Critical success factors in ERP implementation

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Abstract

This study conducts state of the art literature review of critical success factors for enterprise resource planning systems implementation success. Since research on critical success factors for ERP implementation success is very rare and fragmented, this study provides a more comprehensive list of ten factors that companies that have adopted and struggle with the implementation, as well as companies who are in the process of considering implementation of ERP system can easily adopt and follow. The main contribution of this paper is that these ten new critical success factors are identified through a thorough analysis of 22 selected research papers and is more comprehensive and straightforwardly employable for use.

Keywords: ERP systems, CSFs, ERP implementation, proposed list of CSFs.

Introduction

Today's companies face difficulties in maintaining competitive advantage, especially in the domain of information and communication technologies, since the lack of seamless integration of business processes that will allow companies to leverage from customer data on one hand, and faster supply flow on the other, leads to poor decision making and slow actions and reactions to the changing nature of the business environment. Thus, there is a need for integration of these business processes which can be done through an Enterprise Resource Planning (ERP) system.

This paper provides a literature review of the critical success factors (CSFs) for ERP implementation. These become more and more needed due to the fact that, although every organization has differing definitions of "success" and "failure," more companies are defining their projects as failures when compared to previous years (21% in 2015 compared to 16% in 2014). These results come from Panorama, a consulting company that quantifies results from 562 ERP implementations around the world in their "2015 ERP Report" (Panorama Consulting Solutions, 2015).

1. Critical Success Factors as found in literature

Critical Success Factors (CSFs) for ERP systems implementation are covered in a great deal in academic literature. Looking at existing research, four main papers are distinguished. These research papers are considered to be the foundation of the concepts of CSF for ERP implementation. They have over one thousand citations and are referred in a vast amount of the other papers.

To start with, Umble et al., 2003, in their research work identify critical success factors, software selection steps, and implementation procedures critical to a successful implementation of ERP system. Although many companies that in the 90's had implemented ERPs have reported positive feedback such as savings in millions of dollars due to inventory reduction, logistics, materials management, still the risks and challenges remain high with these projects. ERPs take a long time for implementation and are very costly. As CSF that mitigate the risk of system failure, they distinguish amongst factors three main areas: 1) 9 CSFs for successful ERP implementation; 2) 12 CSFs for ERP system selection; and 3)11 CSFs for Implementation steps. The first nine factors from the first area are vastly recognized in the literature. To start with, the understanding of the strategic goals of the organization, top management commitment, project management practice, change management practice, the selected team, data quality, training in all levels of the organization; performance measures of the system; and last, the implementation approach for handling the multi-site issues– are the factors most important for organizations to prepare themselves to reduce the risk of failure of an ERP implementation (Umble et al., 2003).

Then, Nah et al., 2001 in their paper state that research on CSF for ERP implementation success is rare and scrappy, and identify 11 CSF. To be more accurate, they put the significance of the constitution of the team that will work in the ERP project implementation, change management, premier level of management support; clear plan and vision for implementation; minimum customization, project management practice, communication, performance indicators, software preservation, and managing business and IT legacy systems as CFS. Unlike Umble et al., Nah et al. factors extend over the whole life-cycle of ERP implementation.

Afterwards, Hong and Kim, 2002, analyze the high rate of ERP failures from the insight of the "*organizational fit of ERP*". Given that the data they collect is primary data from interviews and questionnaires, their study plays a part in the awareness of the success factors. Out of the thirty four organizations interviewed, empirical analysis shows that organizational fit has significant effect on the success rate of ERP implementation, as well as that organizational resistance has negative effect on ERP implementation success.

To finish with, Holland and Light, (Holland, Light, & Gibson, 1999), recommend framework for CSFs so that organizations can develop their ERP implementation strategy. The factors are distinguished between business or within technical scope, and divide the CSFs into two main groups of factors: 1) strategic and 2) tactical - where in the first importance of understanding the legacy systems, ERP strategy, business vision, top management support and project plan/schedule are key CSFs; and in the second, the significance of consultation, personnel, BPR, software configuration,

acceptance, monitoring and feedback, communication and troubleshooting are crucial CSFs. Although 8 case studies were included to make the framework more significant, this framework however lacks to assess the impact of the factors on the ERP implementation.

