



## THEORY OF DECISION MAKING FOR THE EFFECTIVE ANALYSIS OF ERP SELECTION AT SME

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**Abstract.** The decision making theory in the area of organisation theory is very mature as a field of research. Since mid of the 20<sup>th</sup> century the management decision making theory is divided into normative (rational) decision making and descriptive (behavioural) decision making. With the work of Kahnemann and Tversky the economical behaviour was strengthened.

Mainly these theories have been taken into consideration analysing an important decision making process at Small and Medium Size Entities (SME) – the selection and purchase of an Enterprise Resource Planning (ERP) System. This strategic decision is one very critical. The management usually focus mainly on the implementation an extensive process which often cause cost overruns. Focus for this research was purely on the selection of the ERP system and all influencing decision criteria. The reflection with the efficiency of the process as well as the satisfaction with the decision was one result along a developed process.

Expert Interviews and Case Studies have been executed to support the theoretical approach and literature review. The interviews provide a clear overview of the current practice and support the hypothesis that ‘a clear and structured process and the awareness at senior management level from the very beginning’ would lead to a high efficient long-term decisions. The focus of the case studies was mainly on testing the model, process and theoretical findings.

In summary a theoretical model along a clear execution process, clear decision makers and a structured set of decision criteria for this specific research scope are the main scientific results for this study.

**Key words:** *decision making, Enterprise Resource Planning (ERP), Small and Mid-size Entities (SME), selection process*

**JEL code:** D80, L20

### Introduction

Strategic decisions have been made since centuries by every emperor and leader in history but the term strategic decision making in management has been discussed just in the 20th century. Theorists as Barnard, James March, Herbert Simon, and Henry Mintzberg laid the foundation for the study of manage-

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rial decision making with their research and novel papers. 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 of it might be enormous (cf. Buchanan et. al., 2006 and Harrison, 1993).

Strategic decisions for small and mid-size entities (SME) are very critical and more relevant than ever given the need for globalization. Due to the historical approach and set up of these companies, business processes even for critical areas are not structured. Especially the question of “who makes the decision and how?” has rarely been analysed.

As an example, one very critical and special event is the process of ERP selection. It is a one off strategic decision process in which usually the decider has little or no experience. This acquisition is a fundamental cost factor. In a lot of industries in mid-size companies it is over 5% of the yearly turnover (cf. Biermann, 2005). The decision for one specific ERP package defines not just the IT framework with hard- and software, the selected system is the backbone for all business processes. The interviews with industry experts provide a clear overview of the current practice and support the propositions that awareness 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 leveraged for SME considering their specifics.

The main aim for this research will focus on the use of a proposed theoretical model for in a very practical environment. Combining theoretical approaches with operational findings based on a specified example.

The novelty of the research is a suggested theoretical model which has been developed with the input and requirements of experts and tested in real life cases in combination with detailed operational results. The efficiency of strategic decisions which are usually made like this example on an irrational basis can be increased using a rational approach.

## Theoretical background and literature

The history of decision making 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 organizational behavior has just the main desire to help to achieve better outcomes. Leaders of all kinds have been forced to make decision like the emperors in wars, but it wasn't until the seventeenth century before humankind's understanding of numbers was up to calculate risk and decision making. Daniel Bernoulli, Friedrich Gauss and Francis Galton have been the ones before the 20<sup>th</sup> 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. In the 20<sup>th</sup> century the studies and interest of researchers in the management fields occur and new theories have been developed rapidly. 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 organizational behavior and Simon rejected the classical notion of rational decision making. Henry Mintzberg positions decision making in the context of managerial work in the 1980ties. Followed by Amos Tversky and Danies Kahnemann 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.

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 (cf. Buchanan et al., 2006)



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There are multiple possibilities to differentiate the different disciplines of decision making. Harrison defines decision making models in four categories: the rational (classical), the organisational (neoclassical), the political (adaptive) and the process (managerial) decision making (cf. Harrison, 1993, p.28). More common is the distinction between normative or prescriptive and descriptive or positive decision making which was developed and established end of the 20<sup>th</sup> century. Most of the time decision making theories are focusing mainly on the normative 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 normative 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 normative, optimal decision making often created hypotheses for testing against the actual behavior the two areas are very closely linked.

