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ABSTRACT

Although research and practice has attributed considerable attention to Enterprise Resource Planning (ERP) projects their failure rate is still high. There are two main fields of research, which aim at increasing the success rate of ERP projects: Research on risk factors and research on success factors. Despite their topical relatedness, efforts to integrate these two fields have been rare. Against this background, this paper analyzes 68 articles dealing with risk and success factors and categorizes all identified factors into twelve categories. Though some topics are equally important in risk and success factor research, the literature on risk factors emphasizes topics which ensure achieving budget, schedule and functionality targets. In contrast, the literature on success factors concentrates more on strategic and organizational topics. We argue that both fields of research cover important aspects of project success. The paper concludes with the presentation of a possible holistic consideration to integrate both, the understanding of risk and success factors.

Keywords

Success Factor, Risk Factor, Enterprise Resource Planning, ERP Implementation, ERP Project

INTRODUCTION

In recent years Enterprise Resource Planning (ERP) systems have become a necessity for most companies to stay competitive. In contrast to stand-alone applications, ERP systems are integrated standard software systems supporting core business processes across several functions. As such these software systems have considerable potential to contribute to business value creation (Davenport 1998). The large and fast growing market for ERP systems reflects this importance: By 2011 the market is expected to grow to 47.7 billion USD, achieving a compound annual growth rate of 11 % (AMR Research 2007).

Expected benefits from ERP systems range from tangible ones, mainly productivity gains through cost reduction (e.g. inventory reduction, reduction of personnel, reduction in IT and procurement cost, transportation and logistics costs, reduction in the need for system maintenance) and increased effectiveness (e.g. improvement of cash flow management, improvement in on-time delivery performance, improvements in order management) to intangible ones, such as increased visibility of corporate data, improved responsiveness to customers, increased flexibility, and global information sharing (Al-Mashari Al-Mudimigh and Zairi 2003).

The challenge in realizing the above mentioned benefits is deploying such systems successfully. For various reasons (e.g. ERP systems build on legacy systems or because of their cross-functional nature) ERP projects tend to be more complex than typical software development projects and thus also tend to bear a higher risk of failure. Pawlowski, Boudreau and Baskerville (1999) estimate that the failure rate in ERP projects equals 50 %. Panorama Consulting Group, a market research

company, found that one third of ERP implementations take longer than expected. Two thirds exceed the initially projected budget and fail to realize more than half of the expected benefits (Panorama Consulting Group 2010). Failed ERP projects can severely affect company performance as illustrated by the well known example of FoxMeyer, a drug company, which blamed its bankruptcy on a failed ERP implementation (Scott 2004).

There exist two main approaches in the literature, which deal with success and failure of ERP projects in a narrow sense. On the one hand researchers on risk factors are concerned with how to identify, assess and control events that might influence the project's success negatively. On the other hand, researchers on success factors concentrate on variables that promote project success. Given these common definitions, risk factors and success factors should be two sides of the same coin and deal mainly with the same topics. However, in the current literature risk and success factors are mostly considered separately. Thus, the goal of this paper is to integrate these two streams of research within a holistic consideration by conducting a comprehensive literature review and analyzing similarities and differences of risk and success factors in ERP projects.

LITERATURE REVIEW

Methodological Approach

To ensure a systematic review of the state of the art literature, we follow the approach suggested by Webster and Watson (2002). In a first step, we searched the online databases EBSCO, ScienceDirect and the ACM Digital Library using the search terms "risk", "failure" "success", and "erp" in the abstract, title and keywords. In total around 600 papers were identified.

In a second step we filtered the identified articles for whether they were published in A or B ranked journals following the MKWI 2008 ranking. The MKWI 2008 ranking was established at the multi-conference of information systems in Munich 2008 (MKWI 2008) and covers most of the AIS top 20 journals. In both research fields, the journals "Information & Management" and "Business Process Reengineering" yielded the most results. In order to avoid a cultural bias we focused on studies in the western (i.e. North America and Europe) region only. Finally, a shortlist of about 70 papers from 24 different journals was created, which we believe is a good representation of the literature. These papers were analyzed in detail concerning the risk and success factors they present. Table 1 lists the number of identified articles in each journal.

