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Spotting the Critical Success Factors of Enterprise Resource Planning Implementation in the Context of Public Higher Education Sector

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ABSTRACT

The failure of Enterprise Resource Planning (ERP) implementation in higher education institutions (HEIs) worldwide is much higher than other sectors, such as banking or manufacturing, yet limited research has been conducted on this field. To date, previous literature has identified some critical success factors (CSFs) mostly either in the domain of information system (IS) or in the industrial context. Hence, this article identifies and categorises CSFs of ERP implementation in HEIs from multiple aspects. Semi-structured face-to-face interviews were conducted with technicians and managers from three Public Jordanian HEIs. The main finding of this study is the identification and characterization of three new sector- and context-specific CSFs. This research contributes to identifying new CSFs with evidence of successful implementation of ERP systems in the public higher education sector, which has not been fully investigated in any documented literature in the sector. The research also brings out some insights for the need for sustainable ERP in the sector during crisis time.

KEYWORDS

ERP implementation; critical success factors; higher education institutions

Introduction

HEIs are not only functioning to impart education but are also responsible for many activities like admissions, placements, financial management and payroll, library management, and many other processes, which ERP systems can help automating all such processes (Noaman & Ahmed, 2015) to ease communication between stakeholders within the sector (Nwankpa, 2015) and to respond to the rise in demand from students to change the teaching pedagogy from a traditional lectures to online studies and e-learning programs (Diabat, 2011). The core of an ERP system in HE is focused on activities like administration of students, management of human resources, payroll systems and financial services (Nwankpa, 2015), and the integration of these activities that improve accessibility to information for planning and management of the institution, and the implementation of ERP systems will make it possible to transfer data between individual processes, making it accessible to various users in real time (Aladwani, 2001).

Despite the benefits and synergies of ERP implementation, many educational institutions find it challenging and expensive to implement (Zornada & Velkavrh, 2005), resulting in very high failure rates of implementing such systems (Tarhini et al., 2015) due mainly to the limited nature of organizational resources and the mismatch in system design and its incorporation within existing IT

infrastructure settings (Elragal & Haddara, 2013). Therefore, identification of the CSFs is associated with ERP failure (Noaman & Ahmed, 2015). There are some major reasons for such a failure including the unclear definition of strategic goals; irresponsibility of senior management in participation and implementation; underestimation of the scope, size, and complexity of the project; lack of preparedness of HEI for the integration of information; improper selection of team members; inappropriate training and education of staff members; lack of transparency in communication; and lack of efficiency in system measures to allow the change (Bitsini, 2015). While various studies have indicated that ERP implementation failure rates in HEIs are higher than any other organization (Davis & Huang, 2007; Noaman & Ahmed, 2015), it has been observed that limited literature is available in the context of CSFs for implementation of ERP specifically in HEIs. Therefore, this research is a step toward providing the missing links for CSFs and the successful implementation of ERP systems in the HE sector.

HEIs in Jordan are under increasing pressure related mainly to the decrease of government funding for education with students and parents' expectation from HEIs to deliver ever higher quality services for lower costs (Al-Mashari et al., 2003). Furthermore, Jordan has the highest (and increasing) demand for higher education in the Middle East as the number of enrolments is growing at

a high rate on a yearly basis (Alomari, 2009), and therefore, HEIs will need advanced systems that manage and integrate their entire operations for better control (Al-Hadi & Al-Shaibany, 2017). Furthermore, the demand for ERP systems in Jordan and in the Middle East is rising due to the rapid growth of internet and mobile users and the increase of the literacy rate, which is the highest in the Middle East region (Hinnawi, 2011).

Considering the above, this study aims at identifying the CSFs of ERP implementation in the context of HE sector. A systematic review of relevant literature on ERP implementation practices particularly in the context of HEIs is presented, and the main CSFs identified in previous studies are discussed. Next, we explained our selection of the qualitative methods, data collection process, and the use of the NVivo coding process in this research. This is followed by presentation and analysis of the findings, as well as discussion of the theoretical contributions and managerial implications.

Literature review

A classification taxonomy of eleven CSFs of ERP has been provided by Al-Mashari et al. (2003), which are categorized into five groups based on ERP implementation stages: operational, managerial, IT infrastructure, strategic, and organizational. It was emphasized that leadership and commitment by the top management are the most influential factors of the successful and effective implementation of ERP in an organization. Similarly, Verville et al. (2005) identified ten CSFs of ERP categorized into two dimensions, namely, process factors and people factors. Umble et al. (2003) established several CSFs, which were identified from previous studies and further extended from a case study of ERP implementation. The factors were combination of technical and management dimensions as well as process and people aspects. With similar findings, Somers and Nelson (2004) identified and ranked 22 CSFs of ERP implementation.

Throughout the systematic literature review process (see Figure 2), those CSFs that were cited less than ten times in the reviewed articles were filtered and this resulted in the eleven most frequently cited CSFs in the literature. The eleven CSFs were categorized into four dimensions (abbreviated by the authors with the word “SPOT”) as follows: Social (top management commitment and support), Project (project management, budget, and time), Organization (change management, training and education, and business process reengineering), and Technical (IT

Infrastructure, system quality, system compatibility, and information quality). More details are provided in the following sections.

Organization-related CSFs

Several studies indicate that training is an influential and critical factor in the implementation of ERP systems, and the majority of researchers emphasized the need for training for users of ERP systems (Mandal & Gunasekaran, 2003). Some researchers argued that training related to ERP systems should be part of IT skills development (Voordijk et al., 2003) and that this training should be easily available (Aladwani, 2001) and should be provided by the organization to help the users understand the system’s functionality and to maximize the incorporation of the system during routine operations (Bajwa et al., 2004). It has been observed that the end users and training has been given least importance by organizations in the ERP system implementation because of the expensive nature of training resources (Gargeya & Brady, 2005).