As decision making is such a crucial part of the business and increasingly happens at all levels of management it needs to be differentiated. Based on the different levels mainly three should be considered: Strategic decisions done by owners/ board members, Tactical decisions done by managers and operational decisions done by most employees. (cf. Bowett, 2013). Given this categorization the example of ERP selection for SME, is definitely a strategic decision.

Strategic decision making has long been a topic of interest in the organization theory and strategic management. Considering multiple research papers and theories foster that strategic decision making is highly complex considering a lot of dynamic variables. The identified groups of Harrison (cf. Harrison, 1996, p. 46) categories the variables but support strongly that the example of selection decision is definitely a strategic decision. “The decision must be critically important to the long-term success of the total organization.” (Harrison, 1996, p.46).

## Models of decision making

Following the question on how to make decisions rather than how decisions have been made, models have to be considered as well. An approach Mintzberg (cf. Mintzberg et. al., 2001, p.89) 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. But none of the step-by-step approaches of rational decision making basically consider this. P.A.C.E.D 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 (cf. Bowett, 2013). Reviewing the methodology of decision making, Schwarber (cf. Schwarber, 2005, p.1087) 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. Overall there are multiple different decision making models available. The suggested model developed by the author later on, considers this theoretical part which follows a purely 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.

In summary, 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.



## Research question and analysis

Researchers have analyzed considerably extensive the implementation of ERP systems, the optimization of ERP systems, management of ERP issues and details of ERP functionality (cf. Schlichter et al., 2010, p.496). Very few analyzed the failure of ERP implementations, the selection of the system and the models how to ensure a successful implementation (cf. Sternard et al., 2011, p.1513.)

Based on relevant literature the author identified the most important criteria<sup>2</sup> for selection and measuring satisfaction that are the key driving forces behind successful ERP implementation. Analysing them individually before each system selection is part of a suggested method driving this research. Given that, very specifically for the selection and decision making part of an ERP system is still only little research work done in this area.

This research paper is part of a wider research approach executed over the last 3-4 years. Focusing on the theory, the suggested model and the real life case studies it takes the results of previous research into consideration. A paper published and presented at the international conference in Kufstein<sup>3</sup> in August 2012 discussed some hypotheses along the expert interviews. One key result according to the expert interviews was the confirmation that this important strategic decision is mainly done on an irrational basis. 28 experts supported the hypothesis: “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”.

So, on this basis it would help to support this manly irrational taken decision with a rational approach. People felt kind of satisfied and happy with the decision but the failure rates are very high. A more structured approach in the very beginning would support the success and satisfaction with the ERP system in the end. On that basis the following research question was developed for this research:

*“Is there relationship between the use of a structured approach e.g. executing a model and the efficiency of the decision?”*

This research question leads to the main proposition for this research paper:

*Using a suggested model leads to a higher efficiency with the decision*

The use of a structured model to support the qualitative discussion of the decision making at SME was the basis for further reviews and development during the expert interviews.

## Theoretical model development

On the basis of the theoretical decision making and the operative approaches of ERP life-cycle development the following model was generated with the input of experts and reviews in the later interviews.

This model takes multiple theoretical models as a basis (see Theoretical Background and Literature). These models cannot be compared and one evaluated as the best one. A deeper comparison with the ERP live-cycle models was conducted but these ERP models are mainly focusing on the implementation part of the life-cycle not on the selection, the decision making part. Shaul (cf. Shaul et al, 2012, p. 362) defined the EPR life-cycle in four fundamental phases, planning, implementation, stabilization of the ERP system into normal operation, and enhancement. This is one cycle where only the planning phase would

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<sup>2</sup> Results have been presented at the international conference: “New Challenges of Economic and Business Development” in Riga from 10.-12. May 2012. Title of the paper: “Approach for selecting ERP software at mid-size companies reflecting critical success factors”.

<sup>3</sup> International Conference “International business and economics conference” in Kufstein, Austria from 03.-05. August 2012, Title of paper. “Why do you need an ERP system as a SME Company? How do you know which is the right one? Expert opinions” published by author.



be relevant for decision making. All other models mention from ERP providers or in literature vary only very little and mainly in terminology and wording. Just recently the acquisition part (selection) gets more popular mainly covered by the scientists Verville, Palanisamy and Bernadas (cf. Verville et al., 2010, p. 36). The 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 (cf. Shaul et al., 2012, p. 371). 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 (cf. Markus et al, 2000, p. 255).