Journal	Risk Factors	Success Factors
Business Process Management Journal	3	5
Communications of the ACM	1	2
Decision Support Systems		2
European Journal of Information Systems		1
European Journal of Operational Research	2	2
IEEE Software		2
IEEE Transactions on Engineering Management	2	1
Information & Management	3	8
Information Systems Journal	1	1
Information Systems Management	1	5
Information Technology and People		1
International Journal of HCI		3
International Journal of Information Management	2	2
International Journal of Internet and Enterprise Management		1
Journal of Computer Information Systems	1	3
Journal of Database Management		1
Journal of Information Systems	1	
Journal of Information Technology	3	1
Journal of Management Information Systems	1	
Journal of Strategic Information Systems	2	
Journal of Systems & Software	1	
Journal of the AIS		1
MIT Sloan Management Review	1	
Omega		1
TOTAL	**25**	**43**

Table 1. Number of Identified Articles According to Journal

The articles were published from 1999 to 2010 with a peak of twelve articles published in 2007 and 2008 respectively (see Table 2).

Year	# of Articles considering RF	# of Articles considering SF
1999	2	
2000	3	4
2001		2
2002	2	1
2003	8	3
2004	3	3
2005	6	2
2006	2	2
2007	8	4
2008	5	7
2009	1	1
2010	3	
TOTAL	**25**	**43**

Table 2. Number of Identified Articles According to Year

Results

Altogether, we identified 80 factors in the success factor literature and 67 factors in the risk factor literature. These were classified in twelve groups in order to be able to analyze the differences between these two fields of research. The categorization follows extant approaches in the literature (e.g. (Nah Zuckweiler and Janet 2003)) and is based on the topical relationships between the factors. In the following, we present a short description of each category and the main differences between the risk factor literature and the success factor literature.

Existing Environment and Systems

This category summarizes surrounding conditions that have an influence on the introduction of an ERP system. These are the existing business systems and the legacy system (Al-Mashari et al. 2003; Holland and Light 1999) as well as the size of the company, its structure, cultural aspects and external factors such as the economic and industry climate (Ifenedo 2007). These issues are covered within the success factor literature only.

Planning and Strategy

The category "Planning and Strategy" contains factors like business vision and clear goals and objectives (Akkermans and van Helden 2002; Aloini Dulmin and Mininno 2007; Parr and Shanks 2000) as well as ERP and IS-/ IT-strategy (Bernroider 2008; Lee and Myers 2004). Also a project's justification (Willcocks and Sykes 2000), the financial planning and the workflow planning with a clear project plan (Gargeya and Brady 2005; Holland et al. 1999) are included in this category. The success factor literature puts an emphasises on more strategic factors than the risk factor literature, which attaches more importance to the planning factors, such as the risk of inadequate resources (Karimi Somers and Bhattacherjee 2007). Especially the necessity of a business vision is a strategic factor, which is only considered in the success factor literature. Gargeya and Brady (2005) state that inadequate planning and budgeting is a factor that can result in project failure but does not in itself constitute ERP implementation success.

Selection and Adaption of the ERP System

The careful selection of an ERP system is a crucial factor within implementation projects (Lui and Chan 2008; Plant and Willcocks 2007) as the organizational fit of the ERP system and the company has to be taken into account (Hong and Kim 2002; Krumbholz Galliers Coulianos and Maiden 2000). The differences between the organizational structure and/ or culture and the ERP system have to be reduced by adaption. Here two possibilities exist: On the one hand, Business Process Reengineering (BPR) and, on the other hand, the customization of the ERP system can be employed to even out the differences between the system and the organization (Nah Islam and Tan 2007; Rettig 2007). Scheer and Habermann (2000) amongst others prefer BPR: "ERP implementation should involve the analysis of current business processes and the chance of reengineering, rather than designing an application system that makes only the best of bad processes".