From another perspective, business process reengineering is considered as a CSF for ERP implementation, which is the method followed by an organization that demands radical redesigning of business processes for the achievement of increased efficiency, higher quality, and better competitiveness of operations (Light et al., 2001). The views of Light et al. (2001) also explain the importance of business process reengineering as an organizational technical process that should be adapted and designed to match the capabilities of the ERP software. Moreover, ERP systems are implemented in an organization-wide manner where several stakeholders are involved, and locations are geographically dispersed in nature, which results in a difficult and expensive process of ERP implementation (Markus et al., 2000). Therefore, the results achieved in the implementation of some technology might not prove to be applicable and successful in the implementation of ERP too, which requires organizations to be prepared to become capable of recognizing the entrenched benchmarks and redesigning their core systems and processes achieved from those exemplified by the system. Nah and Delgado (2006) explained that organizations should make preparations to bring transformation in their basic processes of business so that all the areas become compatible with the new ERP system. However, Law and Ngai (2007) highlight the need for the modest personalization of the software that

can help in reducing the accuracies and make it possible to avail the advantages of the recent editions in the software.

Project-related CSFs

It is a universal truth that budget is one of the most important elements for the implementation of any IT project (Bajwa et al., 2004). The cost of the ERP system depends upon the size of its functions and the extent to which it would be implemented and functions. In the case of ERP system implementation, the cost is not limited to just ownership of software (Bajwa et al., 2004), but upgrading the software can be around 30% of the original software cost (Z. Zhang et al., 2005). Similarly, time plays a critical role in the successful implementation of the ERP system, and the amount of time required for the appropriate and proper execution of an ERP system may vary as per the requirements of the end users. Essence and good results from implementation of any ERP project can only be achieved by timely implementation of all key components in a timely manner. In case, the implementation is not made in a timely manner, adverse effects may be noticed on activities of organizational performance (Somers & Nelson, 2004). This time is utilized in the training of employees and conversion of data from the old system to the new ERP system for the quick accessibility of data by all the users through ERP (Z. Zhang et al., 2005).

Technical-related CSFs

The infrastructure of the IT department is an important part of any HEI to ensure the proper implementation of any ERP system (Doll & Torkzadeh, 1991). According to Jarrar et al. (2000) under the configuration process of an ERP system, there lies an iterative IT infrastructure to achieve the merits of the benchmarks provided by the new system. At the same time, it is required that educational institutions consider ERP as a holistic business undertaking and not limited to its implementation to a large-scale project associated with information technology. Furthermore, Ehie and Madsen (2005) asserted that ERP should be considered as a business solution and not limit its scope to being just an IT solution where the standardization of the IT infrastructure ensures the successful implementation and application of the ERP system.

The quality of the system is associated with the features of functioning and performance associated with ERP implementation. Ifinedo and Nahar (2007) explained that the quality of the system is associated with the issues concerning the facilitation, exploitation,

and procurement of knowledge about the reliability and effectiveness of the system. In the context of the IS discipline, the quality of the IS is considered to have a wider scope in comparison to the areas of the IT sector (Andersson & von Hellens, 1997). The quality of the system is necessary to ensure the beneficial exploitation of the IS giving rise to a competitive edge (Earl, 1989). Therefore, system quality is a key factor ensuring and influencing the implementation of ERP in an efficient manner.

Another CSF identified in the literature is the quality of the information as derived from the information systems. Ifinedo and Nahar (2007) explained that the quality of information is associated with the relevance, ability to understand, accessibility, and usability in proving productive data for the system, and in relation to ERP systems, the quality of information is related to the data obtained from the ERP system. In the context of university, ERP is required to support every organizational process like campus management for students and academic services as an educational administration system, student lifecycle management, and procurement, analytics, research, and asset management. Furthermore, ERP maintenance plays a vital role in making the ERP system successful. Maintenance of the ERP system can be referred to as the process which assesses and identifies any required changes to be bought in the system for the improved utility and performance of the system after its successful implementation (Davenport, 2000). A maintenance team is assigned in an organization specifically for this purpose which addresses the requirements of users, vendors, and consultants, and this maintenance team identifies those modifications which are needed to enhance the business processes and make the ERP system successful. The maintenance team makes the request as per the requirements of the vendor for the specific modifications, which are normally related to the software upgradation, monitoring of the frequency of system updates, and updated enhanced training tutorials for the end users (Nah & Delgado, 2006; see Pui Ng et al., 2002).

Finally, according to Schultz and Slevin (1975), the system compatibility can be referred to as the compatibility of innovation and modification with reference to the existing system with respect to its hardware and software specification. In the process of ERP adoption, it is feasible to retain certain software and integrate it with the ERP system because it is easier to integrate a new IT system with an already existing system than the organizational benefits that can be achieved in a more realistic manner (Tornatzky & Klein, 1982).

Furthermore, if the new systems are easily compatible with the retained software, then it will be easier for the end users to understand and operate the integrated systems (DeLone & McLean, 1992).

Social-related CSFs

The most discussed and cited CSF in the implementation of ERP systems is the support and commitment provided by the top management of the organization. Research suggests that the strong and committed top leadership is the most essential success factor in ERP implementation (Sarker & Lee, 2003). Commitment and support by the top management can be referred to as the anticipation by the management in the case of any glitches that might be faced by the users in the adoption of a system. Furthermore, top management is required to make the strategic plans which can be technically applicable in such scenarios (Al-Mashari et al., 2003). Similarly, the support and commitment by the top management should not be lemmatized to the initiation of facilitation stage, but it should be extended throughout the implementation of an ERP system in an organization (Parr & Shanks, 2000).

The top management of an organization must give high priority to the implementation of an ERP system because the system is supposed to revolutionize the business operations of the organization (Gargeya & Brady, 2005). The commitment and support of the top management should be depicted by demonstrating strong leadership and efficient project management and making efforts to achieve early success. If the top management of an organization fails to support the project, in most cases, projects fail drastically or the predicted benefits cannot be achieved (Parr & Shanks, 2000). Furthermore, Althunibat (2015) stressed that the overall organizational commitment can be achieved if the top management has successfully conveyed their commitment and support across all organizational levels. Such organizational commitment can be visibly identified in an organization, and it can play an important role in successful implementation of ERP (Parr & Shanks, 2000).

Research gaps in the literature

As shown in Table 1, most studies were conducted in sectors other than the public HE sector; few studies were conducted in the Middle East and North Africa (MENA) region; and most studies were focusing on internal CSFs for ERP implementation, with no mentioned studies relevant to the external CSFs such as system providers and system customization to fit the current and

sustainable needs for the HE sector. These research gaps paved the way towards the current study which aims at spotting out the critical success factors of Enterprise Resource Planning implementation in the context of public Higher Education sector with a focus on additional factors which were found to be more externally oriented CSFs and more compatible with the needs for future sustainable ERP systems particularly responding to critical changes during emergency and crisis time such as COVID-19.