Methodology and Analysis

Throughout the analysis of these four research studies, a pattern of factors for ERP failure was created as it can be seen in Table1. The severity of the factors is presented with round icons. The fuller the icon is, the more importance is given to the factor. For instance, what all of these authors agree upon mostly is that ERPs typically require and have to get a huge managerial support, while the one that doesn't seem to be the concern of all four of them is that ERPs require consulting firms and consultants firms during the implementation phase. These results show that what these authors portray as factors that influence the increase of the failure rates for ERP implementation, correspond to the disadvantages of ERP systems commonly found in the literature. This again reinforces the statement that literature doesn't seem to have a clear cut representation of the terms used to analyze and describe ERP conditions.

Table 1: Factors for ERP failures based on four most cited research papers

Failure factors / ERP Disadvantages	Umble et al., 2003	(Nah et al., 2001)	(Hong and Kim, 2002)	(Holland et al., 1999)
It takes long time to implement	●	○	◑	○
It disrupts the culture and the business	●	◑	○	○
It needs a lot of training	◕	○	◑	○
It needs a lot of managerial support	●	●	◑	●
It is very costly	◑	◔	◔	◔
It requires consulting/consultants	○	◑	○	◑
It requires reengineering of the business processes (BRP)	◔	●	◕	◑

The analysis of these four papers and another 18 studies, has resulted in a more comprehensive and combined list of ten new critical success factors (see Table 2 and Table 3). Moreover, the reason why 22 studies were selected from a large amount of published research is due to the uniqueness factor and since the other studies deem not to carry whatever thing exceptional to critical success factors and as such, they are merely a repetition or summary of the already existing literature. The four abovementioned studies, where most of the proposed CSFs in this paper have been derived, seem to have created the grounded theory on CSFs on ERP implementation success. Ten main factors were derived from the work of these prestigious authors that can be used by relevant parties interested in implementation of ERP systems that can facilitate the process and the successful completion. As you can see in Table 2, ten clear success factors while implementing ERP are specified. Initially, given that Umble et al. identifies 22 CSFs, Nah distinguishes 11 CSFs, Hong at most 8 CSFs and Holland classifies 13 CSFs in two major categories, it becomes challenging to follow

one specific list that will aid the adoption and implementation of ERP systems. These ten critical success factors given in Table 2 are crafted using meta-synthesis method for qualitative research, an attempt to integrate the critical success factors from the four different but inter-related qualitative studies of critical success factors in ERP implementation success. For each given factor in the table, common rudiments from contextual analysis of the studies are obtained, and for each of the factors where does the author insinuate that it belongs to this category if not clearly stated.

Table 2: Proposed list of Critical Success Factors for successful ERP implementati

	Critical Success Factor	Umble et al. 2003	Nah et al. 2001	Hong et al. 2002	Holland et al. 1999
1.	***Detailed knowledge of the organization and legacy systems***	N/A	Determine the IT and organizational change required for success+ appropriate business and IT legacy systems	Analyzed under the factor Organizational fit (also knowledge of ERP before adoption)	Legacy systems
2.	***Having a clear and concise strategy***	The strategic goals of the organization;	Business plan and vision + Clear Business model	Under the factor ERP Implementation Success	Business vision
3.	***Having top management sponsorship***	Commitment of the top management;	Top management support + project champion	N/A	ERP strategy Top management Support
4.	***Following top-notch project management practices***	Project management practice with clear definition of objectives;	Project management	Mentioned under the factor Organizational fit	Project schedules/ plans
5.	***Following top-notch change management practices***	Change management practice (since ERPs may enforce BPR of key processes within organizations);	Change management program and culture, BPR and minimum customization	Mentioned under ERP Adaptation, and Process Adaptation	Client acceptance Client consultation
6.	***Having a skillful and knowledgeable team composition***	The team that will be devoted and selected according to their skill sets;	ERP teamwork and composition	Under the factor ERP Implementation Success	N/A
7.	***Creating clear procedures for data entry and accuracy***	Data quality that has to be established for accuracy;	N/A	Mentioned not significantly under the factor Organizational fit	N/A

8.	***Conducting training and streamlining the communication***	Training in all levels of the organization (as a most widely recognized CSF for enabling people to work with the system);	Effective communication	N/A	Monitoring and feedback Communication
9.	***Creating performance measures***	Measures of performance for the new system that have to be established;	Monitoring and evaluation of performance	Under the factor ERP Implementation Success	BPC
10.	***Deciding on the implementation approach***	The implementation approach which might lead to the issues of multi-site	Software development, testing and troubleshooting	N/A	software configuration