Change Management

In this category only minor to no differences exist between the two fields of research. Both recognize the necessity of change management due to the organizational modifications in the context of Business Process Reengineering (Somers and Nelson 2004). These changes have an impact on a company's strategy, its processes and its employees. Change management aims at preventing resistance against these changes. Both streams of literature state training and education (Häkkinen and Hilmola 2008; Staehr 2010), user integration and the increase of user acceptance as important factors (Wagner and Newell 2007; Wright and Wright 2002). Only with regard to one aspect, the two fields of research complement each other: Whereas the risk factor literature mentions the resistance against the organizational und cultural changes (Sumner 2000) as important factors but provides few response strategies for it, literature on success factor fills this gap by proposing an effective re-configuration of the organizational culture as a solution (Ke and Wei 2008).

Communication

Although the success factor literature discusses communication issues more intensely than the risk factor literature. Both fields deal mainly with identical factors. Important factors comprise:

- cross-departmental communication (Häkkinen et al. 2008; Plant et al. 2007),

- cross-functional communication primarily between business and IT (Holland et al. 1999),

- communication with stakeholders and users of the system (Somers et al. 2004).

In this regard, communication should always comprise a project's goals and objectives as well as its progress (Al-Mashari et al. 2003; Sumner 2000).

Team Work and Team Composition

With regard to team work and team composition, risk and success factor literature deal with roughly the same factors. These include a balanced composition of the team with internal and external employees from business and IT, the availability of the required skills and the acquisition and retaining of talented team members. A more detailed look reveals that the success factor literature explicitly emphasizes the necessity of cross-departmental co-operation (Akkermans et al. 2002) and deals more intensely with the issue of skills and abilities of the team (Willcocks et al. 2000). The risk factor literature concentrates more on the difficulty of acquiring and retaining qualified employees for the project (Markus Axline Petrie and Tanis 2000; Sumner 2000). In this regard, the success factor literature gives suggestions how to motivate the project members and how to develop a good solidarity within the team (Staehr 2010).

External Expertise

In the category "External Expertise" the two fields of research complement each other. While the success factor literature emphasizes the necessity of the integration of external experts (Akkermans et al. 2002), the risk factor literature works out the risks of employing inadequate consultants. They are essential to bridge the gaps in the company's existing knowledge. In this regard, ensuring long term success requires a knowledge transfer from external to internal employees (Willcocks et al. 2000). This knowledge transfer can of course only take place if consultants are carefully selected and controlled (Somers et al. 2004). These caveats are also mentioned in the risk factor literature which cautions about the high costs of incompetent consultants (Aloini et al. 2007; Markus et al. 2000).

Performance Measurement

Authors dealing with the performance measurement emphasize the careful definition of indicators in order to control the right results (Markus et al. 2000; Staehr 2010). According to Al-Mashari et al. (2003) "measuring and evaluating performance is a very critical factor for ensuring the success of any business organisation and indeed for making IT systems such as ERP pay back". The risk factor literature warns of inadequate success measures as they lead to unknown and disappointing business results (Umble Haft and Umble 2003). In contrast, the success factor literature doesn't only focus on performance measurement after the project is finished. Here, the importance of an early definition of success metrics and indicators for controlling a project's progress is emphasized (Holland et al. 1999).

Project Champion

Parr and Shanks (2000) describe a project champion as an "advocate for the system who is unswerving in promoting the benefits of the new system". He is primarily valuable in the first steps of the project in order to promote the project's benefits within the company and to increase the user acceptance. The project champion is clearly dealt with more intensely in the literature on success factors. Only two authors in the risk factor literature mentioned the necessity of a project champion (Aloini et al. 2007; Sumner 2000).

Project Management

Factors related to the project management are discussed more often in the risk factor literature. However, the two fields of research overlap with respect to the activities of project management: For instance, both categories emphasize the necessity of project planning and control, scope management, human resources management, risk management, management of expectations, crisis management as well as the definition of a clear vision and goals (Gargeya et al. 2005; Somers et al. 2004). Apart from that, the success factor literature gives suggestions about the characteristics of a good project management such as systematic planning, compassing the whole project and the importance of good strategic and tactical skills (Al-Mashari et al. 2003). In contrast, the risk factor literature mentions risks, which can appear during project management, for example the lack of a central management structure, underestimation of size, scope and complexity, ineffective methods and lack of information (Aloini et al. 2007; Häkkinen et al. 2008).