Research methods

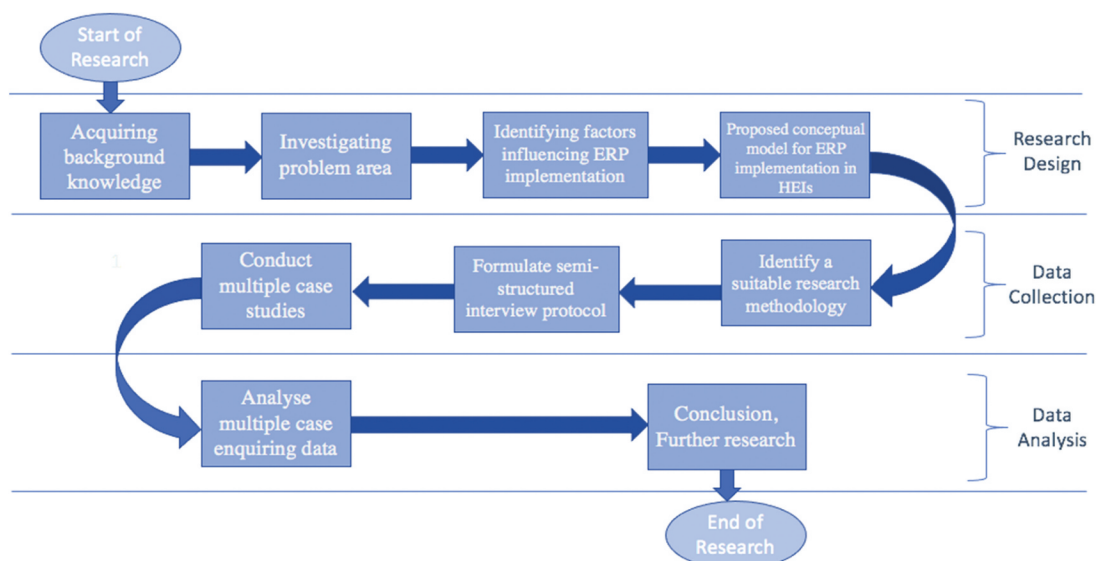
Case studies and sampling

As per the view of Beatty and Williams (2006), a case study helps in conducting an examination of the phenomenon to be investigated in its natural setting through the application of several data collection methods to gather information from all the participants. In our study, an exploratory form of research strategy is applied using the case study method, which investigates the factors that influence the implementation of ERP in public HEIs in Jordan. Exploratory case studies are constructive for the development of theory as they provide evidence to support the work of similar studies in the future. The rationale for selecting the case study method supported by the literature is that case studies are the key tool to understand, extend, explore, and explain the subject under investigation, such as ERP in the context of the current study (Dowlatshahi, 2005). Case studies are generally related to qualitative studies, as these are meritorious to use in assessing a contemporary phenomenon within real-life context when boundaries among phenomena and their context are not clear (Beatty & Williams, 2006).

A semi-structured interview protocol was designed in accordance with the research aim and objectives (see Figure 1 for the research flowchart). Three case studies were selected out of 30 higher HEIs in Jordan due to their maturity in implementing ERP software where they have reached the post-implementation phase. Ten out of Jordanian universities are publicly owned, and the remaining twenty are privately owned institutions. The three selected universities are publicly funded by the government. To select a suitable sample from the population, it is most important that the sample should have characteristics which represent the overall population (Yin, 2016). The selected sample covered the two aspects, namely, ownership, which is public, and the size of the institute in terms of number of students enrolled, ranging from big (around 50,000) to medium (around 10,000) and (small 5000). Case one (HEI_I) has

Table 1. Review of literature and research gaps.

No.	Author/s	Country	Year	Sector of study	Focus of study
1	May et al.	Europe	2013	Manufacturing	IT Infrastructure
2	Chen et al.	China, Taiwan	2012	Financial	Top management support
3	HassabElnaby et al.	USA	2012	SMEs	Information quality, system quality
4	Wickramasinghe & Karunasekara	Sri Lanka	2012	Manufacturing	System quality, information quality, system compatibility
5	Allahyari & Ramazan	Iran	2012	Manufacturing, service	Change management, system compatibility, IT Infrastructure
6	Uçaktürk & Villard	Turkey	2013	SMEs	Project management, change management
7	Choua & Hong	Taiwan	2013	SEMs	System quality, information quality, service quality
8	Xie et al.	UK	2014	SMEs	Top management, IT infrastructure, project management
9	Zhang et al.	China	2013	SMEs	Training and education, change management, system quality
10	Kilic et al.	Turkey	2015	SMEs	System compatibility, budget, time
11	Aslan et al.	Turkey	2015	Manufacturing	System quality, information quality, IT infrastructure
12	Chaabouni & Ben Yahia	Tunisia	2014	SMEs	Project management, change management
13	Monk & Lycett	USA	2016	HE	BPR, training and education, information quality
14	Leger et al.	USA	2014	HE	Change management, BPR, training and education
15	Babu & Sastry	India	2014	SMEs	Information quality, system quality, system compatibility
16	Antoniadis et al.	Spain	2015	SMEs	BRP, training and education, change management
17	Shen et al.	Taiwan	2016	High-tech	Budget, time, change management, BPR
18	Aburub	Jordan	2015	Banking	BPR, change management, IT infrastructure
19	Kosalge & Ritz	USA	2015	SMEs	Change management, system quality, information quality
20	Kharuddin et al.	USA	2015	Manufacturing	Project management, budgeting, timing
21	Janßen-Tapken & Pfnür	Austria, Germany, and Switzerland	2016	IT	Training and education, change management
22	Alharthi, et al.	Saudi Arabia	2017	HE	IT infrastructure, training and education, change management
23	Ramli & Widayat	Indonesia	2017	Manufacturing	System quality, information quality
24	Nađ & Vražić	Croatia	2017	Manufacturing	Budgeting, timing, project management
25	Wijaya et al.	Indonesia	2017	-	Change management, IT infrastructure
26	Mesároš et al.	Slovakia	2017	Construction	BPR, project management, budgeting, timing
27	Baykasoglu & Gölcü	Turkey	2017	-	Training and education, management support, change management
28	Alhadi & Al-Shaibany	Yemen	2017	HE	Top management support, budget, time, project management
29	Leyh et al.	Germany	2017	HE	Top management, project management, IT infrastructure
30	Barth & Koch	Austria	2019	SMEs	BPR, change management, time, budget
31	Fadelelmoula	Saudi Arabia	2018	HE	Top management, training and education, IT infrastructure
32	Althunibat, et al.	Jordan	2019	HE	Change management, training and education, system quality
33	Gabryelczyk	Poland	2020	Public sector, HE	BPR

