing methods range from scoring and ranking methods to mathematical optimization and multi-criteria decision-making models. Even some of the methods are simple but it is difficult to reflect the opinions of the decision makers. Other methods are too complex to use it outside science and research.[195] All these very theoretical methods are more related to an overall model as to the operational process of selection. Focussing in this chapter on the decision making process, the ERP selection, the author decided for the purpose of this study to review the more operational methods which are used by executives and managers.
Therefore the following methods / processes should be considered:
Deep,[196] developed a V-Model process, Percin[197] follows the Analytic Network Process (ANP) a multi decision-making methodology, Palanisamy[198] proposed the organisational

[192] cf. Perera, 2008
[193] cf. Verville, 2002b
[194] cf. Harrison, 1996, p.48
[195] cf. Percin, 2008, p.632
[196] cf. Deep et al., 2008
[197] cf. Percin, 2008, p.635ff
[198] cf. Palanisamy et al., 2010

buying model (OBB) for the acquisition of ERP systems, Schmitz[199] used a structured phased approach as well as Verville.[200]

The Technology Acceptance Model (TAM model) is among (the processes) the most popular one. TAM is tracing the impact of external factors on internal beliefs and attitudes. It focuses on users of IT application.[201] For the purpose of SME companies it is not practical given it is not flexible enough as other researchers pointed out as well. Therefore Negahban developed a new process for SME companies to cover their complexity in a more flexible and adaptable approach. The ERP Adoption Model (EAM) was developed very specifically for the needs of construction companies. For the purpose of this research it does not fit.

The Organisational Buying Model (OBB) is used previously in some studies due to the lack of specific acquisition models for IT / ERP. Researchers like very specifically Verville and Hallingten reviewed many existing processes and models, proposing the OBB for the selection ERP.[202] The OBB Model developed since the end of the sixties. From a three stage model, splitting the acquisition decision into newness of the problem, information requirements for a good decision and consideration of alternatives to a model considering buying behavior as a function of four sets of factors. The OBB model describes the causes and effects in buying behavior and their interactions across the organisation.[203] The study points out the five factors which are influencing the acquisition but mainly for large entities. Even it is the same area of research the process is not sufficient with the specific focus on SME.

More structured processes and so called models are available based on software development considering the software implementation in a later stage. Houdek mention the development of the highly used V-model in the 90ties which has been adapted many time to current needs. The present V-Model – V-model XT considers even decision making points during the phases and very few recurring loops in the implementation process. But even this very mature model doesn't consider much time or a focus on the selection part.[204] Additional processes / models mentioned which have been used intensively since the first software development like the

[199] cf. Schmitz et al., 2007
[200] cf. Verville et al., 2005
[201] cf. Negahban et al., 2012
[202] cf. Verville et al., 2002a,b, 2003a,b
[203] cf. Palanisamy et al., 2010, p.613f
[204] cf. Houdek et al., 2010, p.50ff

waterfall model, the spiral model and the rational unified process do not consider the planning phase in detail or focus on selection.[205]

To summarize, it is important to point out that there are a lot of similarities for the execution of the decision making as to the selection or in literature called acquisition process itself. For the purpose of this paper the process is taken as a multi-stage process with reference to all mentioned authors. The 4, 5 and 6 stage processes usually cover the same activities just describing a different level of detail.

As one example the six stage process of Verville[206] is used very often in reference to other researchers, like Schmitz[207] and as a basis to develop further models.

The process is comprised of the following elements:

(1) planning
(2) the information search process
(3) the (pre-)selection process
(4) the evaluation process
(5) the choice process
(6) the negotiation process

(1) Planning: During planning the team is formed and clear roles and responsibilities defined. The overall acquisition strategy is defined as well as evaluation criteria and all requirements.
(2) Information search process: Two information sources are identified: external and internal. "Internal information emanated from scanning of the organisation's existing memory, both human, paper and/or databases"[208] E.g. reports, studies, processes, analysis.
External information includes all marketing material from ERP providers, publications, market surveys, conferences and trade shows. The information search process is very critical to the selection because any incorrect, doubtful or unreliable information could have major impact on the outcome.[209]

[205] cf. Houdek et al., 2010, p. 62
[206] cf. Verville et al., 2002b and 2005
[207] cf. Schmitz et al. 2007
[208] cf. Verville et al., 2003a
[209] cf. Verville et al., 2003a.

(3) Selection process the long list of possible vendors is shortening to max. 5 vendors after the first high level demonstrations. The proposal phase follows at bigger companies. Smaller companies usually do more detailed workshop with very few vendors.
(4) Evaluation process. A detailed evaluation considers criteria of the technical, functional and vendor area.
(5) Choice process. The evaluation process ends in a final recommendation or choice. The decision is usually prepared by a team and presented to the steering committee or CEO / owner.
(6) Negotiation process. Before the ultimate contract with the ERP vendor will be finalized all detailed terms and conditions are negotiated.

All these phases usually end with a contract for the selected vendor providing the licences for an ERP System. Typically the ERP vendor provides experts to support the implementation and go live as well as long term contracts for services e.g. hotline.[210]

This six stage process was taken as a basis to define and execute later on the requirements for the selection phase of the ERP life-cycle. Usually all other phases are broken into much detail but the selection therefore this very detailed approach seemed relevant and was tested in the same research field that it was a very profound starting point for further definition and evaluation.

2.6 Decision Making People and their Impact (People Approach)

Decision making, very specifically at a strategic level is a dissertation subject itself. Managers in lead positions of small and medium-sized companies influence very heavily the success of the companies based on their experience, skills, decision making capabilities, history and personality. People and how they act in various critical situations have been analysed in literature to a high extend. As a basis for further reference in this paper the state of the art in literature is summarized as an overview in this chapter.
The question how to make decisions efficiently and successfully is still a very philosophical question combining personalities with facts. It will be pointed out that many social and intangible effects impact the decision which should be rational and based on measurable facts.

[210] cf. Verville et al., 2002b, 2005

Very specifically looking at the decision makers there is a significant difference between small and mid-size companies mainly driven by the organisation structures (see as well chapter 2.2.2). Small production companies rarely have an IT-department or purchasing department, in addition administrative and management functions are usually combined. Mid-size companies act much more like the big companies due to their organisation structure and the availability of an IT and / or purchasing department. Reviewing the literature according to this topic there are many opinions presented, which will not be taken in more detail. Verville[211] describes the process with a clear focus on a mid-size rather bigger company. No matter which size of a company is considered, the decision making person is key in the selection process for ERP acquisition at SME.

Shiau confirmed in his study the hypothesis that "possession of rich IS (ERP) knowledge by the CEO has a strong and positive relationship with ERP adoption."[212] With regard to investment decisions, the CEO of small and medium-sized businesses makes most of the critical decisions. Shiau analysed in a very detailed study the impact of the technological background of a CEO of a SME company towards the influence on the decision for an ERP system. They could not really prove a positive or negative impact.[213]
Looking at the 'critical success factors' for ERP selection, Verville stated in his paper, that the distinction should be taken between the functional selection and the people related criteria according to the process. The criteria mentioned in this paper are the importance of clear and unambiguous authority, careful selection of the acquisition team; user participation and use buy-in.[214] So, there is a relation / influence of decision making people on the ERP selection according to the researches executed by Verville.

Focusing more on mid-size companies, Schmitz stated that during all phases of the selection process of an ERP system the CEO, owner or board is significantly involved. The end-user or people of the operating departments are part of the process as well. Usually smaller and medium-sized companies do not have a specific purchasing department, so their responsibilities are even higher. Depending on the size and need, the company does not have IT departments, so all strategic decisions are taken by the CEO / owner. The CEO usually

[211] cf. Verville, 2002b
[212] Shiau et al., 2009
[213] cf. Shiau et al., 2009
[214] cf. Verville et al., 2005

includes a lot of people internally and externally e.g. consultants, friends of the company, associations during the definition phase.[215]

According to Deep[216] it is most important to define the value-adding process up front in much detail. Therefore, he points out that the decision needs to be a taken in cooperation of the end users, functional experts and management. Reference visits are much more important than the demonstrations.
Another very important aspect for the ERP selection is the communication. Because so many people from all areas of a company should be involved, and they might not have worked together before a clear communication plan for the selection as well as later for the implementation is necessary. A regular, consistent, precise and honest communication around all aspects of the project is very important. Regular status reporting during the selection process is necessary.[217]

Reviewing literature and the positive examples from companies making successful decisions, there is a ***clear trend towards team decisions***. Even if the CEO / owner of a smaller company always makes the final call, a lot of key users should be involved to provide professional input and a project team / steering committee should be set up. Discussing the decision making process all aspects of decision making failures due to personalities and personal backgrounds need to be considered.[218] [219]

The strength of making decisions as an executive

Making a decision is the strength of human beings. On average a person makes 20.000 decisions a day so a lot of them are done spontaneously. Not all of them will have a heavy effect on live, performance or work but about 60% of them specifically business decisions are done under time pressure. A third of the decisions by Germans are done on a gut level.[220] People need to be enabled to make decisions and willing to take the chance. Many studies, influencing factors and effects on general decision making have been executed. Mai et al. summarized them and for strategic business decisions as well as every unimportant decision in daily life.

[215] cf. Schmitz et al., 2007
[216] cf. Deep et al., 2008
[217] cf. Barker et al., 2003
[218] cf. Klose, 1994, p.153
[219] cf. Mai et al., 2011
[220] cf. Mai et al., 2011, p. 195

In terms of making a strategic decision which has a very heavy impact on the business, the simple decision making process is reviewed in this chapter to stress the impact on and influencing factors for the very specific case of the ERP acquisition. So a key question is: "What are the effects in terms of decision making symptoms just for any decision in leadership?" The deciders need to be aware of them because people at mid-size and small businesses have much closer relationships to employees, employers, competitors, clients and vendors as people in big companies therefore, some of the effects of decision making have a much bigger impact in business. Managers and other people making important decisions need to consider some human aspects. Out of 15 effects influencing decisions four have been picked by the author because they are related very specifically for strategic decisions in business.

Confirmation-Bias;

The perception is very selective, so all information that fit in a specifically known structure are covered, the rest will not be remembered. Mai quotes the philosopher Frank Baron saying: if the human sense / mind took an opinion once it does everything to confirm it – it neglects all facts which are not in sync, even if much more facts are against the first taken opinion.

For the decision of an ERP system it is a very important effect. If a decider – manager heard about one software package than all other packages are always compared with it.[221]

Overconfidence –Effect;

There is an effect which was proven by the Nobel Prize winners Kahneman and Tversky, the overconfidence effect. Meaning people, especially in business, tend to overestimate one self. The survey was run at the University of Columbia and summarized that managers tend to take all the credits if a business is running well. Managers tend not to reflect the facts in detail as to "why" it went well. They assume it is according to their intelligence and business capabilities. The taken studies confirm how much risk managers are prepared to take, only based on the unconfirmed fact that they know it all.

For the matter of deciding for an ERP system it has a very high impact on. Especially managers / CEO's of SME companies do not want to confirm that there is an area in business where they do not have deep knowledge, specifically in the ERP /IT area where the younger

[221] cf. Mai et al, 2011, p. 199ff

generation considers such it as commodity knowledge. So, the CEO's are the deciders and sometimes make the decision more on gut feel than on real facts.
Mai suggests considering three rules to overcome the effect:

- Involve experts
- Vote against the majority to provoke more details
- Insist on a chaos situation to force structure – get more details[222]

Abilene-Effect,

A professor from the George-Washington University explored the fact that many decisions are based on a strong opinion of a leader. Followers often have not enough and detailed information so they do not disagree or question the opinion. It seems it is a reasonable suggestion / decision only because all seem to agree in silence and nobody is brave enough to disagree even if it is very obvious that it is the wrong decision.

Selecting the wrong ERP system will have a highly negative impact on all areas of the company, so if the boss suggests a software package the involved people have to question the decision in detail.[223]

Repetition-Effect;

Weaver and her colleagues from the University of Michigan confirmed the repetition effect. One finding was that three people are enough to influence a group to come up with a given result. Even more if one person repeats its opinion three times the group tend to think it is the right opinion. This effect is very much influencing the ERP selection at SME; if a person or the leader has a very strong opinion about one specific ERP package and repeats that often, the group tend to think it is the right solution not questioning the detailed facts.

These are just the most important influencing effects for the ERP selection at SMEs. They give some background, "why" specifically at SME companies it is common to select based rather on *gut feel than on facts*.[224]

To summarize; the decision making person is a key influencer for the selection of the ERP software package. Facts like the technical background, the relationships to consultants, colleagues and competitors matter, as well as the advice and experience of friends and other

[222] cf. Mai et al, 2011, p. 206ff
[223] cf. Mai et al, 2011, p. 216ff
[224] cf. Mai et al., 2011, p. 222f.

managers or CEO's. For the very specific topic of the selection of an ERP package it should be differentiated between very small companies and small-medium-size companies. In small ones it is usually really just one person making the decision, because he is he only one being capable of making it. In small-medium and medium-sized companies might be one person making the decision but a team or group of people had been or should be involved. The more key knowledgeable people are involved in the decision making process the more it is likely that a successful rational decision based on facts will be reached.
Summarizing, the execution process, its timing and structure is equally important for the selection of an ERP system as the right combination of knowledgeable people and key deciders uniformed in a homogenous team which is capable of making and executing the decision.

2.7 Decision Criteria for Satisfaction with an ERP system (Criteria Based Approach)

According to many researchers, more important than the process itself are the criteria chosen to evaluate the ERP system. The best fit of these criteria, its evaluation and impact on selection is the key to a measurable, successful implementation. The biggest challenge for the selection of information technology is the definition of all requirements for the expected solution.[225] In the following chapter all requirements for an ERP are collected in literature and evaluated to come up with the most relevant list of criteria.

Verville and Hallingten[226] determined three distinct types of criteria for evaluation: vendor, functionality and technical. Vendor evaluation criteria included size, financial stability, and reputation of vendor etc., functional criteria dealt with the software features and included functionalities specific to front-end interfaces, user friendliness and so on. Technical criteria dealt with the specifics of the system architecture, integration, performance, and security etc.[227] Percin[228] differentiates criteria mainly by system factors and vendor factors using the very specific ANP approach as the decision making process, stressing a pairwise comparison of the criteria.

[225] cf. Schmitz et al., 2007, p.260
[226] cf. Verville et al., 2002b
[227] cf. Baki et al., 2005
[228] cf. Percin, 2008, p.636f

Shiau[229] is focussing on six specific criteria to analyse the decision behaviour and influence of CEO's. Six constructs are: investment decisions cost and benefit analysis, choice of appropriate technology, choice of vendor or brand and suitable innovation for the firm.

Palanisamy[230] investigates in a very detailed empirical study to generally prioritise the criteria. The scope was companies of different sizes in North America. Literature had been reviewed and typical selection criteria compared. The outcome was tested with a survey. Mainly five factors have been identified as most relevant and reviewed using a survey. The factors are: Strategy and performance; BPR and adaptability, management commitment and user buy-in; single vendor integrated solution; and consultants, team-location, and vendor's financing. This is one set of very valid criteria which can be used for further investigation. It needs to be considered that all these very valid factors are groups which are relevant at the different stages of the selection. Palanisamy states that the discussion of these parameters does not include an analysis of the degree of impact they have.

Verville and Halingten came up with multiple sets of criteria in their papers. Dependent on the hypothesis and focus they stress different areas more or less.[231] In a recent paper they divided the factors in two groups to differentiate between them. Factors related to the acquisition as process and factors related to people within the process. These factors are absolutely valid but for the purpose of this comparison and the further use of the criteria the author decided to define a structured acquisition process and the team making the decision independent of the criteria. They focus more on the vendor and ERP as a product.[232]

There are multiple studies containing literature comparison of the influencing criteria for the ERP selection. Each list has a slightly different research background as well as complete different hypothesis as a basis. Shiau[233] focuses with his list on measurable critical success factors to validate the criteria of the ERP acquisition. Shehab[234] lists various papers to provide an overview of the criteria used for SME and large companies. Rahardjo created a list of success factors and factors for failure.[235]. All his criteria for failure have been used but in a positive way as success factors, e.g. "lack of management capability" used as a success criteria "high management capability".

[229] cf. Shiau et al., 2009
[230] cf. Palanisamy et al., 2010
[231] cf. Verville et al., 2002a, 2003b
[232] cf. Verville et al., 2005, p.671
[233] cf. Shiau et al., 2009
[234] cf. Shehab et al., 2004
[235] cf. Rahardjo, 2006

Taking the different dimensions as a basis, Shaul developed very visible a comparison of all criteria. According to the authors definition he mixed some of the key criteria identifying the scope with areas along the selection. Therefore the red dots in the picture below (Figure 2-4) define the dimensions of scope like strategic decision, SME, developed countries, private, neutral in terms of globalisation, management driven, national and driven by technology.[236]

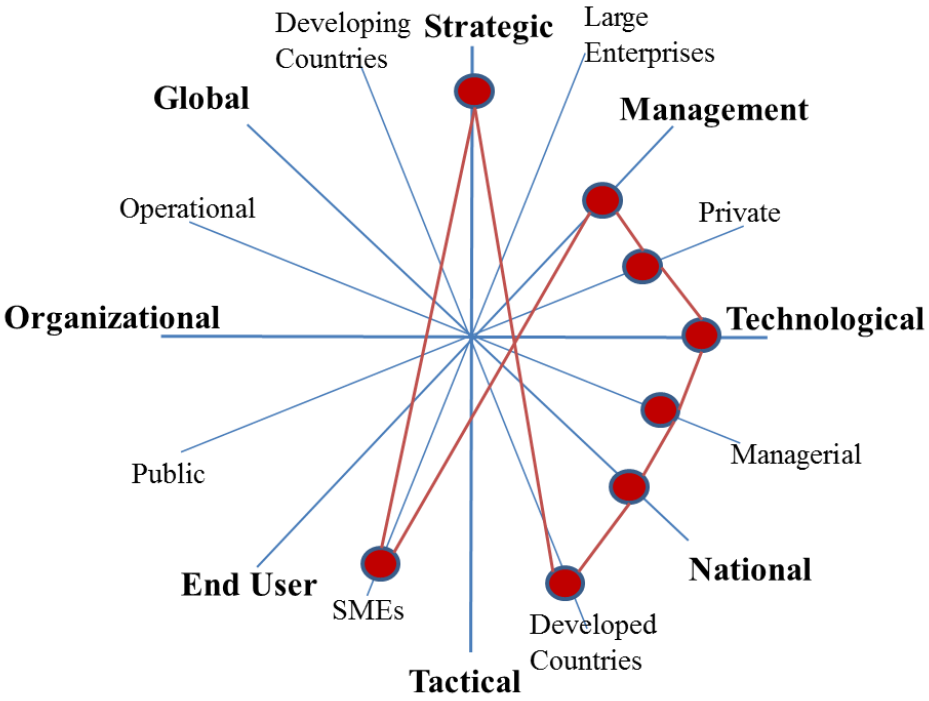


Figure 2-4: Criteria along the dimensions, created by author according to Shaul[237]

Reviewing most recent literature from 2012, Shaul created a literature overview of existing criteria – so called critical success factors along the ERP life-cycle. They defined the ERP life-cycle in four to seven phases where just four are major and three are so called sub-phases. There steps are planning, implementation, stabilization of the ERP system into normal operation, and enhancement. Three sub-phases of enhancement were further refined: backlog, new module and major upgrade.[238] The so called planning phase which can be compared with the selection phase defined for this paper covers 73 criteria summarised in six categories. The results of this research are included in the summary below.

Table 2-3 summarises the result of an intensive literature review about the selection criteria. Different relevant studies have been taken into consideration and clustered. There is a very

[236] cf. Shaul, et al., 2012, p.361f
[237] cf. Shaul, et al., 2012, p. 362
[238] cf. Shaul, et al., 2012, p.362

high overlap in the criteria but according to the level of detail and focus every set has its individual touch, based on the case study or industry focus. This list is not the ***one valid set*** of criteria but it is a very good starting point to be evaluated in combination with the process in further case studies. The author summarizes that in her opinion there should *not just be the one single list* of facts because depended on the initiation there are different aspects which might have to be stressed or broken into more detail.

Scrutinising the various elements of the different authors concerning ERP selection processes, it can again be stated that the majority of the main studies focus on the relevant decision making criteria, which are part of the developed decision making model of this in research study and will be operationalised chapter 4.2, Figure 4-4.

This categorisation in five groups of Table 2-3 has been developed as novelty by the author and the most defined underlying criteria of the theoretical papers extracted and later on evaluated for their relevance in the executed two case studies. In the meantime this detailed list is used as a best practice approach in real live businesses.[239] (See the complete list of five groups with all criteria in Appendix 1)

In accordance with the approach of Homburg and Rudolph the author of the dissertation tried to develop a multi-dimensional set of ERP selection criteria in order to create a measure for the decision outcome respective decision efficiency, which was supposed to flow into the decision maker´s individual evaluation of his satisfaction/dissatisfaction with his decision. Thus, the author's theoretical approach of decision making efficiency combines the approach of Homburg and Rudolph with Herbert Simons "Satisficing" concept.[240]
The decision makers are confronted with the following tasks, which they have to perform: evaluation of the ERP package fit with their companies strategies, functionality fit of the ERP package, technological fit of the ERP package with the companies demands and expectations, vendors' position, reputation and reliability, and economic fit of the ERP package in terms of costs, benefits and after sales support.

The following table summarises the above mentioned selection criteria based on the research of the relevant literature.

[239] Ifl Consulting, SCM, Linz Austria
[240] cf. Homburg C. et al., 1999

ERP Package Selection Criteria:

Comparison of the key characteristics for software selection									
Criteria/measures		Literature							
	Baki and Cakar (2005)	Palanisamy et al. (2010)	Percin (2008)	Perera and Costa (2008)	Shaul et al. (2012)	Shiau et al. (2009)	Teltumbde (2000)	Verville et al. (2002a)	Verville et al. (2003b)
Fit with strategy/organisation									
Business strategy and vision (long-term flexibility)	x		x	x	x	x	x		
Risk, legal, cultural influences and security (user-access concept)	x	x		x	x		x		x
Organisational influences (user buy-in, fit with organisation structure)	x	x			x				x
Interpersonal influences		x							x
Acquisition team members, decision-making and leadership style		x			x				x
Functionality/business process fit									
Implementation ability (in time)		x	x	x	x		x		x
Functional fit and full integration of all functions	x		x	x	x		x	x	
Flexibility (R&D), ease of customisation and reliability	x	x	x				x		x
User friendliness, traininig, online help			x	x	x		x	x	
Technology									
Technical criteria: system architecture, integration, performance, compatibility with other systems	x			x	x		x	x	
Open source for reports, interfaces and enhancements									
Choice of appropriate technology, very actual databases and methodology	x	x			x	x			x
Clear technical concept for releases, upgrades and any technical maintenance					x				
Vendor									
Vendor's position, size, implementation, awards, etc., and market position	x		x	x	x	x	x	x	
External references of vendor from other organisations, industry skills	x	x			x		x	x	x
Financial capability, stability and reliability (long term)		x	x				x	x	x
Economic cost									
Cost and benefits	x	x	x	x	x	x	x		x
Service and support	x	x	x	x	x				x
Consultancy, after-sales management, domain knowledge of suppliers	x		x	x	x				

Note: The individual author considers the criteria as relevant

Table 2-3: Criteria - Literature research, created by author 2012

As describes in Chapter 1.7, Homburg and Rudolph's investment consumer satisfaction theory is comprised of the seven satisfaction dimensions concerning products, sales people, product related information, order handling, technical services, internal personnel and complained handling. According to the table above the author derived a five groups based dimensions ERP customer's theory, similar to Homburg and Rudolph's outline. Those five dimensions flow (at least implicitly) into the ERP system decision maker's satisfaction/dissatisfaction concept, when evaluating his/her contentedness with the eventually chosen ERP package. Those grouped criteria have been part of the empirical investigation of potential decision maker's satisfaction/dissatisfaction with their decisions.

2.8 Limitations of this Research

This paragraph focuses on additional limitations for the selection of ERP systems at SME. Very specifically the geographical scope, the industry and aligned business processes. It finally summarizes all relevant criteria to specify the scope of this dissertation and the defined quantitative and qualitative characters.

Approach taken for this study considering size and geographical scope

As stated before small and medium-sized companies are of significant importance for the economic welfare of Germany. About 91% of all companies in Germany have a turnover lower than 1 million Euro but they hold 59,4 % of all employees with social insurance and have in total about 35,9% of the turnover of Germany. In total, with all freelancers, about 70% of all employees in Germany and almost 83% of all apprentices work in the SME sector. In total for 2011 the SME companies realised an average annual turnover of almost 2.128 billion Euros and employed 15,71 million employees.[241]

Given the economic strength of Germany in Europe the first limitation to the scope is to review SME companies in Germany. To limit the scope even more and reviewing the strength of the SME and family businesses and within regions, after North-Rheine-Westphalia and Bavaria with 18.3% is a very strong region for SME followed by Baden-Württemberg.[242]

The situation is very similar for SME companies in Austria (see chapter 2.2.2). Therefore SME companies in the state of Tirol have also been considered later on in the research for the

[241] cf. Wallau, 2006, p.11ff
[242] cf. Wallau, 2006, p. 12

quantitative analysis.[243] The situation and set up of the companies is very much comparable in the Bavarian (Germany) and Tyrolean (Austrian) region.

Concluding, the geographical limitation to the scope for this dissertation is to the southern part of Germany mainly Bavaria and to Austria mainly Tirol. Due to the fact that all analysis have been executed in that region. The developed model could be tested in Western Europe due to similarities but this was not part of this research (see 5.1. Conclusions).

Approach taken for this study considering industry and business processes

The requirements for an ERP system should be comparable; therefore the industries need to be limited. Insurances, banks, government / public services, health services, transportation services and consultancies have very specific requirements toward the customer relationship management (CRM) as part of the business and are therefore out of scope for this research. Retailers are out of scope as well as all natural resources companies.

The limitation of the scope is towards the production / manufacturing industry. Small trades, trades and all small and medium size production companies are included. The requirements, flexibility, the scope of functionality and organisation structure can be compared for these companies.

The high level scope considers the following business processes which are mainly covering the entire business of a production company, which is: Management, Analysis, Finance and Controlling, Human Resources, Corporate Services, Research and Development, Supply Chain Management, Material Management, Production, Sales and Transportation, Services and Maintenance and Customer Relationship Management.

The ***overall limitations taken for this study*** in summary are firstly, the target group of this paper these are all small and medium-sized companies with up to 250 employees located in Germany. The detailed research is limited geographically to the southern part of Germany, mainly Bavaria. The industry covered is production industry. Due to the actuality of the topic the research considers a timeframe of the last 10-15 years (Year 2000 plus).

Secondly, the very specific focus for this research is the fulfilment of success (efficiency) factors after the implementation of an ERP system at small and medium-sized companies and whether or not the entire organisation and business processes have been changed. In scope are

[243] cf. Oschischnig, 2013, p.73ff

companies which implemented a new ERP or subsystem. The basis for the research and empirical study starts after the ERP system is implemented, just after or some years later. Meaning the decision, purchasing the right ERP system or software selection is part of this research. The implementation is out of scope.

The research covers neither the comparison of current software packages nor providers and their functionality and efficient use. The focus is on standard ERP software packages, not on any individual programming. The selection of hardware and its purchasing process is out of scope.
Finally, small and mid-size companies are very often family business. Some aspects might be covered and pointed out during the research but this paper will provide the specifics for small and mid-size companies not particularly focusing on family businesses.

2.9 Summarising the Analysis and Details of Literature

The review in literature shows that the subject ERP selection and implementation is getting more and more popular. Most of the literature included in this research is from the last ten years where the interest increased significantly. Institutes were founded as the Centre for Enterprise Research of the University of Potsdam, Germany and the one from Verville and Harlingten at the International University of Texas, Laredo, in the department of Management Information Systems & Decision Science, the University of British Columbia - Okanagan, Canada, in the department of IT Management and. As well as many software providers create white papers about their products presenting business processes and the advantages and structure executed with their systems.

Firstly, there are some aspects in the literature review which are more theoretical and profound like the subject of "decision making" and especially "strategic decision making" see chapter 1.1.2 and 1.1.3. These aspects are longer observed and covered more widely in literature. One aspect of decision making was taken into further consideration - rational decision making addresses how a decision ***should*** be made rather than how decisions ***are*** made,[244] which is a very valuable aspect for the subject ERP selection. The decision process organisation has been reviewed and evaluated as a very good basis to consider a self-developed model including the process organisation for this specific case, the ERP selection

[244] cf. Harrison, 1996, p.46

at a SME. The aspect of the process organisation and how it is reflected in literature can be reviewed in chapter 2.5.

Secondly, the selection and acquisition process of SME companies and very specifically the purchase of an ERP system are in practice not part of a CEO's key business, so the subject in the context of SME companies is a topic established in literature only recently. Some universities started to focus on SME companies and their specifics and founded research projects around it (see chapter 2.2.2). The decision makers (people) have been considered and their specific behaviours in SME as well as possible methods used to execute the selection. The aspect of the person making a decision and how it is reflected in literature can be reviewed in chapter 2.6.

Thirdly, reviewing the literature that combines selection criteria and ERP software, most articles focus on the implementation not on the selection part of the ERP life-cycle. There are some detailed case studies available evaluating the criteria sometimes called critical success factors. These have been analysed in detail in chapter 2.7 and consolidated list have been created for further use in this dissertation paper.

To sum up, research papers, cases and empirical studies covering the same detailed aspect have not been found but the topic seems highly relevant in the rising ERP/IT business environment. The current state of research for this topic is very young and there is potential to continue in various aligned areas.

3 MODEL DEVELOPMENT, RESEARCH PROPOSITION AND METHODOLOGY

ERP as a research field has reached a point of saturation in the past decade but primarily driven by practical topics and approaches of the IT industry. Many research disciplines have contributed to the field from various points of interest but mainly using a practical approach. ERP as a pure theoretical research field haven't reached a state of maturity and is in fact a very new field for theoretical examination.

The existing literature has identified some methods, factors, approaches and strategies for the selection of an ERP system. But a more numerous number of studies have been executed according to the implementation of ERP systems mainly in big global entities. A very high quantity has been executed on implementation failure. Given it is a strategic decision, the studies and hypotheses about decision making theories and processes have been considered as well, see chapter 1.1.[245]

Decision making as a research topic is much more substantiated and based on more mature literature. Decision making as a field within organisation theory gained a lot of interest in the 20th century and generated profound theories awarded with Nobel prices.[246] Considering this wider theoretical background and lessons learned from theoretical decision making provided a different angle and valid input for this study.

The research question and hypothesis of this thesis focus specifically on the decision making procedure, the selection of an ERP system at a SME company (see chapter 3.1) and its influence on the satisfaction with the chosen system. The developed model and the identified criteria are covering a wide area but the hypothesis and its possible confirmation is just focusing on the mentioned scope, specifically with the key aspect of SME companies. Reviewing many of the existing papers and paying attention to research areas which are rarely covered, the ERP selection part is one of it. This is confirmed by Shehab with the following quote:

[245] Schlichter et al., 2010, p.486
[246] See as well chapter 1.1

"However, current ERP research has focused on the ERP implementation stage, post-implementation and other organisational issues, the issue of an acquisition process for ERP software is, for the most part, being ignored."[247]

It is a highly relevant topic for further studies and for the development of more intensive methods and detailed hypotheses.

3.1 Overall Research Question and Main Hypothesis

Researchers have analysed extensively the implementation of ERP systems, the optimization of ERP systems, the management of ERP issues and details of ERP functionality.[248] Very few analysed the selection of the ERP system (the acquisition), the failure of ERP implementations and the models how to ensure a successful implementation.[249] Therefore the author wants to focus specifically on the combination of a high quality decision making process resulting in a high satisfaction with an ERP system.

Based on relevant literature the author identified the most important criteria for selection and evaluation of satisfaction, which are the key driving forces behind an effective and successful ERP life-cycle execution. Analyzing them individually, each system selection is part of the suggested model driving this research. Given that very specifically for the selection and decision making part of an ERP system there is still very little research work done, the dissertation paper focus on it with its main hypothesis. The overall research question is defined according to identified opportunities in current literature, summarizing gaps of existing models.

The ***key research question*** for this research is:
"Is there a relation between the suggested selection process of an ERP system and the overall satisfaction with the ERP system at its final state i.e. up and running? And is there a basis for evaluation of selected outcome quality?"

Meaning which model has to be followed during the decision making phase to have a system in the end, used and maintained by satisfied employees.

[247] Shehab et al., 2004, p.374
[248] cf. Schlichter et al., 2010, p.496
[249] cf. Sternad et al., 2011, p.1513

This research question leads to the main hypothesis driving the overall research.

Main hypothesis:
The level of satisfaction with a selected ERP solution is strongly dependent on the execution of the decision making model.

This means in detail for this research work:
The closer the decision making process is executed along a suggested model the higher is the efficiency of the selected ERP system and the satisfaction with it. A SME company implemented an ERP system. But if the selected system was the right one and it was implemented according to the company needs is founded in the very beginning in the selection process. If it follows tightly a very structured, high quality decision making process, the possibility is very likely that the right / or one of the best fitting systems was selected and the people using it are very satisfied. The satisfaction and the decision making are strongly related.

According to the research question and the main hypothesis the purpose of this paper is threefold. The first objective is a literature review very specifically reviewing theories and existing models, relevant decision making models and processes, criteria and the decision making people (see chapter 1.1 and 1.2) to create a common basis for further discussions and provide input for the development of the model. The second objective is to develop a methodological framework. This means to create a suggested new model relevant for the selection part of the ERP life-cycle. This development is supported by experts with the semi-structured interviews and the first company case study. The third objective is to test the model, the aligned hypothesis and propositions with experts and case studies qualitatively and with input provided by ERP professionals via questionnaires and a quasi-field experiment quantitatively.

3.2 Development of a model with underlying variables

The overall research question and main hypothesis cover a wider range of the ERP life-cycle process. *It connects the beginning with the end of the life–cycle* and points out the interrelations of it. Reviewing theoretical decision models it took rational decision models

(see Figure 1-4) as a basis. Considering ERP models it is significant different. Shaul[250] defined the EPR life-cycle process in four fundamental phases: planning, implementation, stabilization of the ERP system into normal operation, and enhancement. Other cycles described in literature vary very little from this definition mainly in terminology and wording (see chapter 2.5).

This connection of phases is a *differentiation factor* to all other research studies which usually focus on one phase mainly the implementation phase. Just recently the selection part (acquisition) gets more popular mainly covered by Verville, Palanisamy and Bernadas[251]. The selection / acquisition is part of the planning phase. Shaul mentioned as well in a very recent publication that problems occurring with the ERP systems should be based on so called critical success factors and should be traced back to earlier phase requirements and decisions.[252] Markus et al. argued as well that the planning phase is usually underestimated and preventing and resolving future problems start before implementing. He points out that analyzing the planning phase can prevent future failures.[253] So, all of the publications support the actuality and relevance of the research question and the model development.

The efficiency of the system can be analysed very late in the process usually during the so called enhancement phase. Efficiency in this case doesn't only mean the system delivers according to a business case and achieved defined benefits; it means as well the overall satisfaction of the users and owners according to defined criteria.

There is additional detail needed to support or falsify the main hypothesis. The main variables are identified according to the following figure (see Figure 3-1). The independent variables are tight to the selection part of the model. The dependent variables specify the result at the satisfaction part of it.

[250] cf. Shaul et al, 2012, p.362
[251] cf. Verville et al., 2010, p.36
[252] cf. Shaul et al., 2012, p.371
[253] cf. Markus et al, 2000, p.255

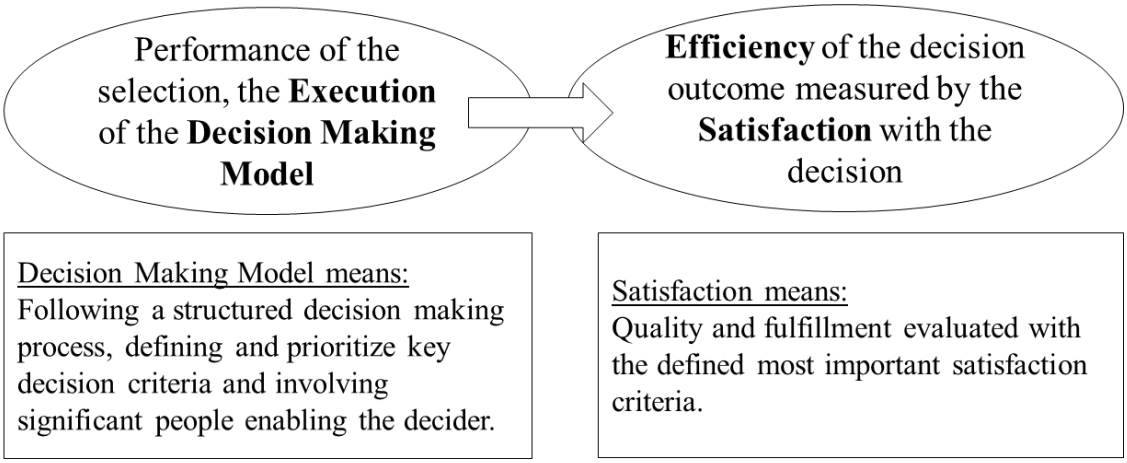


Figure 3-1: Relation of Variables, created by author 2012

The relation of the variables can be summarized in the following declaration:

"The higher the degree of the execution of the suggested decision making model, the higher is the satisfaction with the final selection decision."

This statement will be broken down and analysed in more detail in the following paragraph. Meaning the closer the selection is executed according to the developed decision making model the better for the overall efficiency. The dependent part is the challenge how to analyse the efficiency meaning to measure satisfaction in this dependency. As mentioned above the level of satisfaction is the indicator of the dependent variable decision making efficiency. The measurement of the satisfaction is described in detail in later on in this chapter.

Given it is a mainly unique decision for a company which is not done frequently it is fair to stress that this decision is a purely strategic decision.[254] Strategic decisions of that quality and volume can be categorized as normative decisions where the decision makers mainly should follow a rather rational approach, based on that assumption a model was developed. Considering the outcomes of chapter 1.1, the theory of decision making and the underlying approach was one input for the development of the model. Rational decisions these days are very often influenced by irrational factors. In this case the model provides the starting point for the selection, it enables the decider to make the first decisions on a pure rational basis and avoid spending a lot of time on gaining this rational experience themselves. In addition for a decision like the ERP selection there are always irrational factors which might have to be

[254] See as well chapter 1.1 – Theoretical basis

considered. The relation of the pure theoretical approach and the decision itself as a practical result has to be explained in more detail.

As *an example* a SME company with no experience will select an ERP system. They could start reviewing one ERP software package according to their needs, might add people and requirements to that process over time, review another ERP system add more needs and so on. In this process, they might mix rational and irrational requirements. They end up after an exhausting, lengthy process to decide for an ERP system. The selection itself and possibly the implementation might be a success, but the process executed was very inefficient and the people using the system might be not satisfied. Therefore the company should be enabled at the very beginning to fulfill the main rational criteria and then after a pre-selection add more specific and possibly irrational requirements. A model has been developed considering the various theories and practical experience to ensure this enabling process.

Reviewing the different projections in both theories, the organisational decision making and the ERP life-cycle theory, conclude that most researches are examined about variables but rarely about the nature of the decision itself.[255] Franz and Kramer point out in the article edited by Nutt et al. that a model of decision making should consider the following steps: Decision characteristics and personal & organisational characteristics influence the decision process leading to the decision outcome. They point out that this conceptual model is compatible with the three theoretical orientations: prescriptive, descriptive and naturalistic. Other researchers and theorists add to the decision making approach other orientations like political, organisational and informational.[256]

Comparing and analysing the different theories of decision making (see chapter 1.1.4) and ERP life-cycle process (see chapter 2.5) a decision making model was developed to consider all relevant factors for the efficient selection of an ERP system for SME.

[255] cf. Nutt et al., 2010, p. 535ff.
[256] cf. Nutt et al., 2010, p. 525

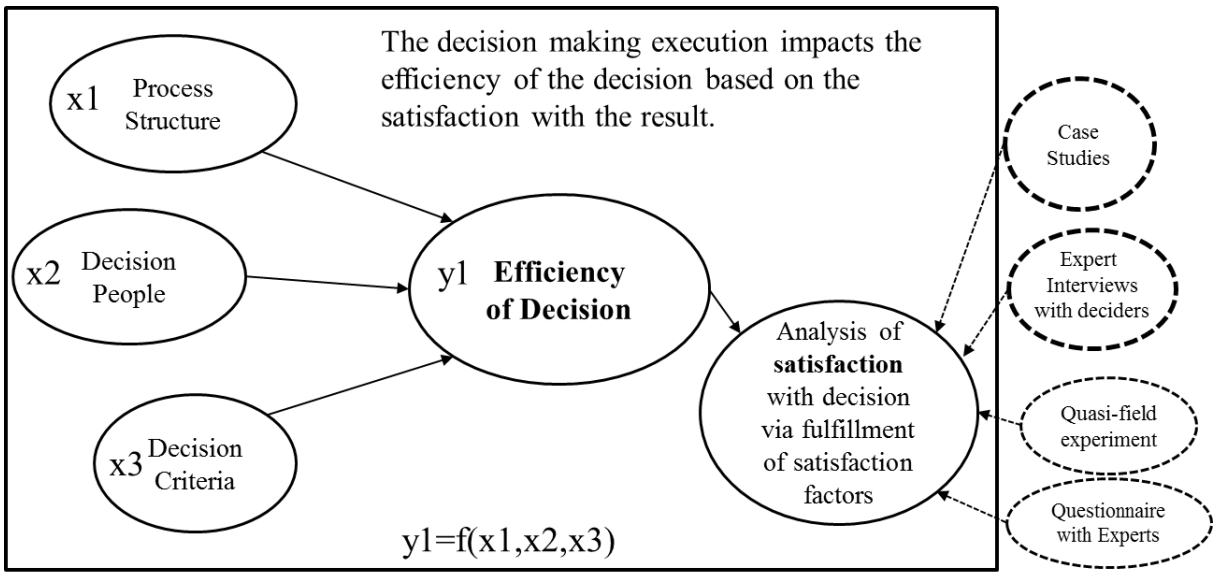


Figure 3-2: Development of suggested model, created by author 2014

This model includes the mentioned variables of Figure 3-1 with the key independent variables of the decision making model; process, people and criteria. This area of decision making contains the most important variables derived from the theory as mentioned in chapter 2.5 - 2.7.