Table 2 is an endeavor to create a more all-embracing list of success factors that companies can follow. As it can be noticed, most of these factors are handled by all of these four authors. When critical success factors are examined, literature takes extensive dimensions. Except for Umble, Nah, Hong and Kim, and Holland, there are many other authors who deal with the importance of critical success factors in pre, during and after ERP implementation process. It is very vital that this list is followed, especially since 48% of any ERP implementation is either a failure or it hasn't reached the success envisaged, and that most of the implementations, around 60% are over budget (Panorama Consulting Solutions, 2015). Figure 1 shows the reasons why companies end up over-budget, and Figure 2 depicts the reasons of exceeding the planned duration of the ERP implementation.

Figure 1: Reasons why ERP implementations go over budget.
Source: (Panorama Consulting Solutions, 2015)

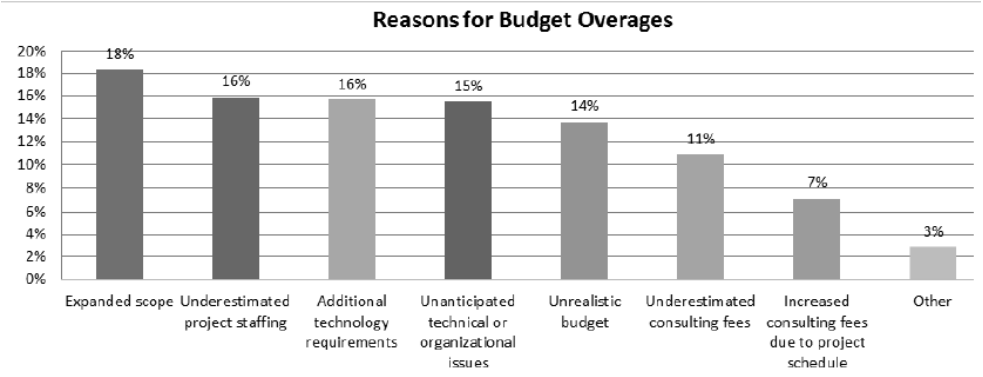
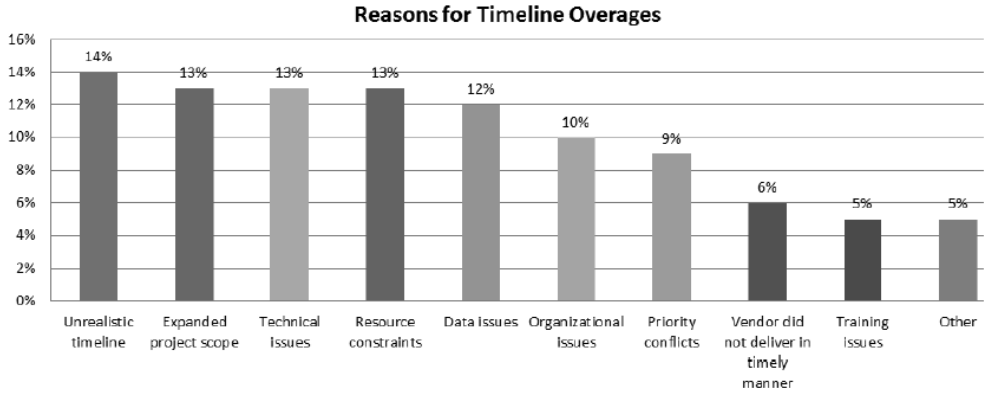


Figure 2: Reasons why companies go over planned duration.
Source: (Panorama Consulting Solutions, 2015)



To emphasize the importance of having clear list of critical success factors, and looking at Figure 1 and Figure 2 makes it more clear that there is a need for such a list, each of the ten identified factors is explained in the result section of this paper to give a more detailed rationale why it was chosen among many others as a critical one.

Results

To start with the detailed analysis of the 10 identified and proposed critical success factors, which is the main contribution of this paper, a rationale that shows extensive work to obtain the same is given in Table 3. It is an endeavor to showcase the importance of the ten identified success factor by looking at their appearance in the list.