**Figure 1.** Research flowchart.

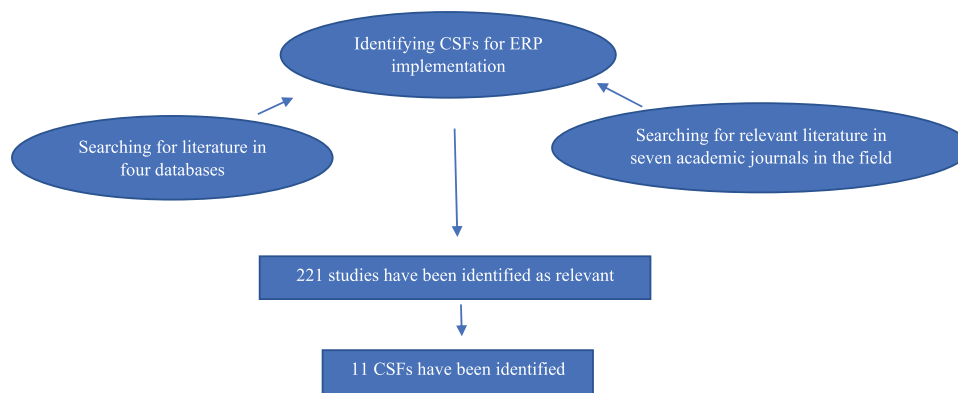


Figure 2. Systematic literature review process to identify CSFs for ERP implementation.

more than 10,000 students from different countries of the Middle East who are enrolled in undergraduate and post-graduate programs offered by the university in different fields of academia. The second case (HEI_II) is a specialized institute in the discipline of engineering at bachelor's and diploma levels and has more than 47,500 enrolled students. The third case (HEI_III) is also a public university which has recently signed a cooperation agreement with an Integrated Technology provider to implement a solution for educational and technological needs. Hence, the overall population for the study is these three HEIs who have implemented the ERP systems in their routine operations. The participants were selected from two higher hierarchical levels of management (see Table 2). The semi-structured interview protocol was tailored to the two classifications as per the hierarchical levels in the universities, which are 1) top management which includes the policy-makers and decision-makers who had the authority and responsibility to introduce and implement any system which can benefit the overall performance, productivity, and functioning of the institute and 2) technical management level personnel which includes the technical personnel who had the duty to

follow the instructions from the top management, were responsible for the implementation of any new project or system approved by the higher hierarchy, and were the users of that system. The participants interviewed by the authors, after their consent, are 33 participants. The demographic details are illustrated in Table 2.

Identifying CSFs for ERP from systematic review of literature

The authors conducted a meta-approach (Hannes & Lockwood, 2011) to identify the CSFs of ERP as they appeared in the previous literature. Using four databases (Science Direct, Emerald Management, Academic Search Complete, and Business Source Complete), literature search was conducted in the domains of computing and information systems, management development, and education. In addition, the authors conducted search in the following seven relevant academic journals: MIS Quarterly, European Journal of Operational Research, Computers in Human Behaviour, Information and Software Technology, Business Process Management Model, Journal of Computers Information systems, and Journal of Enterprise Information Management. The following trend of keywords was applied in the literature search in the previous databases and the seven academic journals: CSFs ERP implementation, ERP implementation in HE, and ERP systems in Jordan. Figure 2 shows the systematic literature review process for identifying the CSFs of ERP implementation, and Table 3 shows CSFs of ERPs for different sectors.

As shown in Table 3, the authors reviewed 221 relevant papers to CSFs of ERP implementation. Most papers identified a relevance to the eleven CSFs explained in the literature. To show the overall trend of CSFs of ERP studies, the authors have listed some selected examples of literature for the period 2012–2021 in Table 1.

Table 2. List of interviewees in the three public universities.

Position	Frequency
Top Managers (TM)	
President	3
Vice president	3
Dean	3
Managers of human resource, finance, supply chain	10
Technical Level (TL)	
ERP project manager	3
ERP system engineer	3
IT director	4
Technical advisor	4
Years of experience level	
More than 10 years	8
Between 5 and 10 years	15
Less than 5 years	10

Table 3. Trend of most frequently cited CSFs of ERP in the literature.

No.	CSFs	Frequency of articles
1	Change management	28
2	Training and education	26
3	Business process reengineering	21
4	Project management	24
5	Budget	17
6	Time	19
7	IT infrastructure	21
8	System quality	14
9	Information quality	16
10	System compatibility	11
11	Top management commitment and support	24

Data analysis

The data collected were analysed using content analysis. Content analysis is the most widely used qualitative analysis technique and can be referred as a systematic and replicable technique to compress and consolidate a bundle of words from a text into few categories of content based on its coding (Yin, 2016). The case study data have been analysed by a systematic process of manual coding assisted by the NVivo 11 software. According to Yin (2016), qualitative data analysis through NVivo 11 can be conducted to identify the major elements from the rich text which are predefined codes and can be defined as tags or labels for assigning units of meaning to the descriptive of inferential information compiled during a study. The predefined codes were refined during the process of analysis as a tree-like node structure was developed at first in NVivo software to present the CSFs prior to the finalization of the framework.

Two methods are normally used to generate the code and themes in textual data which are the manual and computer-assisted method. The present study adopted

the manual method of code generation and themes identification to have flexibility and transparency. Different colours were used to highlight multiple codes. Furthermore, several reading practices of transcripts were adopted to refine the codes and themes. Searches for themes and codes from the quotes of participants in their semi-structured interviews are presented in the next section. More details of the importance of factors' loads from interviewees of the three HEIs are presented in Figure 3, where the importance was measured by the number of responses on the Y axis for each university.