For the dependent part success would be claimed if the ERP system is productive. So, the implementation and the selection of the system might be successful, but that doesn't automatically means the people are satisfied with the system, its functionality, the usage and so on. It doesn't also mean the decision was efficient. Other important factors to be considered for efficiency are the fulfillment of the business case and the fulfillment of the business performance. These dependent variables might have to be considered for efficiency but rather to generalize the model. For the purpose of this research these factors are out of scope and not further captured. Mainly the satisfaction of the users with the ERP system is considered and therefore the efficiency of the decision making is measured via the fulfillment of satisfaction. Therefore all qualitative expert interviews and quantitative questionnaires have been executed with experts who have been involved in the decision making process, most of the time with the decision making people themselves. This is a clear containment for this research. Talking to other employees who haven't been involved in the decision making might lead to a different result, and would give a less comparable outcome.

Continuing with the *example*; the company defined their requirements, there decision criteria for an ERP system at the very beginning at the selection part, the right knowledgeable people

provide input and a structured selection process was followed. In addition, they might have added supporting requirements to the list of criteria to be fulfilled. A while after the implementation and use of the system the main users been asked according to all defined and prioritised criteria to evaluate the ERP system. So, the satisfaction with the ERP system can be evaluated along a set of defined and possibly fulfilled criteria. There is a clear indication for the efficiency of the decision with the system at that point in time.

Along that model the set of independent variables and the one dependent variable has been identified and will be elaborated in more detail.

Identifying the *independent variables* is important at the very beginning of the decision making process, the selection of the ERP System.

"Performance of the execution of the decision making model".

Meaning how close the model was followed according to the suggested model. The key driving factors for this are the selection process, the involved decision making people and identifying and prioritizing the right decision making criteria (requirements) for selection.

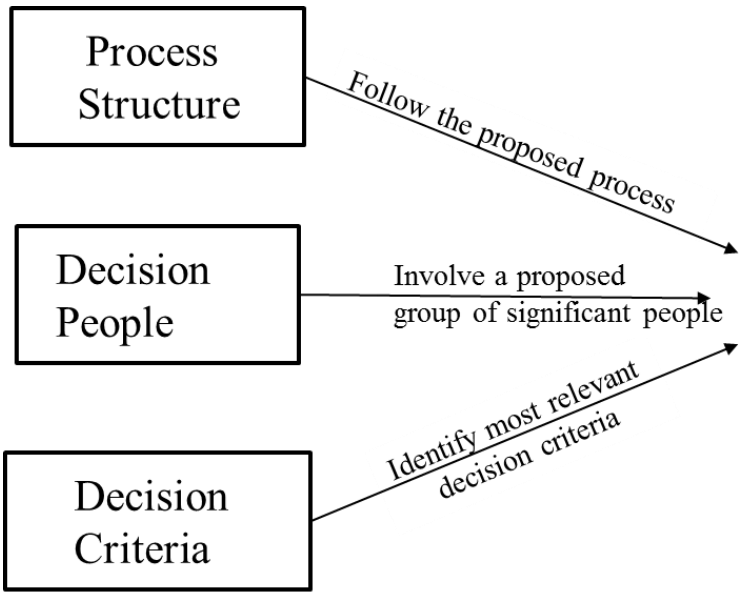


Figure 3-3: DM Model, Inductive Input, created by author 2012

These independent variables are derived mainly from literature. This is an inductive input which can mainly be divided in the three mentioned areas:

The selection process structure which has been deduced from various theoretical and existing processes which has been developed for either decision making, acquisition, IT or different parts of the ERP life-cycle process.
Decision people to be involved have been analysed focusing on decision making of SME companies and acquisition.
The most relevant set of decision making criteria has been derived from literature as a first cut. They are mainly developed for the entire ERP life-cycle, but have been selected in detail purely for the selection part including the decision making specifics linked to the relevant requirements and triggers.

So, the performance of the execution of the decision making model is high if

- the proposed selection process is followed
- the most important, decision making people are involved
- the set of decision making criteria is defined according to the requirements and triggers as well as they are analysed and prioritized

The details of the model, the process, people and criteria have been developed using literature, discussed and verified by the expert interviews and confirmed by the case studies.

In this content, success as a term has a complete different meaning and usage as the term satisfaction. "Success" is that the ERP system goes live – that it is used in production. But this doesn't necessary means the decision making process was high performing and the people are satisfied. Therefore the term "success" seems too generic in that defined content. The "satisfaction" is the key focus of this research.

The *dependent variable* is the satisfaction or better set of satisfaction criteria defined to be able to measure the satisfaction with the ERP system. But these are not the general criteria defined for any ERP implementation, these are the criteria defined in the selection phase as decision making criteria and then measured as satisfaction criteria in the end. These criteria are categorized according to the literature review in chapter 2.7. A very recent study from Shaul[257] reviewed the criteria relevant to the different phases of an ERP life-cycle which he called critical success factors (CSF). For the planning phase they identified 73 relevant success criteria. Details have been compared and incorporated with the chosen criteria in five mentioned categories (see Table 2-3). The final list of factors the author came up with as a

[257] cf. Shaul et al. 2012

novelty was derived from literature, developed further and prioritized. It was and used and evaluated and reconfirmed in detail in the case studies (see appendix 1 and 6-9). More important for the companies than setting up a set of criteria is the detailed prioritization and weighting process. The system should fit perfectly according to the defined requirements and even if it doesn't fit perfectly the owners / users need to be aware of the possible problems up front to be satisfied in the end.

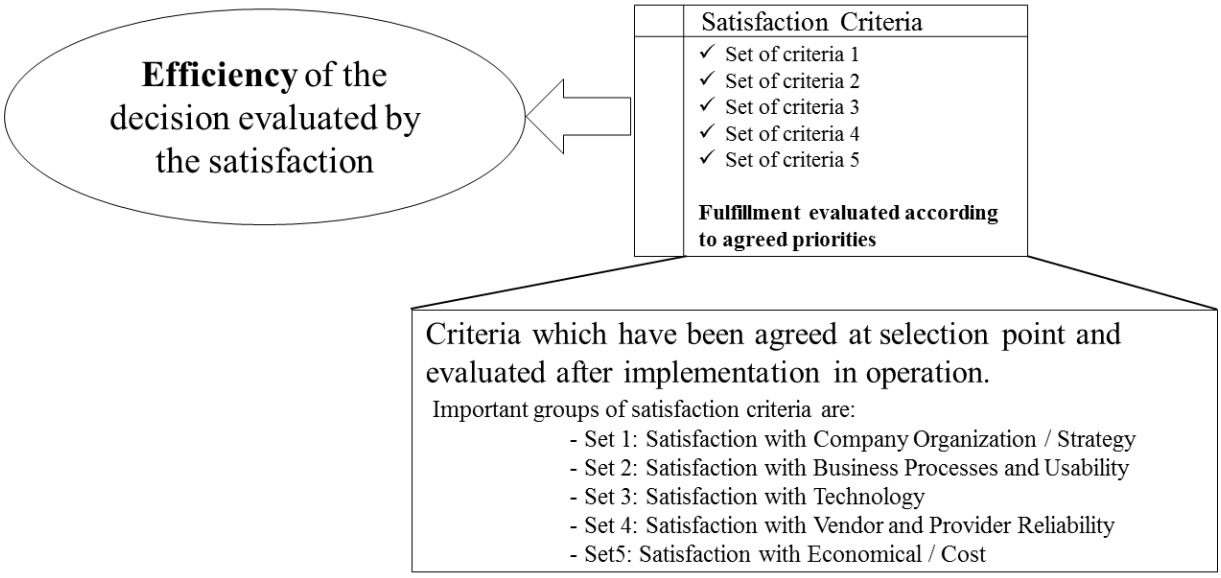


Figure 3-4: Depended variable, created by author 2014

The developed list of criteria was derived from literature and categorized for the very specific event of the selection phase. It is a basis to create the one individual valid list for the company in this very specific point in time for the specific situation and with the current requirements. There is *not the one valid list*. The list is a guideline which will be reviewed and evaluated in the process of selection. For each criterion it will be decided if it is necessary, relevant and how important the fulfillment of this one criterion is rated. So, at the end of the life-cycle in a very stable phase each individual criterion is measured, meaning whether the *BEST FIT* was achieved according to the upfront agreed percentage of fulfillment.

Examine the variables in combination with each other there might be a cause-effect relation even if the variables should only be considered qualitatively in further research. A function could be created according to the variance approach mentioned in theory. The relation of all factors can provide some dependencies but will not be analysed or measured quantitatively.

So, in summary *IF* the proposed selection process is followed, the best people have been involved and the decision criteria have been analysed, defined and prioritized up front while selecting an ERP system *THEN* after the implementation of the system in a stable environment the percentage of fulfillment of the criteria can be measured. If then the upfront percentage is fulfilled the selection of the ERP system, the company is satisfied with the decision very clearly along facts which can be evaluated.

3.3 Elaboration of Supporting Propositions

The variables have been pointed out in detail and will be taken as a basis to develop supporting propositions.

The efficiency of the decision is dependent on the execution of the developed decision making model. This dependency is analysed in more detail by breaking down the variables into more precise propositions.

There are *three propositions* taken for the explorative part of the independent variables. The areas are analysed firstly with a deep literature review (see chapter 2). Next the propositions have been tested qualitatively in company case studies and in expert interviews. These results have been tested quantitatively by a quasi-field experiment and a questionnaire with experts. The interrelation of the variables will be provided. All three propositions, whether they will be confirmed or falsified, will provide valid input to discuss the main research question in the end.

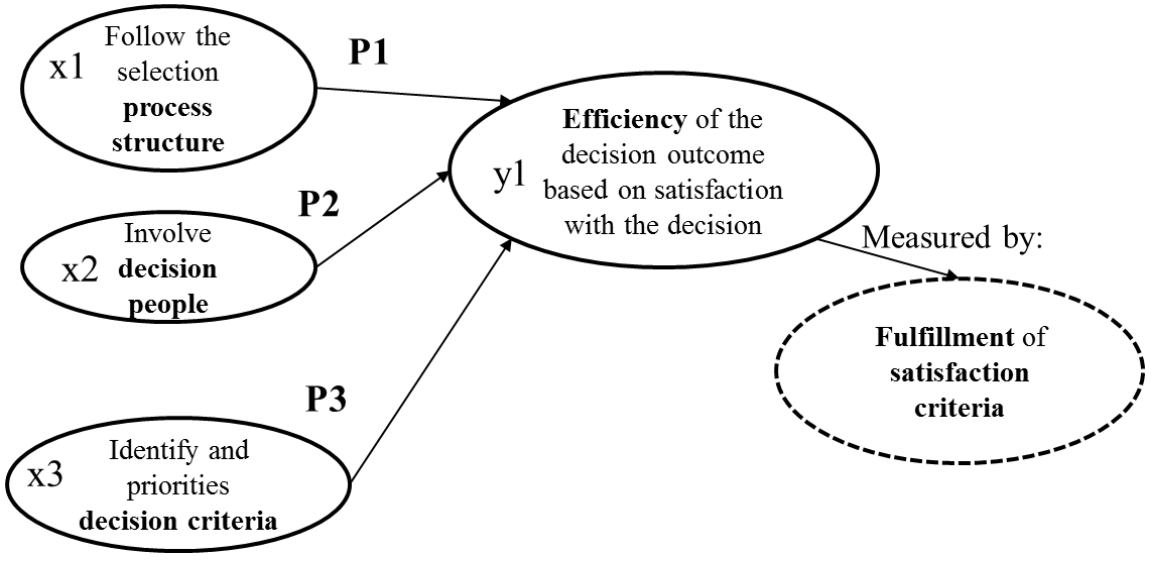


Figure 3-5: Interrelation of Variables and Propositions, created by author 2014

The execution of the decision making model is divided in the three key areas as mentioned before: Execution of the selection process structure, the decision people involved and the identified criteria prioritised (meaning the relation with the expected percentage of fulfillment to be achieved).

The efficiency of the decision needs to be analysed by measuring the satisfaction. To some extend the people and process are important but the criteria can be examined according to the priorities set at the beginning. This provides a measurement tool for satisfaction with the selected ERP system.

The three propositions are tightly linked to the dependent and independent variables.

- P1: The use of the suggested selection process has a positive impact on the satisfaction with the decision.

- P2: The involvement of decision people has a positive impact on the satisfaction with the decision.

- P3: The use of specific decision criteria has a positive impact on the satisfaction with the decision.

3.3.1 Proposition 1: Use of the Suggested Selection Process Structure has a Positive Impact

The ERP system implementation is a short phrase often used for the ERP life-cycle process, which might comprise usually 3-4 phases. The phase everybody is referencing to is the implementation phase, this is commonly called. Sternard references three phases called: selection, implementation and operation phase.[258] Shaul et al., mention four fundamental phases called: planning, implementation, stabilization and enhancement while dividing the enhancement phase into the sub-phases backlog, new module and major upgrade[259] (see chapter 2.5 to compare). Summarising all reviews of papers, ERP white papers and discussing with providers, a common process for the ERP life-cycle was developed by the author based on Sternards three phases:

[258] cf. Sternard et al., 2011, p. 1512
[259] cf. Shaul et al., 2012, p.362

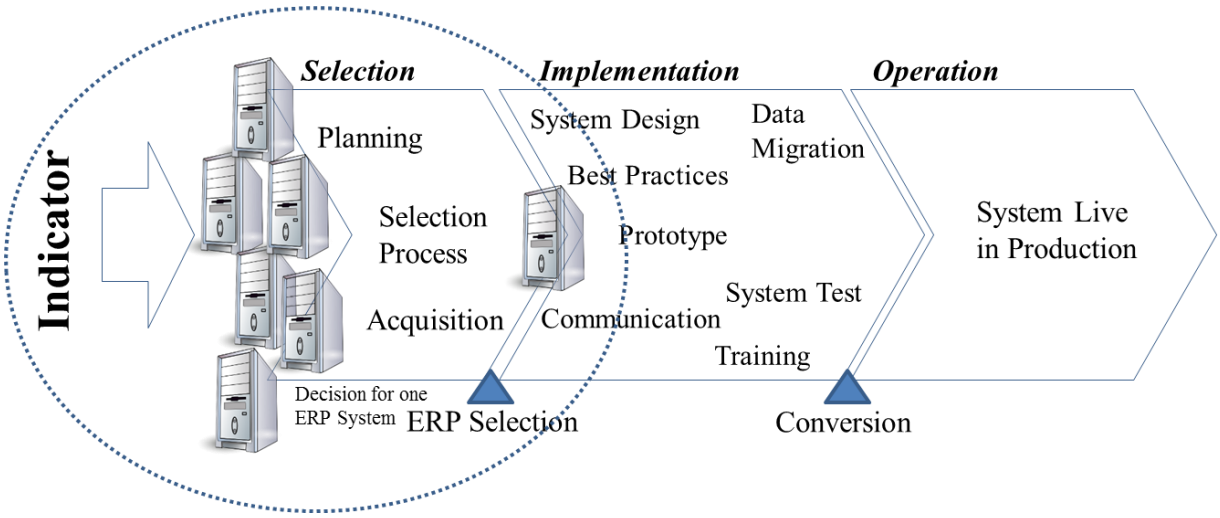


Figure 3-6: ERP life-cycle, current common practice, created by author 2012

The first phase is the so called and defined selection phase which can be broken into a subset of detailed steps itself. For this research paper the focus is only on the selection phase of the ERP life-cycle. The details of the selection process will be broken in more detail in a later section (see Figure 3-7).

It is a valid consideration that for any SME company an easy and structured process is needed. A very complex approach, like most of the big global companies are using seems inappropriate for SMEs (see chapter 2.5).

During international conferences (Riga Nov 11, Riga May 2012, and Tirana December 2013) the author challenged the subject considering more detailed analysis on the process development and the time taken for decision making; or better, the focus on selection in a standard process. The following statements have been analysed and presented. "A process should be followed or used as a guideline for the acquisition of an IT/ERP system for small & medium-sized companies." And "The planning and selection part of the process is very short at SME in comparison to the implementation". Both statements could positively be confirmed, so it is important to consider this detailed proposition according to a required standard process.

In literature there are multiple processes, so called models which have been considered for the ERP life-cycle, for the ERP implementation, the ERP selection and the evaluation of an ERP system. Most of the processes mentioned in chapter 1.2.3 and in much detail in chapter 2.5 have been developed for acquisition / buying in general, IT in general, software development

or computer usage. Some of them have been adapted in previous research for the selection and acquisition of an ERP system.

Most of the models referenced take the entire ERP life-cycle as the process or model but the pure selection phase, ending with the decision, is very rarely covered in detail and seldom detailed in process steps.

Given there is no standard process to be followed for the detail of the selection of an ERP system for SME companies, the author considered the following proposition:

> P1: The use of the suggested selection process has a positive impact on the satisfaction with the decision.

This proposition will be reviewed in detail in this research considering multiple research methods and challenging a proposed process focusing on the selection part. Very important for the process development is the loop with the satisfaction which has to be closed developing a cohesive approach.

Development of the suggested selection process within the ERP life-cycle

The construct process is based on key parameters identified by research in literature over the past years. There is currently not a general, overall valid process available in science or IT practice to measure the satisfaction with an ERP system as the basis for ERP selection. Therefore existing structures have been reviewed and considered for the process development. The first constructs were developed about 35 years ago modeling with a clear focus on various sub-areas of ERP existing at that time. MRP, MRP II than CRM and SCM were the areas scientists focus on. In the next generation of measures, financial and non-financial measures were added to a very diverse picture. Considering that ERP as a term became most popular in the 1990 ties researchers started to concentrate on that field and until the end of 2000 about 200 publications can be found but only very few (ca. 10%) had been journal articles. The authors mention frequently the high outstanding potential in this research field, but until then, most authors focus on the implementation part of the ERP life-cycle, the other parts are almost ignored.

Beginning of the 20th century, due to the increase of mobility and internet, the “e” wave and the enormous number of startup companies in the IT area, ERP became massively more

popular for researchers. The number of publications increased significantly since then to about a hundred journal publications a year. Most of the authors published just one journal article or conference paper only, about twenty authors published more than one. Focusing on the last decade the publications covered a wider range of interest. Looking at the ERP life-cycle management the implementation phase and optimization potential remained the highest ranked. The potential on the selection process couldn't be identified in detailed numbers. But some researchers covered that topic as well.[260]

The multifaceted influence from other disciplines and focus on business process execution has led to the problem of missing common definitions and this in consequence has caused fragmented research focusing only on parts of the ERP life-cycle, mainly the implementation. New theories have been developed based on pure need before existing ones are verified thoroughly. Therefore currently there is not a common method, model or approach to be used or validated nor a process to be followed.

However the objective of this research is to understand how enterprise resource planning systems can be selected for small and mid-size companies using a clear and understandable approach / process while defining a set of criteria to reach satisfaction.

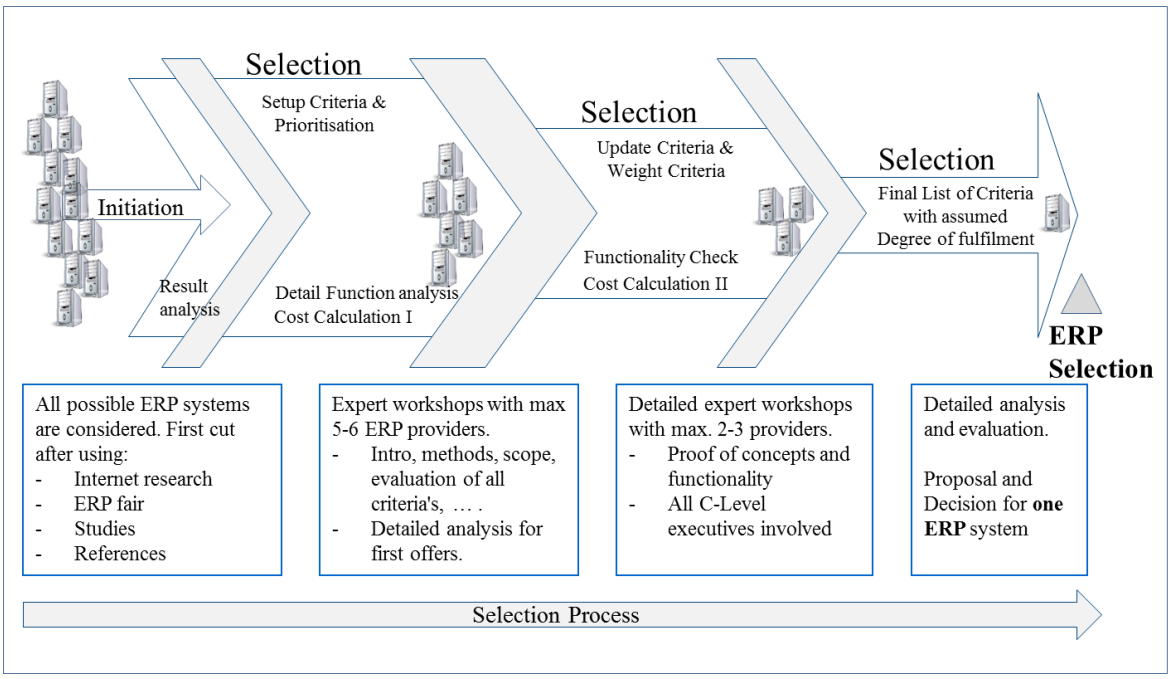


Figure 3-7: Selection process of the ERP life-cycle, created by author 2012

[260] cf. Schlichter et al., 2010, p.492f

The author reviewed many existing processes and created this very theoretical generic process, as a proposed process (see Figure 3-7) for this research. This process shows purely the selection part of the ERP life-cycle which is finalized with the decision for one ERP system at the end of the selection phase. Therefore the milestone indicated is called “ERP selection” or more precise ERP system selected. This developed process flow can be compared with multiple existing process phases in terms of steps, phases and milestones. The uniqueness of this selection process appears clearer in the generic illustration in combination with the ERP life-cycle. It firstly defines in detail all selection criteria which will be used through-out the entire life-cycle and secondly operationalize the details on steps as well as templates for selection.

The selection part of the model developed is a significant starting point for the overall model developed by the author. To support the main hypothesis significantly the model was completed by covering the different stages of the criteria until the final state. It would be beneficial to illustrate the process flow in a circle to connect visually the beginning with the end. This connection is novelty in comparison to all models just taking a fixed flow into consideration.

This ERP life-cycle is the basis for this research comparing the selection criteria with the satisfaction (see Figure 3-8). The selection process shows in detail the initial step taken during the decision making, pointing out all the details in the sub-steps to review all criteria in detail. Various very detailed templates have been developed and tested in the Company Case study II. The exchange of the selection with the satisfaction in a circular approach, but an additional illustration of the same detail might confuse more than clarify.

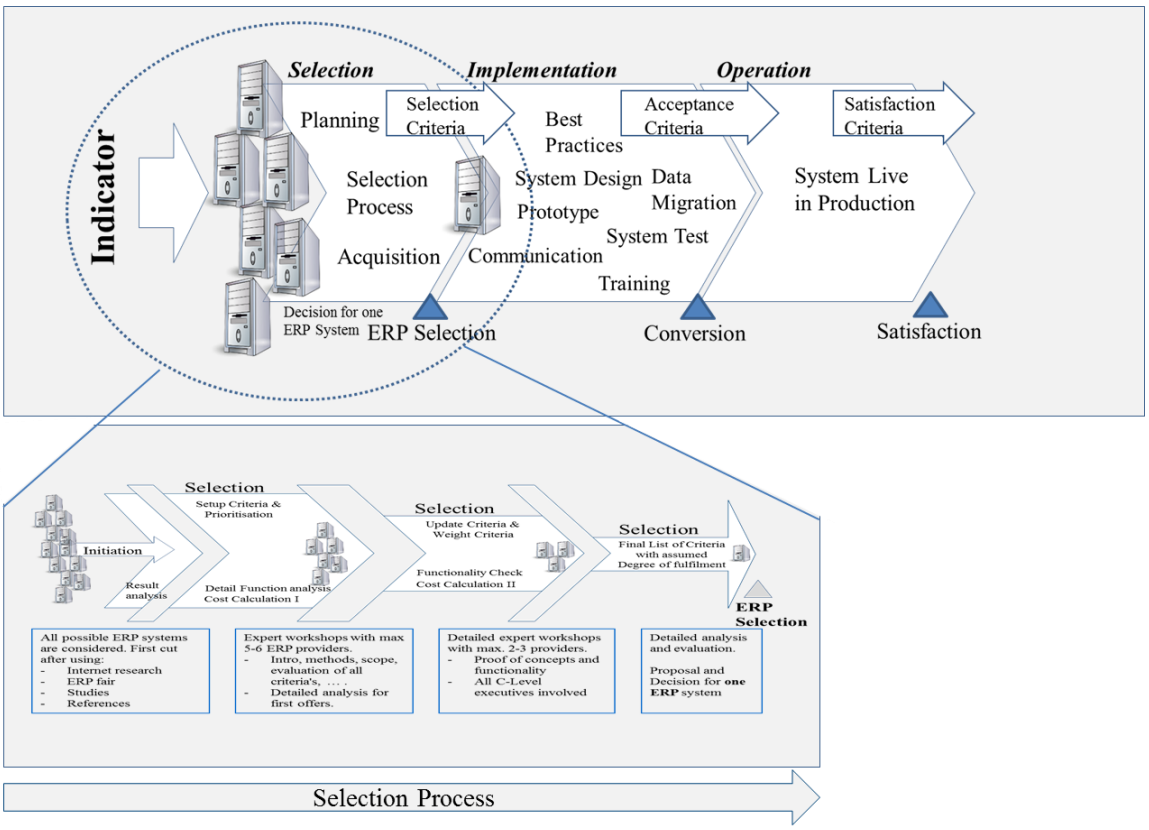


Figure 3-8: Generic process breaking into detail, created by author 2012

The approach points out that there is usually an ‘Initiation/Indicator’ starting the process of planning and selection. The set of selection criteria is generated and finalized at the point of selection of an ERP system hand over in the implementation phase. The set is updated during the cause of the process of implementation. At the point of conversion the decision for go live is based on fulfilling the acceptance criteria. While running the business in operation the set of criteria finally gets updated to a set of satisfaction criteria. This set of criteria should be a remaining set of information to measure the satisfaction with the EPR system on a long term basis. This closes the loop and shows in detail how the satisfaction with the system is connected with the selection. Defining, analysing and prioritising the individual set of selection criteria is a key activity during selection.

In sum, according to the proposition 1 there was a decision model developed combining the selection process with the satisfaction part of the business. A lot of operational documents have been developed which is an additional novelty.

3.3.2 Proposition 2: Involvement of Decision People has a Positive Impact

The early involvement of decision making people plays an important part in the decision making. As stated in Chapter 2.6 the decision making people are most relevant especially at SME companies given the very strong involvement of the owners specifically in family businesses and their emotional, sometimes irrational decision making. It is most important that very specifically in small up to medium-sized companies strategic decisions are based on facts and figures involving a team. So, important, top-quality, skilled people with a high knowledge of the subject or on details should be involved. Therefore for the specific strategic decision of selecting an ERP system, the involvement of a skilled team should be considered. The following proposition will drive the research towards the people integration:

> P2: The involvement of decision people has a positive impact on the satisfaction with the decision.

The proposition focuses on both, the people being involved for their functional, business opinion during the cause of the selection process and on the decider himself. The decider is relevant concerning his professional qualification, motivation and input.

The author challenged the question about the involvement of people at two international conferences in Riga 2011 and in Istanbul 2014 with the following statements which could positively be confirmed leveraging the results of the detailed researches of expert interviews and a detailed case study.
“The most knowledgeable leaders /people /teams from all management levels have to be involved to collect and prepare the information and enable to make the “right” decision.” And: “The selection of the criteria and its prioritisation vary by decider dependent on the position in the company.” And finally: “The selection of the ERP is a negotiation process between the decision making people and the vendors along a set of criteria.”

All of these statements cover a slide different angle of the topic but in total support that the taken proposition P2 is a valid consideration for this research.

3.3.3 Proposition 3: Use of Specific Decision Making Criteria has a Positive Impact

A significant part of this research is the specification of decision criteria incorporated in the hypothesis and proposition framework. A set of decision criteria is defined in the beginning as an independent variable. The set of so called decision making or selection criteria should be analysed, structured and prioritized while defining the requirements for the system.
Therefore the following proposition is taken into consideration:

> P3: The use of specific decision criteria has a positive impact on the satisfaction with the decision

Literature review did not reveal *the one valid* set of selection criteria, often called "critical success factors", but rather provided a basic set of criteria for selection and evaluation (chapter 2.7). Therefore a new grouping in five categories is completed by the author on the highest level covering: Strategy/Organisation, Functionality/User acceptance, Technology, Vendor and Economics.

Analysing and defining a first set of decision criteria, called selection criteria, at the very beginning of the life-cycle execution, is very important. But all people involved need to understand this set is not a static set it will be updated and re-prioritised and weight multiple times until the end of the project. At the end of implementation the set of criteria will be called "acceptance criteria" to support the decision for conversion. At the very end the set of criteria should be finalized and used for the evaluation of the system. This set is called satisfaction criteria and is an instrument to measure the satisfaction and even success of the project. The set of satisfaction criteria is an adjusted set which developed of the selection criteria over the cause of the implementation phase of the ERP project.

According to this detailed analysis an aligned hypothesis has been published at an international conference in Riga May 2012 and Slovakia GV Conference in April 2014. The hypothesis was called: "There is a constant interrelation and prioritisation of the critical success factors (CSF) during the selection process." It was analysed in more detail with the second company study and could be confirmed. This is just an additional confirmation that the proposition P3 should be considered to be relevant for further research in this dissertation.

So, agreeing that defining the set of selection criteria in the beginning is very important to the ERP selection and the entire project, it is very important to understand what the drivers for it are. Every ERP project has an indicator or a set of indicators starting it. These indicators should drive the development of the selection criteria as a starting point. Therefore it is a valid consideration that any SME company has a serious trigger/indicator to verify and start the planning for an ERP system implementation.

One clear or multiple clear triggers lead to the reason, why a company is investigating in an ERP system or even provide more detail to the requested scope, timeline, budget and possible other needs. Therefore more detail on the relationship of the selection criteria, which should be defined at that early stage of the life-cycle, and the fulfillment of satisfaction criteria evaluating the satisfaction at the end should be considered.

Example for possible triggers:
If a company has been sold and the existing ERP system will be switched off in a certain point in time – a "new ERP system in time" is the trigger. So "time" itself is one of the most critical rationale for the ERP project life-cycle and will be ranked very highly above some business functionality for example. Globalization or expanding in foreign countries is another trigger as well as merging with another company having a totally different IT environment.

The ERP vendors usually have a very detailed sales presentation along their success factors or even more along their own unique selling points (USPs). So, the vendor always tries to sell along a pre-prepared set of business processes, sets assumptions on scope and interfaces to cover the individual deficits. Due to a lack of knowledge, usually the client hardly challenges it. With their set of required criteria defined in the beginning the customer has a starting point for the discussion and can clearly question and reprioritize the fulfillment.

Finalizing the literature review and the first discussions the questions raze which are the most important criteria which have to be considered. Presenting some parts of the subject at scientific conferences and very intensive discussions, it all leads to the first two critical questions. The question about "cost" and the question about "time". Therefore these specific criteria will be evaluated very specifically in detail. Usually the SME companies are not known for spending money on IT/ERP. Everything needs to be faster, easier and cheaper in comparison to big companies. There is a huge amount of possible ERP systems available, so the discussion is around selecting the right system for a fair price and getting the system up

and running in a defined time. These are the expected discussions and experiences around that research question.

According to the proposition 3 there was set of selection criteria developed categorized in five groups, combining the selection with the satisfaction part of the business. A lot of operational documents have been developed with the second case study which is an additional novelty.

3.4 Research Methodology and Design

This section is an attempt to enhance the transparency of the research methods used and the details of the design. ERP is a very young field in research and even if the decision making theories are quite mature, very specifically the detailed research complexity of ERP and SME needs to be considered. Therefore, this sub-chapter aims to discuss the relevant methodology resulting in a coherent design.

The source for data analysis is rather complex. There is not the one valid source to pick from. Data and information deserve the study, the analysis and interpretation. Due to the personal involvement and engagement there are many different realities. Methods and theories aim to differentiate the truthfulness and systematic, controllable interpretation of data.[261]

3.4.1 Methodological Principles and Multi Method Approach

In the 19th century natural scientists have been very successful. Therefore not just nature but culture and not just material but social behaviour should follow methods and principles. Ever since, all specifically organisation science is struggling not to copy natural science even if the rigor of methods, the straight and demanding testing mechanism and the mathematic rules just ends in themselves. Therefore very often scientists aimed to collect quantitative data to count, calculate or compare results even if there was a qualitative basis for it. In the 19th and 20th century theorists like *Quetelet*, *Comte* and *Le Play* developed mainly new principles of social statistic and dynamic in combination with the social reality. They addressed that the social reality can be empirical evaluated by using the observation, interviews, social surveys and experiments which was provocative for their time. Their scientific works can just be implied

[261] cf. Atterslander, 2000, p.1

here but it should be stated it was the foundation and the early days to differentiate qualitative and quantitative research.[262]

Empirical research is based on many different processes and methods which have been developed over the last two centuries. For a long time it was based primary on critical rationalism mainly influenced by Karl Popper. He describes his logic of research mainly on finding a solution for a problem. "Understanding the world" and "theory is the net we cast in order to catch the world – for rationalizing, explaining and controlling the world."[263] Popper focuses on methods and systematic structures to prove any research question. It is not important what is really true, rather what are the relations to other logics and methods and how it can be proved or falsified. The validity is tested in a deductive way. Popper base all of his theories on a concept to follow: Setting up an axiom, a basic assumption which can be validated or falsified – then a hypothesis which can be validated or falsified – then a prognosis which can be validated or falsified. This approach is mainly rational always following an assumed same structure. This basis supported the continuous development for all administrative and social science. End of the 20th century the selection of the research method gained a lot of importance. The state of the art in every different theory influenced the research question and research method.[264]

[262] cf. Atterslander, 2000, p.9ff
[263] cf. Popper, 1966, p. 31
[264] cf. Albers et al., 2009, p.4f

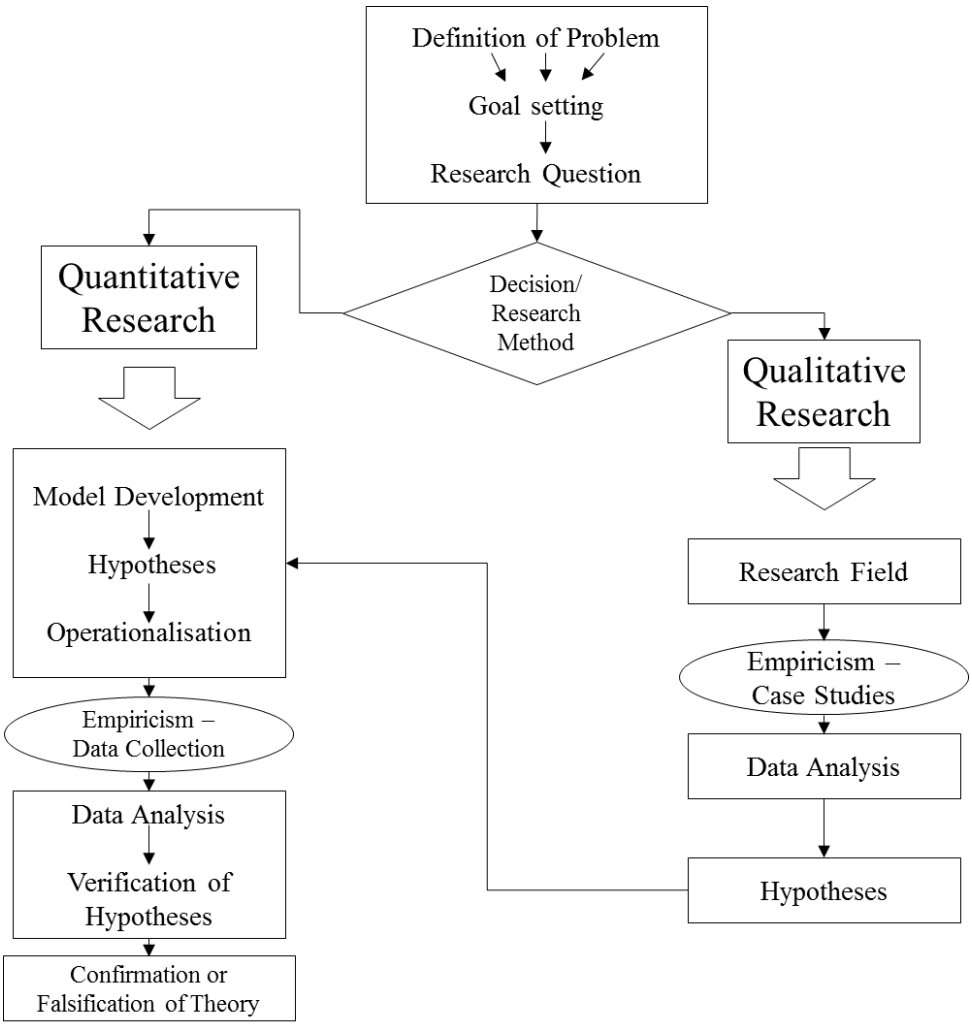


Figure 3-9: Research Process, created by author according to Albers[265]

The research question by its nature affects the adopted method. The research question is only meaningful if they can be evaluated in a mythological way. Valid results require a structured and adequate method. To set up an empirical testable approach, every research should aim to result in the following five steps. At the first level the terms are defined to ensure a common understanding of concepts and terminology. This ensures for the next level a uniform description, followed by a consisted explanation. Level four is consistent with *Poppers* approach for testing the theory. The last level summarize and emphasis valid recommendations.

[265] cf. Albers et al., 2009, p.4

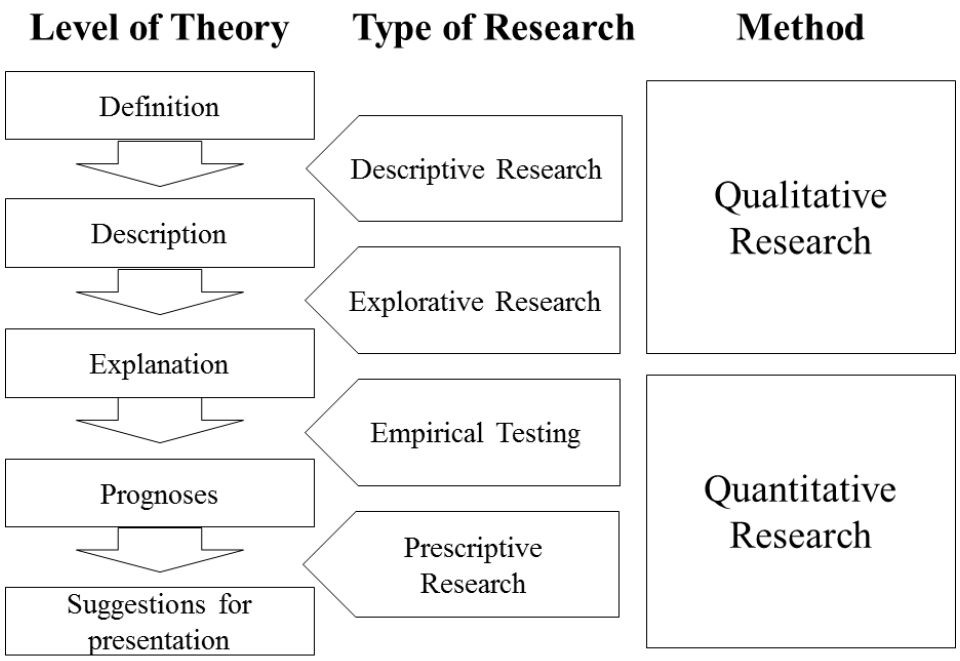


Figure 3-10: Level of Research and Methods, created by author according to Albers[266]

During the execution of research, the operations of theories transfer through the distinct levels using different methods along the specific research fields. In summary, it can be differentiated between high volume, quantitative researches and low volume qualitative researches.

Quantitative Research determines the variability of the criteria with a defined and structured coordination of numerical values. The quantity of all values is called data. Usually quantitative data are much easier to capture and handle as qualitative data, therefore quantitative research is based on much higher volumes. The result can easier be generalised and the control sample is much more representative. Therefore quantitative research is usually used to confirm hypothesis and generic recommendations deviated. Researchers test and verify causal and correlational relationships with variables they have identified before by applying unbiased approaches and by employing various statistical procedures e.g. regression analysed. The main tools used are surveys, interviews and experiments in its different variations.[267]

On the contrary, *Qualitative Research* approaches have gained increasing attention in the past decades and developed towards an almost confusing discipline.[268] It determines the variability of criteria with a verbal description of carefully selection individual cases. Qualitative studies

[266] cf. Albers et al., 2009, p.6
[267] cf. Albers et al., 2009, p.7
[268] cf. Flick et al., 2012, p. 13f

are mainly used in new research fields with little or new experience with the goal to gain deep appreciation of complex real phenomena. On that basis researcher defines very often hypothesis as a result rather than a starting point, but these hypotheses have an overall validity. In that content case studies are very often used as a tool and to develop and support theories. Case studies allow an investigation to retain the holistic and meaningful characteristics of real-life events – such as e.g. individual life-cycles, organisational and managerial processes.[269] Other commonly known methods are qualitative interviewing, group discussion and participatory observation. Advantages are a high contextual validity through an opened questioning process rather than a predetermined approach; this increases the subjectivity of the results.