Roll out and Configuration

Concerning the roll out and the configuration of an ERP system, the two research areas agree about the importance of making architecture decisions, conversion and correctness of the data as well as company-wide integration and testing (Markus et al. 2000; Plant et al. 2007). Issues such as the company-wide integration and testing are more important in the risk factors literature. In addition, the risk factors of:

- a poor specification and system design,
- an inadequate roll out,
- complex legacy systems,
- a difficult and costly maintenance and
- a variety of interfaces and bugs are mentioned (Lui et al. 2008; Sumner 2000; Wright et al. 2002).

These factors are not mentioned in the success factor literature, but here the importance of a structured and disciplined approach for deploying an ERP system is pointed out (Umble et al. 2003).

Top Management Support

The availability of top management support is a very often-cited factor in the success factor literature. In contrast the risk factor literature pays little attention to it. The necessity of top management support results from the company-wide consequences of ERP implementation projects (Holland et al. 1999). The involvement of the top management is necessary throughout the whole implementation process and particularly important in controversial projects (Lui et al. 2008).

Table 3 shows a ranking of the categories according to the numbers of authors discussing factors within these categories. A detailed mapping of authors to categories and factors to categories is available upon request.

Rank	Success Factor Literature	#		Rank	Risk Factor Literature	#
1	Selection and Adaption	19		1	Selection and Adaption	16
1	Change Management	19		2	Change Management	12
1	Planning and Strategy	19		3	Roll out and Configuration	11
4	Team Work and Composition	18		4	Project Management	10
5	Top Management Support	17		5	Planning and Strategy	9
6	Project Management	13		6	Team Work and Composition	8
6	External Expertise	13		7	External Expertise	5
8	Communication	12		8	Top Management Support	4
9	Project Champion	9		9	Communication	3
10	Roll out and Configuration	8		10	Performance Measurement	2
11	Performance Measurement	7		10	Project Champion	2
12	Existing Environment and Systems	5		12	Existing Environment and Systems	0

Table 3. Importance of Risk and Success Factors According to Citations

Table 3 illustrates that the categories "Selection and Adaption of the ERP System" and "Change Management" are in both fields of research the categories with the highest number of citations. This confirms the results of Finney and Corbett (2007), which also rank these two factors among the most important ones. One of the biggest differences between the two fields concerns the roll out and the configuration of a new system. In the risk factor literature it is the third most frequently cited

factor while in the success factor literature it is only ranked tenth. The low rank in the success factor literature is in line with the results of other studies where the roll out and the configuration also ranks low (Finney et al. 2007; Gargeya et al. 2005).

