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Critical Success Factors for ERP Projects Revisited: An Update of Literature Reviews

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***Abstract*—The aim of our study was to provide an update to the research field of critical success factors (CSFs) of enterprise resource planning (ERP) system projects. Therefore, we conducted two literature reviews, more specifically systematic reviews of relevant articles in different databases and among several international conference proceedings from mid-2012 to 2023. These two reviews serve as an update of previous analyses that we conducted covering the period from 1998 until mid-2012. In our current analysis, we identified 272 relevant papers – single or multiple case studies, surveys, and literature reviews or articles from which CSFs can be derived. From these existing studies, we discovered 33 different CSFs for ERP projects. The top three factors identified are 1) Top management support and involvement, 2) Organizational fit of the ERP system, and 3) User training. Our analysis shows that the majority of important CSFs are organizational factors with a strategic perspective. Nevertheless, important technological CSFs should also be decisively considered in ERP projects. These CSFs must be coordinated and aligned with the organizational factors in order to contribute to the holistic success of the ERP project.**

***Index Terms*—ERP systems, ERP projects, Enterprise resource planning, Critical Success Factors, CSF, Literature Review**

I. Introduction

INFORMATION and communication technology (ICT) has undergone rapid changes over the last ten years, with far-reaching effects on almost every aspect of daily life. These changes and the associated digitalization have led to companies as well as public institutions, organizations, and private individuals increasingly shifting their activities to the digital world. More and more, companies are using e-commerce to tap into new market opportunities. Public authorities are turning to e-government to reduce the administrative burden, and social interactions are increasingly shifting to the digital world of social networks. Even a large proportion of global financial transactions are almost inconceivable without the use of ICT [1].

For companies, digitalization opens up the opportunity to develop and establish new business models. Companies can make their products and services "smarter" by connecting them to digital Internet of Things (IoT) platforms and collecting and analyzing data. This approach makes it possible to create new forms of value based on cross-company data exchange, the sale of data-based expertise, or data-supported collaboration on digital platforms. The consideration of data-based value creation activities through digitalization offers companies significant competitive advantages, enables more sustainable economic activity, and creates more diverse and attractive jobs in respective regions. This development underlines the role of digitalization as a key component for growth and success in the modern, dynamic economic world [2], [3], [4], [5].

Although digitalization affects all industries at different speeds and to different degrees, hardly any company can escape this development. In order to remain competitive, companies must actively shape their own digitalization and utilize the opportunities that arise [6], [7]. Therefore, for companies, an in-depth understanding of digital transformation in general, and digital innovations as well as ICT in particular is essential. This is the only way for companies to fully utilize the potential of new technologies and develop innovative business models. The ability to recognize digital trends at an early stage and integrate them into the corporate strategy in a targeted manner is crucial to future success. Companies must, therefore, continuously invest in training their employees, optimizing their processes, and, above all, adapting their own enterprise system landscape to leverage the potential of digital transformation [8], [9], [10], [11], [12], [13].

From a more technical viewpoint, the focus is primarily on enterprise systems (ES) as company-wide application systems. Over the last two decades, both technological and organizational innovations have significantly expanded the functionalities of ES. Despite decades of experience, these

implementation, adaptation, and integration projects remain complex and challenging, as changes in the ES landscape often have a profound impact on corporate structures and processes. Well-thought-out project management, embedded in long-term digital transformation strategies, is, therefore, essential for any significant change to the ES landscape in companies and public administrations [14].

Enterprise resource planning (ERP) systems are one of the most important classes of ES. For many companies, ERP systems form the basis for optimizing internal processes and are, therefore, essential for dealing with the challenges of digitalization. The implementation or adaptation of ERP systems are complex and time-consuming projects, which offer companies great opportunities, but also harbor considerable risks. To avoid being overwhelmed by these risks, companies must focus on the factors that can influence such projects. Studies have shown that paying attention to so-called "critical success factors" (CSFs) can have a positive influence on the success of ERP projects and effectively minimize risks. Paying attention to these CSFs is also relevant for other digitalization projects. Companies should consider these in every software or digitalization project, be it the implementation of new systems and technologies or the adaptation or replacement of existing systems. Therefore, the central research question underlying our previous and current analyses of CSFs is:

Which critical success factors influence ERP implementation and adaptation projects?