Table 3: Extended list of critical success factor for ERP implementation

Critical Success Factor	Jarrar et al, 2000	Sommers and Nelson 2001/04	Akkermans and Helden 2002	Al-Mashari et al, 2002	Wong and Tein, 2003	Ehie and Madsen, 2005	Olson and Zhao, 2007	Hawking, 2007	Finney and Corbett, 2007	Ngai et al, 2008	Sammon and Adam, 2008	Bradley, 2008	Al-Fawaz et al 2008	Poonam Garg, 2010	Han et al, 2010	McLeond et al, 2011	Hanafizadeh et al, 2011	Shaul and Tauber, 2013
1.Detailed knowledge of the organization and legacy systems	✗	✓	✗	✓	✓	?	✗	✓	?	?	✗	✓	✗	✗	✓	✗	✗	?
2.Having a clear and concise strategy	✗	✓	✓	✓	✗	✗	?	✗	?	✓	✗	?	✗	✗	✓	✗	✓	?
3.Having top management sponsorship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓
4.Following project and process management practices for BPR	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
5.Following top-notch change management practices	✓	✓	✗	?	✗	✗	?	✗	✓	✓	✗	✓	✗	✗	✓	?	?	?
6.Having a skillful and knowledgeable team composition	✗	✓	✗	✓	✓	✗	✗	✗	✓	✓	✗	✓	✗	✓	✓	✗	✓	✓
7.Creating clear procedures for data entry and accuracy	✗	✓	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
8.Conducting training and streamlining the communication	✗	?	?	?	✓	✗	✓	✗	✓	?	✗	?	?	?	?	✗	?	?
9.Creating performance measures	✗	?	?	✓	✓	✗	✗	✗	✗	✓	✗	✓	✗	✗	✓	✗	✗	✓
10. Deciding on the implementation approach	✓	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓

Detailed knowledge of the organization and legacy systems – Umble et al, doesn't seem to give a lot of importance to this factor. But Nah et al. believe that the knowledge of the organization is required for change planning and knowledge of legacy systems is needed to create an appropriate business and IT system (Nah et al., 2001). Hong et al. also give importance by analyzing this under the organizational fit factors (Hong & Kim, 2002), whereas Holland et al, says that without a proper understanding of the legacy systems there cannot be a successful implementation of an ERP project. It is of an immense importance that organizations understand that they need to recognize their business processes for the purpose of fitness between the ERP package and the overall business strategy of the organization. Legacy systems also have to be carefully evaluated and defined to determine the nature and scale of the problems that the organization may come across during the implementation. Some authors (like Bradley) also link a complete management function that will choose the right system according to the legacy systems in place. According to Finney, the consideration of legacy systems is a tactical factor during the implementation of ERP systems. (Al-Mashari, Al-Mudimigh, & Zairi, 2003; Bradley, 2008; Ehie & Madsen, 2005; Finney & Corbett, 2007; Han, Liu, Swanner, & Yang, 2010; Hawking, 2007; Ngai, Law, & Wat, 2008; Shaul & Tauber, 2013; Wong & Tein, 2003)

Having a clear and concise strategy – It is obvious that all the four authors analyzed when this factor was derived agree that a company will not be successful during ERP implementation if it does not have a clear list of strategic goals (Umble), clear business model and plan and vision (Nah, Holland, Hong). Moreover, Mashari states that without a clear guidance and thorough strategic planning, ERP implementation initiative can suffer a huge failure. Bradley adds by analyzing this from the management perspective and puts it in the planning management function by exclaiming that there should be clear project goals, detailed formal plan and well defined tasks. Clear goals, clear objectives, the business vision and mission, strategic plans, focus and scope are factor in most authors that deal with critical success factors (Akkermans & van Helden, 2002; Al-Fawaz, Al-Salti, & Eldabi, 2008; Al-Mashari et al., 2003; Bradley, 2008; Finney & Corbett, 2007; Hanafizadeh & Ravasan, 2011; Olson & Zhao, 2007; Shaul & Tauber, 2013; Somers & Nelson, 2001; Wong & Tein, 2003***Having top management sponsorship*** – this factor is of immense importance for every large scale project, and especially IT project for one organization (Laudon & Laudon, 2012). According to Akkerman, if the top management is not actively backing up the ERP project there is little hope that the project will be successful. Bradley adds it in the leading management function where he states that top management is not just involved, but engaged, and the support can come in form of bonuses tied with success or in any other form. Appropriate involvement of the top management is also described by Somers, who proposes that a steering committee if formed consisting of senior management from across different functions, project management representatives, and end users who will have daily contact with the ERP. One thing is in common, without top management sponsorship, ERP project have little chance of success. (Akkermans & van Helden, 2002; Bradley, 2008; Ehie & Madsen, 2005; Finney & Corbett, 2007; Jarrar, Al-Mudimigh, & Zairi, 2000; McLeod & MacDonell, 2011; Ngai et al., 2008; Somers & Nelson, 2001).