The quality of scientific knowledge exploitation has to be validated for quantitative as well as qualitative researches along defined quality criteria. Reviewing multiple approaches like the one from *Yin, Lamnek* and *Albers* there is not a uniform set of criteria to be used. The main areas are validity, reliability and objectivity and additional postulates of qualitative research. To ensure validity of the theoretical construct, there are main tactics to collect data. The approach is to use multiple methods to review the social phenomena in the social reality according to multiple perspectives. Meaning all disadvantages of the use of one method is compensated by the use of an additional method.[270] Second, for complex research questions relevant literature should be used a priori identifying specifications of various constructs. The third tactic mainly used by *Mayring* and *Flick* is the communicative validation of research reports. The internal and external validity is the main quality criteria for all researches, covering cause-effect-relations of additional cases and argumentative validation. External validity due to the high number of samples is the main factor for quantitative researches. Reliability is supported by clear, complete and detailed documentation as well as objectivity due to standardisation of the data collection.[271]

Quantitative and qualitative research approaches might be contradictory, as described above the use of multiple methods is trying to settle this conflict between the approaches as well as within one method. Very specifically in recent qualitative research publications, it gained additional interest to verify using quantitative methods in a more mature stage of the research. It is a possibility to validate or ensure objectivity; it is seen as a strategy to gain a deeper and

[269] cf. Yin, 1989, p. 14f
[270] cf. Yin, 1989., p. 36
[271] cf. Albers et al., 2009, p. 45f

more profound understanding of the results. Meaning a strategy where scientific findings are substantiated, verified, justified and validated.[272]

3.4.2 Research Design in the context of ERP Decision Making

Verville and Halington[273] proclaimed that *"the acquisition of ERP software is not without it challenges. It is considered a high-expenditure activity that consumes a significant portion of an organisations' capital budget. It is also an activity that fraught with a high level of risk and uncertainty. ... This highlights the obvious need for making the right choice of software. ... little research found on that topic... ."* So, it is an important strategic decision for an organisation which is mainly done once, especially for SME companies. Given the little research executed in that field the assumptions are tight back to theories. Three factors challenge this research. Firstly, strategic decisions for SME companies are mainly executed by the owners, board or high executives, who are hardly available for to support. Second, studying ERP at SME demands interdisciplinary research. However, specific aspects like not comparable scope, business processes and requirements increase the complexity. Thirdly the field is dominated by the ERP companies publishing white papers in pushing their solutions, which is not an objective approach but very widely supported mainly by big global entities. This chapter will elaborate on design and methodological considerations that have to be taken when researching strategic decision making for SME in the field of selecting an ERP system. In addition the methodology of decision making according to its theory has to be considered as well.

As introduced in section 3.4.1, the decision to use quantitative or qualitative methods generally depends on the research question. Quantitative approaches might be used to re-test hypotheses on a larger scale by sending out surveys mainly in the area of method used, success or failure as well as overruns in time and budget. Qualitative approaches might be used to more sensitive and precise questions regarding decision making, decider knowledge and behavior and effectiveness. The ERP selection is a rather new field of research, the qualitative approach might have to be considered when choosing the research design, methodology and designing the process, given there is very little data available and the complexity of data gathering mentioned above. Later on in the research process additional quantitative methods might be considered to specifically verify the results acquired.

[272] cf. Flick et al., 2012, p. 309ff.
[273] Verville et al., 2005, p. 665

Firstly the methodology will be reflected according to the mature theoretical field of decision making, secondly the research field of ERP will be reviewed according to the used qualitative methods and finally results re-tested quantitatively.

Data collection in *decision-making studies* is important as well as the conclusions drawn, which can be incompatible due to the wide variety of methods that are applied. "Research approaches in such studies have varied from qualitative to quantitative, simulation to case study, interviews to surveys."[274] Decision making is similar to many other areas in social science investigating in different paradigms, disciplines and data collection methods which has created two major difficulties; rigour and relevance. Qualitative researchers, which are very often used in that field, are criticized for lacking rigour. Researchers tend to reject formal quantitative methods because they associate formal modelling with positivism or with over-qualifying. On the other hand researchers which focus on quantitative approaches tend to exclude things which are difficult to measure. This can lead to limited generalizability of the findings. However; both qualitative and quantitative research approaches have many striking similarities in the field of decision making. Validity and relevance are next to cultural differences most important factors which have to be considered by setting up the research for decision making. Nutts defines that rigour and relevance must be balanced. Decision making is the key activity for senior managers and poor decisions can lead to the demise of an organisation. So, dealing with the decision itself and not an abstraction makes it more likely that the research finding will be useful in practice.[275]

Reviewing the very recent collection of studies of the editors Paul Nutt and David Wilson[276] the research field of decision making still has its challenges and many areas which still could be analysed. Neither the use of qualitative nor quantitative research methods are suggested given the very complex environment and diversity in that field.

The *research field very specifically focussing on the ERP selection* for a SME has mainly been analysed by Schlichter.[277] His main focus has been all available journal publications starting in 2000. The research field of ERP is very young so there are hardly representative, comparable and relevant publications before that. The differentiation for the research methods has been in the following categories; case studies, archival papers, theoretical papers, surveys,

[274] Nutt et al., 2010, p.19
[275] cf. ibid, p. 20
[276] Ibid; Nutt and Wilson cover on almost 700 pages classic and recent developments, illustrating practical consequences of theories, collecting articles of international experts and pointing out areas of future research.
[277] cf. Schlichter et al., 2010

experiments, descriptive papers, design science papers, combined papers and not mentioned methods. "As regards to methods used in studying ERP, case studies have been the most prevalent and were used in 22 per cent of the papers, followed by papers using surveys, which account for 15 per cent. A total of 12 per cent of the papers have used a descriptive and/or normative method; 11 per cent of the papers have been strictly theoretical; 9 per cent have used design-science methods; 8 per cent of the papers have used archival methods; 5 per cent have used combined methods; and only 2 per cent have used experimental methods. We were not able to classify 16 per cent of the papers on the basis of the abstract, since no methodological consideration was mentioned at all."[278] There are some significant changes over the last 10 years for example where in 2000 as many as 43 per cent of the published papers did not mention the research method it decreased to 5 per cent. Given the field of ERP gets more popular researches got more successful using surveys recently. The number increased from about 5 per cent to about 30 per cent recently. But mainly used for a more mature area of the life-cycle e.g. implementation.

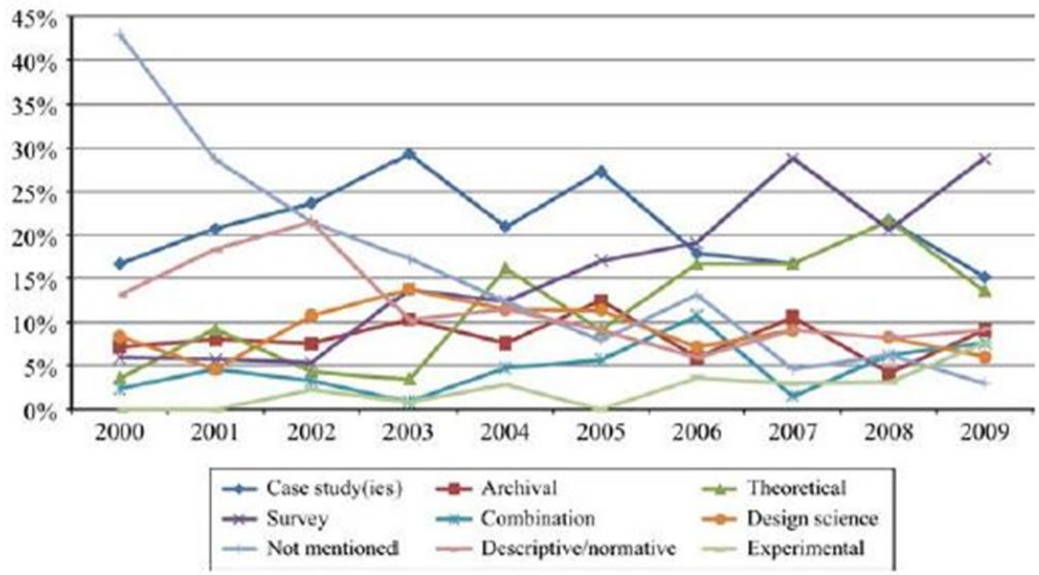


Figure 3-11: Methods used in ERP publications, Schlichter[279]

It is fair to state, that the ERP field has matured based on the findings that the number of theoretical paper increased in the previous years as well as the numbers of surveys raised. ERP is very much an interdisciplinary field and that the field has been driven by an interest in an empirical phenomenon more than indicating that the ERP research is a new research discipline.

[278] Schlichter et al., 2010, p.505
[279] Schlichter et al., 2010, p.509

Conclusion and implications on the research design

Decision making, SME and ERP as the specific objects of this study are characterised by many factors influencing the research design. Mostly in the theoretical field of decision making qualitative researches has been successful end of the last century assuming purely rational behaviours. These results can be taken and considered for further comparison. The challenge is to draw valid, reliable and objective conclusions which bear the comparison. The mentioned number of increasing surveys for the area of ERP is a very good basis for further research. Alternatively, qualitative research methods could apply to provide a deep inside and understanding of the object being studied. As mentioned above, mainly case studies are used qualitatively to confirm propositions. Is this case, the researchers are confronted with the generalization of their conclusions due to the uniqueness of a described case, very specifically using single case studies[280]. Therefore the qualitative research is executed using case studies and expert interviews. In this case there is not the intention to have globally applicable results due to the geographically limitation with this methods. In addition very specifically for the same scope of research a quantitative research can be added but only to verify the given achieved results not to have the intention to gain wider applicability of the results. The generalization will remain the defined geographical and industry scope.

3.4.3 Theoretical Foundation of relevant research methods

This section will elaborate the key methods used for the research, their contextual factors and their effects on the overall research strategy. Reviewing all possibilities, methods and state of the art theories for researching the ERP and decision making field leads to the strategy for this research. A qualitative approach will be used elaborating mainly expert interviews and case studies. The data collection and evaluation of the results will consider the different basis. A minimum of generalization should be ensured using a quantitative questionnaire with experts and executing a quasi-field experiment, confirming the model developed on a practical basis with the experts. Details for the methods, its challenges, strength and weaknesses are detailed below.

Semi-structured expert interviews

The research method ‘Expert Interview’ is one approach used to conduct qualitative research. In comparison with other qualitative interviews the group of people chosen is selected

[280] cf. Yin, 1989, p.27f

according to their detailed qualifications, which support their expertise. Current literature is very inconsistent in the definition and application of this method. According to Sußner[281] it is a trichotomy in executing the interviews using the explorative knowledge and the content knowledge or the company knowledge of an expert.

There are many different interview techniques described for the field of qualitative research. Personal interviews, telephone interviews and questionnaires set the main structure of the interviews. The structure can differ by executing focused interviews, semi-structured interviews, expert interviews, problem focused, narrative interviews or any combination of these techniques. Analyzing the requirements, advantages and disadvantages of each method the author has to consider the realistic options of execution, implications and focus / interest in research.[282]

Reviewing documented problems with the use of expert interviews the author summarised the definition and framework of multiple authors to define the relevant criteria for the chosen subject. The expert interview follows factual interest, a constructive method of interviewing, the motivation is based on facts and knowledge and it is an exchange of knowledge. The person executing the interviews needs to be an expert himself to get the appointment as well as being able to flexibly interact in the interview.[283] [284] Semi-structured expert interviews are mainly used in the area of qualitative empirical research. The main advantage to a fully structured interview is the possibility to add related information or background information to evaluate the relevance of the answers immediately. The disadvantages are that it might take longer and the need of a more qualified interviewer.[285]

Considering many detailed examples from the referenced books and articles, the author chose for the field of research to adopt the method of semi-structured expert interviews.[286] This decision was supported by the experience of the key researchers of the field. The return rates of surveys are rather poor given the workload of C-Level and IT people in general and very specifically for SME companies.[287] Primary researchers and institutes for this field of research

[281] cf. Sußner et al., 2005, p.12
[282] cf. Albers et al., 2009, p.38f/578
[283] cf. Mieg et al., 2005, p.9
[284] cf. Sußner et al., 2005, p.12
[285] cf. Schnell et al., 2008, p.387/589
[286] cf. Przyborski et al., 2009
[287] cf. Schmitz, 2007, p.252

are using case studies and expert interviews themselves and consider these to be the main methods for rather new scientific areas.[288]

The definition of an expert and very specifically of an expert for this field of research needs clarification. There are multiple definitions available in literature, which were considered and evaluated for the purpose of executing a semi-structured expert interview. Sußner differentiate definitions for experts: the voluntaristic including the constructivisitic and the method-relational expert, the social-representational and the knowledge sociological expert[289]. Mieg differentiates between social and natural science for the definition of an expert. The differentiation is between competence and the role in society which is very similar to the definition of Przyborski. Mieg points out as a main problem with experts that everybody has an opinion related to the subject but not profound knowledge and experience. The author opted to use the following definition for an expert as a basis for their selection.

"Experte = jemand, der /die aufgrund langjähriger Erfahrung über bereichsspezifisches Wissen/Können verfügt." [290]. Translated Mieg defines that an expert is a person who has profound knowledge and many years' experience and competence in an area.

This definition of an expert and the criteria to select experts were considered for the defined scope of companies in the relevant field of research (see chapter 4.1.1). According to Hardes 2002 the selection of a relevant expert is dependent on the organisation he or she is working for and that he or she has gained their experience, their reputation and a position as a recognized subject matter expert that can the influence relevant decisions made by company for their area of expertise.[291]

For this field of research a qualitative interview is preferred to provide flexibility and comparability. Even so the difference between qualitative and quantitative interviews should be pointed out because there might be some valid quantitative aspects to be considered during interviewing.

[288] cf. Verville, 2005, p.667
[289] cf. Sußner et at., 2005, p.4
[290] Mieg, 2005, p.7
[291] cf. Hardes et al., 2002, p. 2/7

Differentiation within the Interview	Variants - Detail	Quantiative	Qualitative
Intention of Interview	Detect knowledge Impart knowledge	+ -	+ +
Standardisation	Structures Semi-Structured Not Structured	+ + +	- + +
Structure	Individual Interview Group Interview /Discussion Paper - Pencil	+ + +	+ + -
Communication	In person In writing	+ +	+ -
Soft Skills	Hard facts Soft Skills Neutral	+ + +	- + +
Kind of Questions	Closed Open	+ +	- +
Media for personal Interview	Face-to-face Telephone	+ +	+ -
Media for written interview	Personal letter Mass survey In Newspaper	+ + +	- - -

Figure 3-12: Differences in interviewing created by author according to Lamnek[292]

The expert interviews as executed follow mainly all the requirements as indicated in the figure above. Using semi-structured interviews the structure of a quantitative interview is somehow included due to the provided questionnaire but the flexibility is still allocated given the possibility for open and free questions. The circles indicate that the semi-structured expert interviews as executed follow a clear qualitative approach.

Company Case Studies

Using Company Case Studies (so called Case Studies) as a research approach needs to be differentiated from other researching methods like experiments, interviews or artificial business cases[293]. It has recently been used more often for research fields and issues which are newer to scientists and where limited sources of information, history and theory are

[292] cf. Lamnek et al., 2005, p.331
[293] cf. Verville et al., 2005, p.667

available.[294] Whilst it seems a very new method, the use of case studies has been further developed by the sociologists Barney Glaser and Anselm Strauss who presented their research method, grounded theory, in 1967. The popularity of using case studies has increased really developed in recent decades and is especially used in the area of testing hypotheses, education, as a teaching method and as part of professional development for business and legal education.

The author has concluded that there is no common definition of case studies, or how to use them for research, but for the purpose of using case studies for this area of research the following definition of Yin is preferred by the author:
"A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. … The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies in a multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development if theoretical propositions to guide data collection and analysis."[295] This definition is commonly used for the area of economics as well as for research in other social sciences. Pointing out that this method is very flexible, more open and minimises research paradigm. The author supports this definition for research because it is a qualitative topic in the wider field of economics.

There is a differentiation in literature between two main types of case studies; single-case design and multiple-case design. The single-case study is similar to the single experiment and focuses on critical, extreme, typical, representative but very difficult cases which might have to be observed for a long period of time. Multiple-cases are comparable cases where similarities and dependencies can be demonstrated. Usually the results count as much more reliable and robust than the results from single-case studies.[296]

The strengths and weaknesses of case studies have been analysed and described in much detail by Boutellier and Gassmann of the University Zurich: "Case study research has some important strength compared to quantitative methods and experiments. Case studies describe the real world without influencing or simplifying it. Theories can therefore easily be tested in real world examples. As phenomena first appear in real life, (inductive) case study research,

[294] cf. Li, 2011 p.491
[295] Yin, 1989, p. 23f.
[296] cf. Albers et al., 2009, p.36f, 578

describing real world phenomena, is also an important tool in theory building."[297] Weaknesses are always pointed out by researchers preferring the quantitative methods. The main criticisms are that results are not generalizable due to insufficient data, few statistical facts, or due to the small number of analysable comparable cases. A formal objection is that case study documentation is generally too big and unstructured.[298]

The case study is one method mainly in the area of qualitative research. The single case study does not have any significance in the quantitative research because it does not have any strength in generalization and consolidating detailed data but still in the area of testing hypothesis it has some relevance. According to Lamnek, in spite of the lack of acceptance by quantitative researchers there is a need for single case studies specifically in an explorative phase and in illustrative summarization of results.[299]

	Quantitative Case Study	**Qualitative Case Study**
Number of cases	Many cases	Few cases
Number and type of information	Many and wide range of information	Many and deep insights
Number of Methods	One method	Multiple methods
Scientific View	Particularistic view	Holistic and integrated view

Table 3-1: Differences of the research design, created by author according to Lamnek[300]

The author used the case study method for an in-depth analysis and was able to obtain some important insights as well to reconfirm the structured model. Two independent company case studies were chosen according to the defined requirements (see chapter2.2.1) to support the hypothesis. The approach used was the single-case study method applied for two distinct and non-comparable case studies. In sync with Lamnek's definition (see Table 3-1) the author confirms that the use of case study in the defined research field is qualitative not quantitative.

Quasi-field experiment

For the specific case of an investment decision for an ERP system it is rather difficult to find a large sample group, who act in a relevant environment and have been conducting actual ERP decision processes recently. The same problem applies while selecting for case studies. A

[297] Boutellier et al., 2008, p.3/8
[298] cf. Boutellier et al., 2008, p.3
[299] cf. Lamnek, 2005, p. 302f
[300] cf. Lamnek, 2005, p. 309

multiple case study approach could not be taken further due to the fact that it was not possible to find similar companies (in terms of size, industry and geography) in the same stage of the selection process. To find representative "real world" decision making samples, the approach of a quasi-field experiment was chosen. The sample members recruited show a highly identical demographic background. They are all professionals in the field of ERP for some years and they have been involved in an ERP selection process for a SME company.

An experiment as a research method can be differentiated into a laboratory and a field experiment. The laboratory experiment as it is indicated by the term is executed in an artificial environment, a laboratory. The advantages are that it represents a highly controllable environment, the influencing factors can be limited, but the external validity might be weak. A field experiment is usually executed in the natural or working environment. The external validity is usually very high, which leads to a higher degree of generalizability of the results.[301]

The ERP professionals involved in our research have been selected randomly, according to the two different test samples. Our experimental approach can be characterised as a quasi-field experiment. Apart from the fact that our experimentees are real world decision makers, we confronted them with two real world case studies concerning decision making procedures for an ERP system selection. The experimentees where supposed to evaluate the quality of the decision making procedure and the expected decision making outcomes via a standardised and structured questionnaire (see appendix 12). This means that on the on hand the dependent and independent variables where fully under control of the experimentators, even though the experimental task and treatment was based on a real world decision making case. This mixture of a laboratory and field experiment is labelled quasi-field experiment.[302]

Questionnaire with ERP Professionals

In addition to the quasi-field experiment another rather quantitative approach had been considered. Given the complexity and time intensity of the expert interviews the more general approach of executing a questionnaire was considered. For the collection of primary data this is one of the main quantitative methods used be researchers. The use of a standardised survey in comparison to the quantitative interview (see Figure 3-12) is less intensive because it is usually independent of the questioned ERP professionals' schedule. The reliability of the

[301] cf. Schnell et al., 2008, p.225ff
[302] cf. Neuert, 2011

results is usually very high. The accuracy of data and the represent ability very high, the cost, flexibility and time low.[303] The quality of the result is dependent of the questions. Mainly closed questions should be asked as well as questions which can be answered on a scale. These types of questionnaires' are highly representative to gain quantitative comparable results.

3.4.4 Goals, Threats and Quality Criteria for the Research

In this sub-chapter the goals achieved and threats for this research will be pointed out as well as a clear focus on the quality criteria achieved.

Goals for the research

It is a goal for this research to present the state of the art in literature regarding the very specific topic of ERP selection. This research points out that the following three dimensions are the key to compare the results.

- Review and reflect existing models for selection and provide a suggested model specifically valid for small and medium-sized companies
- Reflect the influence and impact of the person making the decision in the strategically important decision making process
- In detail the literature review comes up with a set of selection criteria along a common basis.

Provide Lessons Learned from Experts and Professioals to avoid future mistakes for other SME companies. Development of a theoretical model, that the quality of the decision making process influence measurably the satisfaction with an ERP system. Compare the approach for big large entities based on successful implementations and point out the differences to SME to develop a pragmatically approach. Point out that the optimal point in time making the decision is usually much later than the decision is actually made. Ensure the awareness of the SME companies about the optimal point in time to make a strategic decision.[304]

Threats to the research

The literature review started in 2010. Given it is a rather actual topic it was a challenge to find relevant literature and narrow it to the very specific part of the ERP life-cycle. Therefore

[303] cf. Albers et al., 2009, p.53f
[304] cf. Geissler, 1986, p.232

research had to continue until 2014 to include all recent papers. A very good overall research paper was published in 2010 by Schlichter, covering and summarising all related topics and pointing out relevant scientific papers of the field. This confirmed that the most relevant authors, papers and books have been considered for the research.[305]

The comparison of decision criteria or so called 'critical success factors' in literature was in intensive part of the theoretical research given the diversity of the very few papers considering decision criteria in acquisition and at SME companies. Using the experience of big companies and reviewing cases and papers in detail a comparable set of criteria could be elaborated even further. It was most important for further classification to align the level of detail and scope. Considering the initiation / requirements made it very clear that there will not be the one set of criteria. The level of detail, content, scope and entry trigger will always have an impact on the chosen set.

Deciding on the research model opened further threats. Company case studies and semi-structured expert interviews had to be executed in addition to the literature review. Very specifically CEOs or CIOs of SME companies are very difficult to consult. The limitation to a region increased the feedback rate. SME companies prefer the personal contact which was possible due to the chosen scope.

The company case studies have been a specific challenge because the timing and availability was very critical. The company had to be just at the start, before the selection phase, they needed to be available and open to try something new as honest and serious to execute it in the three year timeframe of the dissertation. The background of long year experience helped the author to get the possibility to support the two company cases, which have been selected according to the defined requirements (see chapter 2.2.1 and 3.4.3).
The semi-structured expert interviews provided the same challenge and the return rate of 65 % could just be achieved due to the possibility to visit most of the experts in person. The interviews followed a questionnaire as a guideline to be able to compare the answers. The interviewing person had the advantage to be an expert in the research field herself, so the experts discussed very openly and the results could be compared and related. An anonymous questionnaire was not sent given the return rate for a similar scope and peer group is usually under 10%.

[305] cf. Schlichter et al., 2010

Quality criteria for the research

The quality of the research should be ensured considering the following quality criteria's: validity, reliability and objectivity.

With validity it is questioned, if the feedback from the expert interviews and case studies is acceptable? To ensure comparability the expert interviews are based on a semi-structured questionnaire which was used for every interview as a basis. The set-up for the interviews has been very similar and comparable no matter whether the interview was conducted in person or via telephone. The interviewer was always the same person. The acceptance of the interviewer in terms of interview and communication acceptance and reliability was very high due to the expertise. The variables and structure was always very similar. Questions which could be analysed following the Likert scale and open questions tried to be narrowed to comparable results on a pure qualitative basis. For the quantitative survey a group of highly knowledgeable experts have been selected and a tested questionnaire been used, for the quasi-field experiment the high knowledge of the experts have been significant for the validity.

There should not be an area / room for criticism given that all results are based on expertise not just on observation.

Reliability means: Could all results been repeated and would reach the same result? The semi-structured interview and the questionnaire which has been used for the interviews have been the same and could be reused. If the interviewer would have the same experience in that field to be accepted by the interviewees, so the set-up, structure and atmosphere would be the same, the answer is yes. Yes; the interviews could be repeated. But still it needs to be considered that an interview in person always includes personal opinions, cognition and attitudes of both parties which might influence the results.

The company case studies are a bit different. Given the specific situation of the company at the time, that they needed a new system, the set up and people involved would hardly lead to the possibility to repeat the case study the same way. The author tried to describe the situation, structure, people involved in very much detail that the situation is understandable and comprehensible on a very high level. But for both case studies the situation can't be repeated and with the additional experiences of the involved people the results would definitely be different. The question would similar case studies lead to the same result? The answer is: maybe. The criteria have been defined in detail but there are always so many influencing factors. Very specifically people and their personality in making the decisions, the

set-up of the environment and the personality of the interviewer could just be summarized as a guideline to execute a similar interview or case study.

Key factors which can be pointed out as a guideline are:

- Point in time. Just at the beginning of the ERP life-cycle before the selection and planning phase
- Size of the company
- Organisation structure of the company – decision making team or owner driven
- Functional Scope
- IT environment, IT scope, IT affinity of the people or IT lead

Any other company in the same set up and structure as described might lead to similar results which could fit and support the propositions. Nevertheless, even with very accurate standardisation and operationalization of the cases it cannot be avoided that a similar case study would lead to a different result. For the quasi-field experiment it can be assumed that the same field experiment would lead to a similar result using the same knowledge experts in the same industry and region.

The objectivity for the interviews, case studies, surveys and field experiments during analysis, execution and interpretation has been ensured by paying specific attention to limit personal contacts, subjective freedoms and relationships. The influence of the interviewer can be assumed as very limited because the competence can be seen at a very similar level. The level of expertise of the interviewees is very high therefore there shouldn't be an influence but it cannot be totally excluded scientifically. Wherever possible the high level of standardisation reduced the possibility of personal influence. The number of expert interviews is very high so this critical mass should ensure additional objectivity.

3.4.5 Concluding Rational of the Selected Research Approach

This empirical approach of the research relied firstly heavily on qualitative, rather than quantitative measures to confirm the developed model in this very new field of research. A more quantitative approach would only have been plausible from the very beginning if SMEs were observed to utilise structured and more directly comparable methodologies to drive their ERP implementations. Given this complexity, the author decided to use multi-method as an approach for this research with the intention to enrich the quality of the research due to the

different approaches. According to Mayring[306] the research can be based on different sources of data, different interpretation of the same results, different methods as well as different theories. For this research the use of different research methods, so a multi-method approach have been chosen due to be able to compare results firstly on a qualitative basis and later verify the qualitative results and assumptions with a quantitative approach.

Semi-structured interviews with a subject matter expert (the author) were firstly preferred to questionnaires as this ensured greater consistency in the presentation and interpretation of questions and their answers during the actual interviews. A questionnaire with eight topics was developed and used as the basis for each of the interviews. This approach led to more reliability in the subsequent comparison of the information and data collected.

From the information collected in literature and during this series of semi-structured interviews a hypothetical ERP selection process (see Figure 3-7) was developed and then tested using two company case studies. The first company case study used the suggested model to drive the decision. It was used to initially create and test a "decision making process" and a corresponding set of "selection criteria" in order to drive the ERP selection process. The second company case study focused on a detailed execution and test of the "selection process" and "selection criteria" developed during the first company case study.

On that basis a rather quantitative approach was add. All results and the developed model have been verified quantitatively using a quasi-field experiment. The setup of the model was tested and confirmed statistically as well as the detailed for the propositions used. All experts supported the chosen, and qualitatively developed criteria, and the statistical correlation is significant. In addition multiple decision maker/ experts have been questioned in a survey very similar to the questions of the expert interviews. This quantitative detail was added to answer the key propositions and support the research hypothesis.

[306] cf. Mayring, 2002, p. 147

4 SPECIFICATION OF THE APPLIED RESEARCH METHODS, FINDINGS AND RESULTS

An ERP life-cycle (selection, implementation & operation) is very complex and challenging to execute, even for large organisations, but especially so for SMEs which seldom use a structured process.[307] It will be a valid approach for the research to use a series of semi-structured expert interviews and company case studies. The methodology described in chapter 3.4 follows firstly a qualitative research strategy. Even so, both methods can be used in a quantitative matter for this research it is used mainly qualitatively. Taking the rules and possibilities of a multi-method approach into consideration, the results achieved by theoretical research, by the semi-structures expert interviews and case studies are additionally analysed and tested with a quasi-field experiment and questionnaires with experts following a more quantitative matter. The quantitative survey considered the questions of the expert interviews.

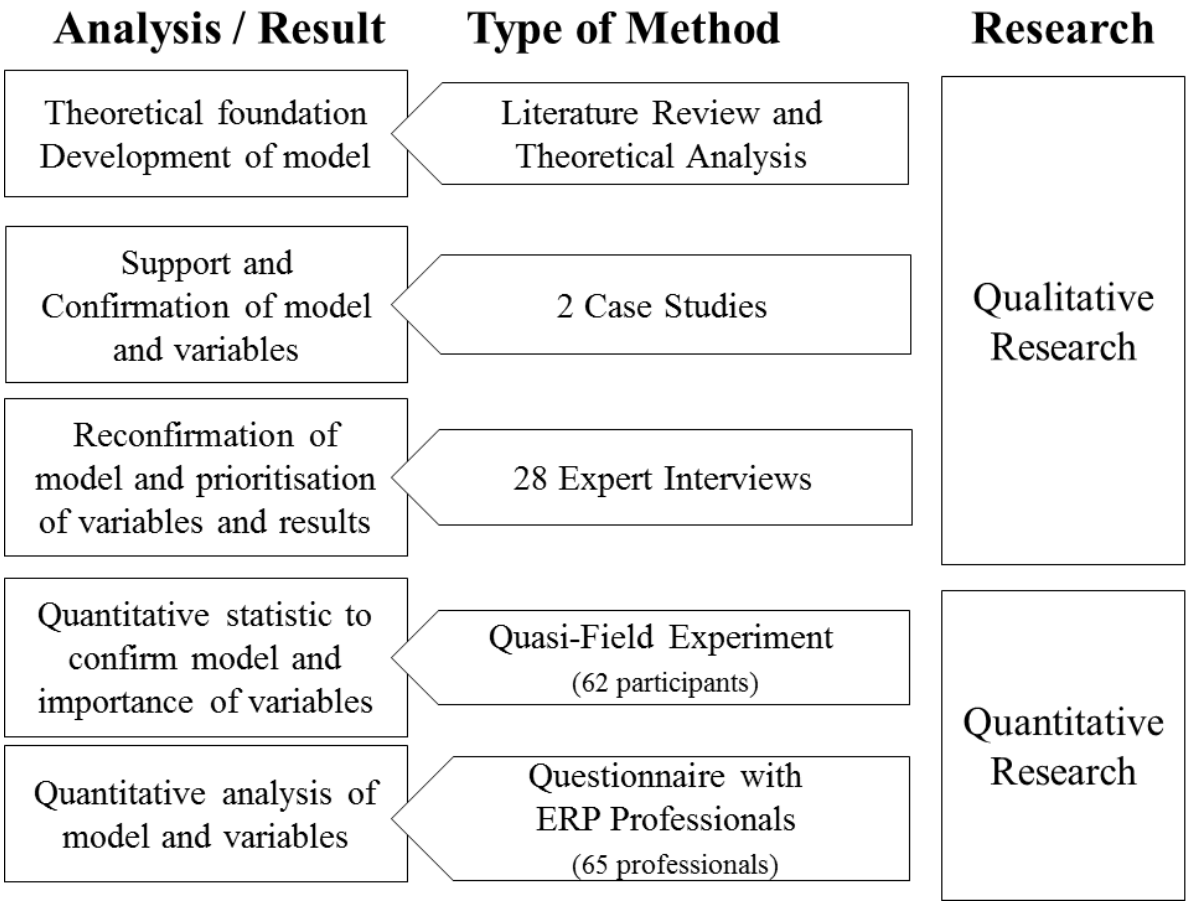


Figure 4-1: Research approach taken, created by author 2014

[307] cf. Verville, et al., 2003a, p. 585

4.1 Research Methods applied

An extensive literature review has been conducted starting from 2009 until 2014. Using the findings of this and the leveraging the experience of other scientists the decision to use and elaborate semi-structured expert interviews and company case studies has been made. Starting with an extensive case study working with Company I in autumn of 2010 the first literature results have been tested and reflected. The joint results of the Company I and the literature review have been used to adjust the suggested model and selection process and the questionnaire for the semi-structured interviews. Between autumn 2010 and spring 2012 - 28 expert interviews have been executed in parallel accordingly. Considering all findings the case study with Company II started in autumn 2011 completed in spring 2012. In spring 2012 an opportunity was taken to do a final interview with the IT-Lead of the Company I - 16 month after go live. The propositions have been tested in that circle of events. The main hypothesis and propositions were reviewed from different perspectives.

Using all qualitative results, the model and relevance of the dependent and independent variables had to be supported quantitatively. Given the complexity that the model can only be tested in a certain stage of the process e.g. at the very beginning of the ERP selection it could not be considered that more case studies would be found. Therefore a quasi-field experiment was executed with professionals beginning of 2014. In this set-up the relevance of the model and variables could be tested. In addition a questionnaire was executed with ERP professionals in line with the questions of the conducted expert interviews. The relevance and interlinkage of the variables could be tested to add a quantitative result to the qualitative trend.

4.1.1 Semi-structures Interviews with Experts of SME Companies

A questionnaire was developed (see appendix 2) as a guideline for the expert interviews. The interviews were conducted mainly in person with the expert interviewees which all have been the decision makers of the SME. Given the busy schedules of some the interviewees, some interviews were conducted on the telephone but all followed an identical structure. Every individual interviewed person can be identified as an expert (defined chapter 3.4.3). In addition she/he has been asked in detail about the expertise, which was confirmed stating they all have many years of experience and a very high seniority. All interviewed people have been significant decision making people involved in the ERP selection process.

The questionnaire had been submitted in advance of the interviews to allow for preparation by the expert interviewees, when and if time permitted. All answers were discussed fully during the interviews, not just written down on the questionnaire. Some experts sent additional supporting material and brochures after the interview. During all interviews notes were taken and if allowed by the interviewees, the interviews were also voice recorded. For each interview the answers were documented for analytical purposes and can be reviewed.

The companies in scope are small and medium-sized companies and therefore the relevant experts tended to be the company owners, board members or CEO's or in medium-sized companies the CIO or IT department leads. For the specific area of ERP system implementation consultants covering the wider picture of multiple companies, were also considered. Question two of the questionnaire confirmed that the selected interviewees had the relevant expertise. The question had two parts. The first part asked if the person consider himself or herself to be a relevant expert. The second part asked the person to confirm whether he/she has representative knowledge and expertise for a specific group of experts. All 28 interviews confirmed both questions positively and confirmed to be experts as defined.

A total of 41 companies were contacted. Of these, 13 companies decided not to participate for various reasons. The remaining 28 companies with identified interview partners were conducted in 2011 and 2012. From 6 mainly small companies the interviews were executed with CEO's. From all size companies the interview partners were CIO's/ IT Leads (18). In addition 4 experts were interviewed who were consultants supporting small and medium-sized companies during the selection and implementation process which were referring their results to specific examples. In summary, they were all highly knowledgeable and relevant experts.

In summary all expert interviews provided very valid input and feedback to the propositions and outlined very good results for the detailed analysis of the main research question. They provided input and reviewed the developed model. During the cause of the interviews the model developed using the interview feedbacks and additional input to a more mature stage being tested with the case studies, quantitative surveys and field experiment later on.

4.1.2 Company Case Study I – KEC Kitchen Exhaust Hood Company

Executing a case study successfully requires that certain rules are followed and repetitive requirements are met. The conceptual and main structural requirements were considered whilst selecting and executing the two case studies, meaning working with two real life companies. Due to the fact that the case studies could not be compared it is executed as single case studies, the approach for multiple case study didn't apply (see chapter 3.4.3).

Company I was chosen (according to the requirements of chapter 2.2.1 and 3.4.3) very early in the research process to be able to review the findings over a longer period of time. An expert interview finalised the company study after almost two years reviewing and validating the findings. (All details regarding the execution of the Case Study I can be reviewed in appendix 6).

Initiation for the ERP system:

The trigger, to think about an acquisition of an ERP system was the international and rapid growth of the company. The production volumes and sales increased as well as the number of customers. Due to a limited product range the customer relationship management was the highest concern of the owner. The connection to the WEB-page and search engines needed to be established as well as communication set up in various languages. The handling of the customer information base was at its limits. In addition the controlling and management reporting needed to be restructured according to international needs. Altogether enough reasons underlined the necessity of an ERP system with a strong CRM module.

Model used

Once the decision was made to proceed with the selection of an ERP system, the appointments been arranged between the owner, the sales department lead and the consultant. After clarification what targets should be achieved the detailed process of responsibilities and timeline has been set up. The following process was proposed based on literature review and experience. This gave weight stressed to the phase of entire selection, even though the timeframe was rather tight.

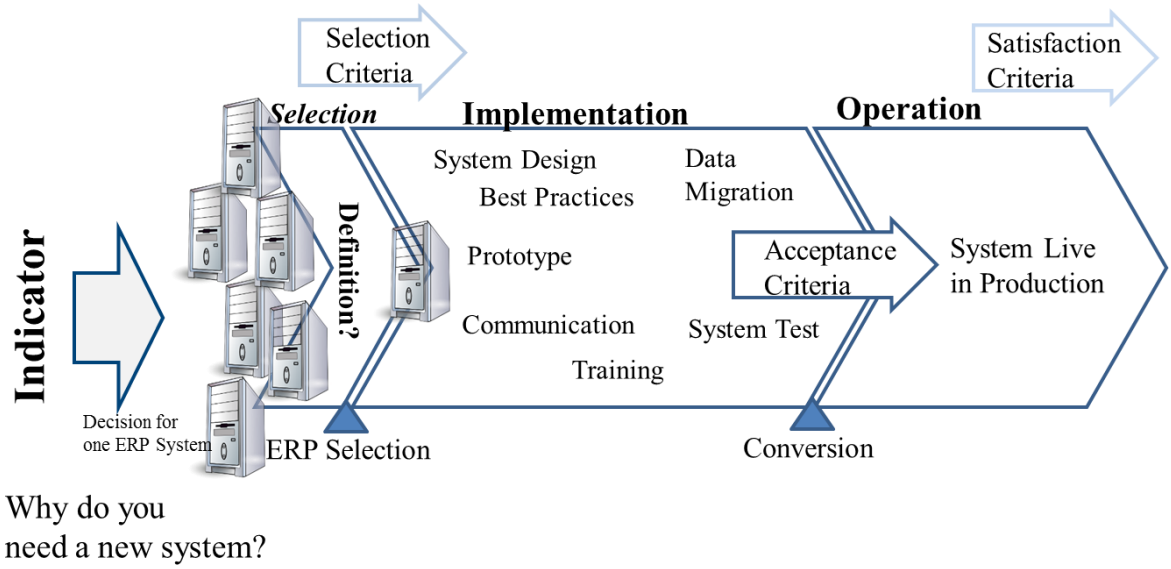


Figure 4-2: The process a challenge of current common practice, created by author 2010

During the initial phase of the selection the first list of possible vendors was created based on industry, old systems and specific CRM requirements. About 8 different systems have been discussed in detail according to the defined targets. Corresponding criteria have been worked out.

Need for a new system:

- Defined by the owner, with requirements for management and controlling.
- The internal sales manager, with requirements for CRM functionality preferably integrated with invoicing and finance.
- The main workforce, the sales representatives in the field, use mobile devices and had been independent of the old software, they could be integrated but didn't require it.

While reviewing all business processes and defining the key criteria the CEO was able to set key priorities. His first approach was just to focus on cost and speed. Using all relevant success factors and reviewing possible requirements the high level feedback for the areas changed to these key requirements:

Strategy / Organisation: Should be stable for a longer time, support all areas of growth
Functionality: CRM and reporting, old data should be automatically transferred; later the requirements for an ERP system have been identified according to all business processes.
Technology: Old hardware is reused, no external hosting required, Data should remain in-house

Vendor: No freeware or open source, well established reputable software company
Economic: as cheap as possible – during the selection process a business case was basis for selection. The intangible benefits gained high priority.