Critical success factors for ERP projects have already been examined in numerous scientific and practice-oriented publications. Various case studies, surveys and the results of literature reviews have been published. In our own literature analyses [15], [16], we have previously shown that CSFs for ERP projects and their importance to these projects change over time. We have, therefore, emphasized the need to update the literature reviews at certain intervals. To address this and update the existing reviews by including current ERP literature and to provide insight into the current discussion on CSFs for ERP projects, we conducted two literature reviews. The first was done in 2017 (covering the period from mid-2012 until mid-2017), and the second review was done in 2023 (covering the period from mid-2017 until 2023). More specifically, these were two systematic reviews of articles from different databases and from several international conference proceedings. The CSFs reported in this paper were derived from 272 papers identified as relevant, and the frequency of the occurrence of each CSF was counted. The aggregated results of these reviews will be presented in this paper.

This article is structured as follows. The next section presents a short overview of our data collection methodology in order to make our review reproducible. Subsequently, in Section 3, the most important critical success factors that were focused on during the reviews will be explained in detail. Additionally, Section 3 deals with the results of the literature reviews. We will point out which factors are the most important and which factors seem to have little influence on ERP project success. Finally, the paper concludes with a summary of the results as well as the critical acclaim of the conducted literature reviews.

II. Data Collection Methodology – Systematic Literature Review

The literature reviews to identify the CSFs were performed in several steps similar to the approach suggested by Webster & Watson [17]. The steps taken in both current reviews are strongly based on the procedure that we used in our previous literature reviews on the topic of CSF for ERP projects [15], [16].

For the current analysis, we conducted two separate literature reviews according to the same search procedure and steps. The first one (hereafter referred to as *Review 2017*) was done in mid-2017, and covered the period from mid-2012 until mid-2017. The second review (hereafter referred to as *Review 2023*) was conducted at the end of 2023, covering the period from mid-2017 until the end of 2023. In general, these were database-driven reviews with an additional search in the proceedings of several conferences in the field of information systems (IS). To make our review reproducible, we listed tables with the databases and search terms in the Appendix (see Tables IV and V).

The steps taken in our review procedures are presented in the following paragraphs. An overview is given in Fig. 1 and Fig. 2 with regard to the numbers of papers identified or remaining during/after each step. With each step, the number of papers was reduced according to the assembly of different criteria. In particular, papers were deemed relevant for our analyses that either:

- examined CSFs in empirical studies (qualitative and/or quantitative),
- presented CSFs in literature reviews, or
- derived specific (partly individual) CSFs based on theory.

These criteria were chiefly applied in Step 4 and Step 5 (see below) in the more detailed analysis of the abstracts and paper content.

Step 1: The first step was to define the sources for the literature review. Therefore, several databases and conference proceedings were identified (see Table IV).

Step 2: In this step, we had to define the search terms for the database-driven review. Keywords selected for this search were nearly the same keywords as in our previous studies (see [15], [16]). In those studies, the keywords were mostly derived from those supplied and used by the authors of some of the relevant articles identified in a preliminary literature review. The search terms that we used are listed in Table V.

As not every database has the same search fields and search functions, the search fields listed in Table V differ depending on the database. However, we have made sure that the search fields are at least somewhat similar—insofar as this was possible—depending on the functionalities in the databases. For not every conference, appropriate search fields or search functionality could be applied. Hence, we decided, if necessary, to review the abstracts and titles of the papers in this step sometimes manually.