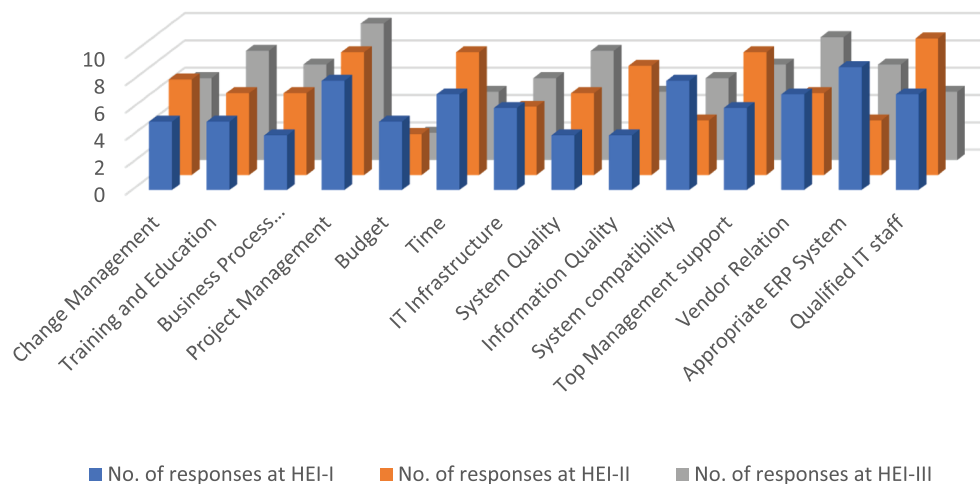
Results and analysis

Organizational factors

The organizational factors highlight the organizational dimension of CSFs for ERP implementation. There are some general features for every organization, and every organization exhibits some unique characteristics which make that organization distinctive in the organizational community. The relevant sub-themes which emerged under the organizational factors for the successful implementation of ERP system are change management, training and education, and process reengineering.

(1) Change Management:

The findings from the interviews show that change management described the process, tools, and techniques to manage the people side of change to achieve a required business outcome. Implementation of any new system requires change and transition. Management of change can help in the successful implementation of ERP. To

**Figure 3.** Importance of each CSF as identified by the interviewees.

introduce a change in the existing system and operations of the organization, proper management and planning are needed to incorporate the change and transition within the organizational structure. This sub-theme highlights that the strategies that manage change are important for the implementation and deployment of ERP systems within organizations to get the expected output. The findings also confirm that participants were more concerned about change management policy at the very beginning of the project, which can reduce the impact of resistance on the effectiveness and success of any new project.

(2) Training and Education:

Users of the ERP system should be made aware of new technological advancements through training and updated knowledge. Education and training are also important for the personal growth of individuals as well as for organizational growth. Analysis has revealed that education and training can enhance and increase the chances of the success of the ERP system for the achievement of its predefined goals and objective in HEI_II. TM02 and TL03 indicated that training of technical staff can improve the successful implementation of the ERP system. TM02 stated:

“Well educated, well trained and well-equipped technical staff can be in a better position to serve the organization and making the ERP system successful.”

(3) Business Process Reengineering:

The need for business process reengineering arises within the different processes of the organizations. Analysis showed that a new system has been introduced in the university, and this system has some of its own organizational needs and requirements. These needs and requirements of the new ERP system need to be addressed and catered to during the implementation phase and post-implementation phase. As per the words of a technical-level participant TL05,

“Implementation of the new ERP system can get affected and results can deviate from the predefined aims if the business processes of the organization in which the ERP is supposed to be implemented are not reengineered according to the new demands and requirements of the new system.”

Technical factors

The technical perspective of implementing an ERP system is necessary to implement ERP successfully, as it cannot be implemented successfully from only an

organizational perspective. The findings show that the ERP system sub-theme of this dimension is divided into the following groups: IT infrastructure, information quality, system compatibility, and system quality. To make the implementation of the project successful and effective for improvement of performance of the organization, the continuous support of the system by the management and staff is an important aspect which should be considered at the time of evaluation.

(4) IT Infrastructure:

To implement an ERP system, an updated IT infrastructure can be termed as the need of proper infrastructure and this need cannot be ignored at the time of planning as well as the actual implementation phase. Participants from the top management and the technical level identified the need for IT infrastructure for the successful implementation of the ERP system. As per TM05, “An updated IT infrastructure is the basic requirement for the successful implementation of an ERP system in an organisation”

Technical support for the IT infrastructure and continuous maintenance of the equipment was also highlighted by some of the participants. In the words of TL01,

“In any organisation, IT infrastructure requires technical support and maintenance on daily basis and delay in this technical support can cause difficulties in the smooth running of the ERP system”

It can be said that ERP should be considered as a business solution and not limited in scope to being just an IT solution where the standardization of the IT infrastructure ensures the successful implementation and application of the ERP system. Therefore, to implement an ERP system in an educational institution, there is a need to ensure the availability of an efficient IT infrastructure.

(5) System Quality:

The views of the participants supported the idea that the quality of the ERP system can also have an impact on the evaluation of the ERP implementation. Achievement of goals and objectives depends upon the quality of the ERP system. According to TM02,

“No one can achieve pre-defined goals and objectives from a poor-quality ERP system”

Analysis of the responses indicated that the quality of the system which is being adopted in the organization also plays an important role in the evaluation of the ERP system for the evaluation of pre-defined targets. As per TM04,

“A poor-quality ERP system cannot be expected to achieve the targets of the organisation”

(6) Information Quality:

Any information which is needed to be input in the ERP system must be done according to standards and set protocols. The quality of the information can influence the whole process of ERP interpretation. A participant from the technical level stressed the importance of the quality of information by stating that:

“A very important technical factor which can affect all modules of ERP system is the quality of information. Effect of this factor is retrospective and can hinder the successful implementation of ERP system as well as the achievement of specific goals and objective”

The quality and performance of an ERP system depends upon the quality of information fed to the system. Clear, standardized, relevant, accurate, and true information can enhance the quality of output given by the ERP system. As TL03 stated,

“Good quality information can enhance and accelerate the performance of ERP system, whereas any error at the time of input of information can affect all the modules of the system”

(7) System Compatibility:

Respondents were of the view that system compatibility was based on the legacy unintegrated multisystems. Before this new ERP system, the bank ERP system was implemented in HEI_1 which had the issues of compatibility and relevancy. Technical-level participants highlighted the need for a compatible and appropriate ERP system, and this compatibility of the system should be accessed in the pre-implementation phase. According to TL03,

“There was a main frame system in HEI_1 which have various applications but the coordination and integration among these applications and the existing system was not harmonious with the desired goals and objectives of the organisation. Hence, there was a need to amend and modify a system which can be compatible with the requirements of business”

Integration of academic operations with the modules of the ERP system was carried out in a properly organized stepwise manner through a phased roll-out approach, which made the ERP system more compatible and user-friendly.