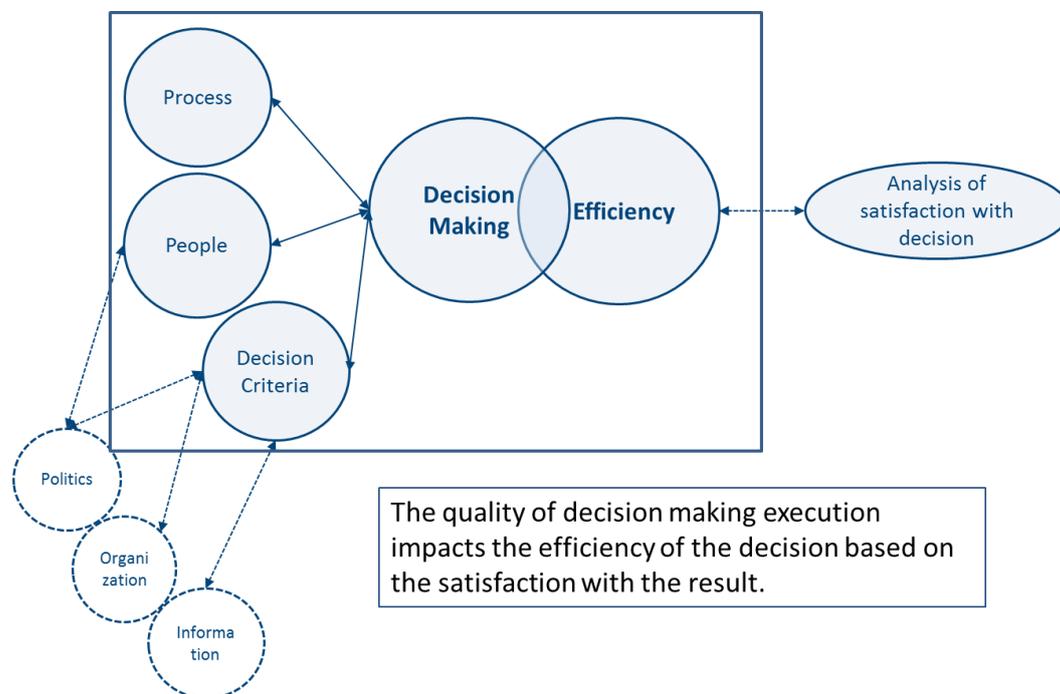


Fig. 1. Decision Making Model created by author 2012

Discussing existing models with the experts and comparing them with the rational decision making models which are used for the bigger companies the suggested model (see Figure 1) was developed by the author. Key elements influencing the strategic decision making have been identified and discussed. The main aim of the model is to be simple and understandable for managers and executives of SME. Therefore complexity was reduced as much as possible and elements reduced or summarized.

The key elements guiding and influencing the decision making model are: the decision making process, the deciders and supporting knowledgeable people and a list of detailed decision making criteria which are defined and prioritized at the very beginning. The impact on the decision making by politics, company organization structure and information provided can be neglected but might be considered as influencing factors for the defined elements.

The model itself is very generic; it could be used for almost any strategic decision making process at a SME. Only the content of the elements needs to be distinct specifically according to the detailed research field, like this example of the ERP selection.



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These three elements identified on a theoretical basis are derived mainly from literature. This is an inductive input which can mainly be divided in the three mentioned elements and the wider content support the details according to the ERP selection at SME:

- The process structure which has been deduced from various existing processes which has been developed for either acquisition, IT or different parts of the ERP life-cycle.
- The people to be involved which have been analyzed focusing on decision making of SME companies and acquisition.
- The most relevant set of decision making criteria which has been derived from literature for the entire ERP life-cycle and very specifically are linked to the relevant requirements and triggers.

The efficiency of the decision can be evaluated in relation to the satisfaction with the system. Satisfaction can be analysed according to review the fulfillment of the use of the process, the involvement of important knowledgeable people and the definition and set up of decision making criteria. Very specifically the decision criteria are categorized according to the literature review. A very recent study from Shaul (cf. Shaul et al., 2012) reviewed the criteria relevant to the different phases of a life-cycle which he called critical success factors (CSF). The decision criteria are defined and prioritized in the beginning and evaluated later on for efficiency. Even on a pure qualitative basis this gives an indication about the efficiency and satisfaction with the decision.