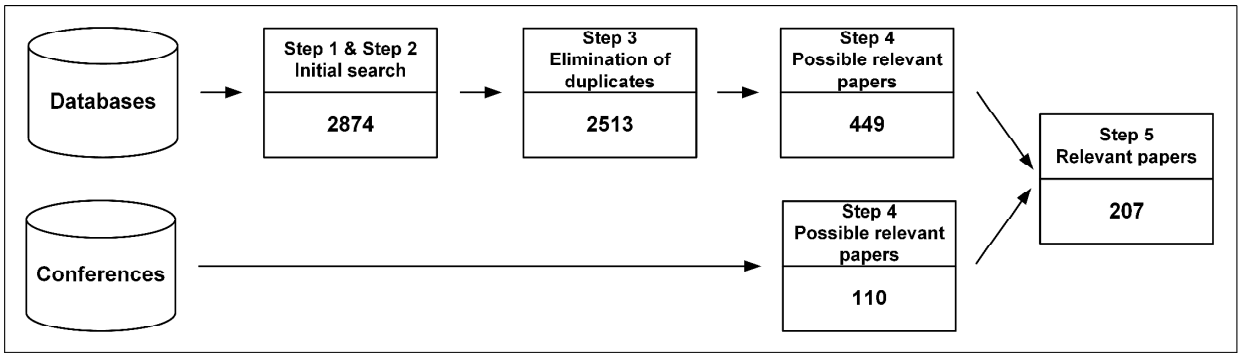

Fig. 1. Progress of Review 2017

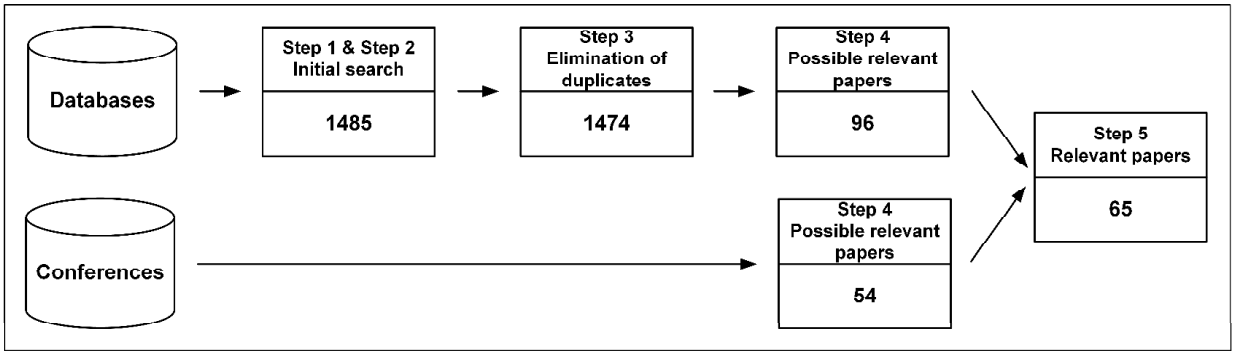

Fig. 2. Progress of Review 2023

Step 3: During Step 3, we performed the initial search according to Steps 1 and 2, and then eliminated duplicates.

- **Review 2017:** The initial search provided 2,874 papers from the databases. After eliminating the duplicates, 2,513 articles remained. From the conference search, 110 papers remained. Altogether, 2,623 papers were identified during the initial search step.
- **Review 2023:** During the initial search step, 1,485 articles were found. After deleting the duplicates, 1,474 papers remained. From the conferences, 54 papers remained. Therefore, altogether 1,528 papers were found during this step.

Step 4: Step 4 included the identification of irrelevant papers. During the initial search, we did not apply any restrictions. The search was not limited to the research field of IS; therefore, papers from other research fields or papers that did not address CSFs of ERP projects (directly or at least indirectly) were also included in the results. Thus, these papers had to be excluded. This was done by reviewing the abstracts of the papers and, if necessary, by examining the paper content.

- **Review 2017:** Of the identified papers in the previous steps, 449 stemming from the database search and all 110 conference papers remained. In total, this review yielded 559 papers that were potentially relevant to the field of CSFs for ERP system implementations (see Fig. 1).
- **Review 2023:** In this review, 96 papers resulting from the databases and all conference papers remained as potentially relevant. Altogether, 150 had to be read in depth according to Step 5 (see Fig. 2).