Figure 1 shows the number of citations in each category relative to the total number of articles in the risk and the success factor literature respectively. By taking into account the differences in the absolute numbers of papers found in each field of research, the respective foci between the two fields become clear. Whereas the risk factor literature seems to focus on the categories "Project Management", "Roll out and Configuration", and the "Selection and Adaption of the ERP System", all other categories are cited more frequently in the success factor literature.
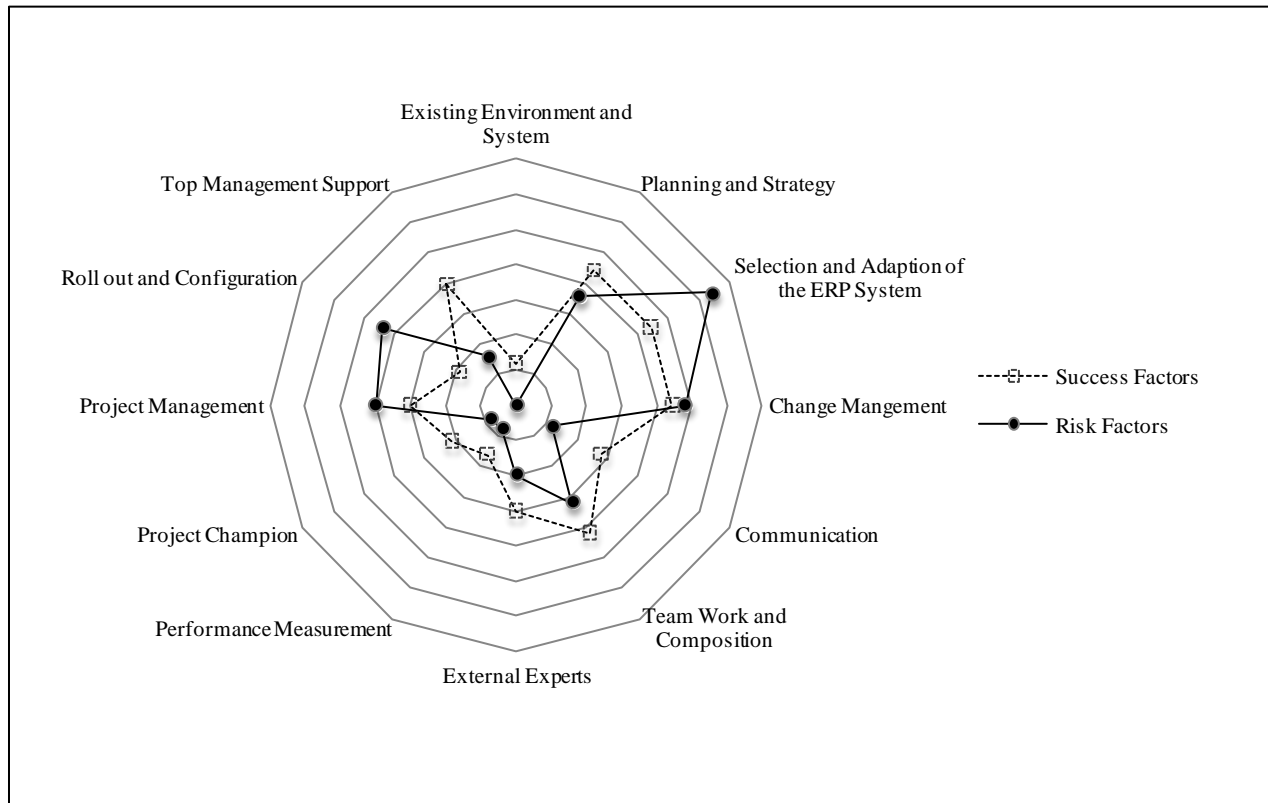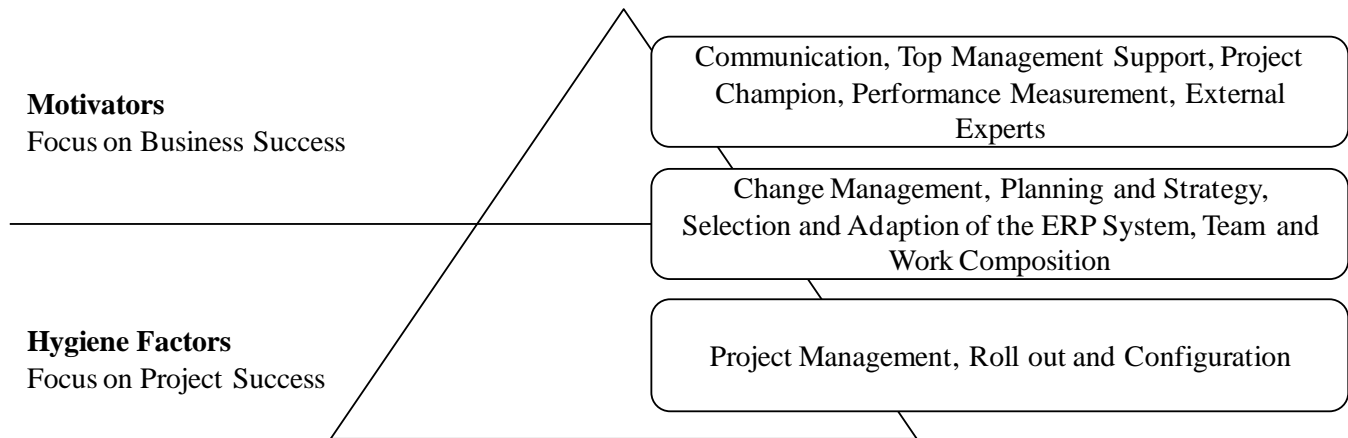