People involved:
- CEO / owner as the final decision maker
- Internal sales manager to define structure and prioritise all functional requirements
- Independent external consultant and student trainee to structure and support the process and provide all necessary information
- ERP vendors to present their product and sell it, providing all details according to required criteria

Summary of results according to company I
The acquisition of an ERP system was a new task for the company. The investment accounted for about 1 % of the turnover. The key decision maker and manager had been very busy with the daily business and had not much capacity for this additional project. Their general interest in IT and software is rather low, they had no technical background. Therefore in the beginning the focus was on cost and on the need covering their growth. During the longer selection process they opened up and got a wider perspective and interest in the possibilities the ERP packages offer and prioritised all criteria. The small company had been overextended with this task. The hired consultant led and supported and guided through the process with years of experience. Without an independent or an external experienced person there is the very high risk of taking the cheapest product or the one of the best sales representative. The CEO stated after the implementation that the task, workload and problem were clearly underestimated by him and the one other decision making person. The use of the model was very helpful as well as the details of the selection process and tools and pre-defined set of criteria.

In terms of a measurable result that the selected ERP system was the right one and the company / people are satisfied with it, Company I is on a very good track. It is in the top right corner as indicated in Figure 4-13. The successes criteria have been defined in detail before go live and measured 16 month after go live. In the final interview the five groups of success criteria have been rated with 9/9/8/8/6 where cost was the worst rated with 6 given the system was more expensive as expected up front, but not more expensive as calculated during the selection phase. The company plan to continue to keep the criteria updated while adjusting or adding to the system.

4.1.3 Company Case Study II – Heat Pump Company

Company II was chosen much later in the process after some expert interviews had been executed. The "model" and "selection process" had been developed and the theoretical research on "decision criteria" had been finalised. The case study was used to test the developed model, approach and the set of selection criteria in much more detail. This study took about a year and strongly validated the propositions and main hypothesis.

The main difference between the two company case studies is not just the length of supporting them, each company had a different sub-set of propositions to test and prove to a different level of certainty. (All details regarding the execution of the Case Study I can be reviewed in appendix 6).

Relevance

The Company is relevant for this research as a study because it fulfills all criteria (defined in Chapter 2.8):

- Small company about 30-50 employees so between the pre-defined 10-150 IT Users
- Geographically situated in south of Germany – Bavaria
- Production Company
- Trigger for the selection is growth possibly international
- Just at the beginning to define business processes and ERP selection - Timing
- People with very little time and now knowledge about the acquisition process
- No defined requirements nor business processes nor method at the starting point

The project fulfilled all requirements to test and possible reconfirm the developed model as well as to analyse and prioritise the set of criteria in much detail during the phases.

Selection Process Used

Leveraging the experience of the literature review and the execution of the company case study with Company I, the selection process was reviewed and more details have been added due to the higher complexity. For a much bigger functional scope and more parties involved an additional step in the selection process seemed relevant. Not all requirements could be defined up front as well as not tested in a single review. Therefore according to the results of the expert interviews the selection phase was even more extended but in a very structured way.

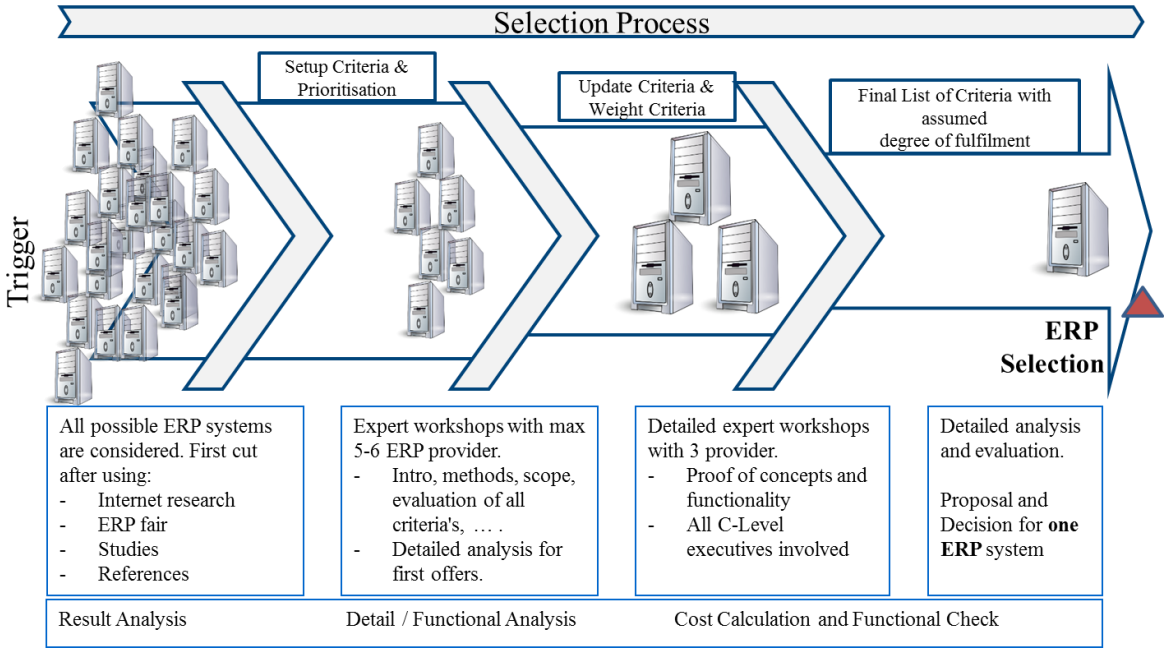


Figure 4-3: Selection Process and Documents, created by author 2012

During the very initial phase the first long list of possible vendors was created based on industry, specific requirements, input from a study and the input from various meetings at an expert fair, for ERP systems for small and medium-sized companies. This list of about 10 different providers and systems has been discussed within the team in detail. Even without the analysis of the detailed requirements this list went down to 6 reasonable providers as a first shortlist. The vendor selection workshops with all team leads have been executed to get input for the key functional requirements. The list of maximum criteria was reviewed multiple times and at its finalization the responsible people discussed priorities of the requirements in detail. So, a final list of criteria was established and agreed with mutual priorities for each task.

The first round with all vendors was executed documenting all their functionality, benefits, strength and weaknesses according to the set priorities and factors. The final result was made after a longer analysis of the details, discussions along all criteria and their fulfilment. The involvement of the team members as well as board members helped for a joined decision where all involved people felt part of.

The selection process finalized with the decision took about 6 month. This was much longer than expected but everybody felt very satisfied with the joined decision and convinced that the implementation will be on time due to a very competent provider and product.

Set of Requirements – Selection Criteria

Based on the needs – the indicators for the system, the literature review and the identified detailed requirements the list of criteria was selected, created and prioritised. Given there was no existing production and some of the people just had been employed, the functional scope could be aligned openly with the functionality of the system. Therefore the focus was on key criteria according to the set priorities.

The scope of the functionality had to be defined on a low level of detail and aligned. In addition it was important to define all other criteria:

Strategy / Organisation: Flexibility, languages, foreign legal requirements, interface standards, authorisation concept, full integration of all processes real time, etc.
Functionality: Serial number handling, entire system all functions integrated, Service management, BDE integration, focus on purchasing, production, quality and packaging in the first step. Including -> *Change Management:* End User friendly, easy handling, training concept, online help,
Technology: Release strategy available, add on handling, platform / database Microsoft standard, external hosting possible but optional.
Vendor: International Vendor, regional offices, at eye height in terms of size and client focus
Cost - Economic: The one time and on-going costs have been compared. The analysis needed to be very detailed but without reflecting the benefits. This effort has been executed via the weight factors

The defined and prioritised list of criteria is a long term tool which can be used to measure the fulfilment of all criteria with the system at and after go live. Very similar to the list checked with Company I. The list created for this Company II is just much more detailed according to the wider scope and the people involved. Given the financial sponsors, the board had an interest to establish a set of criteria which can be used longer term to measure the satisfaction with the ERP system.

People involved / Decision making

Experts have been involved from all relevant functional areas as well as managers from all fields. Given it is a start-up company where the financial foundation was external; there was a very high need to manifest the decision and be able to justify the investment in much detail. The three board members with different functional background have been one group of

involved experts as well as the second management level for the preparation of the decision on a very detailed level. Talking to the people they feel that all relevant people had the chance to provide input therefore they feel it was a joined decision and everybody is satisfied.

Summary of results according to Company II

The acquisition of an ERP system was a new task for the company and the investment very high (about 2-3% of the expected turnover). The key decision makers and managers were very busy with their daily business and did not have much capacity for an additional project. The hired consultant led and the internal IT person supported and guided through the model with years of experience. Without an independent or an internal experienced person there is a very high risk of taking the cheapest product or the one of the best sales representative. The team and the executives confirmed that they feel prepared for the implementation knowing the advantages and the disadvantages of the new system.

The selected criteria have been reflected with the indicators and requirements multiple times. All criteria have been constantly updated during the process and the team involved does know exactly what they get and do not get with the new ERP system. In addition, they have a tool to measure satisfaction with the system after implementation.

4.1.4 Quasi-field experiment

The **Demographics** of our experiment are as follows: The experiment was executed in the southern part of Germany, covering Austrian and Bavarian companies. About 65 people and companies have been asked to participate and the result was 62 valid questionnaires, equally divided into two gut samples. 47 are men and 15 are women. Their level of experience varies from up to three years' of experience (30 people), up to 5 years (16 people), and up to 8 years (10 people) and more than 8 years' of experience (6 people). The experimentees work in companies with up to 50 employees (22 experts), up to 250 employees (23 experts) and 17 experts work in bigger companies. The industry is mainly production industry, with a focus on production, logistics and IT.

The **Setup** and the **Treatments** of the experimentees are as follows: In combination with the previously executed case studies and the feedback from the expert interviews two different "real world" decision situations were developed. The first situation, "Treatment A", was generated according to the feedbacks of the expert interviews. The selection of an ERP system

is mainly done very rapidly, according to very little information and without a proper evaluation of the requirements. The other situation, “Treatment B” was generated according to the case studies, where detailed requirements and critical success factors have been outlined.

Each participant was either given a decision case of “Treatment A or Treatment B”, randomly selected. The exact outline and description of “Treatment A and Treatment B”, can be seen in appendix 11. To analyse the results, an identical questionnaire was distributed to all participants (see appendix 12). Given the volume, comparability and identical questionns and groups of highly experienced experts the qualitative results of the case studies and expert interviews have been challenged.

4.1.5 Questionnaire with ERP Professionals

Situation/Analysis and Execution

The semi-structured expert interviews have been executed along a prepared questionnaire. At the point in time of the research the results provided significant input to finalize and reconfirm that model and support the hypothesis and proposition. Due to the fact that the experts for that subject in a SME company are mostly the owners themselves it was very hard to get the expert interviews confirmed and the very valid results added more qualitatively to the analysis of the hypothesis and couldn’t be enlarged to a size to gain a quantitative relevant result.

At the beginning of 2014 the author got the opportunity to extend the research and get input of a much wider group of the same quality of experts. In combination with an event there was the possibility to position a questionnaire to a wide group of experts. This developed questionnaire basically followed the main question of the semi-structured interview guidelines (see appendix 13).

A group of 65 experts could be obtained to answer the questionnaire. There relevance as an expert could equally be compared to the demographics of the expert interviewed.

Demographics:

Of the involved 65 people, fifty-eight have been men and seven been a women. Over 50% of them have more than 10 years of work experience in the relevant field of expertise and another 25% over 5 years. The rest has still more than three years relevant work experience.

So, all involved people could be classified as an expert. All of them represent experts of medium sized companies according to the definition (see chapter 2.2) and the company is a production company including logistic and development in the Alpine Region either Bavaria (60%) or Tirol (30%) or other like north Italy. According to the mentioned demographics the results are comparable and fit as a quantitative addition to the results provided by the expert interviews.

Results

The people answered the questionnaire in writing without the possibility to discuss the results in detail. Given the format of the questionnaire the results are very much comparable with the results gained at the expert interviews so it is a quantitative support to all relevant areas. Of the 65 results five have been invalid and couldn't be considered for further evaluation.

The question "why a new system was selected?" was answered using the same categories as the expert interviews. In sum about 2/3 selected a new system due to future requirements of international growth. The remaining 1/3 due to the need of replacing the old system or a merger situation. The companies spend about 27% of the overall time on the selection process in relation to the overall time invested for the entire process including the implementation and go live. In terms of decision making people, the decider is most of the time the owner or company lead considering at least some input of the relevant teams. Still 20% of the leaders made the decision independently of their departments and knowledge experts. In terms of the use of a process almost half of the companies used a process to select and implement the ERP System but about a third didn't define the requirements for it. In terms of the key criteria identified time and cost pressure on a scale where 10 is very high time or cost pressure, the companies are on 6.7 for time pressure and 4.9 on cost pressure. So, time pressure is mostly more important.

The overall satisfaction with the system is based on gut feel and the perception of the leaders given almost no company has any structured tool or method to measure satisfaction. But they feel mostly happy with their selection and the average on a scale up to 10 where 10 is highly satisfied with the ERP System, is on 6.4.

Overall all these results are supporting the trend which has been indicated by the expert interviews for similar companies in the same region.

4.2 Operationalizing of the variables

Chapter 3.4 is the foundation for the decision of the research methods. The use of semi-structured expert interviews as a well as case studies with companies has been explained there. Chapter 3.1 is the basis for the development of propositions. Figure 3-5 points out the relation of all propositions according to the variables. After the detailed description of all executed results in chapter 4.1 the relation of propositions, variables and research methods seems relevant before explaining the detailed results.

All independent and dependent variables need to be operationalized to be able to support the propositions. The three independent variables need to be considered in the detail of the identified three independent variables the selection process, the significant people and the set of decision criteria. For each variable at least one indicator is identified to analyse and evaluate the results accordingly. The use of the proposed structured selection process has as an indicator the use of the suggested, developed selection process, as well as the time used for the selection process in comparison to the rest of the ERP life-cycle. The involvement of decision people should be measured differentiating if the right person made the decision and if the person had enough information by a supporting team to make the decision. The definition and prioritisation of the decision criteria is measured as well as the detail for some specific criteria. Seeing the independent variables reflecting the ideal quality delivered it would mean; the suggested model should be used, the right people are involved and the most relevant criteria for an ERP system are identified prioritised and weight – challenging the pure initiation of the selection.

The dependent variable “efficiency” is just one variable broken down to an indicator. “Satisfaction” defines the dependent result but this will be checked and evaluated about its fulfilment. Satisfaction could be evaluated according to the fulfilment of your predefined criteria. So, the indicator for the satisfaction with the ERP system can be broken into: “Can satisfaction be evaluated?” and “Are the identified individual criteria fulfilled?”

	Variables	Indicator	Measures (e.g. Exp.Int)
Independent Variables	Process Structure	Process used	1-4 (not, kind of, standard and structured process)
		Ratio Planning /Selection to rest of ERP Life Cycle	Ratio measured in % of overall time
	Decision People	People involved	Team involved (yes or no)
		Decider enabled	Right decider (yes or no)
	Decision Criteria	Indicator / Trigger exists	(yes or no)
		Selection criteria defined	(yes or no)
		Criterion Time	1-10 (not important – important for decision)
		Criterion Cost	1-10 (not important – important for decision)
Dependent Variable	Efficiency	Satisfaction criteria evaluated	1-3 (not, sometimes, always)
		Satisfaction fulfilled	1-10 (not important – important)

Figure 4-4: Operationalization of the variables into indicators, created by author 2012

The variables and indicators has to be reviewed in more detail to come up with evaluators which have been used in the semi-structure expert interviews and verified in the company case studies.

The variable regarding the selection process is using the evaluation of the process usage and the ratio measuring the selection phase in comparison to the other phases of the ERP life-cycle. The question “was a model used?” or “was a structured process followed?” can be clearly answered with yes or no. The question “how much time did the company dedicate to the selection part of the model / execution process?” can be measured in percentage to the total time used. So, the answer is a clear number in per cent. The variable about the decision people involved can be measured again with clear yes/no questions. “Was the right person enabled to make the decision?” and “Have the right people be considered for their input for the decision?”

The identification and prioritisation of the most relevant decision criteria can be measured as well with clear yes/no question. The indicator or so called trigger to initiate the selection of an ERP system affect the set of decision criteria. The question was asked and can be answered clearly. The next question “if decision criteria have been defined?” can be answered with a

clear yes/no. For the subject of ERP selection, implementation and conversion there are critical criteria which are always considered. These criteria are “cost” and “time” and should be considered and evaluated. So, on a scale from one to ten the question is assessed if the criterion “cost” is driving the selection and or the criterion “time”. If both are not relevant, other criteria of the set will get priority, usually the original indicators driving the selection.

The “efficiency” measured by satisfaction with the system, the dependent variable, can be operationalized by the questions “is the satisfaction with the ERP system evaluated?” and the question “is the company satisfied with the ERP system?” These questions can be answered usually on a scale. The question if the criteria a measured can be answered in a threefold: “No, sometimes, always”. The question about satisfaction is evaluated on a scale form one-ten. Where one is: not satisfied at all and ten is: very much satisfied with the system.

The utilised empirical questionnaire for the quantitative research into the decision making efficiency with the ERP system contained a threefold question to investigate the decision maker’s satisfaction with the chosen system. This approach refers to Herbert Simon’s satisficing theory in the following terms: the satisfaction or dissatisfaction with the chosen ERP package is supposed to mirror the contentedness of the decision maker with his decision. His respective answers represent the degree of efficiency of the respective single decision. In addition, the empirical approach also mirrors Homburg and Rudolph’s multidimensional consumer satisfaction theory by asking the decision maker for his degree of satisfaction/dissatisfaction with the technological fit, the economic fit and the system fit in general of the chosen ERP package. Thus, the empirical research of the decision maker’s satisfaction resp. the decision making efficiency and refers to the author’s theoretical outline in Chapters 1.1.7 and 2.7.[308]

All propositions are related to the developed model and support the main hypothesis. The following chapter points out in detail all results achieved during the execution of the multi-method approach with qualitative interviews and two company studies and quantitatively expert surveys and the quasi-field-experiment.

[308] cf. Homburg C. et al., 1999

4.3 Detailed Results of the Qualitative Analysis concerning the Propositions of the Research Question

The main results of this research studies are presented in this chapter in relation to the research method. All areas of the research model are described in detail and the results reflected with the propositions. In summary all these findings support the main research question and lead to confirm the main hypothesis.

The overall research question has been presented in chapter 3.1 along with the main hypothesis: *The level of satisfaction with a selected ERP selection is strongly dependent on the execution of the decision making model.*

The supporting propositions have been developed in chapter 3.3. The three propositions have been analysed qualitatively with input from the literature review, the semi-structured expert interviews and the company case studies. In addition with the quasi-field experiment proposition 3 was qualitatively challenged as well as with the distribution of a questionnaire to a wider group of experts all three propositions have been re-tested on a quantitative basis. This chapter will point out how the events worked together and according to the input and specifications results have been achieved.
The literature review provided input mainly for case study of Company I and the expert interviews. The model and selection process was developed and tested with Company I. The set of decision criteria and decision people to be involved was tested in the case study with Company I as well as questioned with experts. All the findings from Company I have been the basis to create revised model for Company Study II. Both Company Studies ended with an interview along the defined set of criteria. At Company I there was an additional interview one year after go-live, a final interview checking the fulfillment of decision criteria (see appendix 7). The case study of Company II was finalized as well with an interview (see appendix 9). All qualitative results have been the basis for the development of the quasi-field experiment to challenge and provide input to the propositions with the focus on the decision criteria quantitatively. The expert survey took the questionnaire of the semi-structured interviews as a basis to add quantitatively to all propositions.

4.3.1 Results according to Proposition 1 – "Process structure"

This variable is linked to very critical questions before starting the selection. Which selection process should be used as a basis executing the entire ERP life-cycle? Which is the right

process to follow and get started? Usually there is very little knowledge and interest and it is not clear that a very structured journey should be executed. This proposition assumes a positive relationship between the use of a structured selection process and the result, an ERP system all users are satisfied with. So, the following proposition was checked firstly in literature about existing processes for ERP selection (see chapter 2.5).

- P1: The use of the suggested selection process has a positive impact on the satisfaction with the decision.

At the semi-structured interviews, the experts have been asked in detail regarding the process followed. The aligned questions are defined according to the measurable indicators (see as well chapter 2.7). The questions which have been asked are linked to the selection process and the times spend for it. The question if a process was used or not, could easily answered with a clear "yes or no". In summary the people using a selection process still didn't know it in detail and used it due to pure conviction.

In addition, the selection part is usually very much underestimated. Even companies which used a structured model and life-cycle process might have the problem that they didn't take sufficient time for the selection phase. The next question asked, according to the variable process was the measure of time by the ratio in per cent between selection and the rest of the ERP life-cycle. The following additional research questions have been challenged at conferences and provide a good basis to get input to the proposition P1:

- A model should be followed or used as a guideline for the acquisition of an ERP system for small & medium-sized companies.
- The planning and selection part of the process is very short at SME in comparison to the implementation.

After the literature review and the analysis of the state of the art selection process a first process was created and tested during the first company case study. Using the positive feedback and many questions and discussions with experts during the interviews an enhanced model was developed and challenged during the second company case study. During the final interviews with the experts of both companies confirmed that the model was very sufficient and the suggested structured approach let to a measurable result. The results of the expert's interviews are reflected in the Figure 4-5. It shows that mainly the very small companies

didn't start or follow a structured selection process. The medium-sized companies usually employ consultants who provide their structured process or model.

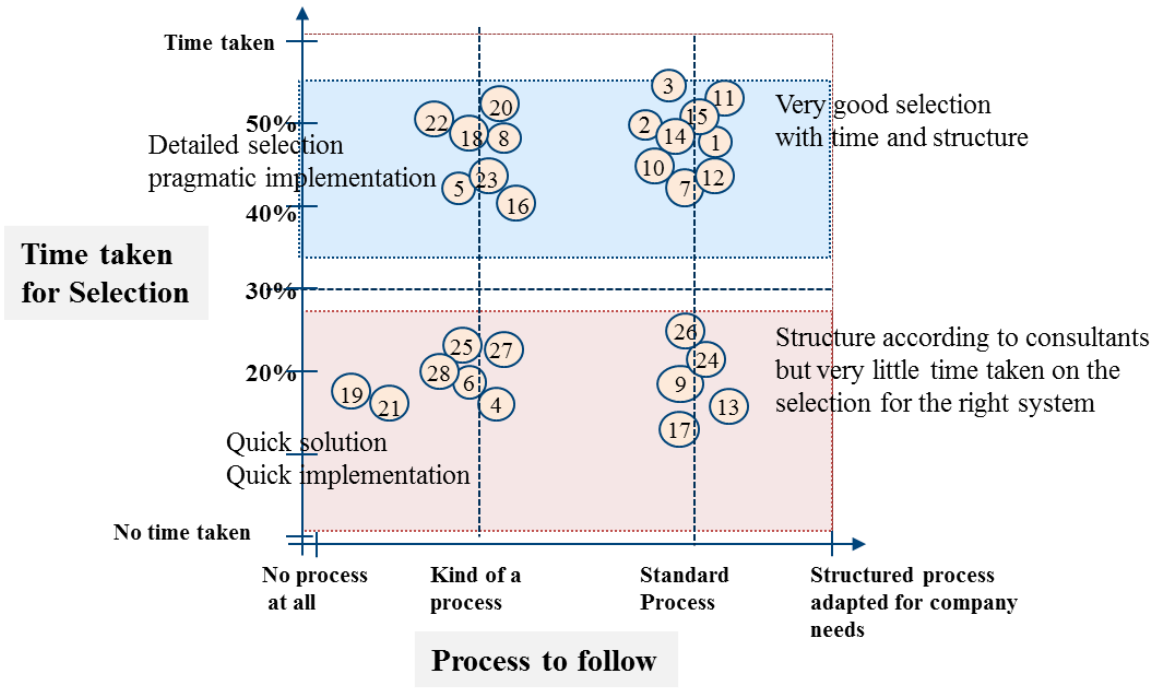


Figure 4-5: Result according to the indicators of P1, created by author 2012

Interpretation of the results according to Figure 4-5. The X-axis shows if the Company used a structured process at all. The answer is categorized in 4 groups; no process, kind of a process, standard process and structured process adapted for company needs, according to the questionnaire and the answers given. None of the experts which have been asked have been very happy about the process used. They commented mainly 'we looked up some processes', 'the software provider recommend some approach' or 'we did it according to somebody's experience.' Smaller companies followed rather a random or almost no process, bigger companies used the suggested process and approach mainly provided from external resources. So, basically all 28 experts can be grouped into the two columns in the middle. The Y-axis shows how much time has been taken for the selection phase. The percentage shows a ratio of the time spend for selection in comparison to the ERP life-cycle. 20% means, 20% of the overall time has been spending on selection until the decision for ERP system was made. According to longer expert discussions, experience and the operating experience with the two companies at ratio of 40-50% time spend for selection would be sufficient and support a detailed analysis up front and make a well-founded decision about the ERP system. Therefore the dark (blue) bar indicated that too little time was used for selection; the light (red) bar indicated the companies which used adequate time for the planning and the selection of the ERP system in relation to the overall time spend in the ERP life-cycle.

The results can be grouped in four. The two top groups where the companies took some time to select the ERP system. The left corner embossed by less structure, the seven companies in that group got some guidance but took enough time to select and consider the system. The right group, with nine companies, had either some experienced people in the team or an external company – consultant was involved guiding them through a thoughtful selection and planning process.

Reviewing the bottom groups, the left seven companies are very representative for smaller companies doing the selection the first time under high pressure and with little experience. They didn't really follow a structured selection process and hardly had any time for it. They looked for a quick solution followed by a quick implementation. The right group with five companies represent pairs with experience support from out or inside guiding them through a standard process but taking very little time for selection. Sometimes these are companies where the decision is predictable based on a technical environment or previous systems. Overall the bottom groups represent the SME companies starting a strategic unknown area. The overall theme in the lessons learned of the expert interviews has been a recommendation to use an approved, structured process and spend time at the selection phase.

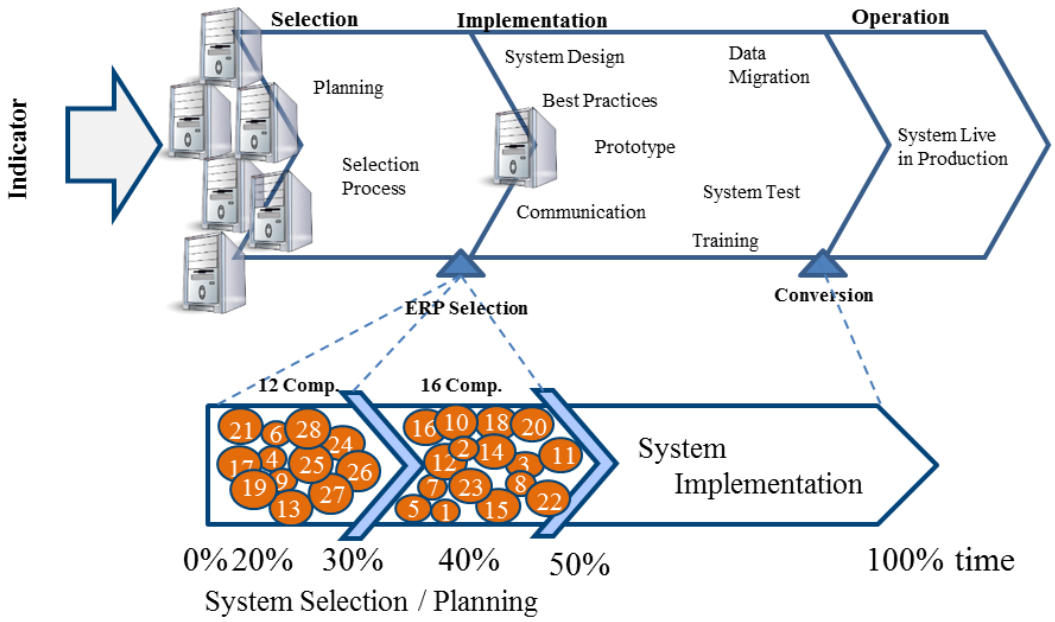


Figure 4-6: Time taken for the selection of an ERP system, created by author 2012.

The Figure 4-6 illustrates the rational taken by the companies represented in the expert interviews according to the suggested process. The two different bars from the previous figure (Figure 4-5) represent the groups on this picture in the left arrow the lighter (red), bottom bar,

in the right arrow the top, dark (blue) bar. The result is not different but it is more obvious how the time was spent. Most of the experts confirmed, that more time at the beginning would have led to a more intensive selection process taking the requirements into consideration. It would have supported a result in the end, where the satisfaction with it could be related back to the defined requirements.

Company I planned almost no time at the first discussions, a very quick decision was preferred. This was challenged and changed during the project and 40 % of the time was dedicated to selection in the end. Company II planned some time but didn't expect the requirements of that many details. The detailed selection workshops with the vendor took much a significant amount of time (about 40%) but as stated in the final package it was worth it. Both companies confirmed that the time taken at the beginning according to the defined, structured process was really worth wile spent and had led to a better result in the end.

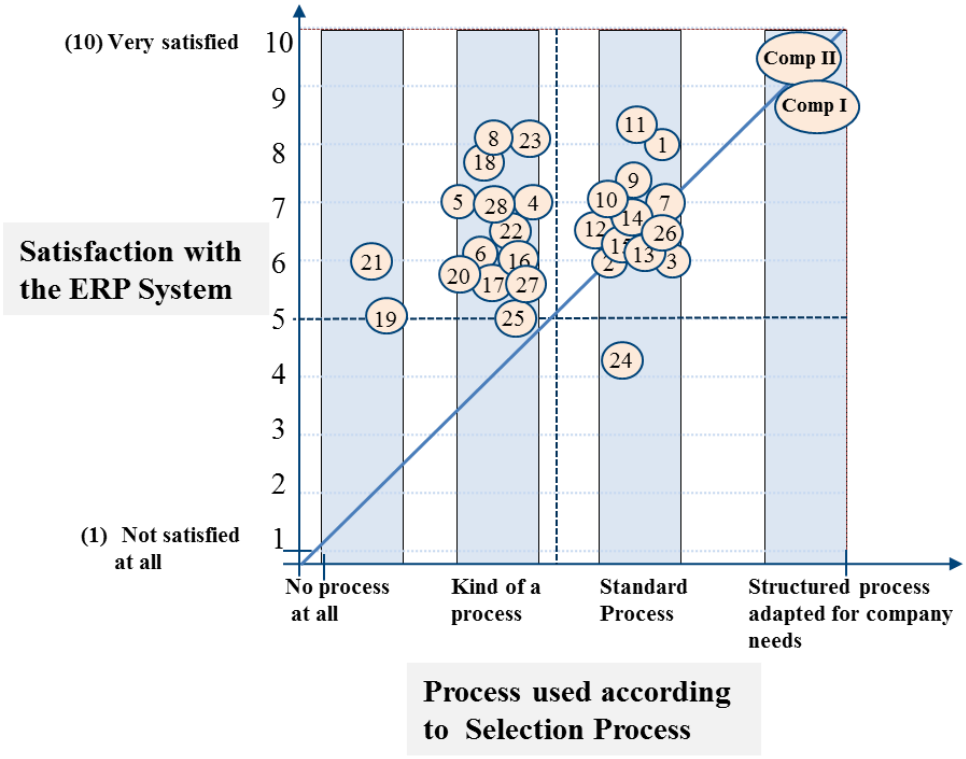


Figure 4-7: Summary of findings regarding the variable "process", created by author 2013

Overall the execution of a high performing process was taken in a relation to the satisfaction. The assumption "as higher the performance of the executed selection process as higher the satisfaction" would be a diagonal straight line. Most of the companies interviewed answered accordingly. The exceptions where, where high effort was spend on the execution but the result seems not very satisfying like the companies 19 and 24 as an example. They might have

other factors (variables) where they lack support. Some other companies as an example number 1, 8, 11, 18 and 23 and didn't use a proper process but they still feel satisfied with the outcome of the system. They had other areas (variables) where the input to the selection was very much outstanding. The case studies I and II executed a selection process and as a result they feel very satisfied with the solution. The executed process according to the one variable is an indicator for satisfaction.

Proposition 1, the use of the selection process has a positive impact on the satisfaction with the decision was supported by the experts. That a structured process which considers time for planning and selection is needed could be confirmed. The link to the overall satisfaction by doing it was verbally confirmed by the experts and company studies and will be analysed with more detailed indicators in later paragraphs.

4.3.2 Results according to Proposition 2 – "Decision People"

The people making the decision are really crucial for the selection of an ERP System. Discussing that the right person or the right team was involved implies that the result was positive according to that factor or positively seen by a lot of people. Therefore the following proposition has been analysed:

- P2: The involvement of significant people has a positive impact on the satisfaction with the decision.

There are two main indicators driving this proposition which are very much aligned. One is the significant person being enabled to make the decision for the ERP system and the other indicator is if the right people, team or department has been involved and considered for input to enable to decider to make the decision. The first indicator implies that the person making the decision was the right person making it. Very specifically for smaller companies this is without questioning it the owner of the company but even so they have to consult for input.

This area about the decision making person has been challenged on an international conference as well asking the question: "The most knowledgeable leaders /people /teams from all management levels have to be involved to collect and prepare the information and enable to make the "right" decision." It could positively be confirmed reviewing the result of the

expert interviews and company case studies and in the wider discussions with the intellectual society at the conferences.

Proposition 2 operationalized with the two indications, people involved and decider enabled, have been challenged mainly in the expert interviews. The question is not simple because it depends as well on the person asked. But discussing the topic sensitively it can be differentiated whether the decision was made based on the position and power in the company or not. In addition it is very important to consider the basis of the decision. Did the person have enough input from the various people or teams to be enabled making the decision?

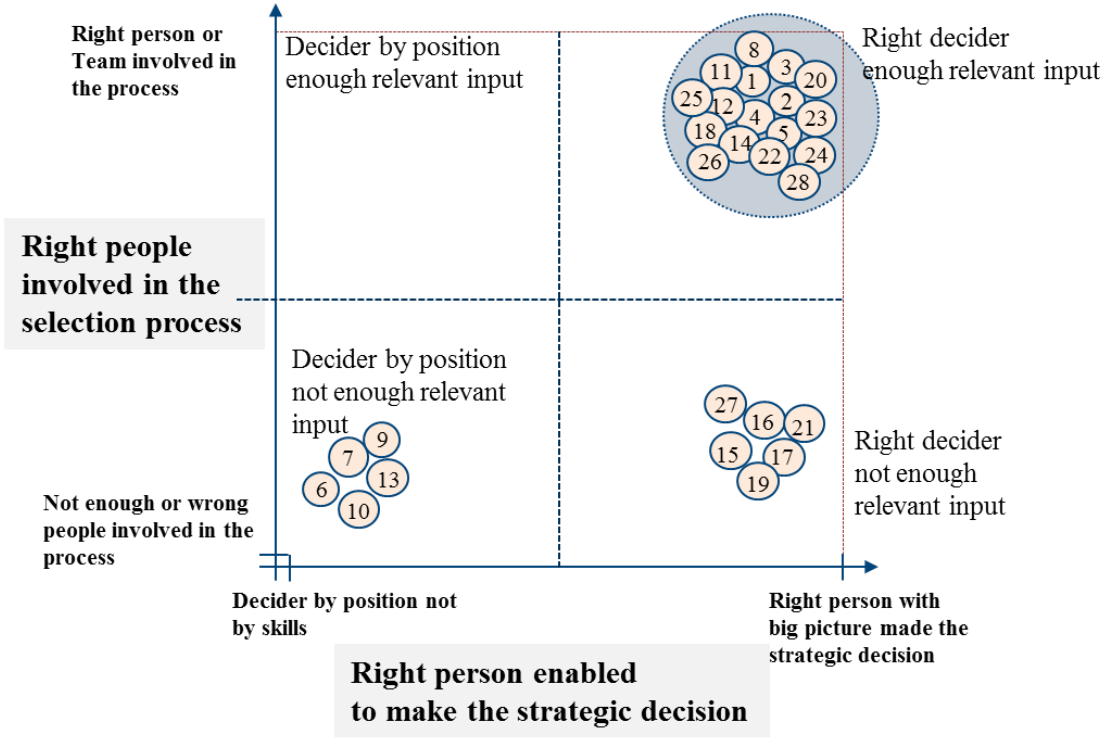


Figure 4-8: Result according to the indicators of proposition 2, created by author 2012

The results can be grouped and interpreted by the author the following:
The first group; right decider and enough relevant input are very much satisfied with the input given and used for the decision. Usually it was a team involved supporting the decision and providing a lot of input. Even if just experts have been asked, they explained the information gathering process. This group covers the majority of the companies with 17 experts confirming.

The second group; right decider and not enough input are mainly small companies which made the decision rather quickly without the involvement of other people mainly due to lack

of experience which information is needed. This group are six companies which are small enough that the decider, being the owner is still involved in the daily business to be able to decide with a lot of expert knowledge himself.

The third and last group of five companies at the bottom left is a mixture. Decider made the decision based on her/his management title but not according to overall strategic knowledge. In addition none, the wrong or too few people have been involved. The deciders are either very dominant or replaced after that decision. The overall feedback about the decision in this case and the decision making process is very negative in the perception of the consulted expert.

This proposition can mainly be based on the expert interviews because the influence for the company case studies to require the right people is probably leading to a wrong or not objective result. For both companies the deciders have been appointed and the supporting team enabled as part of the project. In Company I the owner delegated the preparation process to a very knowledgeable IT / Sales lead and an experienced consultant. The decision was prepared according to the discussed requirements and the priorities reviewed with the owner, by the time the decision was made by the owner all involved people felt part of the decision and the result was not a surprise. In Company II the decision making team was the board of three directors with different functional background. The team preparing the decision involved all team leads and consulted the key player for their input, experience or opinion. Therefore the decision made by the board felt as well as accepted by all relevant people due to intensive preparation.

In addition, the IT lead of Company I confirmed during the final interview, that in their opinion, the right people have been involved during the selection process.

The proposition 2 can be confirmed. If a knowledgeable management team was involved and the person been enabled, the decision was seen as positive.

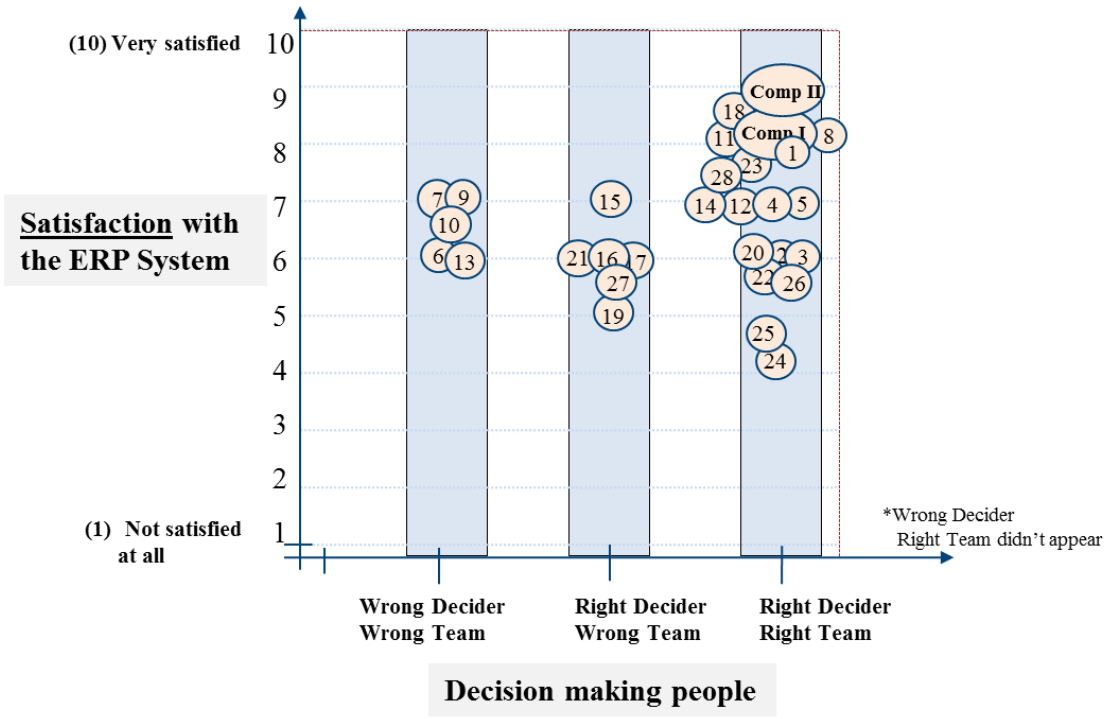


Figure 4-9: Summary of findings regarding the variable "people", created by author 2013

The overall relation of the combination of the people involved and the satisfaction is analysed in Figure 4-9. There is one group which didn't appear as a result but didn't logically make any sense; the combination of the wrong person making the decision appointing the right knowledgeable team. The group, where the interviewed person had the feeling another person should have been appointed with the support of another team (wrong decider, wrong team) reached some satisfaction similar to the next group. It was the automate decider but the wrong people defined the requirements for the ERP system. If the mainly the right team is involved with the most knowledgeable people and the right person make the decision the satisfaction tend to be much higher. For the case study companies the requirements for the decider and the supporting team was given with a skill set along with the executed process. The result supports this approach with a very high satisfaction.

In summary, in relation to the satisfaction with the ERP system, the experts confirmed that the overall feeling for the selected system was much more positive if the people felt the relevant knowledgeable people had been involved. Given the satisfaction was always mainly based on gut feel it therefore had a positive impact on satisfaction. Given we are talking about SME where the automate decision maker is usually the owner, a knowledgeable decision support team is most important. All experts interviewed confirmed this statement.

4.3.3 Results according to Proposition 3 –"Decision Criteria"

This proposition race a question at the very beginning of the journey. Why does a company consider implementing an ERP system or changing the existing one? The various reasons and answers are analysed aligned with this these proposition.

- P3: The use of specific decision criteria has a positive impact on the satisfaction with the decision.