Step 5: The fifth and final step consisted of a detailed analysis of the remaining 559 and 150 papers from both reviews and the identification of the CSFs. Therefore, the content of all papers was analyzed in depth to categorize the identified success factors. Emphasis was placed not only on the wording of these factors but on their meaning. Following this step, 207 relevant papers that presented, discussed, or mentioned CSFs remained from Review 2017 and 65 articles remained from Review 2023.

Therefore, both reviews led to a final sum of 272 relevant papers. After identifying these papers and the factors stated within them, we developed a concept matrix to match the factors with the papers for the analysis. For each paper, the CSFs were captured as well as the year, the type of data collection used, and the number and size of the companies from which the CSFs were derived. The results of the analysis of these papers and their respective CSFs are described in the following sections.

III. Literature Reviews – Results

A. Critical Success Factors Identified

A CSF for ERP projects has been defined by Finney & Corbett [18] as a reference to any condition or element that was deemed necessary for the ERP project to be successful. Within the analyzed papers, 33 CSFs were identified (see below, ordered alphabetically).

- Available resources (e.g., employees, budget)
- Balanced project team (cross-functional)
- Business process reengineering
- Change management
- Clear goals and objectives (e.g., business plan, vision, decision strategies)
- Communication
- Company's strategy / strategy fit
- Data accuracy (analysis and conversion)
- Data security and privacy
- Environment (e.g., language, culture)
- ERP system acceptance / resistance
- ERP system configuration
- ERP system tests
- External consultants
- Interdepartmental cooperation
- Involvement of end-users and stakeholders
- IT structure and legacy systems
- Knowledge management
- Monitoring, performance measurement and maintenance
- Organizational culture
- Organizational fit of the ERP
- Organizational structure
- Project champion
- Project leadership / empowered decision makers
- Project management
- Skills, knowledge, and expertise
- System and data availability
- Top management support and involvement
- Troubleshooting
- Use of a steering committee
- User training
- Vendor relationship and support
- Vendor tools and implementation methods

To provide a comprehensive understanding of the different CSFs and their concepts, these are described in this section before presenting a further analysis and discussion of the results. However, only the top five CSFs (see Fig. 3) are described as well as the two factors (*System and data availability* and *Data security and privacy)* that were newly identified in our two current reviews. A detailed description of each individual factor can be requested from the first author or can also be found in Leyh and Sander [16].

Top management support and involvement: Top management support and involvement is one of the most important success factors for ERP projects [19]. A committed leadership at the top management level is the basis for continuous accomplishment of every project [18]. Thus, innovations, in particular new technologies, are more widely accepted by employees if they are promoted by top management. Before the project starts, top management must identify the peculiarities and challenges of the planned ERP project. Since many decisions that have to be made during the project affect the whole enterprise, they will need the acceptance and the commitment of senior managers, and often they are the only ones who can make such decisions [20]. Commitment of top management is important in allocating necessary resources to make quick and effective decisions, solving conflicts that need enterprise-wide acceptance, and reaching and supporting cooperation from all departments [21].

Organizational fit of the ERP System: The fact that the organizational fit of an ERP system should be examined and considered comprehensively before its implementation appears to be logical. Nevertheless, ERP vendors tend to set up blind confidence in their ERP package even if it is obvious that the organizational fit is weak. Hong and Kim [22] empirically examined to what extent the implementation success of an ERP system depends on the fit between the company and the ERP system and determined that the adaptation and configuration effort negatively correlates with the implementation success. Therefore, it is essential to select an ERP system carefully by considering its specific organizational fit, such as company size or industry sector. Thus, the right ERP system selection is an important factor to ensure the fit between the company and the ERP system.