Following top-notch project management practices and process management practices for BPR – It sounds very obvious that a project will not succeed if it doesn't follow practices of the project management, as well as that a major project such as an ERP requires business process reengineering to improve the functionality of the software in accordance with the needs of the organization. According to Somers, *"minimal customization Fortune 1000 companies regarding ERP customization policies indicates that 41% of the companies re-engineer their business to fit the application, 37% of the companies choose applications that fit their business and customize a bit, and only 5% customize the application to fit their business"* which shows the importance of customization of the business processes in the organization (Somers & Nelson, 2001). Ngai states that organizations should reengineer business processes to fit the software instead of trying to modify the software to fit the organizations current business processes. Mashari, in his study verbalizes that one of the major benefits of ERP comes from its enabling role in reengineering the company's existing way of doing business, and that to take advantage of an ERP, BPR is a prerequisite. On the other side, project management practices are of mammoth significance during an ERP implementation. Somers gives this role to the project champion, whereas Akkerman states that the success should be projected to be positively associated with fit and compatibility with the IT vendors employed. Olson, puts this factor under the second phase of an ERP implementation – into planning and phase 3 – where the actions are taken by the project champion. According to Hawking, lack of commitment to project management and project activities lead to many failures, including here ineffective communication, user resistance and reporting failure. Bradley looks at this factor from the management perspective in the organization management function. In line with this, he states that there is a need for full time project manager, reporting level, time, budget, scope and workload clearly defined. In the planning function, clear project goal must be outlined, and in the staffing function there is a need to identify project leaders who are likely to be veterans, team members to be decision makers, and a project champion who will be held responsible (Akkermans & van Helden, 2002; Al-Mashari et al., 2003; Al-Mashari & Zairi, 1999; Bradley, 2008; Finney & Corbett, 2007; Hawking, 2007; McLeod & MacDonell, 2011; Ngai et al., 2008; Olson & Zhao, 2007; Somers & Nelson, 2001).

Following top-notch change management practices – According to Umble, practice for change management is required since ERP implementation enforces BPR of key processes within organizations. Hong does give a slight importance mentioned under the ERP adaptation process as well as process adaptation, whereas Holland implies that change management is important especially for client acceptance of the project. Change management involves the effective balancing of forces in favor of a change over forces of resistance (Ngai et al., 2008). Thus training and education become imperative in the change management process. According to Mashari, *"it is estimated that about half of enterprise system projects fail to achieve hoped-for benefits, because managers significantly underestimate the efforts required to manage effectively the wide range of changes involved"* (Al-Mashari et al., 2003). Shaul states the importance of dealing with conflict management issues, management expectations and risks, as well as identifies change management program and colture as one of the most

important factors in ERP implementation. Bradley, on the other side, states that change management should go hand in hand with project management function, whereas Finney, looks at change management as strategic role for managing the change and the cultural change ERP imposes to the organization (Al-Mashari et al., 2003; Bradley, 2008; Finney & Corbett, 2007; Jarrar et al., 2000; Ngai et al., 2008; Shaul & Tauber, 2013).

Having a skillful and knowledgeable team composition – Many authors have identified that the composition of the team that will lead the ERP project implementation should be consisted of people selected according their skill sets and that will be devoted to the project. Mashari, in his study depicts that inadequate training has shown to be one of the significant reasons of many ERP systems failures. Somers and Akkerman also ad that the competence of the team is of significant importance for project success. Payam seems to give this factor more value by dividing two categories: under staff with three factors and under skills with three factors as well. Shaul emphases that knowledge, morale and motivation, as well as retention of the skilled members of the team paly a huge role in implementation success, whereas Finney suggest that the best, the brightest and empowered decision makers should be members of the team composition that will lead ERP project implementation (Akkermans & van Helden, 2002; Al-Fawaz et al., 2008; Al-Mashari & Zairi, 1999; Bradley, 2008; Finney & Corbett, 2007; Hanafizadeh & Ravasan, 2011; Shaul & Tauber, 2013; Somers & Nelson, 2001; Wong & Tein, 2003).