The question about the reason, business trigger for an ERP system and its requirements has been raced during the expert interviews. All experts confirmed that there is always a strong business reason to start the discussion about the ERP system, the change or the implementation. Given it is such an enormous strategically project the business need is usually very significant. The results of the expert interview provide in detail the criteria to be reviewed. Five companies started the project due to a merger, four due to the replacement of an older ERP system and 19 companies due to growth including internationalisation.

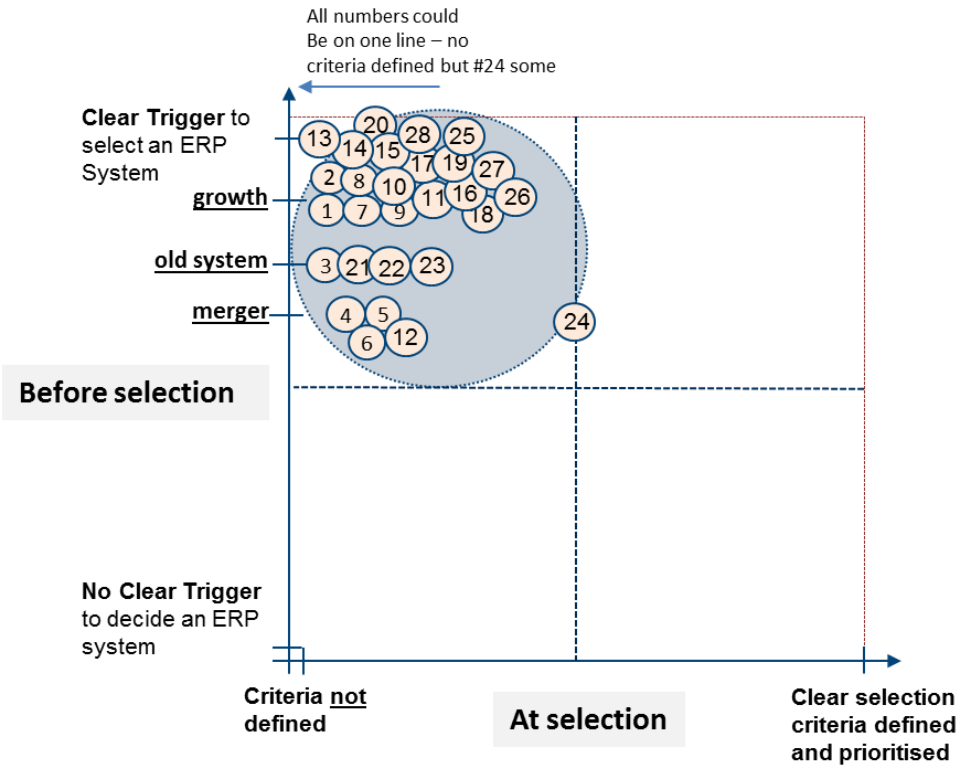


Figure 4-10: Result according to "Decision Criteria", created by author 2012

So, a clear first set of requirements always existed before any further discussions. Knowing why they needed the new system included sometimes the additional requirements for change.

At an international conference a research question was challenged and positively confirmed that: “A clear trigger always exists to start the discussion about ERP selection”.

In addition the clear set of requirements will lead to develop the first list of criteria for the selection. All experts have been asked if such a list of criteria, business requirements for the ERP system, critical success factors, and other characters have been set up, but none of the experts could confirm it. Only one company expert said there is a vague list which could serve the mentioned purpose.

Reviewing Figure 4-10 shows illustrates a clear picture about the companies. All companies have a reason – indicator to consider the ERP implementation but none of them documented the requirements for further evaluation of the ERP software or any other purpose. So the interpretation of the figure is relatively straight. All numbers could be printed on top of each other in the top left corner but company no.24. Using the picture to show some more differentiating reasons divided the number into the tree main blocks. 19 experts stated that their company started the planning process according to the growth. One main part of it is international growth so the small and medium-sized companies consider selling or producing outside Germany. Mainly very small companies didn’t have a system before they had manual solutions using tables and databases as well as paper versions. Most of the time finance was done by the auditing company. With foreign requirements the old solutions do not work anymore and the owner / director need to find a proper system solution.

Four companies stated they had too old systems where the hardware and / or the software run out of maintenance. Other five companies changed their internal organisation structure they bought an additional part of the business or their part of the business been sold. Therefore they need to set up their own ERP solution.

Company I fit into the first group due to international growth the old system could not be used anymore. Company II fit to group one and two. The old system, manual tables and Microsoft Office products and DATEV do not serve the business requirements anymore and with the start of the main production there is significant growth planned.

So, there is always a clear trigger (reason) existing to start such a project. Such an ERP project is nothing which is a regular event, trend or habit. The additional research question

can be confirmed positively. Every company had a significant business trigger to start the ERP selection.

The picture (Fig.4.10) shows in the other dimension (x) the result for the question “is a clear set of criteria defined along the requirements?” The triggers are one of the most important criteria which should be fulfilled with the implementation. So, it actually questions if the system selected serves the purpose. This question is has been defined challenged at a conference: “There are no CSF defined in the beginning (at selection point in time) and they are not measured after go live for satisfaction.” And “clear trigger factors help to evaluate and prioritize the criteria for the decision making point in time.” The measurement of it is a task for further purpose.

Figure 4-10 shows in addition that no company set up a list of measures the requirements. Given that many companies do not even define their requirements and criteria in detail, this figure confirms that the set of requirements which always exists – the trigger – is not documented or clearly pointed out at the selection point in time. There is just one expert found to confirm that the identified criteria are somehow documented (Company no.24).

That a trigger exists most of the time was confirmed with the expert interviews. Setting up a list of requirements or better a list of criteria would help to support the decision. The discussion with the expert confirmed that they have been aware of the key requirements but haven’t used it that much.
During the lessons learned most of the experts confirmed with statements according to the question ‘what you would do differently the next time?’

- Clear picture on functionality very specifically on lack of functionality
- Very detailed as-is analysis and definition of all requirements and to-be model before the first ERP systems are selected or considered
- Trigger for a new system is one thing to be taken into the selection process but the functional requirements should be defined as well
- Set measurable results according to trigger / changes
- System provider checklist for a structured implementation
- Define what is really special in terms of production requirements, what might be similar to other companies and requirements

- Document what is really special, what is standard, what needs to be in scope and in the system
- Analysis of the requirements in detail

The triggers and a list of criteria defined and documented, for the selection have been confirmed with Company I. The requirements have been clear and used for further discussions. At the decision making point in time it was a differentiating factor for the selection of the ERP system that all criteria are fulfilled. At Company II it went even in much more detail. The very detailed list of criteria has been set up and was defined including the trigger factors. These have been evaluated and prioritised in various sessions and it was a critical part for the ERP selection to fulfil these criteria. Overall the hypothesis can be confirmed that the variable "decision criteria" is relevant for further research.

The main set of criteria has been derived from the literature review (see table Table 2-3). This was taken as a basis for further evaluation with the companies and during expert interviews. A question was challenged during an international conference: "There is a constant interrelation and prioritisation of the critical success factors (CSF) during the selection process." This question was mainly challenged with the researchers along the case of Company II.

With Company I the requirements for the system discussed and documented in detail. Then criteria from literature have been reviewed and relevant factors added to the list. All factors have been reviewed and prioritised with the owner and IT lead to compare more than just costs. This was the main list just valid for KEC Company. While discussing details and functionality with possible vendors, the list has always been checked for fulfilment and checked after the final interview has been executed a year later, measuring the decision criteria for selection.

Company II started the process even more mature. The requirements defined in detail along the list and with all relevant deciders each criterion was prioritized and weight. During the very first round it was important to get the list down to six possible vendors. All six vendors have been invited and a framework and requirements for the product presentation was given. The presentations have been documented in detail along the 35 detailed criteria. The results have been reviewed by the team and board. Three vendors continued in the next round. Knowing many of the differences, strength and weaknesses the list of criteria has been reviewed and some priorities changed due to the additional knowledge gained. After the next

round of presentation all criteria been documented again and after the final decision the list was complete. For the selected ERP system the strength and weaknesses been almost clear as well as the possible degree of fulfilment. It can be confirmed that the selection is a constant interrelation and discussion along a set of criteria (see appendix 8/9).

Discussing the topic with many experts the question about **'costs'** arises immediately. Many especially smaller companies have no budget in mind for an ERP implementation. They have no view about the big picture, as well any idea about the one off costs and the on-going maintenance costs need to be considered. In addition due to the need to work internationally and grow outside the comfort zone **'time'** gets more and more an issue including in the selection and implementation of the ERP system.

The questions have been asked as part of the expert interviews. Independently the two factors had to be rated on a scale from one to ten. One means the factor is not important or relevant for the decision, ten means the decision was made absolutely according to that factor. The result has been evaluated and analysed in the following graph.

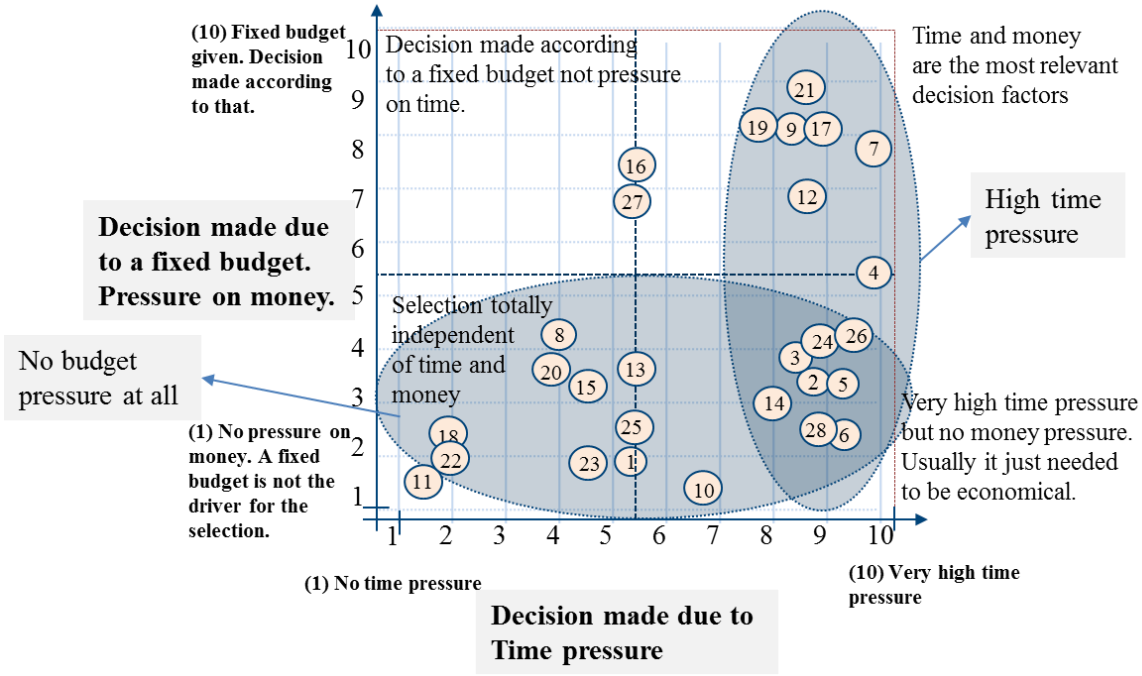


Figure 4-11: Result supporting Proposition 3, focus on cost & time, created by author 2012

The impact and influencing factor regarding cost and time behaves differently as a first quick analysis would predict. About 60% of the companies the focus is clearly on 'time'. That means the 'costs' need to be economic but the driver for the decision is rather on 'time' as on

‘costs’. Where small companies face a very high pressure on both ‘cost and time’, the pressure is much more on time for medium-sized companies.

Company I faced cost pressure at the beginning. After the discussion on requirements and values the priorities changed to an economic view with much more focus on time and functional requirements. Company II started with a balanced view on the factors. Discussing and analyzing all requirements very early in the process there was not a higher priority to these factors. ‘Cost’/ budgets need to be justified to the finance director, so they have been evaluated in much detail and an economic comparison was executed. ‘Time’ was more of an issue due to the need for an on ‘time’ production start, but even that was not the driver because the relevant products showed equal limitations on time.

As feedback from the interviews there is always more pressure on time than on money. Budgets need to be economic but are rarely fixed up front.

It was confirmed by almost all expert interviews that nearly none of the companies defined their selection criteria or their detailed requirements up front. Discussing the proposition with the experts they mainly focus on individual criteria like the mentioned ‘time’ or ‘money’. If the company was ‘on time’ or ‘in budget’ they considered the ERP system implementation as a success and they are satisfied with the selection. Discussing it in more detail all experts confirmed that a set of criteria defined at the selection point in time would have let to a measurable satisfaction.

Only with Company I it could be really confirmed that ‘the use of criteria has a positive impact on the satisfaction with the decision’. The final interview with the IT lead confirmed it in detail by checking every criterion and its fulfilment supporting the overall feeling for satisfaction.

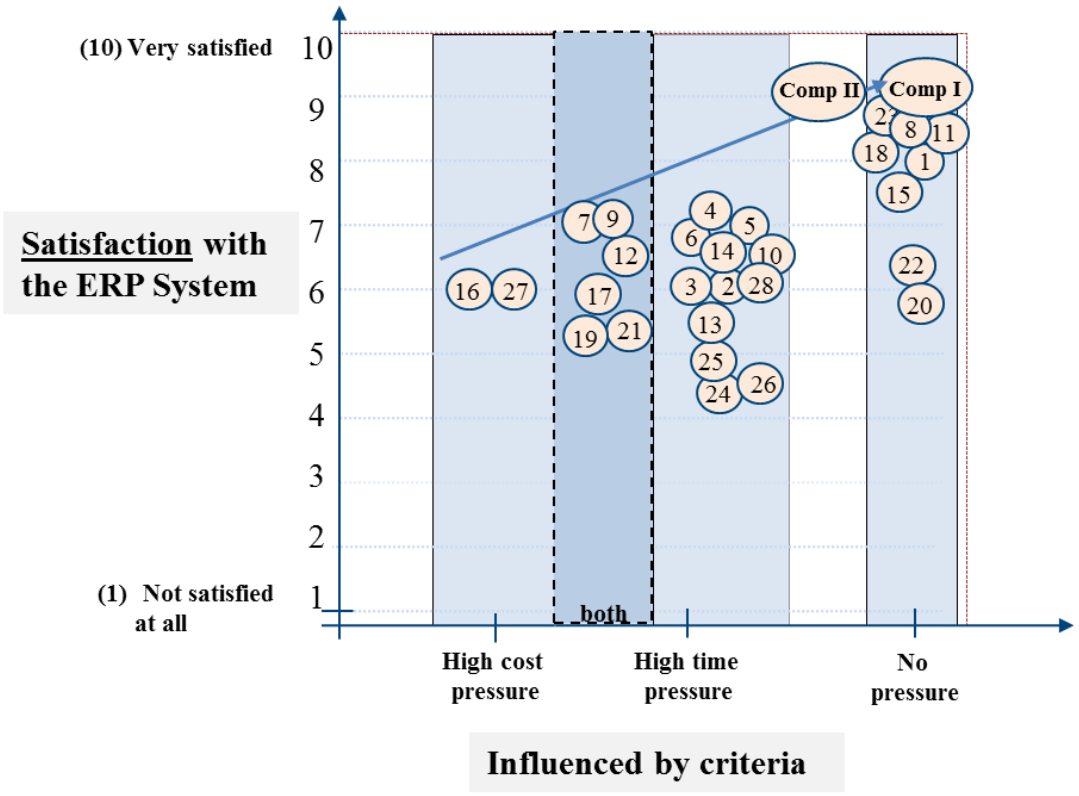


Figure 4-12: Summary findings according to variable "Criteria", created by author 2013

Comparing the results with the satisfaction the key defined criteria 'time' and 'cost' can be evaluated in four categories. High pressure even only on one criteria leads to a gap in satisfaction. The satisfaction is slightly higher if there is time pressure. Overall if there is "no" pressure on 'time' and on 'cost' the decision making process can focus on most relevant criteria independent of 'time' and 'cost' – the satisfaction is higher. The case companies had kind of time pressure but this could be compensated by spending enough time on all other criteria and requirements. Therefore at the case companies there is a higher satisfaction with the result.

4.3.4 Results concerning the dependent variable "Satisfaction"

The dependent variable "satisfaction with the ERP system" merges all three propositions and as shown in Figure 3-5 combines them into a model of dependencies. The level of satisfaction is measured in relation to the three variables closing the ERP life-cycle combining the beginning, the selection of the EPR system, with the end, the measurement of the satisfaction. Therefore the dependent variable doesn't result in new propositions it finalise the existing ones with additional information and results in the research questions.

The main messages about ERP implementations specifically for small and medium-sized companies are not positive. There have been many reports of unsuccessful ERP implementations.

The big headlines stress the revocation of contracts with ERP providers and usually the focus is on high costs and consultant failures. Wong analysed these failures in detail along four case studies.[309] 14 critical criteria factors have been analysed and next to the mentioned management mistakes, two very important failures have been "ERP misfit" and "Poor quality of Business Process Reengineering". These criteria are linked most closely to this research relating the requirements defined at the beginning with the achievements in the end. In addition this provides the company with clear factors which should be achieved to a defined extend.

One key critical question after the ERP system implementation is the question, if it is the right system and if the people are satisfied with it in the daily business, then it is evaluated. Two related research questions have been asked to operationalize the variable towards the mentioned indicators. During the interviews and company studies and the results have been openly discussed as well as at an international conference. The first question is aligned to the proposition no. 3 the 'criteria set up' and then measured in the end for satisfaction. "There are no criteria defined in the beginning (at selection point in time) and they are not measured after go live for satisfaction". The other assumes that success is hardly measured and challenged with the experts. Given the experience with bigger companies and the two company studies it was a high likely hood that success is mainly not measured and defiantly not measured according to predefined criteria. Therefore the question is asked regarding positive and negative feedback. "The satisfaction with the ERP system is mainly gut feel. Only problems, complains and negative impressions are registered. If the ERP system runs successfully it is not captured in numbers."

The questions have been asked as part of the expert interviews. Satisfaction as such had to be rated on a scale from one to ten. One meant the company was not satisfied with the system at all; ten meant they are absolutely happy and satisfied with the ERP system. The next question was much more difficult, the question if they measure the satisfaction or what they relate their result to. One finding was that analysing the satisfaction with the system is hardly based on facts but rather on less negative feedback and feelings. If there are no complains about the

[309] cf. Wong et al., 2005, p.498

system and the issue log is rather low the assumption is the people are satisfied with the system. None of the companies set up a measurement system or structure for evaluation up front.

The following graph (Fig.4.13) shows the relationship of the level of satisfaction with the fact how satisfaction is measured. The results from 28 expert interviews are pretty aligned. Most of the companies are satisfied with their solution but none (but one company (24) once) evaluated it. So, it is always gut feel of the senior executives or IT leads. The IT leads stated that they would know if there would be any problems because they would have a lot of negative IT tickets and hotline calls.

The author's interpretation of this result is less positive as it is seen from the management. To specify the result the next level down should be asked, so employees working with the ERP system on a daily basis. None of the companies measure the success or satisfaction in any way. So, even another round of interviews wouldn't be more than gut feeling on a different level. Result from all expert interviews regarding it, can be summarized. That they do not measure the satisfaction but even more they do not measure against the original requirements. None of the companies know in detail if the system fulfils the first intentions.

Company I is in the top right corner as indicated in Figure 4-13. The successes factors have been defined in detail before go live and measured 16 month after go live. In the final interview the five groups of success factors have been rated with 9/9/8/8/6 where cost was the worst rated with 6 given the system was more expensive as expected up front, but not more expensive as calculated during the selection phase. The company plan to continue to keep the set of criteria in mind while updating or adding to the system and continuous evaluating satisfaction.

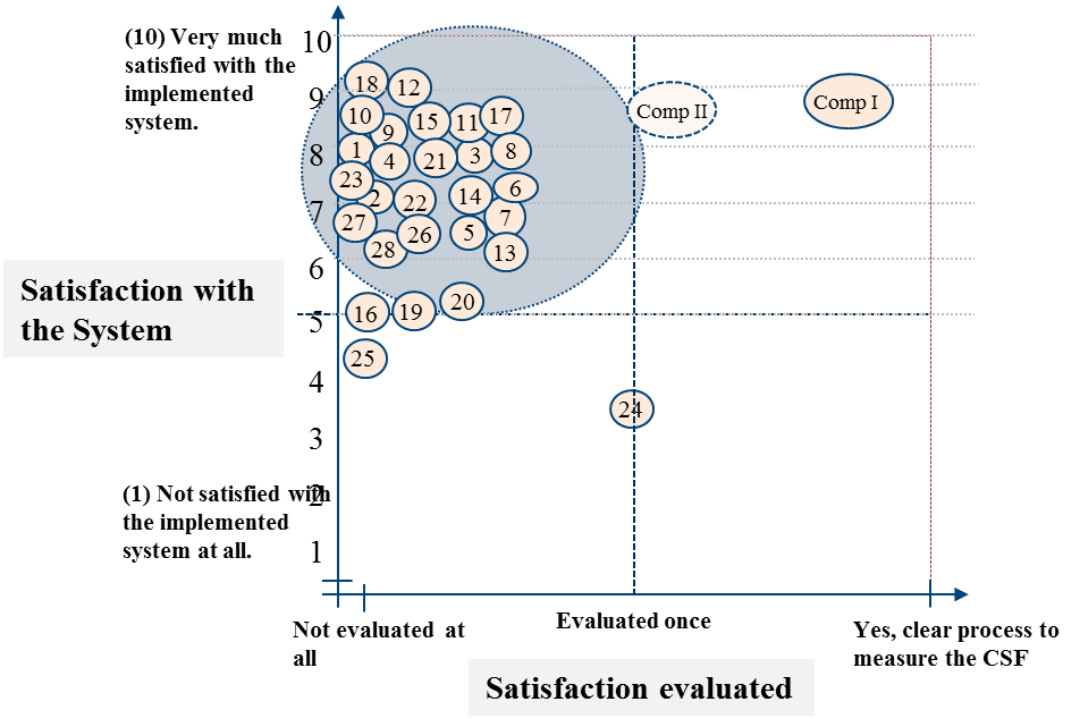


Figure 4-13: Result of variable ”Satisfaction”, created by author 2012

In summary; satisfaction has never been evaluated even if most of the people feel satisfied with the system. Satisfaction is based on gut feel and lack of complains. Even the one requirement, the main trigger, is usually not evaluated after go live and beyond. None of the experts did measure efficiency in a structured way and not related to the requirements which triggered the system implementation. Even in the lessons learned of the expert interviews, it was mentioned that criteria should be defined in the beginning and evaluated afterwards for efficiency/success (see paragraph 4.3.3)

The chosen method of interviewing experts after the ERP system was implemented could not confirm in hard facts that companies are not satisfied with the system. They felt satisfied on basis which is not measurable or supportable in clear hard facts or criteria. With the discussions around the three propositions, the research question taken and the lessons learned, basically all of them confirmed that using a clear structured model, along a selection process, involving the most knowledgeable people in decision preparation and defining requirements (clear criteria) at the beginning would lead to measurable satisfaction with the ERP system. The final interview of the case study, Company I confirmed and supported it by measurable facts. The Company II tends to prove it as well, which could be measured a year after conversion.

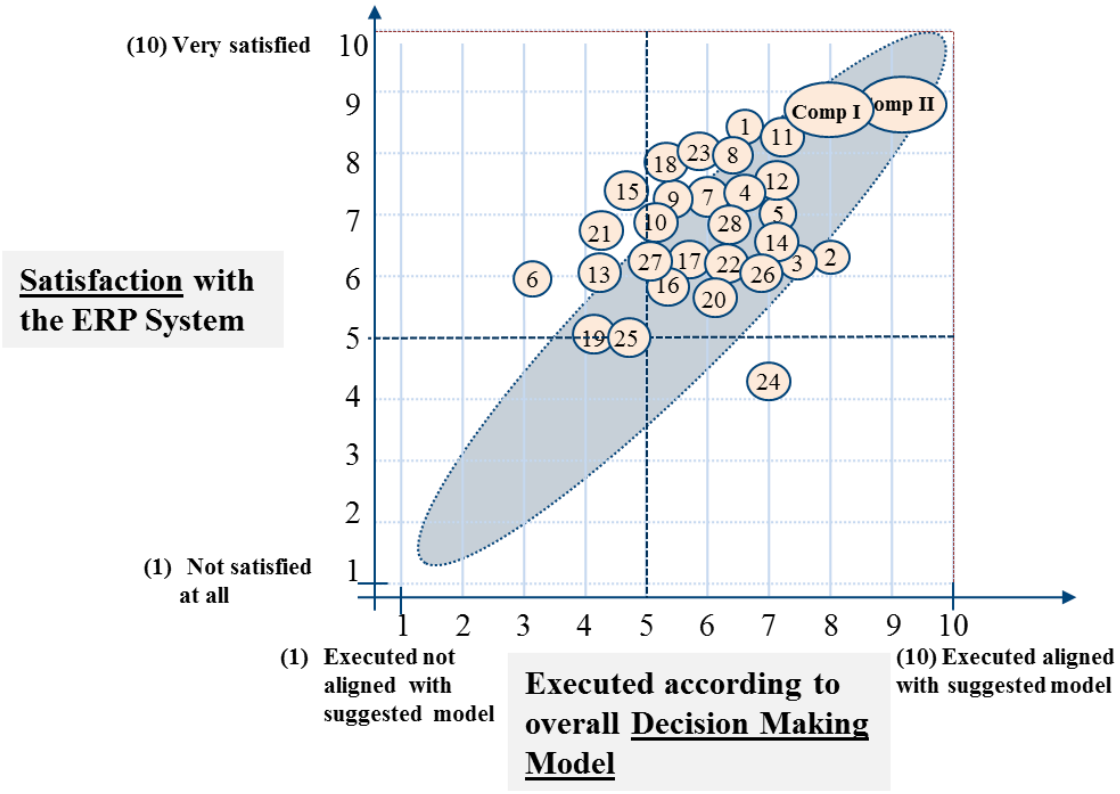


Figure 4-14: Summarized results of all qualitative findings, created by author 2013

In summary, Figure 4-14 provides an overview of the three variables, process, people and criteria, operationalized to one factor the execution aligned with the decision making model during selection. Summarizing the indicators mentioned in the previous chapters into one trend, the main research question can be supported on a high but visible level.

As higher the executed efficiency of the selection, as higher the satisfaction with the ERP system and the overall outcome.

A straight diagonal line indicates this statement and most of the company results are along this line. The case study companies had been executed using all information and relevant variables to the best intent; therefore it was not a surprise that the result was mainly positive confirming the assumptions. The selected ERP system was seen as highly positive by them. An overview of all data was created and all inputs (process, people and criteria) in relation to the satisfaction. All independent variables have been taken as equally important. In this figure (Figure 4-14) they have been summarized on the X-axis with the execution according to the decision making model. The satisfaction on the Y-axis was measured and discussed in the interviews.

As an example the two extremes Company Number 11 and 19 are detailed. At company number 11 the very old system had to be replaced due to the aim of international growth, a consultant company had been asked for support. They provided kind of a structured selection process, the company took a lot of time for the selection, teams have been involved and the CFO making the decision consulted all relevant departments for their input. There was only little time pressure and the budget was restricted to be economic but not tight. Considering this environment, company no. 11 made a decision for a system where most of the people are satisfied with.

At company no. 19 the situation was completely different. The company had no ERP system at all and needed one due to growth. The CEO decided without consulting other team leads. Due to high time pressure and budget restrictions, the decision was done very rapidly and unstructured without any process. The satisfaction with the system is seen as low because very little requirements could be considered and are fulfilled.

The results have been summarised to one set of factors to stress the trend even more (see appendix 10).

4.4 Quantitative Research Results from the Quasi-Field Experiment

We assume that the quality of the execution of the decision-making process is highly relevant for the decision making outcome. Key success factors have already been identified by our previous qualitative case studies and expert interviews, and will be used for this quantitative research as a complementary evaluation complex. Therefore the quasi-field experiment could support the verification of the main hypothesis, supporting the relation for the three propositions. Two different “real world” decision situations were developed according to the qualitative findings. Each participant was either given a decision case of “Treatment A or Treatment B”, randomly selected. The exact outline and description of “Treatment A and Treatment B”, can be seen in appendix 11 and the aligned questionnaire in appendix 12.

The relevance of the previously evaluated success factors was reconfirmed via the questionnaire which was given to all 62 experts. The key question to reconfirm the relevance of the success factors (asked in question 4 of the questionnaire) was: “Which elements of satisfaction with the investment decision are important in respect to the investment success?”

Question 4	[1] not relevant	[2] less relevant	[3] medium	[4] important	[5] very important	mean	Standard Deviation
Organisation, flexibility and strategy	0	5	8	32	17	**3,98**	**0,86**
Business Processes and Functionality	0	3	4	20	35	**4,4**	**0,82**
Technical Environment and Feasibility	2	4	10	26	20	**3,94**	**1,02**
ERP Provider and the long term relation and reliability	0	3	14	30	15	**3,92**	**0,82**
Economics of the ERP System	0	3	16	22	21	**3,98**	**0,9**

Table 4-1: Results Question 4, created by authors 2014

The frequency results in the table above strongly indicate that all of the suggested satisfaction elements show a high relevance and importance. The grouping of the list of decision criteria could be supported positively with this quantitative analysis.

Concerning the two different treatments in our experiment, we achieved the following frequency results:

Treatment A:

The situation describes a very rapid ad hoc selection of an ERP system, followed by a fast strategic investment decision, buying the ERP system with very little definition of the requirements and triggers.

According to Question 1 (how would you evaluate the taken approach), about 70% of the experts confirmed that they understand the situation and taken approach as much unstructured, not following a standard process. For Question 2, about 60% of the experts evaluated the approach as not very much elaborated. Question 3 (the assumed success rate of the system) has been seen negative by 70%. Question 5 (the evaluation of the in Question 4 defined criteria) is seen as not successful until almost medium successful by 90% of the experts. The trend of all results is clearly towards a detailed understanding that the selection procedure is important and the critical success factors have to be fulfilled for a successful investment decision.

Treatment B:

The treatment describes a very detailed selection process of an ERP system, defining and evaluating the requirements in particular. The strategic investment decision, of purchasing the ERP system, was executed with a lot of input from all departments involved.

According to Question 1 (how would you evaluate the taken approach), about 70% of the experts confirmed that they understand the situation and the taken approach as very structured. For Question 2 about 70% of the experts evaluated the approach as highly elaborated. Question 3 (the assumed success rate for the system) has been seen positive by 85%. Question 5 (the evaluation of the in Question 4 defined criteria) is seen as successful by 75% of the experts. The trend of all results is clearly towards a detailed understanding that the selection is important and the critical success factors should be fulfilled for a successful investment decision procedure and that with the given scenario it is highly fulfilled.

The **Statistical Procedure** of our experimental data showed the following results:
In order to evaluate the use of the adequate statistical test, we conducted the Shapiro-Wilks-Test, to find out whether the data of our samples are normally distributed. For almost all of our questions in the questionnaire for "Treatment A and Treatment B", the statistics points out that with a high degree of probability there is a normal distribution (the Shapiro-Wilks-Coefficients range from 0,643 to 0,976):

Shapiro	Question 1	Question 2	Question 3	Question 4	Question 5
Treatment A	0,796	0,954	0,951	0,916	0,923
Treatment B	0,634	0,976	0,855	0,930	0,965

Table 4-2: Results Shapiro-Test, created by authors 2014

The results of the Shapiro-Wilks-Test allow for utilization of the T-Test procedure, which requires a normal distribution of the test data set. In addition, we also conducted the Wilcoxon-Test, which is "free" of any parametric requirements.

The T-Test and the Wilcoxon-Test procedure are aiming at the question, whether there is a significant difference of the experts' evaluation in the two treatments, in order to find out, if the quality of the decision making process and the likelihood of a high decision making performance are different or equal. The following table shows the results of the T-Test and the Wilcoxon-Test procedures.

Comparsion of Treatment A and Treatment B:				
	Question 1	Question 2	Question 3	Question 5
Two tailored **T-Test** with independent means				
T-Value	13,319737	7,031401	5,342309	5,053792
P-Value	<0,00001	<0,00001	<0,00001	<0,00001
Significance	P<0,05	P<0,05	P<0,05	P<0,05
Two tailored **Wilcoxon Test**				
R1 Z-Value				
Z-Value	-4,7821	-4,7513	-4,0467	-3,7846
p-Value	0	0	0	0,00016
Result	significant at p≤0.05	significant at p≤0.05	significant at p≤0.05	significant at p≤0.05
R2 W-Value				
W-Value	0	1,5	41,5	48,5
Critical Value of W	137	137	distribution normal	137
Result	significant at p≤0.05	significant at p≤0.05	z-value should be used	significant at p≤0.05

Table 4-3: Comparison Treatment A and B, created by author 2014

The test results clearly substantiate our hypothesis and propositions that the probability of a successful decision making outcome strongly depends on the degree of quality of the decision making process execution.

Finally, in order to test our Proposition 3 (P3: A positive fulfilment of the requirement oriented decision making criteria has a positive impact on the satisfaction with the investment decision of an ERP system // **The use of specific decision criteria has a positive impact on the satisfaction with the decision.**) in more detail, a correlation analysis of the two questions (Question 4 and Question 5) was executed for the two treatments. Question 4 covers the relevance of the criteria as the independent variable (x) and Question 5 the evaluation of the fulfilment of those specific cases, as the dependent variable (y).

For "Treatment A" the correlation coefficient **r= -0,3729** for "Treatment B" the correlation coefficient **r=0,10233**. Therefore, Proposition 3 can be confirmed. "Treatment A" shows a negative correlation, meaning that the important criteria are mainly not fulfilled. "Treatment B" shows a positive correlation, meaning that there was sufficient time taken for the precise evaluation of the requirements, and the success criteria seem to be highly fulfilled. The correlation analysis also supports our main hypothesis.

4.5 Quantitative Research Results from the Questionnaire with ERP Professionals

In addition to the quasi-field experiment another rather quantitative approach had been considered, the more general approach of executing a questionnaire was executed. For the collection of primary data this is one of the main quantitative methods used be researchers. The reliability of the results is usually very high but dependent on the questions. Mainly closed questions have been asked as well as questions which can be answered on a scale. These types of questionnaires' are highly representative to gain quantitative comparable results.

An event was used in the beginning of 2014 to take the chance to distribute this questionnaire to ERP professionals (see appendix 12). Of a much wider group, 65 professionals chose to answer the questionnaire, of these 60 valid results could be evaluated. The professionals support all areas of the chosen scope for this research as well as expertise and demographics.

The 60 valid results follow the provided demographics:

Sex:	54 men	6 women		
Work Experience	14 under 5 years	11 up to 10 years	30 up to 20 years	5 over 20 years
Size of Company	15 work in a small company	45 in a med-size company		
Working field	47 in Production	13 in ERP / IT		
Country	18 Austria	40 Germany	2 North Italy	

Table 4-4: Demographics ERP Professionals, created by author 2014

The questionnaire was handed out and answered anonymously. In relation to the qualitative expert interviews similar, comparable questions have been asked but the answers have been much more summarized due to the fact there was no conversation about more details of the taken approach. All ERP professionals had been involved in an ERP selection process, mainly as the decider and further more have been involved in the implementation and maintenance of the ERP system later on. Table 4-4 above, shows all relevant demographics of the involved professionals.

Results:

The results have been evaluated in relation to propositions and therefore very specifically in relation to the overall efficiency measured by the satisfaction – the dependent variable.

Results according to Proposition 1

Questions 2c and 2d checked in detail the time taken for the selection of the EPR system. This is an indicator verified in the expert interviews for the intensity of the selection and for the selection process structure taken. As less time is considered for selection as fewer a process have been used at all.

The result shows that on average less than 25% of the overall time was taken to select the ERP system. People feel satisfied with the decision but the people asked have been the deciders and satisfaction is never been measured. Very similar to the results of the Expert Interviews the results are just based on the gut feel of the people.

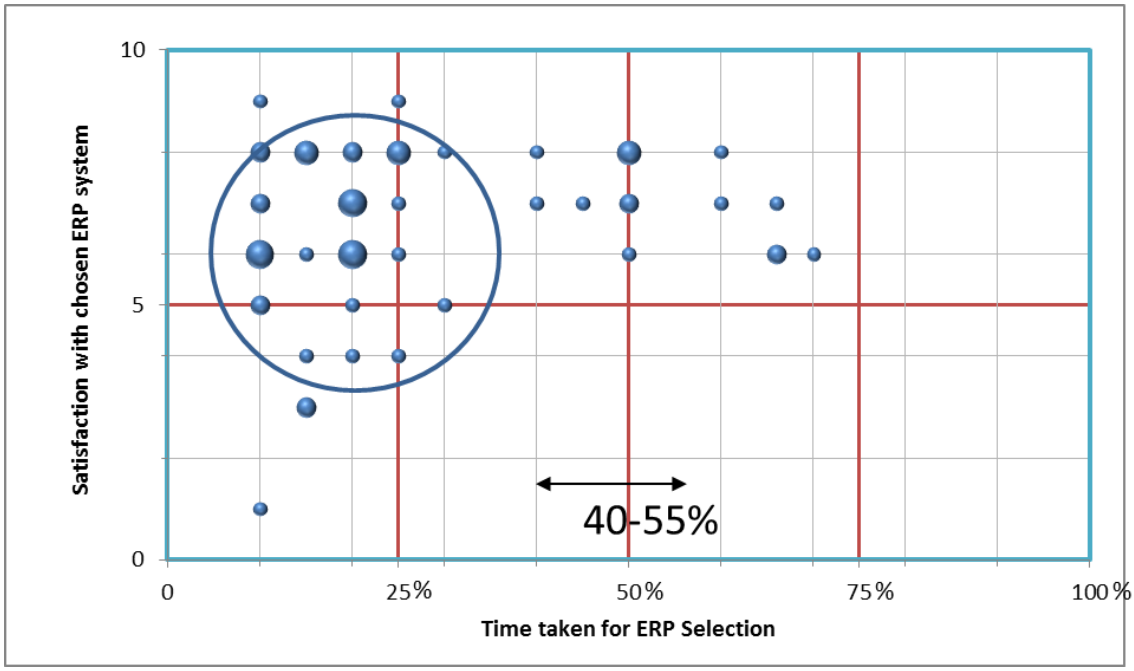


Figure 4-15: Quantitative results of ERP professionals regarding P1, created by author 2014

The size of each bubble indicates the amount of people voting for the same result. As smaller as less people have the opinion, as bigger as more. A significant amount of time has to be taken for the evaluation of the EPR system. The recommendation is about 40-55%. Even with much less time taken, the average is 27%, the people still do feel kind of satisfied with the chosen ERP system. But as well due to the fact the questionnaire was provided by the deciders.

Question 2g, the direct question about the use of a process for the selection of an ERP system was asked as a pure yes/no question. Of the 60 valid results 31 answered, they used a process.

Overall proposition 1 could be supported; a structured selection process is an indicator for the efficiency of the selected ERP system but not with the same quality of the results as with the expert interviews.

Results according to Proposition 2

Questions 2e and 2f checked in detail the decision people involved in making the decision or better selecting the ERP system. Who is responsible for making the decision is a key topic but not such a clear indicator towards the efficiency of the selected system.

The result shows a clear indication towards the involvement of the key knowledgeable team supporting the decider towards the selection of the EPR system.

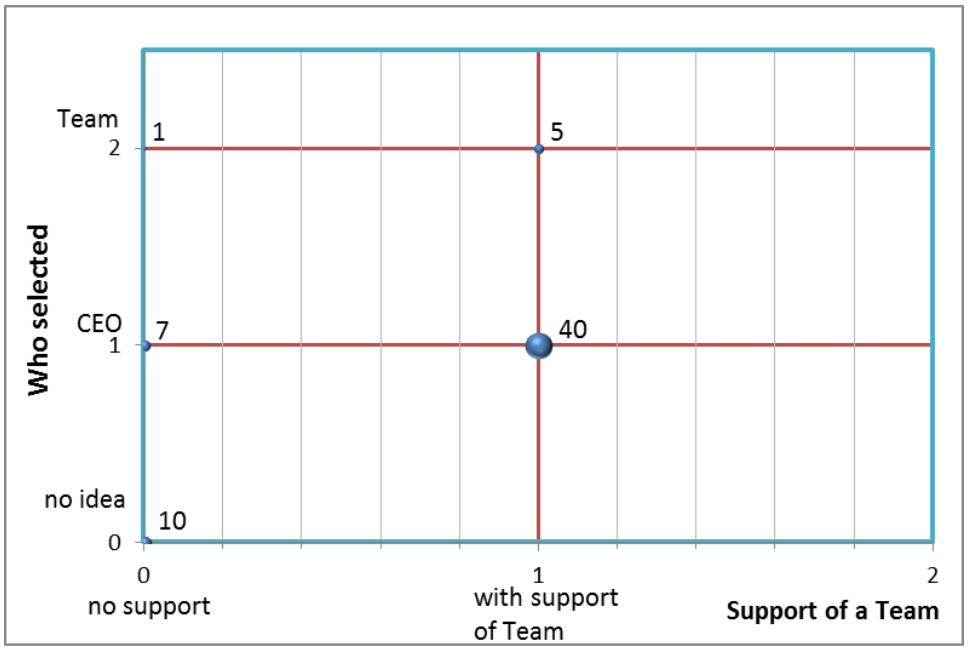


Figure 4-16: Quantitative results of ERP professionals regarding P2, created by author 2014

"Who" was responsible for making the decision was another key topic. It was differentiated between the decider and the supporting team. For about 30% the decision was made without any team involvement which seems usual according to the specific expert interviews.