User training: Often, missing or lacking end-user training is a cause for failure during the implementation of new software. The main goal of end-user training is to provide an effective understanding of the new business processes and applications as well as the new workflows that result from the ERP implementation. Therefore, it is important to set up a suitable plan for the training and education of the employees [21]. Furthermore, during such an extensive project it has to be determined which employee fits best for which position or application of the new software. This depends strongly on the employee's previous knowledge and on who will require additional training courses [23].

Project management: Project management refers to the ongoing management of the implementation plan [18]. The implementation of an ERP system is a unique procedure that requires enterprise-wide project management. Therefore, it involves the planning stages, the allocating of responsibilities, the definition of milestones and critical paths, training and human resource planning, and the determination of measures of success [24], [25]. This enables a better organized approach to decision making, and guarantees that the most suitable company members will make decisions. Furthermore, continuous project management makes it possible to focus on the important aspects of the ERP implementation and ensures timeliness and that schedules are met [24]. Within project management, a comprehensive documentation of the tasks, responsibilities, and goals is indispensable for the success of ERP implementations [26].

Change management: Change management involves early participation of all persons affected by a change process in order to reduce resistance against these modifications. An important component is adequate training, especially of the IT department, as well as early communication of the changes to provide employees with an opportunity to react [24]. Change management strategies are responsible for handling the enterprise-wide cultural and structural changes. Therefore, it is necessary to train and educate the employees in various ways. Change management aims toward preventing rejection and supporting acceptance. Moreover, its goal is to make employees understand and desire the changes. Early integration of the employees in planning and implementation is important in achieving this understanding. In addition, during the user training sessions, a support team should be available to clarify and answer questions regarding the new processes and function. Furthermore, an additional evaluation with the end-users should be conducted following the "go-live" of the ERP system to uncover problems and avoid discords [27].

Data security and privacy: Data security and privacy play a crucial role in using ERP systems via cloud computing. The migration of sensitive data, as well as the confidentiality of data in the cloud must be guaranteed at all times. Data security also includes the security of services, data centers, and media [28], [29]. Protection against unauthorized access is essential. Data security and privacy are the two main factors involved with cloud computing; however, they also represent concerns on the part of users, which need to be counteracted. Various security techniques and methods can help to protect data in the cloud (see e.g., [30], [31]).

System and data availability: The CSF *System and data availability* describes the capability of a (cloud) ERP system to transmit the right data to the right place at the right time, regardless of location. If there are disruptions and interruptions in accessibility, the implemented system will not fulfill its purpose. Data should be immediately accessible to the end-user via a wide variety of platforms [30], [32]. Especially in times of increasing networking or mobile work, unrestricted availability of services is required. It is, therefore, imperative to agree on continuous availability by means of a service level agreement (SLA) when choosing a provider [33].

B. Analysis of Critical Success Factors and Discussion

As stated above, 272 papers (single- or multiple-case studies, surveys, literature reviews, etc.) were identified that referred to critical success factors of ERP projects. These papers were reviewed again in depth to determine the different concepts of CSFs. Overall, 33 factors (the top five with regard to both of our reviews were described above) were identified. With 33 factors, we used a larger number in our analyses than earlier researchers, because we expected the resulting distribution to be more insightful. If broader definitions of some CSFs are needed later (e.g., grouping the CSFs more coarsely), further aggregation is still possible. Compared to the 31 CSFs from our previous analyses [16], two new factors (also described above) were identified in these reviews: *System and data availability* and *Data security and privacy*. These two new CSFs were identified exclusively in cloud ERP papers.

Table I shows the distribution of all analyzed articles per year. Most of the papers were published between 2012 and 2017. Since 2012 until 2017, approximately more than 30 papers were published each year. Despite similar initial

databases for both reviews, since 2018 only around ten papers or even fewer were published about CSFs each year. Therefore, it could be argued that existing literature reviews should still be updated for the topic area of critical success factors for ERP projects. However, a broader focus should be placed on digitalization projects in general and their CSFs, especially against the backdrop of ever faster developing and changing technologies and technological possibilities.