Figure 1. Relative Importance of Categories in Risk and Success Research

DISCUSSION

In the following we present an approach which integrates our understanding of risk and success factors. The different foci in the two fields may be due to different views on project success. Taking a look at the focus categories in the risk factor literature, we propose that they particularly concern traditional dimensions of project success, i.e. adherence to schedule, budget and functionality objectives of a project (Atkinson 1999): "Project Management" concern means to achieve a high project management efficiency, whereas the "Roll out and Configuration" is primarily concerned with implementing the required functionality. The risk factor literature's emphasises on traditional success dimensions is in line with the results of de Bakker, Boonstra and Wortmann (2010). However, as recent research suggests, project success also comprises several other dimensions such as user acceptance or strategic benefits in addition to schedule, budget and functionality (DeLone and McLean 2003; Shenhar Dvir Levy and Maltz 2001). These factors, which constitute business success, are accounted for in the success factor literature: The categories: "Top Management Support", "Project Champion", "External Experts", "Communication", "Performance Measurement" tend to aim at achieving long term success dimensions.

An analogy may be drawn to Herzberg's (1968) Two-Factor-Theory about motivation at work: Whereas the absence/ presence of "Hygiene Factors", which include factors such as firm policies and administration, work conditions and income, result in dissatisfaction/ no dissatisfaction at work, the so called "Motivators" can cause satisfaction/ no satisfaction. In the context of ERP projects this requires differentiating between unsuccessful – not unsuccessful and successful and not successful projects. An unsuccessful project may be one which is not finished in time, budget or with the required functionality, whereas a not unsuccessful one satisfies each of the three criteria. Successful projects would also realize long

term individual or organizational benefits. Thus, following Herzberg (1968), also risk and success factors might be divided into "Motivators" and "Hygiene Factors" depending on which success criteria they focus (see Figure 2).

Motivators
Focus on Business Success

| Communication, Top Management Support, Project Champion, Performance Measurement, External Experts |

| Change Management, Planning and Strategy, Selection and Adaption of the ERP System, Team and Work Composition |

Hygiene Factors
Focus on Project Success

| Project Management, Roll out and Configuration |

Figure 2. Exemplary Categorization of Risk and Success Factors

We propose that the categories "Communication", "Top Management Support", "Project Champion", "Performance Measurement", as well as "External Expertise", which are discussed with particular emphasis in the success factor literature, can be said to be "Motivators". Factors in these categories ensure business success. On the contrary, the categories "Roll out and Configuration" and "Project Management", which are foci in the risk factor literature, are suggested to be the "Hygiene Factors", which are mainly concerned with project success in a narrow sense. The categories "Change Management", "Planning and Strategy", "Selection and Adaption of the ERP System" as well as "Team and Work Composition" have influence on both, project and business success. We conclude that the risk factor literature emphasizes a project manager's perspective, i.e. the necessity for finishing a project within time, budget and with the required functionalities. In contrast, research on success factors concentrates more on the executive's perspective, i.e. realising organizational or individual benefits. These different perspectives of project managers and executives have been confirmed by earlier studies (DeLone et al. 2003) and might offer a preliminary explanation for the discrepancy between the risk and success factor literature. Integrating these two streams of research in more detail might help to achieve more successful projects from both, a project manager's and a senior executive's perspective.

SUMMARY AND CONTRIBUTION

In this paper we identified 80 success factors and 68 risk factors in ERP projects. In order to analyze differences in these two fields of research we mapped the factors to twelve categories. Though some topics are equally important in risk and success factor research, the literature on risk factors emphasizes topics which ensure achieving budget, schedule and functionality targets. In contrast, the literature on success factors seems to concentrate more on strategic and organizational topics. By drawing an analogy to Herzberg's (1968) Two-Factor-Theory about motivation at work we propose an approach to integrate these two streams of research. Due to their different foci, a more detailed integration might help to manage ERP projects more successfully.

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