The board, CEO or owner needs to take the responsibility for the decision, but he needs to take the full support of a team providing all detailed requirements. The proposition 2 could be supported as well that there is a relation between the decision making person and the team supporting the decision for the selection of an ERP system.

Results according to Proposition 3

Questions 2h checked if any of the requirements towards a system have been specified at all and 2i and 2j checked in detail the identified most relevant decision criteria ‘time pressure’ and ‘cost pressure’ in relation to each other in relation to the efficiency measured via the satisfaction.

Looking at the requirements cost and time pressure have been identified as key factors in the qualitative research. Even at SME companies where the assumptions is, there is a shortage on budget the answer is mostly on time pressure – see Figure 4-17. The qualitative finding could be supported that time gets more important as long as the ERP system seems economical.

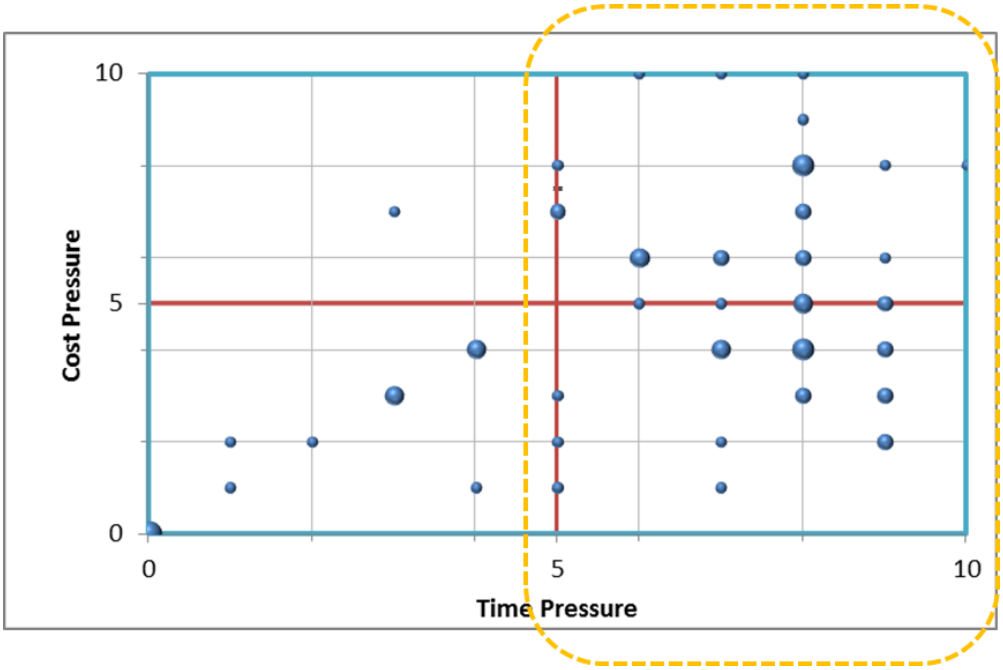


Figure 4-17: Quantitative results of ERP professionals regarding cost & time, created by author 2014

As stated with Figure 4-17 the pressure on time is much higher more circles are in the right area pressure on time 5-10 than generically on the top part cost pressure 5-10.

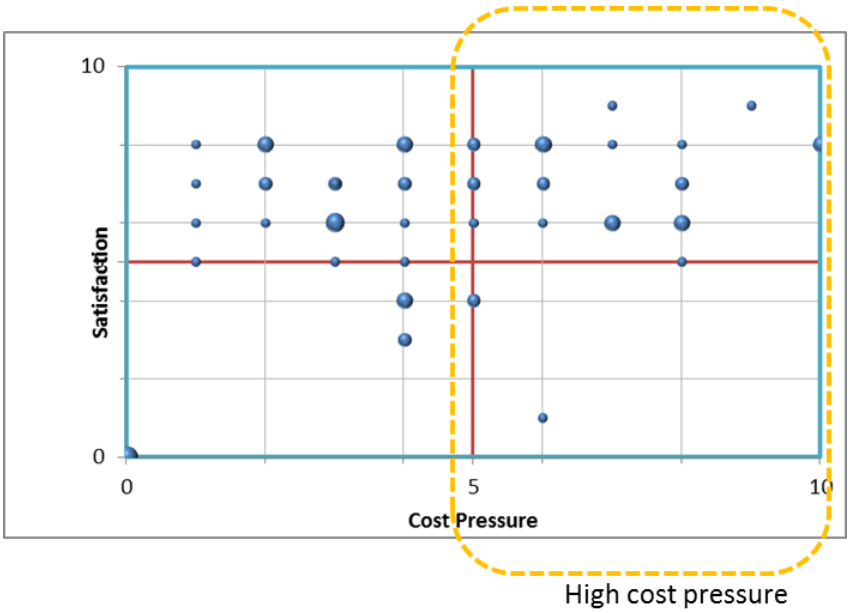


Figure 4-18: Quantitative results of ERP professionals regarding cost & satisfaction, created by author 2014

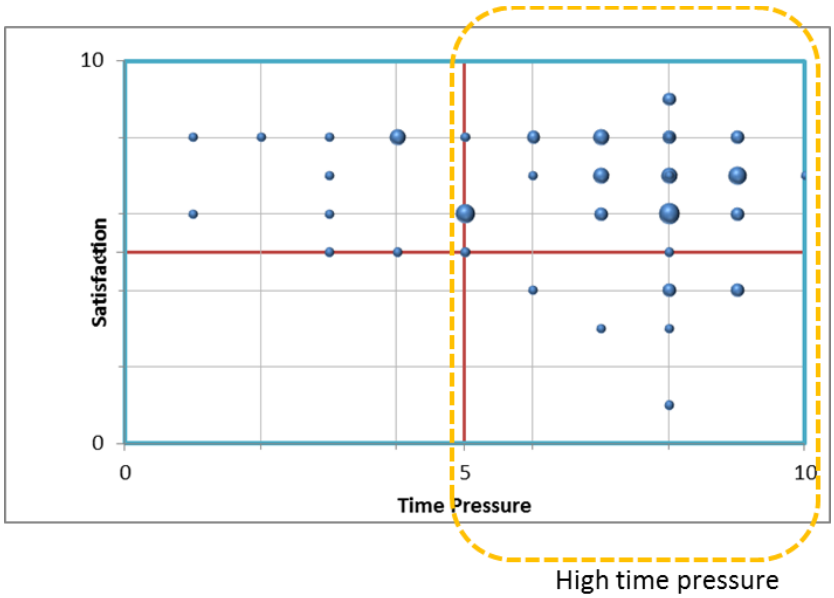


Figure 4-19: Quantitative results of ERP professionals regarding time & satisfaction, created by author 2014

In relation to the satisfaction with the system the companies felt they chose the good system irrelevant of cost and time pressure.

In addition a correlation analysis was executed to verify the relation of time with satisfaction of the system and cost in relation to the satisfaction with the system. The correlation coefficient between cost and satisfaction is positively but weak R= 0.15. The value of R^2, the coefficient of determination R^2 = 0,02. The correlation coefficient between time and

satisfaction is negatively but weak R= -0.13. The value of R^2, the coefficient of determination $R^2 = 0,02$ (all details are in appendix 14).

The previous slides indicate that, irrelevant of the indicators and measures, the experts are satisfied with the chosen ERP system. The last question clarifies this impression.

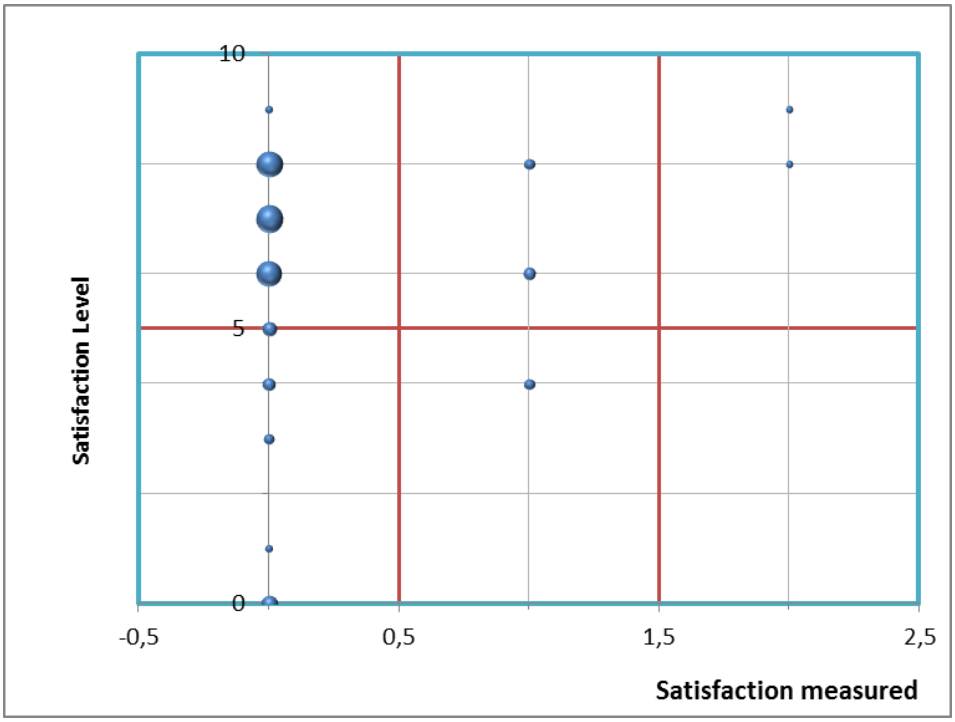


Figure 4-20: Quantitative results of ERP professionals regarding satisfaction measured, created by author 2014

The experts have been asked how they evaluate the satisfaction with the system. They base it mainly on "gut feel", less negative feedback and a small error log. But there was never an evaluation whether the system fulfils the requirements. Overall the experts feel satisfied with the selection of the ERP system but there is no measurable confirmation and mainly the feedback is based on the view of the key decider.

In sum, the questionnaire executed with 65 ERP professionals support the propositions taken with the qualitative research approach. It can be confirmed that the defined independent variables are relevant for the decision of an ERP system and the overall hypothesis of this research can be substantiated.

4.6 Summary of Research Results

This part summarises all findings according to the main research question and hypothesis as well as the results according to the aligned propositions and research methods.

Reviewing literature in detail and the results of the expert interviews foster the assumptions taken for the empirical research of this study. The company case studies support more intensively the overall model developed. Especially the case study with Company I confirmed the suggested model qualitatively. The quasi-field experiment support the variables and evaluate the relevance of the list of criteria and the questionnaire executed with ERP professionals support the findings of the experts interview in a quantitative matter.

Specifically for the defined scope, the selection of ERP systems for SMEs in the production industry in Germany, Bavaria and Austria, Tirol, the summarised results are:

- Firstly, using a structured model has a positive impact on the satisfaction with the system.
- Secondly, a suggested selection process structure supports the satisfaction positively.
- Thirdly, the involvement of significant, knowledgeable decision people supporting the decision maker for the decision has a positive impact on the satisfaction with the system.
- Fourthly, the setup of key decision criteria at the beginning aligned with the requirements for the ERP system is very important to be able to evaluate the satisfaction of the ERP system in the end. It does have a positive impact on the satisfaction with the system, because the criteria are defined, weighted and prioritised all along the ERP selection and implementation. All key people do know from the beginning what they can expect on a very low level of detail.
- Finally, the model relates the selection in the beginning of the ERP life-cycle process with the finalisation in the end creating a measurement tool for satisfaction.

4.6.1 Interpretation of Results

The results presented need a differentiation between the results achieved supporting the underlying propositions and the results according to the developed model concluding in the

results of the main research question and the main hypothesis. Nevertheless there is of course a relation between all these results.

The overall research question indicated that there is a link between the execution aligned with the decision making model for an ERP system at the beginning, the decision point and the satisfaction with the ERP system after implementation. For the analysis of this question an overall research was taken into some propositions, variables and indicators to measure and confirm the overall assumptions. Firstly, the term execution of the decision making model in was verified and the three independent variables identified; the process structure suggested, the decision people involved and decision criteria defined. Secondly, the overall satisfaction with an ERP system was analysed and the dependent variable operationalized into measureable indicators. Finally, this entire analysis was mainly qualitatively checked with existing literature as well as challenged with expert interviews and company studies. These findings have been reconfirmed quantitatively with a quasi-field experiment and a questionnaire distributed to ERP professionals.

As a final result the overall topic was challenged along the research question and the idea to develop criteria based model for the selection of an ERP system at SME. It was executed, tested and approved using the state of the art of existing models in literature as a basis as well as existing criteria (see 4.6.2). The feedback from the expert interviews (see 4.1.1) especially their lessons learned, supported the development of the model with was tested with Company I (see 4.1.2) and adjusted and detailed for Company II (see 4.1.3). The quasi-field experiment verified all main results quantitatively as well as reconfirming the relevance of the developed set of decision criteria (see 4.1.4). The questionnaire with ERP professionals questioned most of the expert interview questions for a reconfirm the results quantitatively (see 4.1.5).

The results of the overall research question in detail: The quality of the decision executed was subdivided into the three independent variables, process structure, decision people, decision criteria and fourthly the satisfaction as a dependent variable. The results according to the **process structure** used for selection are based on the expert interviews. The interviewee confirmed according to the taken indicators that at their companies hardly used a model / process for selection. Very small companies just started the process, bigger SMEs worked according to internal or external experience using model-process which might not be sufficient or adjusted according to their needs. As smaller the companies the less structured according to a process the selection approach. The experts confirmed that usually the

selection part of the ERP life-cycle got very little attention and about 60% took too little time for the mentioned project. The planning and selection phase was accomplished with very little experience (see Figure 4-5). Most of the experts confirmed, that more time at the beginning would have led to a more intensive selection process taking the requirements into consideration. The questionnaire with EPR professionals supported these findings. Only half of the companies answer that they used a selection process, this fits to the taken demographics of SME for the questionnaire. The quasi-field experiment differentiated two treatments where one had a structured process and the other treatment followed no selection structure. The results supported as well that it is very beneficial for the satisfaction with the system to follow a structure selection process. Overall, the Proposition 1, the use of the selection process has a positive impact on the satisfaction with the decision, was supported by the experts, Case studies and EPR professionals. They confirmed that a structured model which considers time for planning and selection is needed. In addition, the link to the overall satisfaction was verbally confirmed by the experts.

The results regarding the **decision people** involved in the decision are extracted from the expert interviews. The interviewee confirmed that the person making the decision and the team involved are very important quality factors for the decision. Reviewing the results in detail (see Figure 4-8) current common practice is related. 60% of the experts confirmed eligible people made the decision supported by a knowledgeable team enabling them. 22% of the experts stated that expert knowledge has been missing. The right or dedicated leader made the decision but without key information. 18% observed that the decision making person made the decision according to position and title not consulting any expert and it turned out that these 18% of the companies are very low in satisfaction. Almost identical percentages could be confirmed much later with the questions asked to the ERP professionals. In total over 100 companies confirmed the above mentioned relations of the deciders and people to be involved for the selection of the EPR system. The Proposition 2 can be confirmed. If a knowledgeable management team was involved and the decision person been enabled, the decision was seen as positive.

The interviewees confirmed according to the taken indicators, their companies hardly used a defined set of **decision criteria** for the selection of the ERP System. The basis for this is a set or list of requirements ‘why an ERP system is needed’. All experts confirmed there are defined indicators / triggers to start the selection process (see Figure 4-10) but no documentation of these requirements as criteria for selection of the system took place. All

experts saw the need that doing it would be beneficial. In addition to the documented set of selection criteria based on the defined requirements there are some key criteria influencing the ERP life-cycle, such as ‘cost’ and ‘time’. But the impact and influencing factor regarding cost and time behave differently as a first quick analysis would predict. For 70% of the companies the focus is on ‘time’ (see Figure 4-11). That means the ‘cost’ needs to be economic but the higher impact on the decision has the time factor. Where small companies face very high pressure due to ‘cost’ and ‘time’, the pressure is much more on ‘time’ for medium-sized companies. The list of decision criteria was developed in detail during the first case study and adapted to a sufficient list during the cause of the second case study. The developed list of criteria is seen as best practice and is currently used in business by a consultancy to support the ERP selection process. In 2014 with the quasi-field experiment professionals confirmed the relevance of the decision criteria and their groupings qualitatively. In addition they are asked about an evaluation of the impact on satisfaction. This correlation was positively confirmed. The questionnaire distributed to the ERP professionals added to this quantitative result by confirming the relevance of ‘cost’ and ‘time’ as key criteria. Proposition 3 can be confirmed basically due to the interviews. The experts understood enthusiastically the possibilities they would have, documenting the initial requirements in a set of selection criteria up front for continuous use during the entire ERP life-cycle. The ERP professionals supported this in the evaluation of the quasi-field experiment.

The overall **satisfaction** with an ERP system was analysed and the dependent variable operationalized into measureable indicators. This analysis was challenged with expert interviews questioning it along a defined scale, if the companies have been satisfied with the selection ERP system. The answer to satisfaction with the system was overall positive, which was a bit of a surprise according to all problems discussed with the experts before. Reviewing more details explained it further (see Figure 4-13). The author’s interpretation of this result is less positive as it is seen from the management, because none but one of them has any basis to evaluate the satisfaction against. All results, if the system selected is the right one and why they are satisfied with it is based on pure gut feel of the management and IT people. It is more an elimination of problems which confirms satisfaction. If nobody complains then the ERP system selected seems to be the right one. For a complex strategic decision like the selection of long term software, supporting all business processes this tent to be too simple. None of the companies measure the success or satisfaction in any way. So, even another round of interviews wouldn’t be more than gut feeling of a different level.

As a result from all expert interviews it can be summarized, that they do not measure the satisfaction but even more they do not evaluate against the original requirements. None of the experts companies know in detail if the system fulfils the first intentions. The identical result was gained from the questionnaires with ERP professionals. They feel satisfied but hardly measure satisfaction. According to the brief answers on the questionnaires there is a high indication that if there would have been the possibility to interview the ERP professionals, the answers would be identical to the expert interviews.

In summary; satisfaction has never been measured even if the people feel satisfied with the system. Satisfaction is based on gut feel and lack of complaints. Even the main requirement, the overall initiation to start the selection, is usually not measured after go live and beyond. None of the experts and very few of the ERP professionals did measure satisfaction in a structured way, not related to the requirements which triggered the system implementation. Even in the lessons learned of the expert interviews, it was mentioned that criteria should be defined in the beginning and measured afterwards for success (see paragraph 4.3.3). Combining the three propositions supporting the main hypothesis – measuring efficiency, there are only the two case companies which would fulfil all requirements. The satisfaction is rated very high due to the use of the selection process, the involvement and enablement of the right deciders and the criteria have been considered.

4.6.2 Summary of all Findings related to the Developed Model

The three propositions are confirmed by the 28 semi-structured expert interviews and the case study qualitatively and the quasi-field experiment and questionnaires quantitatively.

To finally confirm the overall research question and the main hypothesis all results have to be considered, testing the literature results of the decision criteria and the first results of the semi-structured expert interviews in praxis. With the possibility to execute two projects in real live cases – the selection project with Company I was started. Based on the models in literature and current common praxis, a detailed model was developed. This fosters the relation between the selection and the satisfaction with the system along a set of predefined decision criteria. A major result of the research study is this **developed model which is aligned with a selection process structure, decision people and a set of decision criteria**. It was used as a basis for Company I and II to challenge all propositions. The reality study with Company II focused on a very detailed selection process analyzing, defining and

prioritising the selection criteria as a profound set to be used as a long time tool for evaluating satisfaction.

Results related to the company studies according to the model and variables: At the first discussion, Company I planned almost no time for selection, a very quick decision was preferred. A re-evaluation took place during the project and finally 40 % of the overall time was dedicated to selection in the end. Company II planned some time but didn't think of any details. The detailed selection workshops with the vendor took a significant amount of time but as stated in the final package it was worth it. Both companies confirmed that the time taken at the beginning according to the defined, structured model was really worth wile spent and had led to a better result in the end.

In both companies the decision making person have been appointed with the supporting team as part of the project. In Company I the owner delegated the preparation process to a very knowledgeable IT / Sales lead and an experienced IT consultant. The decision was prepared according to the discussed requirements and the priorities reviewed with the owner. At the time the decision was made *by the owner all involved people supported the decision*. The IT lead of Company I confirmed during the final interview, that in their opinion, they can just confirm that the right people have been involved during the selection process. In Company II the decision making team was the board of three directors with different functional background. The team preparing the decision involved all department leads and consulted additional knowledgeable key player for their input, experience or opinion. Therefore the *decision made by the board was as well accepted by all relevant people due to the intensive preparation.*

According to the existing literature review on this topic there is a need to review and define criteria but which set to use, how to use it and why is discussed diversely. Therefore it was a major issue of the research to develop such a *common set for groups of criteria* (see Table 2-3) and test it in reality, so done in the Company I and II.

Company Study I faced cost pressure at the beginning. After the discussion on requirements and values the priorities changed to an economic view with much more focus on time and functional requirements. Company II started with a balanced view on the factors. Discussing and analyzing all requirements very early in the process, there was not a higher priority to cost and time criteria. Only costs needed to be justified to the finance director, so they have been

evaluated in much detail and an economic comparison was executed. The time factor instead had more impact due to production start. But even that was not the driver because the relevant ERP products showed equal limitations on time.

In terms of a measurable result *that the selected ERP system was the right one* and the *people are satisfied with it*, Company I is on a very good track. It is in the top right corner as indicated in Figure 4-13. The successes criteria have been defined in detail before go live and measured 16 month after go live. The company plans to continue to keep the criteria in mind while updating or adding to the system and measuring satisfaction regularly.

Using all results and the details of the developed model the quantitative approach was taken to support the results with a quasi-field experiment. The 62 experts reviewed the developed model on a significant level of detail comparing real life treatments. There is a statistical, quantitative support of the taken hypothesis and the three propositions. The questionnaire with ERP professionals finally added some more results using similar questions as the semi-structured interviews, so, additional 60 out of 65 ERP professionals supported the results.

In summary, the developed model (see chapter 3.2) and the proposed set of selection criteria derived from literature could be taken as a basis for any other ERP selection at a SME company to increase the chance of satisfaction and success.

4.6.3 Summary according to the Main Research Question and Main Hypothesis

Finally, the main research question should be answered according to all previous results mentioned before in chapter 4.4. The key *research question* was:
"Is there a relation between the suggested selection process of an ERP system and the overall satisfaction with the ERP system at its final state i.e. up and running? And is there a basis for evaluation of selected outcome quality?"

In summary this question was confirmed. The results extracted from the literature and expert interviews confirmed that there is a relation. The company case studies supported this question positively, with Company I the selection process had been tested along a set of criteria and the satisfaction could be confirmed more than a year after go live. With Company II the analyzing, prioritising and weighing of the decision criteria has been more detailed. The feedback regarding the process and set of criteria was positive. The relation was supported

with statistical methods using the professionals executing a quasi-field experiment and the ERP professionals answering the questionnaire.

The aligned main hypothesis of the overall research was:
The level of satisfaction with a selected ERP solution is strongly dependent on the execution of the decision making model.

The performance of the execution is divided in the three areas as mentioned before in the literature research: Execution of the selection process structure, the decision people involved and the identified decision criteria in relation with the expected percentage of fulfillment to be achieved. All three propositions are tightly linked and were confirmed qualitatively in chapter 4.1.1 - 4.1.3 quantitatively in chapter 4.1.4 - 4.1.5. The efficiency of the decision making provides an evaluation of the result for satisfaction with the selected ERP system.

The overall main hypothesis is confirmed. The level of satisfaction with a selected ERP solution is strongly dependent on the performance of the execution of the selection process. A suggested model has been developed and tested, as well as the suggested selection process, people and set of selection criteria tested as a basis for long term evaluation of satisfaction criteria.

5 CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

While searching the literature dealing with the criteria for selection as well as ERP selection models focusing on the selection phase it became clear that these subjects are not complete. This research examined the ERP selection part of the overall ERP life-cycle process with the focus on SME companies. It developed and empirically tested a model relating the selection of an ERP system and the level of satisfaction with the overall ERP life-cycle by defining a set of criteria. The proposed model assumed a high performance approach for execution with the people involved and the criteria defined. The model was tested with mainly one very long company case and a second very detailed company case focusing on the detailed analysis of the set of criteria. In detail the model was validated quantitatively with a quasi-field experiment followed by an expert questionnaire.

This study contributes to academic research by producing empirical evidence to support the theories that the process structure suggested, the people involved in the decision making process and the set of decision criteria defined have a positive impact on the satisfaction of the chosen ERP system for a SME company. According to the wider audience of experts consulted, there is empirical evidence that any other company consulted in the same region, industry and with the same size would conclude to the same result.

Although the findings of the current study contribute to a better understanding of the successful selection of an ERP system with long term satisfaction, there are several limitations to this study. The first limitation of the study is its generalizability. The study presents the viewpoints of corporations in the south of Germany, Bavaria and Austria, Tyrol in the production industry. It is most probably representative for ***Western Europe*** but it is unclear to predict, whether the findings can be generalized for other markets like emerging markets, Asia or the Middle East or even North America where SMEs are in a different position. Furthermore the suggested model and the set of selection criteria should be tested in a greater amount of companies, followed by expert interviews of these companies. It should be considered that project or company cases usually take over one year until the result can be analysed. Additional companies could be tested in an early stage or it could be investigated in a comparable industry or product.[310]

[310] cf. Dezdar, 2011, p. 932f

Summarizing the main conclusions the author identified:

1. In the world of highly integrated business processes even very small companies are forced to use computer systems (e.g. ERP systems) to maintain their competitiveness.
   1.1 There is always a clear business trigger, a set of requirements, before a small or mid-size company starts the selection of an ERP System. The key triggers are: international growth, replacement of an old system and/or a merger/acquisition situation.
   1.2 Due to increasing need the ERP market for SMEs has a high growth potential. Surprisingly the existing market does not meet the specific needs of SMEs identified as high flexibility and an efficient approach to the execution of the ERP life-cycle. Instead the market is very diverse and no standardised methods or processes exist.
2. The research area of ERP and decision making theories is very recent and was found not to be very mature concerning the selection part of the ERP life-cycle process in general. In the existing studies of the small and mid-size production industry the selection part of the ERP life-cycle does not receive proper attention. The author found by retrospectively evaluating ERP life-cycles that the efficiency of the selection process is highly relevant for the satisfaction after implementation of the ERP system.
3. Out of a pool of variables influencing the quality of the selection process of an ERP system three were extracted and specified in detail: a structured selection process, the involvement of significant decision people and the selection decision criteria.
   a. The use of the developed structured decision making model for the selection of an ERP system at SMEs leads to a higher and measureable satisfaction with the system due to a highly structured selection process.
   b. The leadership team in charge of the decision for an ERP system has to involve IT related knowledgeable people or improving their own IT/ERP affinity. This will lead to a better result at the decision making point in time.
   c. The detailed set of decision criteria included in the structured model for the ERP selection provides an efficient approach even for non IT/ERP related people, leading to a highly professional execution and a measurable result.
4. The pressure on a precise ERP implementation which covers all business and functional needs is rated very high for SME companies due to their small size, limited budget and limited resources.
   a. The flexibility and speed of the ERP life-cycle is rated much higher than the pure costs of the system.

b. The price needs to be economic but is not rated as high as the first analysis would predict as long as the ERP system fits the needs of the company.
c. To schedule sufficient time for the selection has a positive impact on the satisfaction with the chosen system.

5. Without a standardised approach the selection of the ERP system is threatened to be highly influenced by irrational factors. These influences are minimized by using the developed structured model which provides a predictable, profound and stable basis.
6. The interviewed and analysed companies confirmed that almost all of them did not use a defined selection process or overall decision making model. By reviewing the suggested model with the interviewees they confirmed that this model would have been beneficial to them in making a structured decision, which would have led to a higher satisfaction with the ERP system.

5.2 Suggestions

Suggestions to the executives of SME Companies:

1. SME Companies have to understand the selection of an ERP system as a strategic decision. Executives must be aware of the high business risk and that a wrong decision has a high impact even on a long term basis.
2. SME Companies in the position to select an ERP system should use the developed decision making model at the very beginning to structure the process and develop details as a starting point for the selection. They need to build awareness for the importance of the selection.
3. SME Organisations have to follow the proposed detailed, clear and structured selection process before starting the implementation of any of the systems.
4. The suggested decision making model enables even leadership and management with little or no IT/ ERP affinity to execute a professional selection process for a SME company.
5. SME Companies should make a detailed analysis of their functional and business requirements at the beginning of the selection process. These factors have to be weighted and prioritised. Later on satisfaction can be measured in relation to their identified set of priorities.
6. The CEO'S and CIO's should be trained to make strategic ERP decisions along the suggested decision making model. This rationalization contributes to a higher competence independently of their previous IT/ERP personal knowledge.

7. CEO's should leverage the experience provided with this strategic decision making process, using the developed model and adapting the functional details for other strategic decisions.

Suggestions to ERP providers:

8. ERP providers can demonstrate that they understand the specific needs of SMEs by using the proposed decision model. Reusing the models of big global entities does not reflect an understanding of the SME market.
9. Using the structured selection process, ERP providers can position themselves and differentiate with an adapted process within a growth market.
10. ERP providers should use the set of criteria developed as a significant sales advantage to explain the benefits of their product.
11. Enlarging the set of criteria for their client's business, ERP providers will have a clear unique selling point, differentiating themselves from their competitors.

Suggestions to the scientific community:

12. The ERP market especially for SMEs is far away from saturation. Therefore the development of standardized templates for the selection process of an ERP system developed to meet the needs of the target group (SME) is of high importance for further Research and Development.
13. The scientific community should use the results and interpretations as a basis to relate the mature decision making theory with further areas of operationalization. The model developed is very generic but the variables are specific to the topic of ERP.
14. The scientific community should consider the use of the model in relation to other fields of decision making which should be elaborated. They should consider the area of selection of an ERP system for SME companies as an important research field.

5.3 Implications for future research

The limitations of the study present opportunities for further research. Given it is a recent topic and only over the last 10-15 years studies have been executed and published, there is a high potential. Nevertheless some topics like the strategic decision making in relation to ERP acquisition can be taken to other more mature areas. Since the expert interviews were limited to a region, this study could be replicated varying by industry, size and market. The focus for

this study where just on some parts of the ERP life-cycle. The set of defined criteria could be specified for other phases like the EPR implementation using the factors as acceptance criteria for the conversion decision.

The basis for this research is a qualitative approach with a quantitative addition. If this research field gains more maturity the results could be tested with a larger volume quantitatively. In the quantitative area you might not be able to ask questions prior to the selection or very rarely, all quantitative studies will be executed retrospectively. Therefore the individual areas of the model, the process used, the people involved and the criteria developed according to the requirements could be questioned. The survey used as a basis for the semi-structured interview have been be used for the development of the questionnaire and might be extended further to cover the possibility for a higher volume e.g. online questionnaire. The role of external consultants at SME companies might be an aligned research field where a study along the processes and models used could provide additional input to strengthen the rational part of the decision.

Future work could consist of further use of this developed model in a wider area of scope or processes. The set of criteria developed, was valid and detailed for the mentioned company cases. Other companies, industry or markets might require another level of detail to an adjusted set of criteria. The role of external consultants as well as the different organisation structures of a production could be considered in more detail in future research studies.

6 BIBLIOGRAPHY

1. Albers S., Klapper, D., Konradt, U., Walter, A. & Wolf, J. 2009: Methodik der empirischen Forschung. Gabler Verlag. 3rd Edition. 578 p.
2. Al-Mashari, M. 2003: A Process Change-Oriented Model for ERP Application. International Journal of Human-Computer interaction, 16(1), pp. 39-55.
3. Atteslander, P. 2000: Methoden der empirischen Sozialforschung. Walter de Gruyter Verlag, New York. 393 p.
4. Backhaus, K., Voeth, M. 2010: Industriegütermarketing. 9. Aufl., Vahlen Verlag, München, 683 p.
5. Baki, B. & Cakar, K. 2005: Determining the ERP package-selecting criteria. Business Process Management Journal, 22(1), pp. 75-86.
6. Bamberg, G., Coenenberg A.G. 2002: Betriebswirtschaftliche Entscheidungslehre. Verlag Vahlen München. 11th Edition, 328 p.
7. Barker, T., Frolick, M. N. 2003: ERP Implementation Failure: a case study. Information System Management, Fall 2003, pp. 43-49.
8. Barros, G. 2010: Herbert A. Simon and the concept of rationality: Boundaries and procedures. Journal of Political Economy, Vol.30, Issue 3, pp. 455-472.
9. Bendoly E., Donohue K., Schultz K.L. 2006: Behaviour in operations management: Assessing recent findings and revisiting old assumptions. Journal of Operations Management, Vol.24 Issue 6, pp.737-752.
10. Biermann. P. 2005: Marketinglösung für das mittelständische Kundensegment der Schweizer Branche für IT. Doctoral Thesis. 372 p.
11. Boutellier, R., Gassmann O. 2008: What makes a good case study. Research Methodology (Forschungsmethodik I), ETH Zurich & University of St. Gallen.
12. Bowett, R. 2013. Organisation – Decision-making in business. [-Online] Available at: http://www.tutor2u.net [25.02.2013 1.37PM.]
13. Buchanan, L., O'Connell, A. 2006: A brief history of decision making. Harvard Business Review and Harvard Business School Publishing, pp. 33-41.
14. Buoanno, G., Faverio, P., Pigini, F., Ravarini, A., Sciuto, D. & Tagliavini, M. 2005: Factors affecting ERP System adoption. Journal of Enterprise Information Management, 18(4) pp. 384-426.
15. Caruso, D. 2005: EPR is in the picture for midsize manufacturers. Manufacturing Business Technology (Ed.), p.20.

16. Casper, C., Hestermann, C., Rideer, F., Tratz-Ryan, B., Kröhler-Krüner, H., Zimmermann, A., Linden A. (2013). StabilerMarkt für ERP-Systeme für den Mittelstand. http://www.silicon.de/41590069/gartner-magic-quadrant-stabiler-markt-fuer-erp-systeme-fuer-mittelstand/ 14.01.2014 9.35 AM.
17. Dean, J. W., Sharfman m. P., 1996. Does decision process matter? A study of strategic decision making effectiveness. Academy of Management Journal. Vol. 39, No.2, p.368-396.
18. Deep, A., Guttridge, P., Dani, S. & Burns, N. 2008: Investigating factors affecting ERP selection in made-to-order SME sector. Journal of Manufacturing Technology Management, 19(4), pp. 430-446.
19. Dempsay, S., Griffin J. 2007: Integrated Information Systems. Choosing the best system for your organisation. Accountancy Ireland, 39(6), pp. 64-66.
20. Dezdar, S., Ainin, S. 2011: Examining ERP implementation success from a project environment perspective, Business Process Management Journal, 17(6), pp. 919 – 939
21. Dwivedi, D. 2007: EPR Software for small business. Better Management Tools, Chemical Business (Ed.) p.27f.
22. Eisenführ F., Weber M. 2003: Rationales Entscheiden. Springer Verlag, 4th Edition, 415 p.
23. EU Commission Paper, Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises. Official Journal of the European Union, Document Number C(2003), 6 p.
24. EU Commission Paper, The new SME definition. User guide and model declaration. Enterprise and Industry Publications. ISBN 92-894-7909-4. 2005, 52 p.
25. Everdingen, Y., Hillegersberg, J. & Waarts, E. 2000: ERP adoption by European midsize companies. Communications of the ACM, 43(4), pp. 27-31.
26. Fisher D., Fisher, S., Kiang M. & Chi R. 2004: Evaluating Mid-Level ERP Software. Journal of Computer Information Systems, pp. 38-49.
27. Flick, U., von Kardorff, E., Steike, I. 2012: Qualitative Forschung, Rowohls Taschenbuchverlag, rowohls enzyklopädie, 9th Ed., 767 p.
28. Fritz, M. 2007: Einführung in kleinen und mittleren Unternehmen – Entwicklung eines toolgestützen Leitfadens. Diplomprüfung 2006/07. Fachhochschule Rosenheim. 99 p.
29. Folkes, V. A. 1984: Consumer reaction to product failure, an attributional approach. Journal of Consumer Research, Vol. 10, p. 398-409.

30. Garcia-Sanchez, N., Perez-Bernal L. 2007: Determination of critical success factors in implementing an ERP system: A field study in Mexican enterprises. Information Technology for Development, 13(3), p 293-309.
31. Garvin, D. A., Roberto, M. A. 2001: What you don't know about making decisions. Harvard Business Review, pp. 108-116.
32. Geissler, H. 1986: Fehlentscheidungen – eine empirisch-explorative Ursachenanalyse. Peter Lang Verlag, Frankfurt. 277 p.
33. Gronau, N.: 2012. Was zeichnet ein sehr gutes ERP-System aus? Wettbewerb zum ERP-System des Jahres 2011. ERP Management 8 (2012), 1, p. 20-23
34. Gronau, N.: 2013. 10 Trends im ERP-Markt. Computerwoche 21.03.2013. http://www.computerwoche.de/a/10-trends-im-erp-markt,2529510 14.01.2014, 10.19 AM.
35. Gzuk, R., 1975. Messung der Effizienz von Entscheidungen. Tübingen, Germany, J.C.B. Mohr (Empirische Theorie der Unternehmung, 5), 490 p.
36. Hardes, H-D., Uhly, A., Wickert, H. 2002: Methodische Überlegungen zu qualitativen Befragungsmethoden, insbesondere Experteninterviews. Fallstudie zur betrieblichen Erfolgsbeteiligung. University Trier.
37. Harrison, F. E. 1993: Interdisciplinary Models of Decision Making, Management Decision, MCB University Press Limited, 31(8), pp. 27-33.
38. Harrison, F. E. 1996: A process perspective on strategic decision making, Management Decision, MCB University Press Limited, 34(1), pp. 46-53.
39. Hedelin, L., Allwood, C. M. 2002: IT and Strategic decision making. Industrial Management and Data Systems, 102(3), pp. 125-139.
40. Hessler, M., Görtz M. 2008: Basiswissen ERP-Systeme. W3L-Verlag, Herdecke, Witten, 406 p.
41. Holsapple, C. W., Sena, M. P. 2003: The Decision Support Characteristics of ERP Systems. International Journal of Human-Computer Interaction, 16(1) p.101-123.
42. Homburg, C., Rudolph, B. 1999: Customer satisfaction in industrial markets: dimensional and multiple role issues. Journal of Business Research, 52, pp.15-33.
43. Hong, K-K., Kim, Y.-G. 2002: The critical success factors for ERP implementation: an organisational fit perspective. Information & Management, 40, pp. 25-40.
44. Houdek, F., Stupperich, M. 2010: Vorlesung „Management von Softwareprojekten. Houdeck 2002-2010, Script University of Ulm, p.66.
45. Ifm Bonn, Statistics 2011. www.ifm-bonn.org

46. Infinedo, P. 2007: Interactions between organisational size, culture, and structure and some IT factors in the context of ERP success assessment: an exploratory investigation. Journal of Computer Information System, pp. 28-44.
47. Jacob, O., Uhink, H-J. 1998: SAP R/3 im Mittelstand. Vieweg Verlag. 358 p.
48. Jacoby, D. 2006: Thinking Big, Midsize companies and the challenges of growth. Economist Intelligence Unit (Ed.), pp. 1-28.
49. Jutras, C. 2009: Mid-size companies need ERP now more than ever. MBTmag.com, p. 13.
50. Kahneman, D., Tversky, A. 1979: Prospect Theory: An Analysis of Decision under Risk. Econometrica, Vol. 47/2, pp. 263-292.
51. King, W. R. 2005: Ensuring ERP implementation success. Information System Management, p. 83.
52. Kirsch, W. 1970. Entscheidungsprozesse I. Verhaltenswissenschaftliche Ansätze der Entscheidungstheorie. Wiesbaden, Gemany, Beriebswirtschaftlicher Verlag Dr. Th. Gabler, 142 p.
53. Klose, W. 1994. Ökonomischen Analyse von Entscheidungsanomalien. Europäische Hochschulschriften, Peter Lang GmbH. 239 p.
54. Kroeber-Riel, W., Weinberg, P., Gröppel-Klein, A. 2009: Konsumentenverhalten. 9. Aufl., Vahlen Verlag, München, 825p.
55. Lamnek, S. 2005: Qualitative Sozialforschung. Beltz Verlag, Weinheim, Basel. 4th Edition. 808 p.
56. Lanninger, V. 2009: Prozessmodell zur Auswahl betrieblicher Standardanwendungssoftware für KMU. EUL Verlag 1st Edition. 535 p.
57. Laukkanen, S., Sarpola, S., & Hallikainen, P. 2007. Enterprise size matters: objectives and constraints of ERP adoption. Journal of Enterprise Information Management, 20(3), pp. 319-334.
58. Laux, H. 2007. Entscheidungstheorie. Springer Verlag, 7th Edition. 540 p.
59. Laux, H., Liermann F. 2003: Grundlagen der Organisation. Springer Verlag, 5th Edition. 667 p.
60. Lee, Z. & Lee, J. 2000: An ERP implementation case study from a knowledge transfer perspective. Journal of information technology, 15, pp. 281-288.
61. Li, Y. 2011: ERP adoption in Chinese small enterprise: an exploratory case study. Journal of Manufacturing Technology Management, 22(4), pp. 489-505.
62. Loizos, C. 1998: ERP: Is It the Ultimate Software Solution? Industry Week.
63. Lotto, P. 2006: Befriending your ERP System. Electrical Wholesaling, p. 54-56.

64. Mai, J., Retting, D. 2011: Ich denke, also spinn ich. Deutscher Taschenbuch Verlag. 384 p.

65. Markus, M. L., Axline, S., Petrie, D. & Tanis, C. 2000: Learning from adopters' experiences with ERP: problems encountered and success achieved, Journal of Information Technology, 15, pp. 245-65.