Fig. 3 shows the results of our reviews in total: the identified CSFs and their overall numbers.

TABLE I. PAPER DISTRIBUTION PER YEAR

Year	Papers	Year	Papers
2023	4	2017	33
2022	7	2016	38
2021	8	2015	44
2020	8	2014	41
2019	12	2013	35
2018	12	2012	30

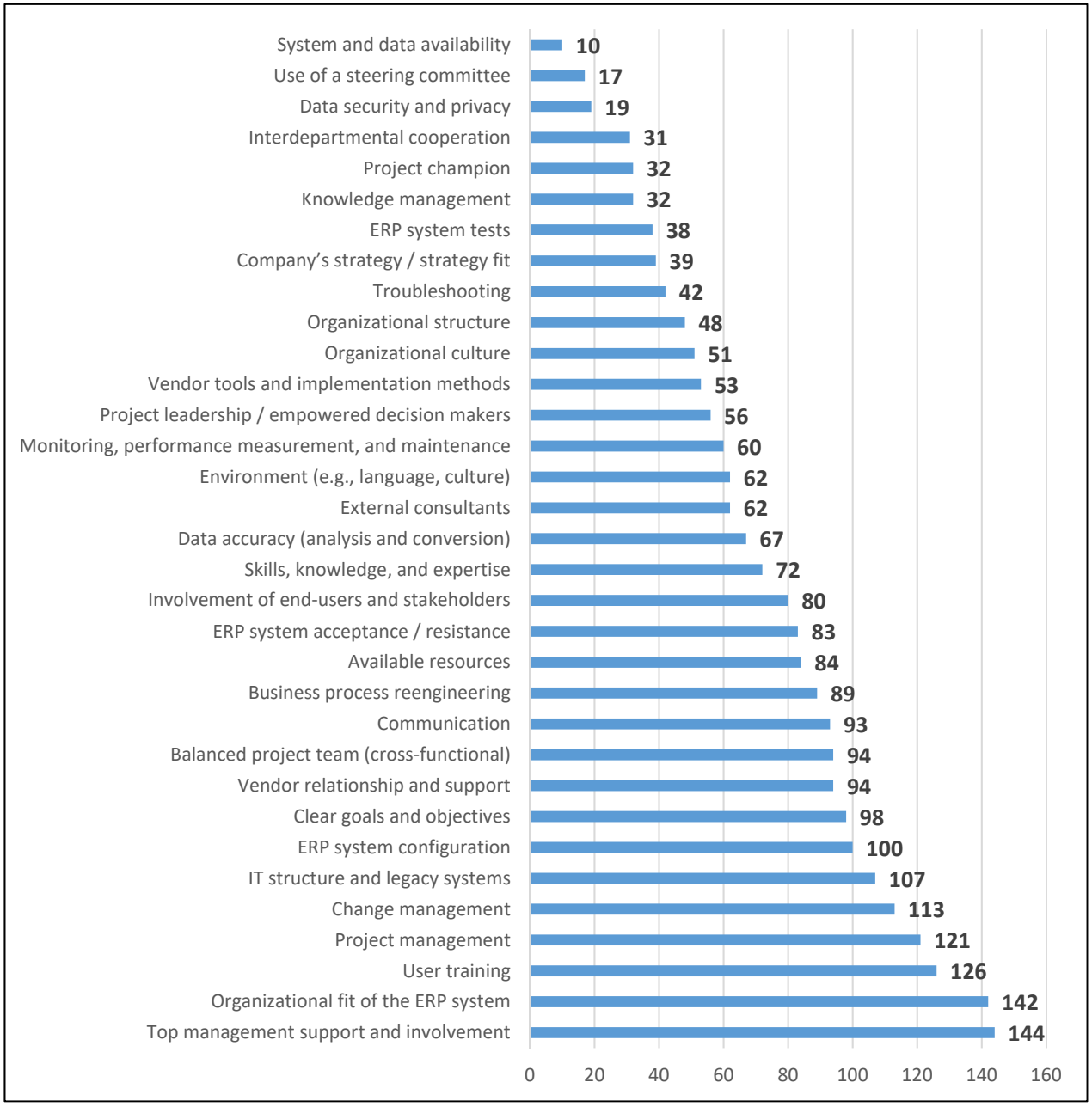

Fig. 3. CSFs Ordered by Frequency (Number of Articles Analyzed = 272)