## Research description

The research is based on a qualitative research approach. 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 (cf. Verville, et al., 2003, p. 585). Therefore it will be a more valid research approach for the research to use a series of Semi-Structured Expert Interviews and Company Case Studies as quantitative approaches where the return rate is expected to be very low.

This empirical approach of the research relied heavily on qualitative, rather than quantitative measures. A more quantitative approach would only have been plausible 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 triangulation as an approach for this qualitative research with the intention to enrich the quality of the research due to the different approaches. According to Mayring (cf. Mayring, 2002, p. 147) the triangulation can be based on different sources of data, different interpretation of the same results, different methods as well as different theories. For this research different research methods have been chosen due to be able to compare results on a qualitative basis.

Semi-structured expert interviews with a subject matter expert (the author) were preferred to questionnaires as this ensured greater consistency in the presentation and interpretation of questions and their answers during the actual interviews. The research field of SME and its executive level has not reputation for being very responsive. Schmitz (cf. Schmitz, et al., 2007, p.252) stated a response rate of questionnaires of 15.1% which was seen as very high and Verville (cf. Verville, et al., 2003, p. 585) in a similar research field stated to just use qualitative methods due to the low response. Therefore as suggested by Atteslander (cf. Atteslander, 2000, p.12ff) the method of semi-structured interviews has been chosen. The main findings have been supported and the suggested model been tested including the process, criteria and people. The real life company case studies have been identified as the only method to support the results with intensive input. These two different methods support the validity, quality and reliability of the research results. 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 allocated from literature and during this series of semi-structured interviews a hypothetical ERP decision making model was developed (see figure 1) and reviewed and then tested using two real life case company



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case studies. The first Company Case Study was used to initially test the “decision making model” and a corresponding set of “decision criteria”, “the decision process” and the “deciders” in order to drive the ERP selection decision. The second Company Case Study focused on an intensive and detailed execution and test as developed during the first company case study.

The expert interviews have been executed in person or on the telephone along the set of questions. The timeframe for each interview was one up to two hours. The first interviews confirmed the critically and relevance of the topic. The model was reviewed, updated and discussed during the last 2/3 of the interviews. The experts have been high knowledgeable managers, IT executives or owners of a small and medium-size production company.

Company Case Study I: Small Production Company in the process of selecting an ERP system. The model and elements with all details have been discussed and used, during the selection process. The company has been supported during the entire cause of the implementation. Just after go-live and after the system reached a saturation point, about a year later additional interviews have been executed with different experts of the company.

Company Case Study II: A medium size production company had to select an ERP system. They used the model and elements in all details and tested the results from the interviews and Company Case Study I. After the final decision for one ERP solution the key decision makers have been interviewed.

## Research results and discussion

The overall research question has been presented along with the main proposition: *Using a suggested model leads to a higher efficiency with the decision.* Supporting questions have been developed along the use of the detailed elements of the model developed. The research question and proposition have been developed and analyzed with input from the literature review, the semi-structured expert interviews and the company case studies.