Social factors

The findings also confirm that participants were more concerned about the social elements: top management support, qualified IT staff, and vendor relations. All participants pointed out that the implementation of the ERP system is characterized as the project and management of the project is one of the most important tasks of the management and implementers of the project.

(8) Top Management Commitment and Support:

Implementation of a project requires continuous evaluation and monitoring, and therefore, the support and commitment from the top management is required at each phase of the implementation process. TM06 stated,

“All the phases of the ERP system require a similar amount of consideration, commitment, and support from the top management to make the implementation successful till its end”

Analysis of the responses indicated that management of the institute is very committed and supportive in this regard and they have not lost their interest till the post implementation phase. According to TL05,

“The top management of the university is well aware of the importance of the ERP system and its help in their decision-making process, so the management is trying its level best to support and handle the different issues of implementation”

(9) Qualified IT Staff:

Maximum utilization of the ERP system cannot be achieved if the users of the system are incompetent and less qualified. In this respect, qualified and competent IT staff is the backbone of the success of an ERP system in an organization. As per TM02,

“ERP system cannot be made successful without the appointment of qualified IT staff because they have to use the system at its fullest”.

It has been identified by the respondents that the staff members of the university, as well as the students, are the users of ERP systems. In the daily activities and operations by the users of an ERP system, continuous support from IT staff is required for day-to-day functions and issues. Hence, the participants were of the view that qualified IT staff should be recruited to utilize the ERP system at its maximum level. TM04 stated,

“There is a lack of qualified and trained IT staff in the organisation and ERP system cannot be deemed successful without the support of IT staff”

Participants were of the view that maximum utilization of the ERP system can be achieved if the end users of the system are competent and qualified to use the ERP system with all its characteristics. Whether the participants were from the top managerial level or from the technical level, all gave the unanimous view that no system can give its best without the support of its users. Qualified IT staff can be in a better position to trace the shortcomings or discrepancies in the ERP system. Similarly, errors in the input of information or processing can be rectified at the right time by the qualified IT users of the system. Participant TL04 stressed that:

“Successful implementation of the ERP system cannot be achieved without the appointment of competent and qualified IT staff, which are basically the users of ERP system and can be questioned about the success or failure of the system”

(10) Vendor Relation:

In an educational set-up, professional vendors are approached to provide the ERP system required to meet the demands of the institution. Participants gave their view that a cooperative relationship between the institution and the vendor can help in the successful implementation of the ERP system. According to TL02,

“Vendors of the ERP system must be approached to impart the training to the users of the ERP system if required.”

Another participant from the technical level also highlighted the fact that:

“Training of the ERP system was considered as insufficient, so the institution must utilize its association and relationship with the vendor to enhance the training of ERP system users”

As mentioned earlier, implementation of an ERP system is not a one purchase item either. For HEI_III, the best vendor was selected for the purchase of the SAP ERP system. As in the words of TM01,

“The HEI_III and ITG signed a cooperation agreement in 2006 for the implementation of the educational and technological solution at HEI_III”

Responses by the participants have revealed that the HEI has had a very good and operative relation with its vendor since their agreement was signed. Analysis revealed that the institution is utilizing the facility of training for their students for the use of the ERP system in the theoretical perspective as well as in the practical perspective. As stated by TL01,

“Our institution has a very cooperative relationship with the vendor and HEI_III students are supposed to attend Dual Study program by SAP to gain experience”

Project factors

For the project dimension, project management, time, and budget were the factors identified, but the participants also added a new factor which is the selection of the appropriate ERP system. In the analysis of the findings, it was observed that an ERP system might be the best system for one HEI, but a total failure for another, and this does not mean that the ERP system itself was a failure. However, the participants have highlighted it as a factor, so it has been proposed in the findings.

(11) Project Management:

All the participants pointed out that the implementation of the ERP system should be characterized as a project and managing the project is one of the most important tasks of the management and implementers of the project. This was illustrated by TM03:

“Implementation of ERP system in the HEI is a project which requires pre-defined procedures to be followed during the phase of implementation.”

Analysis of the responses has also highlighted that proper management of the project needs certain considerations and protocols to be followed. According to TL04:

“project management is expanded from the process of planning to the process of continuous maintenance. Tasks to be performed for management which can be named as assessing the availability of resources, maximum utilization of the available resources, making contingency plans, monitoring and evaluation of the project to make the decisions at a higher level.”

(12) Time:

Participants discussed the importance of time management to make the project successful and effective for the performance and productivity of the organization. ERP systems tend to integrate all the operations of an organization at the same time irrespective of their demographic location. According to TL05,

“In my opinion the most important factor of the project which can influence the implementation process of the ERP system is time. Management of time is an art, which should be consulted to make any project successful and effective.”

(13) Selection of the right ERP system:

Analysis of the participants showed that all participants were stressing on the selection of right and appropriate ERP systems in the context of an organization in which an ERP system is supposed to be implemented. An ERP system can be efficient in one context but inefficient in another context. In the HEI_I, a bank's previous ERP system was implemented because of a previous partnership with HEI_I. The bank ERP system is not suitable with the educational institution requirements since the implementation is different, and for this reason, it resulted in unsuccessful implementation. Now, a new ERP system has been introduced in accordance with the needs and requirements of the educational institution. A participant from the top management stated that:

"It is very important to select appropriate ERP system. Our institution has witnessed a total failure for its first attempt at ERP system because that ERP system was a Bank ERP system. Users of ERP system and institution as a whole were unable to adopt and adjust with that ERP system"

In HEI_II, participants were satisfied with their prevailing ERP system because this system has been fulfilling the needs and the requirements of the organization for a long time. As stated by TM04,

"Most of the requirements of our university are being met by our ERP, therefore the right choice of ERP system as benefitted the university, and it enhanced the overall performance of institution"

(14) Budget:

While implementing any project or introducing any new system for the improvement of performance, financial aspects cannot be ignored or overshadowed. Analysis of the responses gave the view that success of the ERP system is associated with the cost of the ERP system to some extent. Any system which is expensive as compared to its usefulness cannot be termed as an appropriate or successful system. According to the views of TL03,

"Cost of the ERP project must not exceed the benefits of the project."