Fig. 3 shows that *Top management support and involvement*, *Organizational fit of the ERP system*, *User training*, *Project management* and *Change Management* are the five most frequently named factors, each numbering above 110. The factors *Top management support and involvement* and *Organizational fit of the ERP system* ranked numbers one and two, each of which were referred to in more than 140 papers.

Regarding the form of data collection within the analyzed articles, 24% of the papers covered single- or multiple-case studies, 52% were quantitative surveys (paper-based or online) or qualitative surveys (e.g., as part of interview studies), and 24% of the CSFs were derived on a theoretical basis.

To more specifically analyze and categorize critical success factors, Esteves-Sousa and Pastor-Collado [34] suggested a matrix scheme. They considered the tactical or strategic direction of the CSFs and divided them into organizational and technological factors. Thus, tactical CSFs tended to relate to short-term aspects and goals of the system implementation whereby strategic factors aimed for long-term impacts of activities with strong connections to the development of the organization in relation to mission, vision and core competencies of the business activity. Considering the technological and organizational character of the CSFs, the specificity and significance of technological factors strongly depended on the ERP systems themselves, whereas organizational factors focused on corporate culture and its environment with its specific processes and structures [34], [35]. Table II gives an overview of the categorization of the top ten CSFs identified in our literature reviews with a focus on their ranking. It is becoming obvious that the majority of important CSFs in ERP projects are organizational factors with a strategic focus. Nevertheless, two of the top five factors are in the area of tactical orientation. Table II also shows that important factors of a technological nature are strategically oriented, which underlines the conscientious selection of the ERP system as essential for the success of the projects. The CSF *IT structure and legacy systems* thereby can take a strategic as well as a tactical perspective. However, technological factors should, therefore, not necessarily be subordinated to organizational considerations.

TABLE II. CATEGORIZATION OF CSFS FOCUSING DIFFERENT PERSPECTIVES (ADAPTED FROM [34], [35])

	Strategic Perspective		**Tactical Perspective**	
Organizational CSFs	**Critical Success Factor**	**Rank**	**Critical Success Factor**	**Rank**
	Top management support and involvement	1	User training	3
	Change management	5	Project management	4
	Clear goals and objectives	8		
	Vendor relationship and support	9		
	Balanced project team	10		
Technological CSFs	Organizational fit of the ERP system	2		
	IT structure and legacy systems			6
	ERP system configuration	7		

If we compare the top ten CSFs from Review 2017 and Review 2023 separately (see Table III), it becomes clear that although the ranking of the factors has changed, almost all factors appear in the top ten in both reviews. Only the differentiation of the ranking in Review 2023 based on the frequency of the factors mentioned in the analyzed articles is not as clear due to the lower number of analyzed articles compared to Review 2017. However, overall, it can be stated that the importance of the factors in general, at least as far as the top ranking is concerned, has not fundamentally changed over time.

TABLE III. COMPARISON OF THE TOP TEN CSFS FROM BOTH REVIEWS (ORDERED BY RANK AND FREQUENCY)

Review 2017			Review 2023		
Rank / Number of instances		**CSF**	**Rank /Number of instances**		**CSF**
1	111	Organizational fit of the ERP system	1	39	Change management
2	109	Top management support and involvement	2	35	Top management support and involvement
3	95	User training	3	33	Project management
4	88	Project management	4	31	User training
5	78	IT structure and legacy systems	4	31	Organizational fit of the ERP system
6	74	ERP system configuration	6	29	IT structure and legacy systems
6	74	Change management	6	29	Business process reengineering
8	72	Clear goals and objectives	8	28	Communication
9	68	Vendor relationship and support	9	26	Vendor relationship and support
9	68	Balanced project team	9	26	ERP system configuration
			9	26	Clear goals and objectives
			9	26	Balanced project team