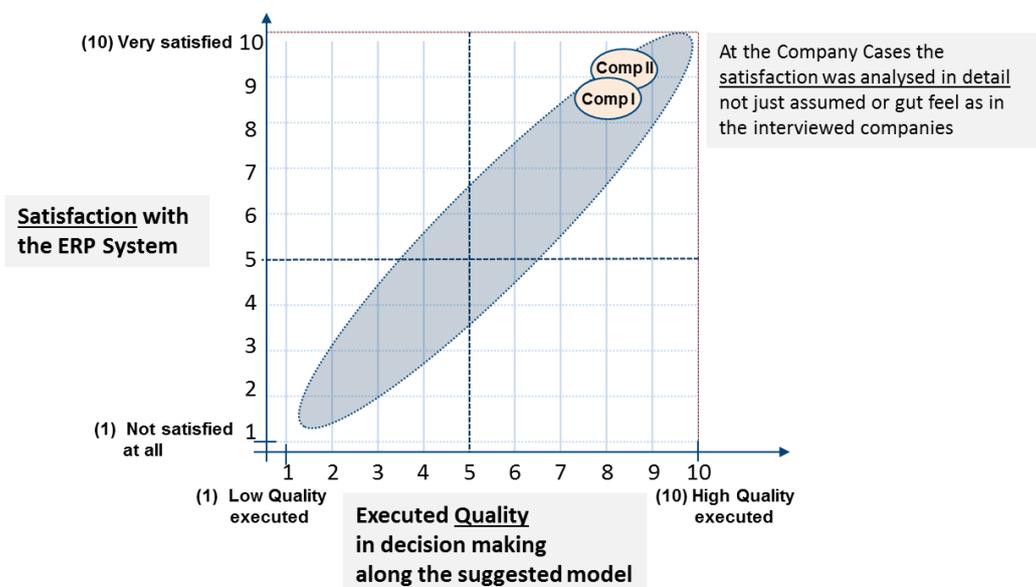


Fig. 2. Overall results created by author 2013



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An overall diagram was developed to summarize the results. This diagram points out the use of the model in terms of quality executed during the decision making. Quality in this diagram combines the three key elements analysed and generated according to this specific decision. As higher the quality meaning: as higher the use of the proposed process, the people and the use of decision criteria, as higher the efficiency of the decision meaning the satisfaction with the system.

Comparing all results in relation, the use of the model and the quality of the decision making according to the proposition an overall trend could be summarized according to the analysed details. Using the suggested model developed with the input of the experts and leveraging all analysed and defined details, the proposition can be confirmed leading to a higher efficiency in decision making.

## Results of Company Case Study I in detail

Comparison of the key criteria for EPR selection				
Group of criteria Requirements	Company Case Study I first ideas	Company Case Study I revised more detailed analysis	Company Case Study I results at go live	Company Case Study I 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 evaluation 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 process. Timeline 4-8 weeks.	Scope extension to a full CRM and EPR 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.



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Group of criteria Requirements	Company Case Study I first ideas	Company Case Study I revised more detailed analysis	Company Case Study I results at go live	Company Case Study I results one year after go live
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 reporting.	The licenses 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. Ongoing service and support is very expensive.

Fig. 3. Results of Company Case Study I created by author 2012

The detailed results of the company case studies confirm in addition that the use of the suggested model would support this usually very irrational decision with the attend to follow a structured and rational model.

## Conclusions and Suggestions

Searching the literature dealing with the decision making theory in combination with the criteria for decision making and ERP selection models which are focusing on the planning and selection phase, it became clear that these subjects are not completely covered by researchers, in addition, these topics are currently not related. This research examined the ERP selection part of the overall ERP life-cycle 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 quality approach for execution with the people involved and the criteria defined.



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The model was tested and validated with mainly one very long company case study and a second very detailed company case study focusing on the detailed analysis of the set of criteria.

This study contributes to academic research by producing empirical evidence to support the theories that the suggested model used would lead in the defined research field to a higher efficiency in executing the decision. Specifically the process, the people involved in the decision making process and the set of 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.

## Conclusions

1. The suggested model (Fig. 1) has been developed as a generic model to support strategic decisions which are usually executed following a behavioral approach, mainly on an irrational basis. Given strategic decisions are critical for companies, very specifically the analysed scope of SME, the rational model would be very supportive for an efficient decision. The valid structure and use of the suggested model could be confirmed by experts and with company case studies.
2. The three key elements defined with the suggested model have been detailed and for this very specific research case, the selection of an ERP system at SME companies, they confirm to increase the efficiency of the decision.

## Suggestions

The use of the provided model is suggested to be used by executives of a SME company, who need to make a strategic decision and do not have enough information, interest, theoretical background or experience to do so. Using the suggested model very specifically for the detailed study of ERP selection the identified elements are analysed, tested and evaluated in much detail. The decision making process is suggested as well as the involvement of the right people and a set of criteria is proposed as a starting basis.

The phenomenon that a strategic decision is just made on a pure irrational basis was confirmed for SME not for bigger entities, global companies or corporations. Therefore the suggestion is to executives in small and medium size companies to consider this rather theoretical model like the suggested one, to support effective strategic decision making with rational input.

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