Creating clear procedures for data entry and accuracy – data management seems to be one of the new factors which is not included in Nah et al, study. It looks like more and more there is a need for validating the data and convert the data into single and consistent format before the system is used. Umble states that data quality has to be established for accuracy, and Hong mentions it not very significantly under the factor organizational fit. However, Somers seems to give an importance to data quality and conversion. Similarly, Shaul, under data management states that there is a need for the organization to create a data analysis plan, quality control, migration and data cleansing as well as data accuracy. Finney considers this factor as tactical under the data conversion and integrity (Finney & Corbett, 2007; Ngai et al., 2008; Shaul & Tauber, 2013; Somers & Nelson, 2001).

Conduction training and streamlining the communication – according to Umble, one of the most recognized CSF for enabling people to work with the system is the training in all levels of the organization. Hong doesn't seem to give importance to this factor, whereas Nah and Holland point to effective communication as a success factor. Communication includes formal promotion of ERP project teams and announcement (Ngai et al., 2008). Moreover, communication has to cover the scope, objectives and tasks of an ERP implementation project (Al-Mashari et al., 2003). Payam places communication under his style factors, whereas Wong et al, place three CSF for training and communication. Bradley from the management perspective in the leading function, gives and importance to management education, communication and expectations, as well as the communication between the team and the rest of the organization as a success factor for ERP implementation. Ehie places the communication under the human resource development but it doesn't specifically

address the issue of effective communication and training, whereas Finney places it as tactical factor where the redesign of the training and jobs is required, as well as a good communication plan for ERP to succeed (Bradley, 2008; Ehie & Madsen, 2005; Finney & Corbett, 2007; Hanafizadeh & Ravasan, 2011).

Creating performance measures – measures of performance for the new system that will be established takes a critical role in ERP implementation success. Successful management of user experiences is found to be related with successful system implementation (Somers & Nelson, 2001). Through monitoring and feedback from the users, the performance of the ERP system can be reviewed and evaluated to see whether it is realizing the goals and objectives of the business (Nah et al., 2001; Ngai et al., 2008; Umble et al., 2003). According to Mashari, *"measuring and evaluating performance is a very critical factor for ensuring the success of any business organization and indeed for making IT systems such as ERP pay back"* and *"it is advisable that regular auditing and benchmarking are considered for optimization of the potential"* (Al-Mashari et al., 2003). Shaul points out to several acceptance control mechanisms like performance metrics, progress against a milestone and feedback management. Similarly, Wong, and Han have pointed to factors for monitoring and evaluation of performance (Finney & Corbett, 2007; Han et al., 2010; Shaul & Tauber, 2013; Wong & Tein, 2003).

Deciding on the implementation approach – Implementation approach might lead to issues of multi-sites, so system integration becomes important due to the cross-module integration nature of the system (Al-Mashari et al., 2003; Umble et al., 2003). Software development, configuration, testing and troubleshooting are commonly mentioned in literature (Bradley, 2008; Ehie & Madsen, 2005; Finney & Corbett, 2007; Han et al., 2010; Holland et al., 1999; Jarrar et al., 2000; Nah et al., 2001; Shaul & Tauber, 2013; Wong & Tein, 2003). On the other hand, some authors for the implementation approach consider the vendor selection process as important factor, as a good vendor can provide support ranging from technical assistance to training (Akkermans & van Helden, 2002; Ngai et al., 2008; Somers & Nelson, 2001).

Conclusions

Since research on critical success factors for ERP implementation success is very rare and fragmented, this study provides a more comprehensive list of ten factors that companies that have adopted and struggle with the implementation, as well as companies who are in the process of considering implementation of ERP system can easily adopt and follow. The main contribution of this paper is that critical success factors are identified through an analysis of 22 research papers and is more comprehensive and straightforwardly employable for use. Indeed, the discussed papers here were selected from a large amount of published research based on their uniqueness factor, since the other papers do not bring anything unique to critical success factors and as such, they are merely a repetition or summary of the already existing literature. Although many research papers are written for CSFs of ERP implementation success, most of them rely on the first four that were analyzed and either extend the factors of one, either are examples of case studies employing another. This study and the list of the 10 success factors bridges the gap in literature

for a newer and updated list of CFS for ERP, which is very needed in organizations, especially keeping in mind that even in 2015, more than 25% of organizations that have adopted ERP have faces failures in implementation of the same.

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