IV. CONCLUSION AND LIMITATIONS

Regardless of company size, an ERP project is a complex and extensive project that often has a profound impact on company processes. A structured approach to the selection and implementation of ERP systems is, therefore, essential. Taking CSFs into account can be decisive for the success of the project and for a long-term increase in efficiency. Well-thought-out *Project management* in conjunction with other factors such as *Top management support and involvement*, the *Organizational fit of the ERP system*, a *Balanced project team* and comprehensive *User training* make a significant contribution to ensuring that the ERP system is optimally adapted to the specific requirements of the company. Effective *Change management* helps to overcome resistance within the company and ensure smooth integration.

By paying attention to CSFs, companies can not only minimize project risks, but also ensure that the ERP system brings sustainable benefits, such as improved processes, increased transparency, and enhanced competitiveness.

Well-planned ERP projects also enable optimized use of existing resources and seamless integration into the company's existing ES landscape. The implementation of a suitable ERP system as the basis of the ES landscape ensures that the company is also able to meet future challenges. The successful implementation and use of an ERP system forms an essential building block for the integration of new technologies and lays the foundation for the company's future digitalization initiatives. Both organizational and technological success factors play a decisive role, and these should be carefully coordinated in order to contribute to the success of the ERP project.

Future research activities in this area can build on the insights gained from our studies. Within our own research project, we plan to investigate individual CSFs (especially the most important ones) in more detail to derive and update recommendations for action for the best use of the CSFs in ERP projects. We plan to apply a qualitative approach by conducting several in-depth interviews with different enterprises. Furthermore, it could be an interesting and informative viewpoint to conduct a study that considers the specifics of individual industry sectors and a more specific focus on company sizes. In this way, we hope to further detail the importance of CSFs for ERP projects. Another starting point for future research could be to analyze CSFs with reference to the different types of ERP systems (on premise

vs. cloud) and the different types of ERP projects (implementation vs. adjustments) to investigate differences in the importance and the definitions of the CSFs. Furthermore, a focus of future study should regard the difficulties of implementing individual CSFs in companies and how these obstacles can be minimized.

Regarding our literature review procedures, there are limitations that must be mentioned. We are aware that we cannot be certain that we have identified all relevant papers published in journals and conferences, since we made a selection of specific databases and conferences. Therefore, journals not included in our databases and proceedings of other conferences might also comprise relevant articles. Another limitation is the coding of the CSFs. We tried to reduce subjectivity by formulating coding rules (based on the approach of our previous literature studies) and by discussing the coding of the CSFs among three independent researchers. Hence, other researchers may code the CSFs in another way.

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APPENDIX

TABLE IV. SOURCES FOR THE LITERATURE REVIEW

Databases	Conferences
• AIS eLibrary (only Review 2023) • Academic Search Complete and Business Source Complete (both only Review 2017) • Business Source Premier (only Review 2023) • Emerald Insight • Science Direct • SpringerLink	• AMCIS • Bled eConference • ECIS • HICCS • ICIS • PACIS • Wirtschaftsinformatik (WI)

TABLE V. SEARCH FIELDS AND SEARCH TERMS

Database + Search fields	Search terms / Keywords
AIS eLibrary: "Title" or "Abstract" or "Subject"	• ERP + success* • ERP + failure • ERP + crit* • ERP + CSF • ERP + CFF • ERP + fact* • "Enterprise system*" + success* • "Enterprise system*" + failure • "Enterprise system*" + crit* • "Enterprise system*" + CSF • "Enterprise system*" + CFF • "Enterprise system*" + fact*
Business Source Premier & Academic Search Complete & Business Source Complete: "TI Title" or "AB Abstract"	
Emerald Insight: "Abstract"	
Science Direct: "Title, Abstract, Keywords"	
SpringerLink: "where the title contains"	