TM04 identified this factor as the basic general factor by stating that:

"It is a common perception to compare the cost of a product with its use or benefits, but sometimes the benefits of a project or process cannot be measured immediately because they can be witnessed in long run operations. Hence the finances for the project must justify the benefits and advantages gained at the end of the project."

Discussion

Themes and subthemes were initially drawn from the review of literature; new subthemes emerged from the analysis of the primary data collected. The codes were interpreted and grouped into sub-themes and themes. The themes, sub-themes, and codes identified are displayed in Figure 4.

The findings of the study confirmed that training and education is important and can influence the successful implementation of an ERP system in an organization.

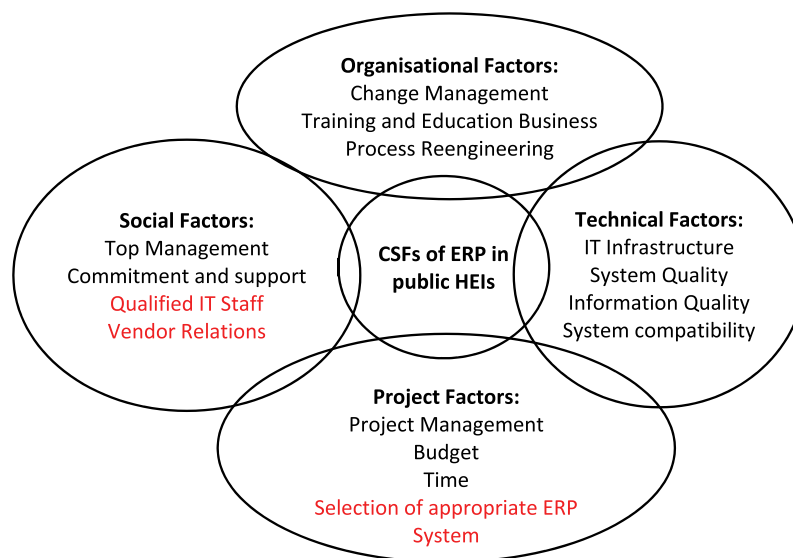


Figure 4. CSFs of ERP in public HEIs.

Users of ERP systems are normally expected to use the system in performing their daily tasks, but this utility can be enhanced and improved with the support of proper training provided by the university. Such findings were also observed in other research studies (Aladwani, 2001; Bajwa et al., 2004; Gargeya & Brady, 2005).

One of the most common issues highlighted in the study is that ERP software lacks some functionality to support existing business processes in the HEI. Facing more difficulties in terms of system expertise due to complexities and less trained personnel supports the successful implementation in the targeted organizational performance. Additionally, there is also a lack of organizational support in terms of change management processes and non-utilization of system-oriented information at the managerial level for the enhancement of organizational performance. The CSF of business process reengineering had a positive effect on the success of ERP implementation, and this finding is in accordance with the findings of previous studies such as Aladwani (2001) and Nah & Delgado (2006). The CSF of “time” was considered as critical to evaluate the successful implementation of ERP in terms of its time value. Time has also been considered as a unique and essential success factor in previous research studies such as Somers & Nelson (2004) and Z. Zhang et al. (2005). For the technical dimension, the most important CSF was the quality in terms of information as well as system. This finding confirms the assertions made by Andersson and von Hellens (1997) which were of the view that the quality must have a broader spectrum in terms of evaluation and multiple elements of the quality can be important to versatile individuals or departments within an organization (Thompson et al., 1991). However, our finding is different from that of Thompson et al. (1991) but is the same as Thompson et al. (1994) for inexperienced ERP users. Long-term consequences mainly measure the career development effect. In our study, most of the respondents are not in the IT line of work. The ERP systems they are using generally play a supportive role in their job.

Overall, although some of the factors in the two dimensions (organizational and technical) affect the ERP system’s implementation success, the organizational factor exerts the strongest influence. This may be due to the fact that ERP, as an enterprise system, requires a lot of coordination and cooperation among the members of the organizations to make it work, which may justify why the organizational dimension is more important than the technical

dimension in determining the success of the ERP systems. However, our study identified three new CSF which are selection of appropriate ERP system, qualified IT staff, and vendor relation.

First, the selection of an appropriate ERP system has been identified as a CSF in the findings of all three case studies. As per the responses of participants, this factor is most important at the pre-implementation phase under the dimension of the technical factor at the time of making decisions about the purchase of the most suitable ERP system as per the requirement of HEI. In the context of HEI_I, this specific factor was the most influential and critical for the implementation of the ERP system. As per the views and opinions of the respondents (top management and technical level), the first ERP system being implemented at HEI_I was unsuccessful because it was not suitable in the context of an educational institution. Although that ERP system was successfully implemented and operating in a bank scenario, it was not able to address the needs and requirements of the academic institution. This was observed in the responses that the bank ERP system was not accepted by the users in the educational setting because of its irrelevancy and different level of technicalities. After the unsuccessful implementation of the bank ERP system, now, the first sample HEI_I has adopted Microsoft Dynamics, which is at its post-implementation phase. Findings from case study one indicated that selection of a wrong ERP system by HEI_I in their first attempt is still affecting the successful implementation and acceptance of the ERP system by the users. The users of the ERP system (Staff and Students) are still showing resistance and reluctance towards accepting the ERP system because of their perception that the ERP system being implemented is not suitable for an educational institution. For the second case study HEI_II, the prevailing ERP system is ORACLE, which has been considered as the most suitable ERP system in the context of a HEI as their IT technical team is responsible for customization and maintaining the ERP. Empirical findings from HEI_II identified that special considerations were given to the selection of a right ERP system to fulfil the requirements of educational setting and achievement of pre-determined goals. Selection of a right ERP system was the most important and critical component of the decision-making process at the pre-implementation phase when the organizational management was planning to make a transition from an old information system to an updated ERP system. In the case of HEI_III, the prevailing ERP system is SAP

which is being implemented by a German organization who is the collaborative partner of educational institution for the implementation of the ERP system. German organization is funding the implementation of the ERP system, and it has selected the German software SAP to be adopted in this specific HEI. Although SAP is one of the best ERP systems, the findings have indicated that the SAP is more complex and sophisticated than expected by the users. Due to the complexity and technicalities of SAP, the users of the ERP system, especially staff members, are showing resistance and reluctance towards the acceptance of SAP and its use for academic as well as administrative functions. The ERP system selected by the management of the educational institution is being considered as less suitable because of its complexities and difficulty in use by the staff members of university, and this fact has also affected adversely the perceptions and response of staff members towards the training sessions of the SAP ERP system.