66. Mayring, P., 2002: Einführung in die Qualitative Sozialforschung. BELTZ Verlag, 5th Ed., 170 p.

67. Melé, D. 2010: Practical wisdom in managerial decision making. Journal of Management Development, 29(7/8), pp.637-645.

68. Mieg, H. A., Näf M. 2005: Experteninterviews. 2nd Edition. Institut für Mensch-Umwelt-Systeme (HES). ETH Zürich, 26 p. http://www.mieg.ethz.ch/education/Skript_Experteninterviews.pdf., 17.07.2011.

69. Mintzberg H.; Westley. F. 2001. Decision making: It's not what you think. MIT Slon Management Review, Spring, pp. 89-93.

70. Negahban, S. S., Baecher, G. B. & Skibniewski, M. J. 2012: A decision-making model for adoption of enterprise resource planning tools by small-to-medium size construction organisations. Journal of civil engineering and management, 18(2), p. 253-264.

71. Neuert, J., Hoeckel, C.A., Woschank, M. 2014. Measuring Rational Behavior and Efficiency in Management Decision Making Processes – Theoretical Framework, Model Development and preliminary Experimental Foundations. Management Studies. ISSN 2328-2185 i.p. 25 p.

72. Neuert, J., 2011, Bericht für das Justizministerium Rheinland-Pfalz, Forschungsbericht 2010/11 Fachhochschule Kufstein Tirol.

73. Neuert, J. 1987: Planungsgrade. Verlag René F. Wilfer. 358 p.

74. Neumann J., Morgenstern O. 1944: Theory of games and economic behavior. Princeton University Press. 60th Ed. 2004. 625 p.

75. No author. Kommission der Europäischen Gemeinschaften 2003: Empfehlung der Kommission vom 06.05.2003 betreffend der Definition der Kleinstunternehmen sowie der Kleinen und Mittleren Unternehmen. (Ed.) Amtsblatt der Europäischen Union, Brüssel

76. Nutt P.C., Wilson D.C. 2010: Decision making. John Wiley & Sons Ltd. 698 p.

77. Oberstebrink, T. 2014: So verkaufen sie Investitionsgüter. Springer Verlag. 159p.

78. Oschischnig, U. 2013. Statistical Yearbook 2013. Wirtschaftskammer Österreich, 99p.

79. Pal, H.R., Pal A.M, Tourani P. 2004: Theories of Intelligence. Everyman's Science, Vol. 39, Issue 3, pp. 181-192.

80. Palanisamy, R., Verville J., Bernadas, C. & Taskin, N. 2010: An empirical study on the influences on the acquisition of enterprise software decisions. Journal of Enterprise Information Management, 23(5), pp. 610-639.

81. Percin, S. 2008: Using the ANP approach in selecting and benchmarking ERP systems. Benchmarking: An international journal, 15(5), pp. 630-649.

82. Perera, H.S.C., Costa, W.K.R. 2008: Analytic Hierarchy process for selection of ERP software for manufacturing companies, Journal of Business Perspective, 12(4), pp. 1-11.

83. Peyton, R.M., Pitts S., Kamery R.H. 2003: Consumer Satisfaction/Dissatisfaction (CS/D): A Review of the Literature prior to the 1990s, Allied Academies International Conference, Proceedings of the Academy of Organisational Culture, Communications and Conflict, 7 (2), pp. 41-46.

84. Polancic, G. 2010: Empirical Research Methods Poster. University of Maribor Faculty of Electrical Engineering and Computer Science. http://researchmethods.itposter.net.

85. Popper, K. 1966: Logik der Forschung. 2. Edition. Tübingen, 441 p.

86. Przyborski, A., Wohlrab-Sahr, M. 2009: Qualitative Sozialforschung. Oldenburg Verlag, 2nd Edition. 403 p.

87. Quiggen, J. 1993: Generalised expected utility theory. Kluver Academic Publishers Massachusetts, Dordrecht, The Netherlands, p. 9f.

88. Rahardjo, E. 2006: Decision making in Information Technology Acquisition: A system analysis approach. Information System Analysis (IS6840), Uni. of Missouri, St. Louis.

89. Rehkugler H., Schindler V.: 1989. Entscheidungstheorie. Verlag V. Florentz, 4th Ed., 337 p.

90. Rieger, A.:2010. Aktuelle Entwicklungen im ERP-Markt. IPL-Magazin 12. July 2010.

91. Roth, G. 2008. Persönlichkeit, Entscheidung und Verhalten. Warum es schwierig ist, sich und andere zu ändern. 4th Edition. Stuttgart, Germany, Klett-Cotta, 349 p.

92. Salinger, E. 1988: Betriebswirtschaftliche Entscheidungstheorie. Oldenburg Verlag. 2nd Edition. 214 p.

93. SAP (Ed.) 2008: Mehr Leistungsfähigkeit und Effizienz für prof. Wachstum. SAP Lsg. Mittelstand, p.1-13.

94. Scheer, A.-W., Habermann, F. 2000: Marking ERP a Success. Communication of the ACM, 43(4), pp. 57-61.

95. Schilling, Volker M. 2011. Was den Mittelstand erfolgreich macht. BF|M Spiegel 2/2011, p. 9f.

96. Schlichter, B. R., Kraemmergaad P. 2010: A comprehensive literature review of the ERP research field over a decade. Journal of Enterprise Information Management, 23(4) pp. 486-520.

97. Schmitz, C., Biermann, P. 2007: Beschaffungsprozesse mittelständischer Unternehmen. ZfKE –Sonderdruck.

98. Schnell, R., Hill, P. B. & Esser, E. 2008: Methoden der empirischen Sozialforschung. Oldenburg Verlag, 8. Edition. 589 p.

99. Schwarber, P. 2005. Leaders and the decision making process. Management Decision, Vol.43 No. 7/8, pp. 1086-1092.

100. Scott, R.W., Davis G.F. 2007: Organisations and Organising. Pearson International Edition. 452 p.

101. Shaul, L., Tauber D. 2012: CSFs along ERP life-cycle in SMEs: a field study. Industrial Management & Data Systems, 112(3) pp. 360-384.

102. Shehab, E.M., Sharp, M.W., Supramaniam, L. & Spedding, T.A. 2004: Enterprise Resource Planning, An integrative review. Business Process Management Journal, 10(4), pp. 359-386.

103. Shiau, W.-L., Hsu P.-Y., Wang, J.-Z. 2009: Development of measures to assess the ERP adoption of small and medium enterprises. Journal of Enterprise Information Management, 22(1/2), pp. 99-118.

104. Simon H. A. 1997: An Empirically based Microeconomics. Cambridge, UK, Cambridge University Press.

105. Simon H. A. 1978: Rational Decision-making in Business Organisations. Novel Memorial Lecture, Carnegie-Mellon University, Pittsburgh, Pennsylvania, USA, Economic Science, pp. 343-371.

106. Simon H. A. 1957: Models of Man. Social and Rational: Mathematical Essays on Rational Human Behavior in a Social Setting. New York. Wiley and Son.

107. Snider, B., da Silveira, Giovanni J.C. Balakrishnan & Jaydeep 2009: ERP implementation at SMEs: Analysis of five Canadian cases. International Journal of Operations & Production Management, 29(1) pp. 4-29.

108. Soh, C., Kien, S., Tay-Yap, J. 2000: Cultural fits and misfits: is ERP a universal solution? Communications of the ACM, 43(4), pp. 47-51.

109. Somers, T.M., Nelson K.G. 2003: The impact of strategy and integration mechanisms on enterprises system value: empirical evidence from manufacturing firms. European Journal of Operational Research, 146, pp. 315-338.

110. Stegemann, A.; Konradin Studie. 2011: Einsatz von ERP-Lösungen in der Industrie. Konradin Mediengruppe, Leinfelden-Echterdingen, pp.1-142

111. Sternard, S., Gradisar M. & Bobek S. 2011: The influence of external factors on routine ERP usage. Industrial Management & Data Systems, 111(9), pp. 1511-1530.

112. Sumner, M., Bock, D. & Giamartino, G. 2006: Exploring the linkage between the characteristics of IT project leaders and project success. Information System Management. pp. 43-49.

113. Sußner, C., Kuckartz, U. 2005: Das Experteninterview in der Bildungsforschung. Phillips-Universität Marburg, Fachbereich Erziehungswissenschaften.

114. Swan, J.E., Oliver, R.L. 1984: The factor structure of equity and disconfirmation measures within the satisfaction process. University of Alabama, Birmingham, pp 1-9.

115. Trimi, S., Sang, M. L., Olson, D. & Erickson, J. 2005: Alternative means to implement ERP. Industrial Management & Data Systems, 105(2), pp. 184-192.

116. Verville J., Palanisamy, R. & Bernadas, C. 2010: Cultural Influences on the Decision Process for Acquiring Enterprise Software: A Comparison of Mexico and the United States. IJGMS, 2(2), pp. 35-66.

117. Verville, J., Harlingten, A 2003a: A six-stage model of the buying process of ERP software. Industrial Marketing Management, 32, pp. 585-594.

118. Verville, J., Harlingten, A. 2002a: Analysis of the decision process for selecting ERP software: a case of the Keller Manufacturing. Emerald Database, pp. 423-432.

119. Verville, J., Harlingten, A. 2002b: An investigation of the decision process for selecting an ERP software: the case of ESC. Management Decision, 40(3), pp. 206-216.

120. Verville, J., Harlingten, A. 2003b: Information searches: a two-dimensional approach for ERP acquisition decision. Journal of information Science, 29(3), pp. 203-209.

121. Verville, J., Bernadas, C., Halingten, A. 2005: So you're thinking of buying an ERP? The critical factors for successful acquisitions. Journal for Enterprise Information Management, 18(6), pp.665-677.

122. Violino, B. 2008: The Next-Generation ERP, Cioinsight (Ed.), pp. 54-57.

123. Wallau, F. 2006: Mittelständische Unternehmen in Deutschland. p. 9-34. In Unternehmensführung im Mittelstand. Schauf, Malcom. Rainer Hampp Verlag. 279 p.

124. Wallau, F. 2011: Familienunternehmen- Das Herz der deutschen Wirtschaft. Festrede. BF|M Spiegel 3/2011, p. 3.

125. Welge, M.; Fessmann, K. D. 1980: Effizienz, organisatorische. Grochla, E. (Hrsg.): Handwörterbuch der Organisation, pp. 577-592.

126. Wong, A., Chau, P., Scarbough, H., Davison, R. 2005: Critical Failure Factors in ERP implementation. 9th Pacific Asia Conference on Information Systems (PACIS 2005) Bangkok Thailand, pp.492-505.

127. Wu, J.-H. ,Wang, Y.-M. 2006: Measuring ERP success: the ultimate users' view. International Journal of Operations & Production Management. 26(8) pp. 882-903.

128. Yin, R.K. 1989: Case Study Research. Sage Publications Inc, Newbury Park CA USA 181 p.

129. Yüksel A., Yüksel F. 2008: Consumer Satisfaction Theories: A Critical Review. Nova Science Publications Inc., New York, Chapter 4, pp. 65-89.

130. Zabjek, D., Kovacic, A., Stemberger, M., Indihar A. 2009: The influence of business process management and some other CSFs on successful ERP implementation. Business Process Management Journal, 15(4), pp. 588-608.

Internet Sources

131. http://www.answers.com/topic/enterprise-resource-planning#ixzz1fl4ztjGA, [13.12.2011, 11.57 PM]

132. Eyes Wide Open, Tips on Strategic, http: //www.smallbusinesshq.com.au/factsheet/20305-tips-on-strategic-tactical-and-operational-decision-making.htm. [27.06.2011, 13.25h]

133. ISO Standard regarding software quality, ISO9126 revised in 2011 to ISO25010. http://www.iso.org/iso/home/store/catalogue_ics/catalogue_detail_ics.htm?csnumber=35733

134. No Author, Indian ETD Repository @ Inflibnet, http://shodhganga.inflibnet.ac.in/bitstream/10603/4835/13/13_chapter%204.pdf, [14.09.2014, 13.52.PM], p.90-122.

135. http://www.managingautomation.com/techmatch/erp-buyers-guide.aspx [12.12.2011, 13.15 PM]

136. Oxford Online Dictionary Term: criterion; http://oxforddictionaries.com/definition/english/criterion?q=criteria, [03.12.2012 9.26 PM]

137. Oxford Online Dictionary Term: signify; http://oxforddictionaries.com/definition/english/signify; [29.11.2012 10.12 AM]

138. Statistics, www.ifm.uni-mannheim.de (Institute für Mittelstandsforschung)

APPENDIX

Appendix 1 - List of Criteria

Auswahlkriterien ERP System		
		Anforderungen
Strategie und Organisation		
	Geschäftsstrategie, Kultur und Vision	Anbieter passt zu Struktur
	Organisatorische Einflussfaktoren	Größe, Länder, Sprachen
	Kosten, Kapazitäten…	Kalkulierbares Risiko
	Verläßlichkeit, Sicherheit, Performance	Das System sollte diese Kriterien voll abdecken
	Standortübergreifende Lösung	Gibt es eine standort- / länderübergreifende Lösung
	Benutzerverwaltung	Detailliertes Benutzerkonzept / Berechtigungen im Standard
	Flexible einfache Handhabung und Compatibility	Endanwender freundlich - Oberfläche verständlich
	Langfristige Flexibilität - deckt Wachstum ab	Flexibel erweiterbar
Geschäftsprozesse		
	Notwendige Geschäftsprozesse integriert.	Funktionaler Fit, muss im Detail verglichen
	Zeitlicher Plan der Einführung und Umfang der Prozesse	Einführbarkeit - passt zu Standard des Providers
	Volle Integration, klare Schnittstellen	Alle Module - Bereiche integriert
	Passt mit Geschäftsprozessen zu einer innovativen Fertigungsfirma	F&E abgedeckt
Technologie und IT Strategy		
	Best Fit mit Hardware Anforderungen, Systemgeschwindigkeiten und Echtzeitdaten	Welche Anforderungen an Hardware? Welche Betriesbsysteme werden unterstützt,
	Datenbanken + Middleware	Welche Datenbanklösungen werden
	Systemtechnische Unabhängigkeit, kontinuierliche Erweiterung, Marktanpassungen	Wie oft Releasewechsel? Welche Strategie dazu?
	Liste der technischen Grundvoraussetzungen; Integrierbarkeit, Anpassungsfähigkeit, Flexibilität und	
	Software Methodik und technische Wartung	Wie programmiert - open source?
	Schnittstellenkonzept oder offene Lösung	Open Source oder gutes Schnittstellenkonzept -
	Alle Funktionalitäten voll integriert.	
	Kundenspezifische Anpassungen	Wie gelöst?
	Backup / Restore / Archivierung	Was wird im Standard angeboten?
	Nur als SaaS (Cloud)	Welche Varianten sind möglich?
	Hosting oder in-Premise Lösung	Was bietet der Provider und was ist
	Lizensierungsmodell	Welche Varianten sind möglich?
ERP Provider / Lieferant		
	Marktposition, Größe, Finanzkräftigkeit und Stabilität	Ein stabiler Partner? Wie lange am Markt?
	Vertriebskonzept - Agenturen oder eigene Beratung / Betreuung	Was sind die Pakete? Wer verkauft was?
	Branchenkenntnisse, lokale Referenzen	Besuche möglich?
	Langfristige Kompabilität	Link zu Technologie
	Team für ERP Einführung	Wirkt kompetent, ist verfügbar, ist flexibel
	Verfügbarkeiten	Man wird als Partner wahrgenommen
Wirtschaftlichkeit		
	Aufstellen einer Kostenanalyse	Klare Darstellung der Kosten - ggfs Nutzen.
	Service und Unterstützung - Wartungsverträge	Was kommt dann?
	(Streichen)	Strategie (siehe IT?)
	Anwendungsfreundlich	Was sagen die Anwender?
	Schulungssystem, Schulungsmaterial und Online Hilfe verfügbar	Dokumentation und Schulung

Appendix 2 - Questionnaire for the Semi-structured Expert Interviews

Expert Interview – for Experts which implemented an ERP system

1. Overview of the company (specifics, numbers, sites)
    a. Just a basic overview
    b. Overview of possible IT department (Responsibilities and organisation structure)

2. Information about the interviewed expert (name, position, how long in company, ..)
    a. Why is he an expert in this subject?
    b. Is he representative for a specific group of experts?

3. Information about the ERP/IT system and landscape
    a. Which systems are you currently using - brand?
    b. Which area is using which system - scope?

4. Story about the implementation
    a. Why was it needed? Documented?
    b. When was it implemented?
    c. Who selected the system?
    d. External support?
    e. How long took the preparation / implementation process?
    f. How were the implementation process structured / organisation structure?
    g. Did you follow an implementation plan?
    h. Estimated time (%) ratio planning /selection/implementation?

5. Decision for the specific system
    a. Who made the decision? Why?
    b. Was anybody else / a team involved
    c. Decision made on which basis?
    d. Should more people been involved?
    e. Time pressure? Scale 1-10 where 1 means no time pressure
    f. Money pressure? Scale 1-10 where 1 means no money pressure

6. Satisfaction about the system? Scale 1-10 where 1 means not satisfied at all
    a. Are you overall satisfied?
    b. Do you measure it? If yes, how do you measure it and what are the results?
    c. Do you have a supporting reporting?

7. Cost of the system?
    a. Do you know the implementation cost? Ca. Euro?
    b. Do you know the running cost? Monthly Euro?
    c. Do you use permanent external support?

8. Lessons Learned?
    a. What would you do different the next time?
    b. Do's / Don'ts
    c. If you have to select another system – how would you start?

Appendix 3 - Details about Execution of Semi-structured Expert Interviews

As stated, expert interviews are one method which is usually used in a newer subject and where it is very difficult to get feedback anonymously e.g. via questionnaires. The advantage of semi-structured interviews is the comparability because they are based on a questionnaire which is used as a guideline.

Between autumn 2010 and spring 2012 - 28 expert interviews have been executed. Therefore 41 companies have been contacted. This is a very good result given the tight time schedule of an expert and a usual return rate under 20%. The experience, the personal contacts and the locations nearby turned out to be of great advantage in order to get the appointments.

Selection:

According to the defined limitations for this research (see chapter 2.8) the companies have been selected. The southern part of Germany has been chosen and production companies in this region inquired. As stated and defined in chapter 2.2 this part of Germany is very representative regarding small and medium-sized companies. By concentrating on this region possible confronting factors were excluded such as: infrastructure, market and political environment.

Figure: Geographical region, created by author 2012

According to the defined selection criteria the following results according to the demographic criteria of the companies can be stated:

- Companies are in the same geographical region
- Companies mainly of the same industry

- All companies are already working with the implemented ERP system
- Size of the companies small or medium-sized according to defined requirements
    - Small 13
    - Medium 15
- In total over 50 companies have been contacted. For about 41 companies the interview made sense according to the defined criteria. 13 companies decided not to participate and 28 companies participated.

Every individual interviewed person can be identified as an expert (defined chapter 3.4.3). In addition she/he has been asked in detail about the expertise, which was confirmed stating they all have many years of experience and a very high seniority.
In addition more information about the interviews are listed:

- Years of experience:
    - Years of experience 5-10 years // 11 people out of 28
    - Years of experience over 10 years // 17 people out of 28
- Level of seniority.
    - 18 are IT department leads CIOs, 6 are CEOs / owners, 4 are professors and/or consultants which are working with IT leads or CEOs.

- Gender:
    - 26 experts are men. 2 experts are women.
- Execution of the interview
    - 10 interviews executed in person and 18 via telephone.
      Only about 1/3 of the interviews had been conducted in person. But much more interviews had been scheduled in person and then postponed to a telephone interview. It was a door opener to offer a personal interview.

Questionnaire

For the interview a questionnaire was created and sent to the interviewee up front. The questionnaire (see appendix 2) is divided in five sections which are mainly related to the detailed propositions.

Section 1: General questions.
Section 2: Information about the ERP System.
Section 3: Story of the implementation.

Section 4: Story of the decision making process (selection).
Section 5: Information on satisfaction.

In total there are 28 questions where 25 mainly been asked and discussed. The 3 questions about detailed costs seemed very interesting in the beginning but interviewees did not want to provide the information. After some interviews the details didn't seem that relevant anymore and the question had been taken out. The answer would provide numbers which couldn't be compared and the more meaningful question was 5f, the question on cost / budget pressure. The question about the priorities between time and cost gained interest and supported additional propositions for a paper presented at a conference, as well as some additional input for the main research question.

Usually an interview took one hour, in person about 30 minutes longer, due to the fact that mainly additional topics have been covered, company presentations provided and sometimes more than just one interviewee participated.

All interviews have been documented according to the questions and related detailed information. 18 interviews were recorded. For the other 10 interviews recording was not permitted. Two companies send in addition the feedback in writing. All interviewees are open to be consulted again in case of further questions.

Analysis / Details

The details of each company are documented in an Excel Sheet – (see appendix 4 and 5).The interviews are documented according to the discussion and along the questions. Most interviews had been in German therefore the 18 interviews recorded are in German as well as the two feedbacks in writing. Naturally all write ups are English.

In general the location for the personal interviews was the office of the CEO or IT-lead – CIO. As a preparation the details of the internet page or any information provided up front have been read. The warm up and general part usually started with an introduction of the participants including the explanation of the purpose of the interview. Sometimes a short marketing presentation or organisation structure was provided.
All interviewees liked to discuss following the questionnaire. Section 1; was introduction and an overview about the company and the expert.

Section 2; the information about the ERP System covered mainly which system was implemented and when as well as the scope of functionality. Sometimes there is a mixture of old systems with specifics for the industry and new ERP systems. Information of the hardware environment was helpful and supported sometimes the decision for a phased or partly implementation.

Section 3; was the story of the implementation. So, mainly all the questions why was a new system required – the trigger – the implementation timeline and the problems along that have been discussed. A lot of information was provided about the structure of the project, details about timeline, people involved and pressure about the different stages.

Even though the selection phase (section 4) seems not logical after the implementation question of section 3 but it needs the discussion about it before you usually discuss why some decisions been made. In terms of building up a relationship with the interviewee section 4 needed more trust to complain about timeline, management decisions and the project setup. Section 3 and 4 have been included the issued that were discussed most.

In section 5; the important question about satisfaction was asked but very vaguely answered. Not because they haven't been satisfied but no one could really specify how satisfied they are and why, not thinking of criteria and clear measures.

The last part was more or less a loose discussion about lessons learned and things they would do differently if they would have to do a selection and implementation again. These results are summarised in the next section.

The telephone interviews went the same way but all of them have been shorter mostly less than one hour. Small talk was very limited and dependent on the personality of the person they stick even more to the structure of the questions.

Even though, all interviews have been executed the same way some might be more some less influenced by subjective factors of the interviewer or interviewee. The interviewer tried to obviate this as much as possible by choosing the same style and atmosphere for each interview.

Results

All interviews have been analysed in detail and compared with the hypothesis and propositions. In chapter 0 all results of the case studies and expert interviews set in relation to main research question. Therefore the details of the questions are not documented again.

The ‘lessons learned’ have been broken down to the following questions “What would you do different the next time?” “What are the suggested do’s and don’ts?” “How would you start the next time?” Regardless of success or failure that section gave the interviewees the possibility to either reconfirm a very good approach or explain the reasons for failures.

Subsequent the most findings extracted from the expert interviews are listed into 30 different ERP implementations at a SME production company in south Germany (key statements quoted multiple times):

- Selection Process
    - A selection process should be done
    - Take time for selection
- People involved
    - Employ external consultants with deep industry knowledge
    - Define a project lead and release the person from the daily business
    - Functional departments need to be involved
    - Involve end users early in the process
    - Define clear responsibilities
    - Owner and board need to support the project 100%
    - Relationship to provider is essential

- Scope
    - Define clear scope
    - Define clear goals and priorities
    - Define functional requirements
- ERP System
    - Do rapid prototyping
    - Early reality check real of functionality
    - ERP should be selected at industry fair not at IT fair
    - Compare solutions and see references within the industry

Other very helpful statements to be thought of before starting a selection process:

- There is not the one and only right solution

- Do not think you are the one and only with this functionality. Most of your requirements will be available in a standard system if you look around in your industry.
- Never just copy the old system to the new system ever again
- Decision making depends on the age of the owner/decision maker. Some findings based on long year experience:
    - Older generation is happy to make decisions, pragmatic and taking all consequences. Set up a team based on trust.
    - Younger generation too uncertain to make strategic decisions, involve much more external consultants, have more sources these days to collect information from and the process takes usually much longer if a decision is done at all.
- Level of complexity increased for SME companies the last years significantly

In summary all expert interviews provided very valid input and feedback to the propositions and outlined very good results for the detailed analysis of the main research question. They provided input and reviewed the developed model. During the cause of the interviews the model developed using the interview feedbacks and additional input to a more mature stage being tested by the case studies later on.

Appendix 4 - List of Expert Interviews

	Expert Interviews Dissertation							
	Position	**Address**	**Size**	**Interview confirmed**	**Best Fit**	**Interview Date**	**in person /telephone**	**Write Up / Scan**
CS 1	IT-Lead - CIO	Raubling	small	yes	yes	19.06.2012	in person	Notes from interview
CS 2	IT-Lead - CIO	Sauerlach	small	yes	yes	26.06.2012	telephone	Notes from interview
1	IT-Lead - CIO	Thansau	medium	yes to do -ar	yes	04.08.11 9h	in person - Thansa	Notes from interview
2	IT Project Lead	Edinburgh	medium	yes, 09.06.1	yes	09.06.2011	Telephone	Notes from interview
3	Prof. Informatik	Rosenheim	small	yes, 22.07.1	yes	22.07.11 14-14.5	in person - 08031-8	Notes from interview
4	IT-Lead - CIO	Raubling	medium	yes, 28.07.1	yes	28.07.11 10-11.1	in person - 08035-8	Notes from interview
5	IT-Lead - CIO	Mainz	medium	yes	OK	20.07.11 12-13h	Telephone - 06131	Notes from interview
6	IT-Lead - CIO	Raubling	medium	yes	OK	13.07.11 12h-13	in person - 08035-8	Notes from interview
7	IT-Lead - CIO	Rosenheim	medium	yes, 04.08.1	yes	04.08.11 11h	in person - Thansa	Notes from interview
8	IT-Lead - CIO	Vechta	medium	yes	yes	30.09.11 10h	writing and teleph	Notes from interview
9	CEO	Ismaning	small	yes	yes	30.08.11 9h	in person - Ismani	Notes from interview
10	IT Lead	München	medium	yes	OK	02.09.11 10.35 -	Telephone	Notes from interview
11	IT Lead	Traun (OÖ, AT)	medium	yes	OK	06.09.11 13.30h	Telephone	Notes from interview
12	Marketing and Servic	München	medium	yes	OK	27.09.11 10h	Telephone	Notes from interview
13	IT Lead	AT	medium	yes	yes	03.10.11 10h -10	Telephone	Notes from interview
14	IT Lead	Wasserburg	medium	yes	ok	07.10.11 13h	Telephone	Notes from interview
15	IT Lead	Rosenheim	medium	yes	yes	05.10.11 Telefor	Telephone	Notes from interview
16	CEO	Bad Aibling	small	yes	yes	05.10.11 10.30h-	in person - Heufek	Notes from interview
17	IT Lead	Raubling	small	yes	yes	06.10.11-15.30h	in person - Kirchd	Notes from interview
18	CEO	Rohrdorf	small	yes	yes	Mo, 10.10. 11 14	Telephone - 08032	Notes from interview
19	CEO	Raubling	small	yes	yes	Di, 11.10 9.30h	in person - Raublir	Notes from interview
20	Prof. ERP	Rosenheim	small	yes	yes	12.10 9.30h	in person - Rosen	Notes from interview
21	CEO	Rosenheim	small	yes	yes	Do, 13.10.11 15l	Telephone	Notes from interview
22	CEO	Germaring	small	yes	yes	13.10.2011	writing and teleph	Notes from interview
23	IT-Lead - CIO	Rosenheim	small	yes	yes	24.10. 08.30h	Telephone - 08031	Notes from interview
24	IT-Lead	Kronberg	medium	yes	yes	16.04.2012	writing and teleph	Notes from interview
25	Marketing and Servic	Vagen - Bavaria	small	yes	yes	25.05.2012	Telephone	Notes from interview
26	IT-Lead - CIO (chan	Salzburg / Wels	medium	yes	yes	04.06.2012	Telephone	Notes from interview
27	IT-Lead - CIO	Salzburg / Wels	medium	yes	yes	04.06.2012	Telephone	Notes from interview
28	ERP IT Lead	Kolbermoor	small	yes	yes	04.06.2012	Telephone	Notes from interview
1	CEO	Hamburg		deferred	yes			
2	Ex CEO	Königstein Taunus		deferred	OK			
3	Prof. Informatik	Rosenheim		deferred	OK			
4	CEO	München		deferred	yes			
5	to talk to CEO	Stephanskirchen		deferred	yes			
1	IT-Lead - CIO	Mainz		No	OK	deferred		
2	CEO	Radebeul		No	yes	outgesourced		
3	IT Lead	Brannenburg		No	yes	no interest		
4	CEO	Kolbermoor		No	yes	no interest		
5	CEO	Kolbermoor		No	yes	no interest		
6	CEO	Bad Aibling		No	yes	no interest		
7	CEO	Bruckmühl		No	yes	no interest		
8	CEO	Bruckmühl		No	yes	no interest		

Appendix 5 - Summary Expert Interviews– Table of all findings

Company	Company Size	Status System	Ratio Planning, Selection	Did you follow a clear process	Right people involved	Right person made decision	Trigger	Focus on Time (1=no pressure)	Focus on Cost (1= no pressure)	Satisfaction (1= not satisfied)	Measured*
1	medium	old system	50%	yes, very structured	yes	yes, a team	growth, international business	5	2	8	no, but working close with departments
2	other	old system	50%	yes, always	yes	yes, a team	growth	8	3	6	not measured
3	other	no or old system	66%	yes, but flexible	usually yes	usually yes	growth, too old system	8	3	6	usually not measured
4	medium	no system any more	20%	yes, high level	yes	yes, key user and owner	Spun off, no system	9	5	7	no
5	other	old system	66%	more or less used as a guideline	yes	yes, all good people been involved	Merger	9	3	7	Only for the bits which are outsourced
6	medium	no system any more	10%	kind of as an upgrade plan	no, more people of the daily business need to be asked	no, not just based on previous experience the decision can be made	Spun off, no system anymore	9	2	6	questionnare once but poor response
7	medium	old system	40%	Yes, defined by consultants	Partly, but more IT people should be involved	No, too much driven by owner - team should have been considered in the details	growth, international business	10	8	7	no, but close to users and external support
8	medium	old system	50%	more or less, the sequence of the subprojects been planned	yes, team of board members, key user and external consultants involved	Yes, team proposal and board decision	growth, international business	4	4	8	no
9	other - small	no system	20%	Yes, always the same stucture	not always, due to time pressure usually decision from top not key user	not always, owner made decision based on reputation. If there is no IT experience it is very critical.	growth and network	8	8	7	no
10	medium - big	old system no maintenance	45%	Yes, standard of consultants	No, too little involvement of IT department	No, too little knowledge cross sites and IT	growth, international business	7	1	7	no
11	medium - big	old self-programmed system	60%	Yes, standard of consultants	Yes, all requirements been considered	Yes, CFO with input from other departments	growth, international business	1	2	8	no, but we would know if not
12	other - big	diverse system landscape	60%	Yes, unfortunately more than one	Yes, a big team of people been involved	Yes, Steering Committee and a team made the decision	common data internationally	8	6	7	no not possible on existing material
13	medium	old system no maintenance	10%	Yes, provided by consultants	No, not a team or key users been asked in detail very specifically not to other systems	No, not really a decision been made. Just run into an upgrade without a strategic view	growth, international business	5	3	6	no
14	medium	no system diverse packages	50%	Yes, classical standard executed	Yes, all relevant people have been considered	Yes, team proposal and board decision with the FH Aachen involved	growth, international business	7	2	7	no, but just sometimes some testing
15	medium	old system no maintenance	50%	Yes, standard of consultants	No, some more functional people and people form sites should have been involved	Yes, team prepared and board decided but it was a HQ decision sites should have been involved	growth, international business	3	3	7	no
16	small	no system manual processes	40%	We will have to	No, more people of the daily business need to be asked	Yes, owners top down	small growth locally	5	7	6	no
17	small	old self-programmed system	20%	Yes, standard of consultants	No, more people of the daily business could be involved	Yes, owners and input form IT leads	growth, international business	8	8	6	no just check complains
18	small	no system	50%	Not really did it step by step	Yes, all relevant people have been considered	Yes, CEO but with a lot of input from relevant departments	small growth locally	2	2	8	no
19	small	no system	20%	No, executed when we had time	No, more end users should be involved but there was no time for that	Yes, CEO decided based on some external information	small growth locally	8	8	5	no
20	other - small	growth different business unit	66%	Need to be set up at the time	Yes, all knowledgeable people have been involved	Yes, the director	small growth locally	3	3	6	usually not measured
21	small	No system	20%	No, executed when we find time	No, more end users should be involved but there was no time for that	Yes, CEO decided based on some external information	No system	8	8	6	no
22	small	Too old system	70%	Not really just sequence provided	Yes, IT and functional	Yes, department lead	Too old system	1	1	6	not needed
23	medium	old self-programmed system	40%	More or less	Yes, all necessary people	Yes, directors, key user and team	Old system no maintenance any more	4	1	8	No
24	other	diverse system landscape	25%	Yes, standard of consultants	Yes, all involved	Yes, IT and functional leads part of strategy	Acquisition of a company	8	4	4	Questionnare sent regulary
25	small	MS Office	30%	More or less	Yes, all necessary people	Yes, the director	Growth and setup	5	1	5	no
26	medium	MS Office - old ERP system	20%	Yes, according to consultants and experiece	Yes, team involved	Yes, board of directors	Growth and old system	9	4	6	no
27	medium	Old system and strategy	25%	Yes, but not a good process took fare too long	No, because even people beedn asked they had no vote	Yes, board of directors	International growth	5	7	6	No
28	small	no old system	20%	Kind of	Yes, more people would hinder	Yes, director	Growth	9	2	7	No

Appendix 6 - Detailed Execution of Case Study I

Situation

Company Profile:

The company, founded in 2007 is a very young and rapidly growing company. The owner is the main inventor of a new innovative product. He is a carpenter building high end luxury kitchens and runs this business at the same time. He is working as the CEO of KEC and is involved in the daily business. The head quarter is situated in Bavaria. In 2010 there were 20 people employed including a network of sales representatives all over Germany. The turnover was four million Euros. The growth strategy is to gain about one per mill of the German and European market. Given the current contracts with the producers of kitchen this target is realistic and the turnover would rise up to about 25 Million Euro in the next 5-8 years. In spring of 2012 the company proved to be on that track given the increase up to 28 employees and an expected turnover of 8-10 Million by the end of 2012. Sales, in 2010 dominated by the German market, expanded to Austria, Switzerland, Belgium, Luxemburg, Netherlands, UK and Australia in 2012.

Besides the development of the patented product the company has to fulfil all business processes of a production company: Design and development of all products, purchase, sales including the support of all sales representatives, customer relationship management. Even though the production is subcontracted to local companies but KEC has to maintain stock, Finance and Controlling, Human Resource Management and IT.

Background; leading to the decision to acquire an ERP

The company started as part of a carpenter's shop designing luxury kitchens with a team of 2-4 people. After launching the exhaust hood the requirements changed completely from a small, local business to a mass production for a much bigger region. IT-support was a small finance and tax system which was able to handle German orders and invoices, supported by many Excel Sheets. These sheets have been maintained by one person and there was a very high dependence on the knowledge of this person. The system was at its limits. There was a high risk of a significant loss of data, information and clients. In addition the sales department started in Austria, Switzerland and Benelux successfully. The system wasn't applicable to cover any foreign country. Furthermore many manual processes were involved. With the export the need of reporting and controlling increased as well and the owner recognized the need of additional IT-Support. The management defined the need for professional IT support: Foremost covering all functionality of the customer relationship management (CRM) part of

the ERP System to track all potential clients and client data in Europe, all functions of the 'order to cash' cycle and set up a proper controlling, forecasting and reporting structure.

Relevance

The Company is relevant for this research as a company case study because it fulfills all criteria (illustrated in chapter 2.8):

- Small company about 20-30 employees, so between the defined 10-150 IT Users
- Geographically situated in south of Germany – Bavaria
- Production Company
- Trigger for the selection is international growth which leads to a Software selection
- Just before the process of ERP selection - Time
- People with very little time and knowledge about the process
- Neither defined requirements nor business processes nor method at the starting point

The project seemed very interesting to check the first propositions and proof the structured method before, during and after the selection point in time.

Analysis /Execution

Analysis of the decision making process

As it is a small company, all major investments are decided by the CEO, the owner. Given he is a very experienced carpenter and the inventor of the product, he usually decides by expertise, gut feel and spontaneously in the situation. Even long-term and expensive strategic decisions like entering a new market or setting up a new building are made mainly by him. This is a normal approach for this size of a business.

Considering the implementation of a new software as a big challenge the perceived the need of external help. An independent, personally known IT expert was asked for advice which system to use. According to the background and knowledge a detailed selection process and support was proposed.

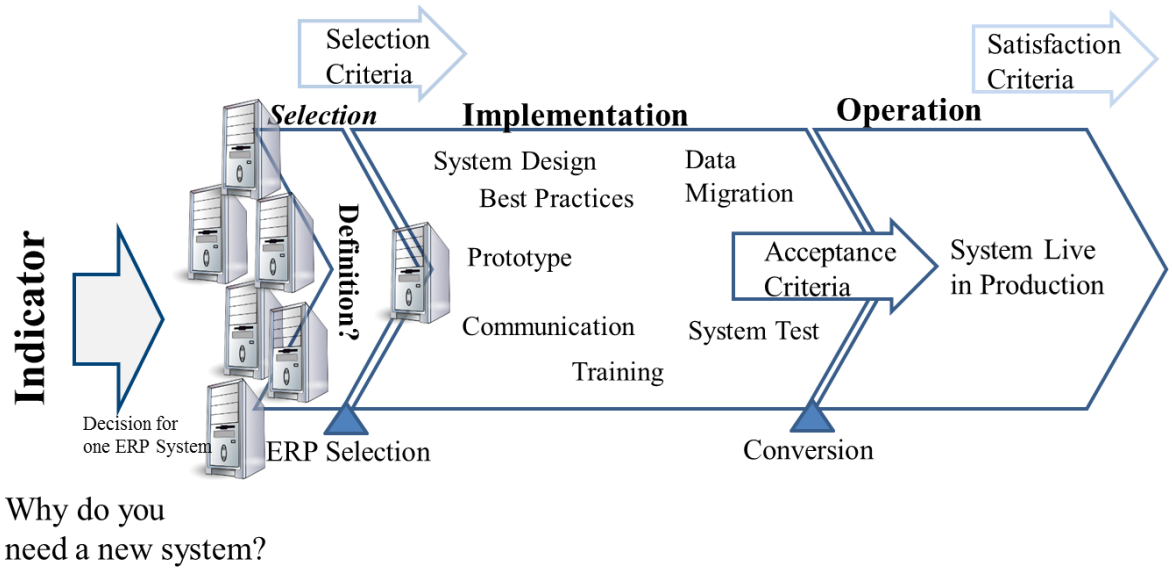
Initiation for the ERP system:

The trigger to think about an acquisition of an ERP system was the international and rapid growth of the company. The production volumes and sales increased as well as the number of customers. Due to a limited product range the customer relationship management was the highest concern of the owner. The connection to the WEB-page and search engines needed to

be established as well as communication set up in various languages. The handling of the customer information base was at its limits. In addition the controlling and management reporting needed to be restructured according to international needs. Altogether enough reasons underlined the necessity of an ERP system with a strong CRM module.

Model used

Once the decision was made to proceed with the selection of an ERP system, the appointments been arranged between the owner, the sales department lead and the consultant. After clarification what targets should be achieved the detailed process of responsibilities and timeline has been set up. The following process was proposed based on literature review and experience. This gave weight stressed to the phase of entire selection, even though the timeframe was rather tight.



The process a challenge of current common practice, created by author 2010

During the initial phase of the selection the first list of possible vendors was created based on industry, old systems and specific CRM requirements. About 8 different systems have been discussed in detail according to the defined targets. Corresponding criteria have been worked out.

Requirements – Criteria:

At bigger companies a team of representatives of all sectors is responsible for the selection process.[311] At a SME company there are usually only few or even just one person responsible. Therefore it is very important at the beginning of the selection to collect the requirements of all sectors, starting with the trigger – which is the need for the system.

Need for a new system:

- Defined by the owner, with requirements for management and controlling.
- The internal sales manager, with requirements for CRM functionality preferably integrated with invoicing and finance.
- The main workforce, the sales representatives in the field, use mobile devices and had been independent of the old software, they could be integrated but didn't require it.

While reviewing all business processes and defining the key criteria the CEO was able to set key priorities. His first approach was just to focus on cost and speed. Using all relevant success factors and reviewing possible requirements the high level feedback for the areas changed to these key requirements:

Strategy / Organisation: Should be stable for a longer time, support all areas of growth
Functionality: CRM and reporting, old data should be automatically transferred; later the requirements for an ERP system have been identified according to all business processes.
Technology: Old hardware is reused, no external hosting required, Data should remain in-house
Vendor: No freeware or open source, well established reputable software company
Economic: as cheap as possible – during the selection process a business case was basis for selection. The intangible benefits gained high priority.

A lot of detailed input for the "to-be" processes has been identified during that process and incorporated in the proposal for decision which changed during the course of the selection process with every additional step and input. According to the proposed model the selection criteria have been defined and prioritised involving the key people.