Second, another new CSF found in the present study was the availability of qualified IT staff in HEIs for in-house maintenance of ERP systems at the post-implementation phase. In the case of HEI_I, the IT staff of the university were not willing to accept the ERP system because of its non-suitability in first attempt. This fact had impacted the training and essential knowledge of staff members for the utilization of the ERP system. In the case of the second ERP system, which is currently prevailing in this HEI, the staff are still reluctant to adopt and use the ERP system because of their previous experience. According to the interview sessions, the availability of qualified IT staff is also important at the implementation phase to implement all the modules of the ERP system in accordance with standardized procedures and protocols. For the case of HEI_II, the provision of qualified IT staff for in-house maintenance of the ERP system is the most key and influential success factor which can affect the overall evaluation of ERP performance. Availability of adequate, competent, and qualified IT staff is needed to reduce the maintenance cost of ERP systems, which can be a significant issue if it is not provided by the vendor. Therefore, contingency plans are required to reduce the continuous maintenance expenses to make comparable inferences with respect to accounting. Furthermore, qualified IT staff can provide the services of training to the untrained IT staff members of the educational institutions for the improvement of their performance and better utilization of the ERP system. In the case of HEI_III, the whole project of ERP implementation was funded by a German organization which was also the vendor of German ERP software (SAP). This German ERP is the most expensive ERP

software, and the non-availability of technical staff for the provision of in-house maintenance to the ERP system by educational institution may be an alarming factor if it was not funded by the German organization. As per the findings of the interview sessions, the participants of HEI_III highlighted the expensive maintenance cost of the ERP system in the case of non-provision by the vendor. Qualified IT staff for the support of the ERP system is related to an organizational factor which is training and education. As mentioned earlier, SAP is termed as a very complex ERP system by its users; therefore, extensive training sessions are required to educate and train the IT staff members of educational institutions for the use of the ERP system. Training sessions should be interactive and activity-oriented to familiarize users with the different features and operations of the ERP system.

Third, our study found that vendors' selection of the right vendor is as important as selection of 'the right ERP system. In HEI_I, the previously failed bank ERP system was selected because of a prejudice decision. In this case, neither the consideration was given to requirements of the educational institution nor the capabilities of the vendor for provision of requested features within an ERP system. The bank ERP system was adopted without any customization, and the vendor of that ERP system did not make suggestions which might have been helpful for the management of the HEI in selecting or customizing the right ERP system in the context of an educational setting. In the case of the second ERP system, the vendor is responsible for the maintenance of the ERP system which is a big hurdle in self-sustainability of the ERP system by the educational institution. Therefore, to select a right ERP system, importance should also be given to choosing the vendor for the purchase of the ERP system. In HEI_II, a more appropriate ERP system had been implemented by the institution with the help of a right vendor. According to the responses of HEI_II participants, the vendor of the ERP system performed its tasks efficiently and successfully and has handed over the maintenance of the ERP system to the qualified IT staff of university. Therefore, the in-house maintenance by qualified IT staff is more important at the post-implementation phase in HEI_II. For HEI_III, there are some bias and partiality in the vendor partnership with the HEI. As per the interview sessions, the German organization responsible for the implementation of the ERP system has prejudicially made the decision for the implementation of SAP in this specific institution (SAP is German software). Hence, the relationship between the funding organization and the vendor of the ERP system is biased, which has affected the overall implementation and selection of the ERP system. The implementing organization preferred a specific ERP system which is complex

and difficult to use. Therefore, it can be concluded that any partiality should be avoided at the time of making decisions about the selection and implementation of an ERP system. The ERP system which is best suited for the requirements of educational institutions within the limits of available resources should be preferred.

Conclusion

It has been concluded that 14 critical success factors were identified considering related literature review and findings of our study. Among these factors, change management and training and education were the most cited CSFs for the successful implementation of an ERP system in an organization. Business process reengineering and customization of the system can also enhance the understanding and utility of the system. An appropriate project management structure is also required to implement the ERP system successfully. Additionally, the success of ERP implementation can be improved by providing training and support to the end users. The new CSFs identified by the study include the need for qualified IT staff and selection of an appropriate ERP system along with a supportive relationship with the vendor.

One of the limitations in this study is the sample size, and therefore, care should be taken in generalization and application of the findings. In the present case study, only three HEIs were selected in one country, and a limited number of respondents were selected from each case study due to the time constraint and practical difficulties. For example, a few respondents were reluctant to give their opinions about decision-making or agenda statements. The other limitation of this study is the static approach involved in the identification and categorization of the CSFs. However, ERP implementation is a process and successful implementation should consider the respective phases in the ERP life cycle (Markus et al., 2000). Despite these limitations, this study makes significant contributions to the knowledge of CSFs for the successful implementation of ERP systems in the HE context. In addition, our original findings of the three new critical success factors provide practical factors that influence successful ERP implementation in HEI.

The collection of data for this study was undertaken prior to the current pandemic situation started in early January 2020, and therefore, the study will be definitely bringing out some insights into the validity of the identified CSFs of ERP in the HE sector during the COVID time. In other words, the study calls for future contributions to understand the issue of sustainable ERP systems as one of the CSFs of ERP implementations. Perhaps two of the three

new factors identified by the study (vendor relations and selection of an appropriate ERP system) open the venue for researchers in the field to further investigate the influence of the external on the work of internal systems (sustainable ERP).

Disclosure statement

No potential conflict of interest was reported by the author(s).

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