[311] cf. Verville, 2002a, p.427

Project:

After the detailed analysis and definition of the requirements and a review of relevant ERP packages for the industry a long list was created. A student trainee ordered many possible software package samples. After the first very detailed selection three software vendors have been invited to present their products. Two vendors have been interested to present. One turned out to be the favourite after the first round. Surely the vendors promised all functionality and the pricing was incomparable. Without clear requirements and the set of prioritised criteria it would have been extremely difficult to finalise to one product.

People involved:

- CEO / owner as the final decision maker
- Internal sales manager to define structure and prioritise all functional requirements
- Independent external consultant and student trainee to structure and support the process and provide all necessary information
- ERP vendors to present their product and sell it, providing all details according to required criteria

Decision making

The decision for the new system was done after the execution of the proposed selection process. It took about 40% of the time of the entire life-cycle of selection, planning, implementing and testing until the go-live of the system. The decision was made by the owner – CEO with the input of very few key people according to the defined requirements.

The decision was made due to the pure fulfilment of functional requirements; given the very good market position and growth opportunities, cost moved to second priority. The process and discussion took about 6 weeks, much longer as the management team calculated. But during the selection process they had been introduced to a set of selection criteria, rather than the values like costs and benefits. Setting clear priorities to other criteria supported the decision and was a strong and clear basis for the discussion with the vendors.

Results

Results at go live of the ERP system

The selection phase took about 6 weeks. During that time the requirements have been specified, the business processes defined and the success factors regarding strategy, time, cost, provider, hardware and ERP vendors prioritised. A two-step approach for the

implementation has been decided. The CRM part of the system went life after additional 2 month implementation and training right in time for the sales fair and the involvement of the external sales representatives. The entire ERP part including the setup of management reporting, link to purchasing and production as well as finance and taxation went life at year end, so additional 3 month later.
The sales / IT lead was happy with the system as well as the owner according to their defined requirements. They weren't sure about the technical support, the provider will offer, because this part seemed very inflexible, expensive and slow.

Results – Check Point about one year after ERP go live
In spring 2012 an additional expert interview was scheduled to check the satisfaction with the system according to the requirements. The interview took part in two steps; one short interview with the owner and a very detailed one with the sales / IT manager.
The owner confirmed that they are satisfied with system; they can track their customers, do foreign business in a structured way and start being successful even in non-German speaking countries. He is happy with the management reporting and the possibilities he has to communicate with his sales people. Overall he rated the satisfaction with the system very high (on the scale about 8-9).

The interview with the sales / IT representative was more intense due to cover more details. The discussion dealt with the set of defined and prioritised requirements and its degree of fulfilment. The system functionality for the CRM and ERP part covered to a very high extend the defined, required functionality. For the daily business and the connection with the external sales representatives he was very satisfied. The various mobile devices could be connected and the reporting is sufficient. The timing, cost and hardware support worked to their full satisfaction. Only the software adaptations didn't work in the beginning as it started very slow and unprofessional and they changed to a different supplier half a year ago.

In summary the ERP system works to their full satisfaction. Satisfaction and ERP system success can even be broken down in more detail according to all defined requirements and were involving all relevant people.

The table below shows the development of the decision criteria over time. Starting with the definition and prioritisation, as fulfilled at go live and reviewing the criteria to analyse satisfaction a year after go live.

Comparison of the key criteria for ERP selection				
Group of criteria	**KEC first ideas**	**KEC revised after more detailed analysis**	**KEC results at go live**	**KEC results one year after go live**
Strategy / Organisation	A cheap system should be implemented to cover all sales functionality. CEO has clear understanding of his view of company needs.	Management team has been involved. Clear requirements defined and prioritised. Scope completely reviewed. Decision making process structured.	The CRM part went live as planned before an important fair. The external sales people could be trained and connected. The reporting requirements of the CEO been fulfilled after go live of the ERP part 4 month later.	Fit with strategy overall evaluated with a 8 (10 is the best evaluation). Only security, user access and risk-legal was evaluated lower (6). They like their ability to influence the processes as well as how decision and acquisition went (9).
Functionality	Main focus was on all client data to be covered and support for the sales processes. Timeline 4-8 weeks.	Scope extension to a full CRM and ERP system with the full management functionality. Timeline extended to 6 months.	Scope covered as expected. Some changes required over time due to very late specification. But implementation successful in scope.	Functional fit, implementation ability, flexibility, ease of customisation, user friendliness, training and online help are rated 8.
Technology	No internal IT department. The maintenance should remain with the existing supporting IT company.	Old hardware should be reused. Hosting seemed possible for some functionality. Additional software support needed.	CRM sever hosted successfully. ERP server in-house. Solution worked fine with old IT support company.	The technology was overall rated as 9. The integration with others and clear technical concept was rated lower.
Vendor	Would be nice to stay with existing brand	No open source system wanted. No freeware. Requirement to check all packages of existing brand plus packages of packages used by friends and colleagues of the CEO.	CRM & ERP solution was fine but the external consultant company maintaining the reports, forms and interfaces was not very professional. Possible improvements have been identified in the first months.	Vendor been rated with an overall 9. Very satisfied with market position, industry skills, long term stability. The problem with the external software support was solved by changing to a new provider. After almost a year they are very happy with it.
Economical	As cheap as possible. Short term investment and long time service costs should be low (under 5000 Euro).	Cost was not the first priority any more. Price should be OK but very cheap is not an option. High priority on intangible factors like scope extension, hosting and additional	The licences been bought to the extend as needed. Additional budget released for yearly changes, maintenance and hotline.	Economical was rated 6. It is much more expensive as though and calculated in the beginning due to many add ons. On-going service and support is very expensive.

Comparison of requirements along a timeline, created by author 2012

Summary of results according to company I

The acquisition of an ERP system was a new task for the company. The investment accounted for about 1 % of the turnover. The key decision maker and manager had been very busy with the daily business and had not much capacity for an additional project. Their general interest in IT and software is rather low, they had no technical background. Therefore in the beginning the focus was on cost and on the need covering their growth. During the longer selection process they opened up and got a wider perspective and interest in the possibilities the ERP packages offer and prioritised all criteria. The small company had been overextended with this task. The hired consultant led and supported and guided through the process with years of experience. Without an independent or an external experienced person there is the very high risk of taking the cheapest product or the one of the best sales representative. The CEO stated after the implementation that the task, workload and problem were clearly underestimated by him and the one other decision making person. The use of the model was very helpful as well as the details of the selection process and tools and pre-defined set of criteria.

In terms of a measurable result that the selected ERP system was the right one and the company / people are satisfied with it, Company I is on a very good track. It is in the top right corner as indicated in Figure 4-13. The successes criteria have been defined in detail before go live and measured 16 month after go live. In the final interview the five groups of success criteria have been rated with 9/9/8/8/6 where cost was the worst rated with 6 given the system was more expensive as expected up front, but not more expensive as calculated during the selection phase. The company plan to continue to keep the criteria updated while adjusting or adding to the system.

Appendix 7 - Write up final Interview Case Study I

Expert Interview – with IT Lead of Case Study I

Final Interview after executing the project

Setup and Status:

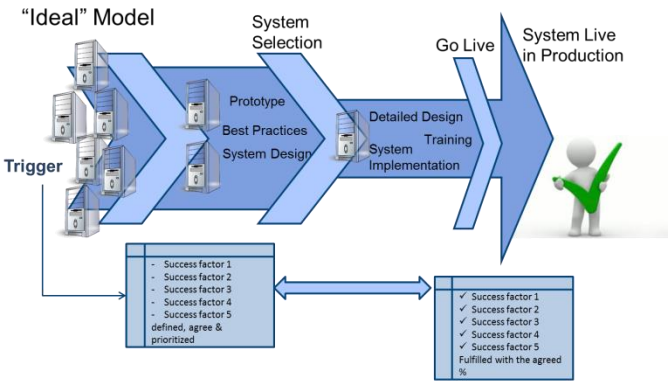
1. **Company:**
   The company is a fast growing company with many sales points in Europe and Australia. The company increasing their customers daily, so a CRM system was necessary.

2. **Project Status:**
   The project was finalized in April 2011.

3. **ERP Status:**
   The CRM system was implemented first in September 2010. The ERP system added in spring 2011. The system is running in production for about 15 month now.

Questions:

Was the executed selection process helpful to structure the selection of the ERP?



The first developed model was a basis for the selection of the CRM system. The selection covered not that many different systems but defined the success factors up front and compared two-three systems until the final decision.

Have the chosen CSF been complete and substantial enough?

The requirements and the input according to the trigger requirements have been analysed, defined and considered in a lot of detail. The groups and detailed factors have been the basis for the selection. The first ideas and requirements have been reflected according to business needs and business best practices. The needs and priorities of the CSF changed in the cause of the selection process. The factors itself have been complete for this point in time.

Comparison of the key characteristics for software selection		
Group	**KEC first ideas**	**KEC revised ideas after more detailed analysis**
Strategy / Organisation	A cheap system should be implemented to cover all sales functionality. CEO has clear understanding of his view of company needs.	Management team has been involved. Clear requirements defined and prioritised. Scope complety reviewed. Decision makin process structured.
Functionality	Main focus was on all client data to be covered and support for the sales processes. Timeline 4-8 weeks.	Scope extention to a full CRM and ERP system with the full management functionality. Timeline extended to 6 months.
Technology	No internal IT departement. The maintanance should remain with the existing supporting IT company.	Old hardware should be reused. Hosting seemed possible for some functionality. Additional software support needed.
Vendor	Would be nice to stay with existing brand	No open source system wanted. No freeware. Requirement to check all packages of exisiting brand plus packages of packages used by friends and
Economical	As cheap as possible. Short term investment and long time service cost should be very cheap (under 5000 Euro).	Cost was not the first priority any more. Price should be OK but very cheap is not an option. High priority on intangible factors like scope extention, hosting and additional reporting.

Have the right people been involved during the selection process? (6d)

> Yes, given it is a small family owned business the owner was involved as well as the sales person who was running IT at the time. Strong input according to reporting and management functions have been given by the owner. The handling of the day to day business was defined and structured by the IT lead. Given it is a small company the right people have been involved.

Did you have a clear trigger to select an ERP system? If yes which one and how did it influence the selection? (3a)

> Yes, the clear trigger was the tremendous growth including the quick growth in a foreign country – Austria and Holland. The current small business solutions didn't function for that type of business. In addition the customer master data was just stored in Excel which was not secure at all.

Was the evaluation process of the CSF efficient enough?

> Reviewing all critical success factors a year after go live we would evaluate it like the following:

Comparison of the key characteristics for software selection		
Group	**Criteria's / Measures**	KEC final eval June 2012
Fit with Strategy / Organisation		**8**
	Business Strategy and Vision (long term flexibility)	8
	Risk, Legal, Cultural influences & Security (user-access concept)	6
	Organisational influences (user buy in, fit with organisation structure)	8
	Interpersonal influences	9
	Acquisition team members, decision making and leadership style	9
Functionality / Business Process Fit		**8**
	Implementation ability (in time)	8
	Functional Fit and full integration of all functions	8
	Flexibility (R&D), ease of customisation and reliability	8
	User friendliness, Traininig, Online Help	8
Technology		**9**
	Technical Criteria: system architecture, integration, performance, compatibility with other systems	8
	Open source for reports, interfaces and enhancements	9
	Choice of appropriate technology very actual databases and methodology	9
	Clear technical concept for releases, upgrades and any technical maintenance	8
Vendor		**9**
	Vendor's position, size, implementation, awards, ... / Market position	9
	External references of vendor from other organisations, industry skills	8
	Financial capability, stability and reliability (long term)	9
Economical		**6**
	Cost and Benefits	7
	Service and Support	5
	Consultancy, after sales management, domain knowledge of suppliers	5

Do you think the right system was selected and why? (6a)

Yes, we are sure it is the right system. All functional requirements are fulfilled and we can do your daily business and even all additional requirements. The functionality fit especially for the purchasing, order management and mobile sales devices. The boss gets all required reports and charts to support his management decisions. Additional ideas and applications can be programmed very flexibly but for additional costs.

What is the opinion of the board?

The owner is very happy to get all supporting reports and information real time. He knows that the current business volume and export requirements couldn’t be handled manually any more.

Appendix 8 - Detailed Execution of Case Study II

Situation

Company Profile:

The company, founded in 2006 is a young, innovative R&D company holding many patents in the heating and cooling area. They have been financed for some years but the core product is getting ready for mass production. The contracts with the first customers are finalized – B-B business – and the production line is in the middle of getting prepared. Currently the focus is at one site in Bavaria but might grow with the customers to other sites or countries. The company employed 30 people, but will grow up to 50 in 2012. There is an urgent need of growth they could sell much more units as sales are limited by production capacity. The confirmed sales forced them into a production plan for the next 5 years which will be very tough even without new products or new clients.

Background leading to the decision to acquire an ERP

Focussing on research and development the entire company runs on Microsoft Products and DATEV. This was sufficient for an R&D business where they never had to build many products therefore the purchasing team was very lean as much as production. The sales, service and quality department didn't exist during development, therefore no business processes have been established. As for many areas there are no master data or master data structures defined. Accounting and HR was done by one person using DATEV. Employing more people and starting a production line requires rethinking of the business processes including the connection to the business partner and the possibility to make business abroad.

Relevance

The Company is relevant for this research as a study because it fulfills all criteria (defined in Chapter 2.8):

- Small company about 30-50 employees so between the defined 10-150 IT Users
- Geographically situated in south of Germany – Bavaria
- Production Company
- Trigger for the selection is growth possibly international
- Just at the beginning to define business processes and ERP selection - Timing
- People with very little time and now knowledge about the acquisition process
- No defined requirements nor business processes nor method at the starting point

The project fulfilled all requirements to test and possible reconfirm the developed model as well as to analyse and prioritise the set of criteria in much detail during the phases.

Analysis /Execution

Analysis and set up of the decision making team to support the selection process

As it is a financed company, the process for selection needed to be very professional and profound. The board of directors asked for a proposal for the decision at the beginning of the year, just in time to start implementation. The team running the selection process was the IT-lead, the production lead and the quality lead, where the latter two just been deployed. Given the big challenge to implement new software on the green field and defining and setting up all business processes from scratch they looked for external help. The company study seemed very interesting fitting the experience and providing the possibility to analyse and test the model and criteria. The selection process was firstly planned for three months.

Given the size and structure of the company a team of an internal and external IT person been defined where the background of the internal IT person was production. A newly employed quality manager, as well as later in the process an employed production lead was added to the team. The team should prepare the decision to present it to the steering board which include the three board members.

Indicator - Trigger for the ERP system

During the research and development phase the company was just using Microsoft Office and DATEV to run the business. Given the volumes this was enough and comfortable. Starting with the production there are much more requirements which cannot be handled without an ERP system. Main requirements are: integration of all processes and master data, Quality Management, handling of serial numbers, sufficient quality management, BDE terminals and purchasing with frame contracts.

Detail triggers: - Production cannot start without system support according to complexity and volume

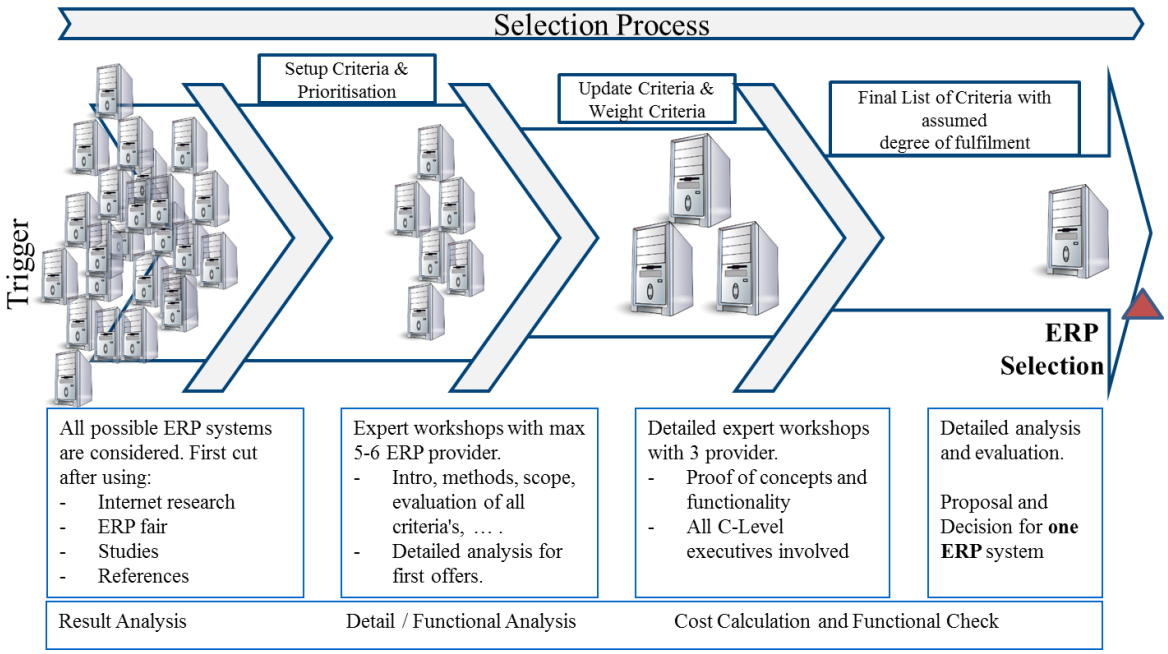
- Support and Service need to track back every single component and article
- Finance needs integrated and real time production cost reports
- Quality management needs to check and track all purchased material
- Growing up to and over 50 people, HR and Finance cannot be handled manually any more

- Growing with the partner the next step into foreign markets will happen shortly. Legal requirements outside Germany need to be fulfilled.
- Sustainable software supporting flexibility and future growth

All these processes with the expected production volume are impossible to be handled manually.

Selection Process used

Leveraging the experience of the literature review and the execution of the company case study with Company I, the selection process was reviewed and more details have been added due to the higher complexity. For a much bigger functional scope and more parties involved an additional step in the selection process seemed relevant. Not all requirements could be defined up front as well as not tested in a single review. Therefore according to the results of the expert interviews the selection phase was even more extended but in a very structured way.



Selection Process and Documents, created by author 2012

During the very initial phase the first long list of possible vendors was created based on industry, specific requirements, input from a study and the input from various meetings at an expert fair, for ERP systems for small and medium-sized companies. This list of about 10 different providers and systems has been discussed within the team in detail. Even without the analysis of the detailed requirements this list went down to 6 reasonable providers as a first

shortlist. The vendor selection workshops with all team leads have been executed to get input for the key functional requirements. The list of maximum criteria was reviewed multiple times and at its finalization the responsible people discussed priorities of the requirements in detail. So, a final list of criteria was established and agreed with mutual priorities for each task.

The first round with all vendors was executed documenting all their functionality, benefits, strength and weaknesses according to the set priorities and factors. Of the six vendors three made it to the next decision level. Two ERP systems seemed very good and similar. One product was distributed just by software providers therefore one product continues with an implementation approach of two different providers. The three companies have been invited again for the next presentation. This was not a high level sales presentation. The invitation for the next very detailed presentation of the product and company was along the key functionality, checking all criteria along their priorities. This time even board members ensured their participation at the half day presentation work shop.

The final result was made after a longer analysis of the details, discussions along all criteria and their fulfilment. The involvement of the team members as well as board members helped for a joined decision where all involved people felt part of.

The selection process finalized with the decision took about 6 month. This was much longer than expected but everybody felt very satisfied with the joined decision and convinced that the implementation will be on time due to a very competent provider and product.

Set of Requirements – Selection Criteria

Based on the needs – the indicators for the system, the literature review and the identified detailed requirements the list of criteria was selected, created and prioritised.

Given there was no existing production and some of the people just had been employed, the functional scope could be aligned openly with the functionality of the system. Therefore the focus was on key criteria according to the set priorities.

The scope of the functionality had to be defined on a low level of detail and aligned. In addition it was important to define all other criteria:

Strategy / Organisation: Flexibility, languages, foreign legal requirements, interface standards, authorisation concept, full integration of all processes real time, etc.
Functionality: Serial number handling, entire system all functions integrated, Service management, BDE integration, focus on purchasing, production, quality and packaging in the first step. Including -> *Change Management:* End User friendly, easy handling, training concept, online help,
Technology: Release strategy available, add on handling, platform / database Microsoft standard, external hosting possible but optional.
Vendor: International Vendor, regional offices, at eye height in terms of size and client focus
Cost - Economic: The one time and on-going costs have been compared. The analysis needed to be very detailed but without reflecting the benefits. This effort has been executed via the weight factors

The detailed list with the analysed criteria, their priorities and evaluation can be reviewed. The defined and prioritised list of criteria is a long term tool which can be used to measure the fulfilment of all criteria with the system at and after go live. Very similar to the list checked with Company I. The list created for this Company II is just much more detailed according to the wider scope and the people involved. Given the financial sponsors, the board had an interest to establish a set of criteria which can be used longer term to measure the satisfaction with the ERP system.

People involved / Decision making
Experts have been involved from all relevant functional areas as well as managers from all fields. Given it is a start-up company where the financial foundation was external; there was a very high need to manifest the decision and be able to justify the investment in much detail. The three board members with different functional background have been one group of involved experts as well as the second management level for the preparation of the decision on a very detailed level.
Talking to the people they feel that all relevant people had the chance to provide input therefore they feel it was a joined decision and everybody is satisfied.

Results
Results at the decision making point in time
The vendors had been categorised. For the three best placed vendors a specific workshop has been set up to test the functionality in detail. All C-Level managers have been involved for

this review. The results for the overall criteria and functionality have been very contradictory to the cost criteria, so priorities and weight factors played an important role for the final proposal. The system and provider fulfilled most of the overall and functional requirements. It was not the cheapest but the value for money being in a good balance. Very importantly due to the details for all areas, it is not just a positive evaluation, the criteria the system/provider does not fulfil, are clearly documented and the deciders are fully aware of it. The final decision was made by the three executives and the shareholders based on the very detailed proposal. They and the entire involved management team have been very satisfied because they do know exactly what they get and do not get with the selected ERP system.

Summary of results according to Company II

The acquisition of an ERP system was a new task for the company and the investment very high (about 2-3 % of the expected turnover). The key decision makers and managers were very busy with their daily business and did not have much capacity for an additional project. The hired consultant led and the internal IT person supported and guided through the model with years of experience. Without an independent or an internal experienced person there is a very high risk of taking the cheapest product or the one of the best sales representative. The team and the executives confirmed that they feel prepared for the implementation knowing the advantages and the disadvantages of the new system.

The selected criteria have been reflected with the indicators and requirements multiple times. All criteria have been constantly updated during the process and the team involved does know exactly what they get and do not get with the new ERP system. In addition, they have a tool to measure satisfaction with the system after implementation.

Appendix 9 - Write up final interview Case Study II

Expert Interview – with IT Lead of Case Study II
Final Interview after executing the project

Setup and Status:

Company:

The company is a start-up company which will start mass production after some years of development in 2012. More and more people get employed to transfer the company from a pure development company into a production company.

Project Status:

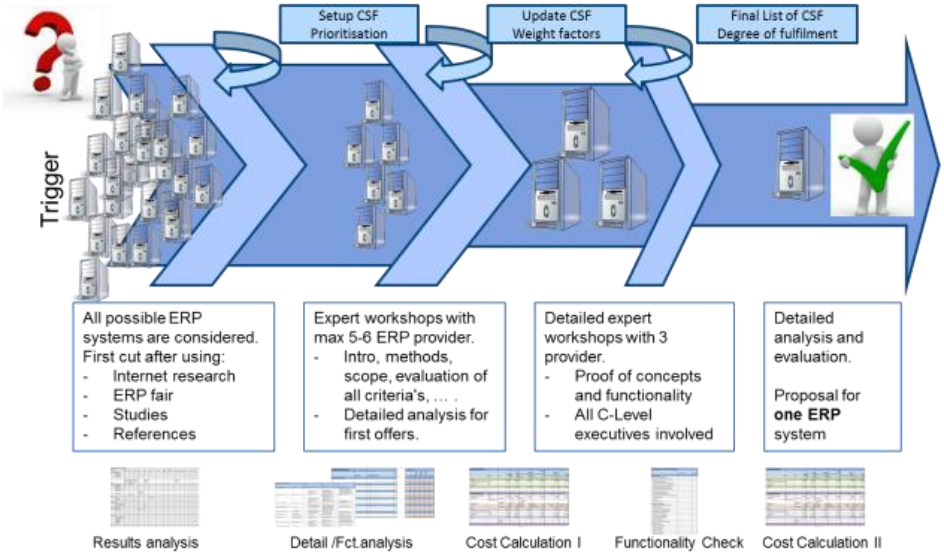
As of June 2012 the selection of the ERP system is finalised. The very detailed analysis and workshops have been executed. The contract with the supplier is finalized and the detailed implementation plan agreed.

ERP Status:

System is not implemented at all. Processes defined and implementation start in September – go live planned beginning 2013.

Questions:

Was the developed model (see figure below) mature and helpful for the selection process?



Developed by author 2012

The suggested model was very helpful. The different layers needed in that detail for the precise process. Even the 3rd level was firstly not plant it was essential to execute it. First level to get a market overview, second to see the strength of each system, third to question possible weaknesses and last to decide for one final ERP. According to the detailed criteria's there was a very high transparency of strength and weaknesses. The time taken to execute the process was very well spent for that.

Have the chosen CSF been complete and substantial enough?

> The list of CSF was absolutely complete for all purposes. There is not the one on only final list but the list taken as a starting point covered all our requirements and was a good basis to evaluate and weight all criteria's for our purposes. All critical points have been stressed and the problems got clarified.

Have the right people been involved during the selection process? (6d)

> Yes, the project was clearly communicated as a company's project not an IT project. Therefore all relevant people with relevant functions have been involved in the selection process as well as in the final decision.

Did you have a clear trigger to select an ERP system? If yes which one and how did it influence the selection? (3a)

> Yes, the clear trigger was the start of the production knowing that the volumes cannot be handled with the existing tools. Growth was planned so a system was clearly needed.

Was the evaluation process of the CSF efficient enough?

> Yes, the process was painful but very, very important for the selection. Of the set of possible CSF the important ones have been selected, prioritized and a weight factor given for it. So at the end of the process it was clear what was important for us as well as what was critical for us.

Do you think the right system was selected and why? (6a)

> Yes, we are sure we selected the right system even without being through the implementation process. Given that fact we know now exactly what we want, what we need and what we will get or will not get with the system we do not expect any surprises.

What is the opinion of the board?

> The key board members have been involved in depth during the process and in a final workshop the decision for the ERP system was executed jointly.

Appendix 10 - Summary of Qualitative Results – Traffic Light Table

The results have been summarised to one set of factors to stress the trend even more.

Company No.	Time taken for selection	Clear process	Right people involved	Right person made	Trigger	Time Pressure	Cost Pressure	Satisfaction
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								

Summary of findings, created by author 2013

This table can be read from left to right, adding all factors to one result the satisfaction. The summarisation of the details in to three categories should not change the details of the findings; it should just provide a quick overview in a “traffic light”. The lightest colour is yellow, the grey is green and the darkest is red. Therefore adding the details from left to right indicates the results. For example Company No. 11; six times green plus one yellow supports a green result, so satisfaction is seen positive. Example Company No. 19; five times red plus

two green has a red result so satisfaction is seen negative. This table should not replace the detailed findings but add on a summarized level the details.

Appendix 11 - Quasi-field experiment – Treatment:

Demographic Data:

a.) Sex: Man:_____ Woman: _____

b.) Work experience in Years _____

c.) Area_____

d.) Size of the company you work for in number of employees.

_____

e.) Industry_____

f.) Country_____

Situation:

Company Huber producing specific parts of engines is headquartered in Bavaria. 40 employees are purchasing, producing assembling and selling the specific products. With all the international growth and an internet performance the requests from foreign customers are increasing rapidly. Currently the company is working on its limits and the main IT support is Microsoft Excel. To grow the company the implementation of an ERP System for SCM and CRM is necessary. 15-20 Employees should use the system from the beginning in the various areas.

Mr. Huber Senior is owner and CEO, his background is production engineering. His main interest is production and development of new innovative productions. Personnel, Sales and IT are not really areas he invests time in. In the next 2-3 years his son will finish his study and will work in the company in these areas and take over Sales, Marketing and IT. Anyway there are necessary changes which have to be considered now. The IT system need to be adapted or more important and ERP system should be implemented to support the foreign customers shortly to reduce effort.

Treatment A:

Mr. Huber went golfing with a befriended CEO of the same industry and comparable size. He discussed his IT environment and gets to know the chosen ERP System. He asks about comparable functionality in production and management. Everything seems fine and he invites the ERP provider to present the system and to make an offer. After half a day

presentation and discussions with him and his son he is very convinced that this is the right product and he buys it to implement shortly.

Treatment B:

Mr. Huber is fully aware that he has very little knowledge about IT and that this will be a major change for his company. His son suggests announcing a master thesis. The chosen master student started a structured approach and took about 3-4 months to evaluate all system requirements. He talked with many important employees of all departments. He summarized the requirements for the business processes including needs and nice to haves. He prioritized and weighted them. On that basis he reviewed many ERP systems and identified 4 which could fit. After some more investigations in functional details one EPR system fell out. So, 3 ERP providers have been invited to present their systems and detailed functionality. The Hubers and key employees participated at the presentation. Each department checks the detailed functionality and evaluated advantages and disadvantages of each solution. All involved people have a common sense that the one chosen ERP System fulfills most of the requirements according to the defined need. Mr. Huber senior buys the product and they implement the chosen ERP system.

Appendix 12 - Quasi-Field Experiment – Questionnaire:

Questions:

1.) How would you evaluate the taken approach? Please mark with a cross:

[1] ad hoc -no structure	[2] less structured	[3] medium	[4] structured	[5] very structured

2.) Which overall indicators and approach are noticeable? Please mark with a cross:

	[1]Not fulfilled	[2]Less fulfilled	[3]Understood	[4] Fulfilled	[5]Strongly fulfilled
Structured selection process					
Enough time taken for the selection of the ERP system					
Involvement of knowledgeable colleagues					
Did the right person make the decision?					
Was there a identifiable trigger to start the selection of the ERP system?					
Have clear requirements been defined for the ERP system?					
Time pressure to selection the System?					
Cost pressure to selection the System?					

3.) How do you evaluate the satisfaction with the chosen ERP system? Please mark with a cross:

	[1] low	[2] little	[3] medium	[4] high	[5]very high
Satisfaction with the chosen, implemented ERP system – prospect of the management					
Satisfaction with the chosen, implemented ERP system – prospect of the users					

4.) Which elements of satisfaction with the investment decision are important in respect to the investment success? Please mark with a cross:

	[1] not relevant	[2] little relevant	[3] medium	[4] important	[5] very important
Organisation, flexibility and strategy					
Business Processes and Functionality					
Technical Environment and Feasibility					
ERP Provider and the long term relation and reliability					
Economics of the ERP System					

5.) How do you expect the elements will be fulfilled according to the situation described above in the case study? Please mark with a cross:

	[1] not successful	[2] less successful	[3] medium	[4] successful	[5] very successful
Organisation, flexibility and strategy					
Business Processes and Functionality					
Technical Environment and Feasibility					
ERP Provider and the long term relation and reliability					
Economics of the ERP System					

Appendix 13 - Questionnaire with ERP Professionals of the Alpine Region:

1.) Demographics:

a.) Sex: Men____ Women __

b.) Work Experience in Years _____

c.) Industry _____

d.) Size of the company _____(number of employees)

e.) Country_____

2.) ERP Questions: (please mark with a cross)

a. Does the company have an ERP System? Yes / No ***(if the answer is NO then you are finished – thanks a lot for your participation)***

b. Why was the ERP System implemented? Growth/ Internationalization/ old system replaced/ merger/ other?

_____

c. How long was the overall ERP life cycle process – implementation?
months:_____

d. In proportion – how much time was dedicated to the selection of the system? (% of overall time)_____

e. Who made the decision for the ERP system/ position?

_____

f. Did this person – decider support of a selection team or other people? Yes / No

_____

g. Was there a structured selection process available/ followed? Yes / No
Which one?_____

h. Have all requirements for an ERP system been identified? Yes / No

_____

i. Did you have time pressure? Scale 1-10

Not time pressure 1 2 3 4 5 6 7 8 9 10 high time pressure

j. Did you have cost pressure? Scale 1-10

No cost pressure 1 2 3 4 5 6 7 8 9 10 high cost pressure

3.) Satisfaction

a.) Are you or are all users satisfied with the chosen ERP system?

Scale 1-10 where 1= very dissatisfied

Very dissatisfied 1 2 3 4 5 6 7 8 9 10 very satisfied

b.) Do you measure the satisfaction with the system? (never, sometimes, always)_____

c.) How to you measures the satisfaction with the system?

_____

Thanks a lot for your participation !!!

Appendix 14 - Results of the Correlation Analysis of the Questionnaire with ERP Professionals of the Alpine Region:

a.) Result Cost related to Satisfaction

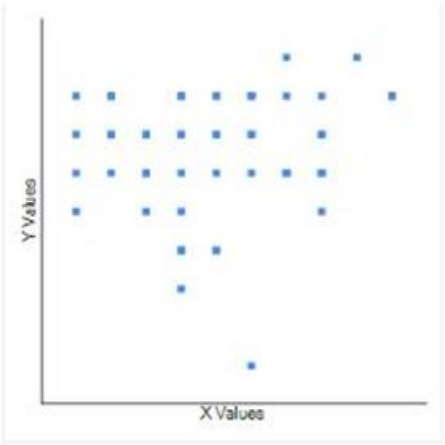
Pearson Correlation Coefficient Calculator

The value of R is: 0.15.

Explanation of results

As you have probably already noticed, the output of this calculator is... verbose. Although most of the information provided below is self-explanatory, there are a few things worth noting. First, the five text boxes spread across the middle of the page represent the calculations that would be required if you were to calculate the R value in stages. Second, there is more than one way to calculate the R value, but these are all mathematically equivalent, so you shouldn't worry if you don't recognize the equation used here. Third, in the "Result Details & Calculations" box, you'll find what we've called a cross-check value, which is the R value calculated using an algorithm supplied by the Meta Numerics statistical library. This should be identical to the value that we've calculated.

X Values	Y Values
2,3,3,5 ,3,2,8, 4,8,1,2 ,6,3,2, 3,7,8,2 ,8,3,8, 1,1,4,1 ,4,7,2, 6,8,4,4 ,7,4,5, 5,6,7,3 ,10,6,4 ,3,5,10 ,9,5,8, 10,4,6, 7,5,4,6 ,6,4,5, 4,4	8,6,6,7 ,7,6,7, 8,7,7,8 ,7,6,7, 7,6,6,8 ,5,6,6, 6,8,4,5 ,6,6,7, 7,6,3,3 ,8,7,4, 8,8,9,5 ,8,6,7, 7,8,8,9 ,7,8,8, 8,8,6,6 ,5,1,8, 4,4,8,4



$X - M_x$	$Y - M_y$	$(X - M_x)^2$	$(Y - M_y)^2$	$(X - M_x)(Y - M_y)$
-2.92	1.52	8.51	2.3	-4.42
-1.92	-0.48	3.67	0.23	0.93
-1.92	-0.48	3.67	0.23	0.93
0.08	0.52	0.01	0.27	0.04
-1.92	0.52	3.67	0.27	-0.99
-2.92	-0.48	8.51	0.23	1.41
3.08	0.52	9.51	0.27	1.59
-0.92	1.52	0.84	2.3	-1.39
3.08	0.52	9.51	0.27	1.59
-3.92	0.52	15.34	0.27	-2.02
-2.92	1.52	8.51	2.3	-4.42
1.08	0.52	1.17	0.27	0.56
-1.92	-0.48	3.67	0.23	0.93
-2.92	0.52	8.51	0.27	-1.51
-1.92	0.52	3.67	0.27	-0.99
2.08	-0.48	4.34	0.23	-1.01
3.08	-0.48	9.51	0.23	-1.49
-2.92	1.52	8.51	2.3	-4.42
3.08	-1.48	9.51	2.2	-4.57
-1.92	-0.48	3.67	0.23	0.93
3.08	-0.48	9.51	0.23	-1.49

Result Details & Calculation

X Values
Σ = 295
Mean = 4.92
$\Sigma(X - M_x)^2 = SS_x = 342.58$

Y Values
Σ = 389
Mean = 6.48
$\Sigma(Y - M_y)^2 = SS_y = 152.98$

X and Y Combined
N = 60
$\Sigma(X - M_x)(Y - M_y) = 35.42$

R Calculation
$r = \Sigma((X - M_y)(Y - M_x)) / \sqrt{((SS_x)(SS_y))}$

$r = 35.4166666666667 / \sqrt{((342.58)(152.98))} = 0.15$

Meta Numerics (cross-check)
r = 0.15

Key

X: X Values
Y: Y Values
M_x: Mean of X Values
M_y: Mean of Y Values
$X - M_x$ & $Y - M_y$: Deviation scores
$(X - M_x)^2$ & $(Y - M_y)^2$: Deviation Squared
$(X - M_x)(Y - M_y)$: Product of Deviation Scores

The value of R is 0.15. Although technically a positive correlation, the relationship between your variables is weak (*nb.* the nearer the value is to zero, the weaker the relationship).

The value of R^2, the coefficient of determination, is 0.02.

Calculate R | Reset

b.) Result Time related to Satisfaction

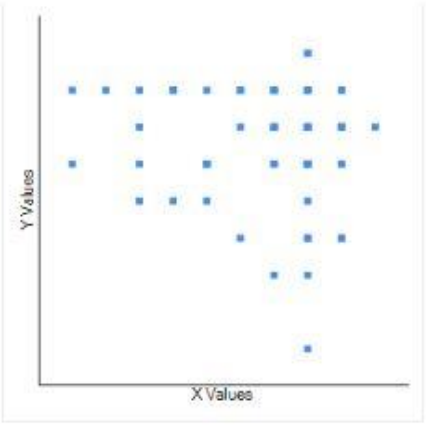
Pearson Correlation Coefficient Calculator

The value of R is: -0.13.

Explanation of results

As you have probably already noticed, the output of this calculator is... verbose. Although most of the information provided below is self-explanatory, there are a few things worth noting. First, the five text boxes spread across the middle of the page represent the calculations that would be required if you were to calculate the R value in stages. Second, there is more than one way to calculate the R value, but these are all mathematically equivalent, so you shouldn't worry if you don't recognize the equation used here. Third, in the "Result Details & Calculations" box, you'll find what we've called a cross-check value, which is the R value calculated using an algorithm supplied by the Meta Numerics statistical library. This should be identical to the value that we've calculated.

X Values	Y Values
5,8,8,9 ,9,9,10 ,4,8,7, 1,8,5,7 ,3,5,8, 2,8,3,8 ,1,4,8, 5,9,5,9 ,6,5,8, 7,3,7,6 ,8,6,8, 3,6,7,8 ,9,8,7, 8,8,9,8 ,4,7,8, 7,4,8,9 ,9,9,7, 8	8,6,6,7 ,7,6,7, 8,7,7,8 ,7,6,7, 7,6,6,8 ,5,6,6, 6,8,4,5 ,6,6,7, 7,6,3,3 ,8,7,4, 8,8,9,5 ,8,6,7, 7,8,8,9 ,7,8,8, 8,8,6,6 ,5,1,8, 4,4,8,4



$X - M_x$	$Y - M_y$	$(X - M_x)^2$	$(Y - M_y)^2$	$(X - M_x)(Y - M_y)$
-1.68	1.52	2.83	2.3	-2.55
1.32	-0.48	1.73	0.23	-0.64
1.32	-0.48	1.73	0.23	-0.64
2.32	0.52	5.37	0.27	1.2
2.32	0.52	5.37	0.27	1.2
2.32	-0.48	5.37	0.23	-1.12
3.32	0.52	11	0.27	1.71
-2.68	1.52	7.2	2.3	-4.07
1.32	0.52	1.73	0.27	0.68
0.32	0.52	0.1	0.27	0.16
-5.68	1.52	32.3	2.3	-8.62
1.32	0.52	1.73	0.27	0.68
-1.68	-0.48	2.83	0.23	0.81
0.32	0.52	0.1	0.27	0.16
-3.68	0.52	13.57	0.27	-1.9
-1.68	-0.48	2.83	0.23	0.81
1.32	-0.48	1.73	0.23	-0.64
-4.68	1.52	21.93	2.3	-7.1
1.32	-1.48	1.73	2.2	-1.95
-3.68	-0.48	13.57	0.23	1.78
1.32	-0.48	1.73	0.23	-0.64

Result Details & Calculation

X Values
Σ = 401
Mean = 6.68
$\Sigma(X - M_x)^2 = SS_x = 286.98$

Y Values
Σ = 389
Mean = 6.48
$\Sigma(Y - M_y)^2 = SS_y = 152.98$

X and Y Combined
N = 60
$\Sigma(X - M_x)(Y - M_y) = -26.82$

R Calculation
$r = \Sigma((X - M_y)(Y - M_x)) / \sqrt{((SS_x)(SS_y))}$

$r = -26.8166666666667 / \sqrt{((286.98)(152.98))} = -0.13$

Meta Numerics (cross-check)
r = -0.13

Key

X: X Values
Y: Y Values
M_x: Mean of X Values
M_y: Mean of Y Values
$X - M_x$ & $Y - M_y$: Deviation scores
$(X - M_x)^2$ & $(Y - M_y)^2$: Deviation Squared
$(X - M_x)(Y - M_y)$: Product of Deviation Scores

The value of R is -0.13. Although technically a negative correlation, the relationship between your variables is only weak (*nb.* the nearer the value is to zero, the weaker the relationship).

The value of R^2, the coefficient of determination, is 0.02.

Calculate R | Reset