FACTORS INFLUENCING ENTERPRISE RESOURCE PLANNING SYSTEM: A REVIEW

M.S. Hasan[1], Z. Ebrahim[2], W.H.W. Mahmood[3] and M.N.A. Rahman[4]

Sustainable and Responsive Manufacturing Research Group
[1,2]Faculty of Manufacturing Engineering,
Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya,
76100 Durian Tunggal, Melaka, Malaysia

[3]Faculty of Engineering Technology,
Universiti Teknikal Malaysia Melaka, Technology Campus,
75450 Hang Tuah Jaya, Melaka, Malaysia

[4]Advanced Manufacturing Research Group,
Faculty of Engineering and Built Environment,
Universiti Kebangsaan Malaysia, UKM Bangi,
43600, Selangor, Malaysia

Corresponding Author's Email: [1]syahidhasan@gmail.com

Article History: Received 1 August 2017; Revised 2 September 2017; Accepted 30 December 2017

ABSTRACT: The purpose of this paper is to provide a comprehensive review on factors that influence the enterprise resource planning system (ERP-S) implementation from literature studies between 2011 and 2016. A set of criteria was set to explore ERP-S related research articles through academic search engines and academic databases. Selected articles were categorized into critical success failure factors (CSFF), ERP-S user factors, and ERP-S assimilation factors. The findings from this paper provides a deeper understanding to both academicians and industrial practitioners regarding ERP-S success factors. A strategic plan can also be developed to ensure successful ERP-S implementation.

KEYWORDS: *Enterprise Resource Planning; CSFF; ERP-S; Influence Factors*

1.0 INTRODUCTION

The enterprise resource planning system (ERP-S) helps a company to ease information flow and sharing between their departments by integrating each department's data or information under one centralized database system. However, not all ERP-S implementation projects were successful. Aarabi et al. [1] stated that the percentage of ERP-S project failure is between 40% to 60%. Due to this challenge, many researches were done to define the factors that influence the ERP-S implementation. Thus, the objective of this paper is to review factors that influence the success or failure of ERP-S implementation from recent literature studies from 2011 to 2016. This paper is organized into the following sections. Section 2 explains the research method used in this review. Section 3 reviews the factors influencing ERP-S implementation, and the conclusion with suggestions for future research is explained in Section 4.

2.0 RESEARCH METHOD

In this paper, the literature study on ERP-S was carried out in two stages. At the first stage, the collection of relevant research articles on ERP-S was done based on the following criteria: (i) selection for research articles was limited to the Scopus indexed journal; (ii) ERP implementation was focused on general industries; (iii) the time frame was set from 2011 to 2016, and; (iv) "enterprise resource planning", "ERP", and "industry" were the keywords used to perform the literature search. This scope was set as it is important to give an overview of the research's extent and boundary [2]. The selected articles were carefully identified and selected as it is important to ensure the discovered knowledge and information are accurate [3]. At the second stage, all the selected articles from the first stage were reviewed and analyzed. In this regard, the information gathered was categorized into several categories: (i) ERP-S critical success failure factors, (ii) factors influencing the ERP-S user, and (iii) ERP-S assimilation factors. All the said factors were analyzed and reviewed. Finally, a conclusion was drawn comprehensively along with suggestions for future research on ERP-S.

3.0 FACTORS INFLUENCING THE ERP SYSTEM

Through the literature studies, the factors that influenced ERP-S implementation were discussed. Information and data extracted from the articles were clustered into three categories: (i) ERP-S critical success failure factors (CSFF), (ii) factors influencing the ERP-S user, and (iii) factors influencing ERP-S assimilation. Figure 1 depicted the ERP-S influence factors.

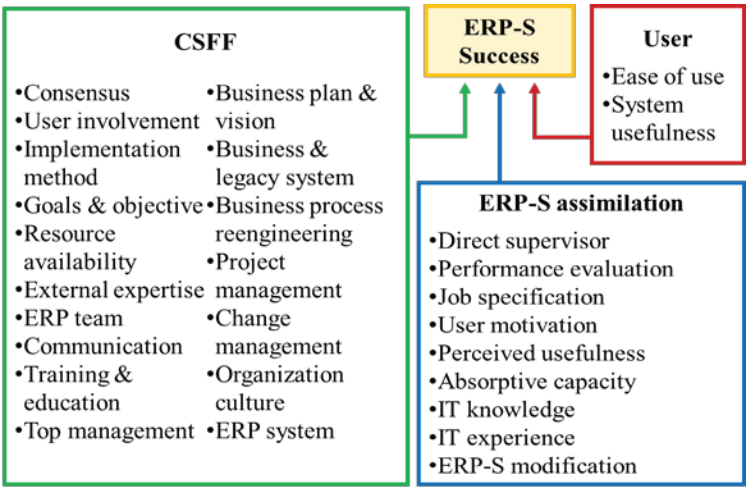

Figure 1: ERP-S influence factors

3.1 Critical Success Failure Factor (CSFF)

A total of 17 major factors were sorted out from the articles. These factors were then clustered to internal, external, and an overlapping between the two factors. From the 17 factors, 13 of them were internal factors which were: top management, business plan and vision, business and legacy system, business process reengineering (BPR), project management, change management, organization culture, ERP system, consensus, implementation method and strategy, goals and objectives, and resource availability. External expertise, which involved both the consultant and vendor, was an external factor and the other three factors, which were ERP team, communication, and training and education were the overlapping factors between internal and external factors.

3.1.1 Internal factors

i. Top management

From all selected research articles, top management factor was the most frequently mentioned factor compared to other factors. Top management support can be defined as how much the top management understands the ERP system's benefit and inspire its implementation [4]. The top management is the most important and essential factor and getting their support and commitment is the first step for the ERP-S implementation process [5–11]. Furthermore, this also involves various organizational risks and a significant expenditure of financial and human capital resources [12].

ii. Business plan and vision

The direction of the ERP-S implementation project is defined by a clear business plan and vision [13]. A clear business plan and vision helps the organization operate behind the ERP-S implementation effort, making work easier and more effective.

iii. Business and legacy system

The business and legacy system is the old system that the organization used before implementing the ERP system. During the initial chartering phase of ERP-S implementation, it is important to have an appropriate business and legacy system [13]. Some organizations decided not to dump their legacy system as replacing it will result to higher risks and longer time consumption [14].

iv. Business process reengineering (BPR)

Integrating all departments under one centralized system will require the organization to reengineer their business process, which is a critical process [10, 13]. Proper planning for BPR is needed so that the organization's process can fit well with the new ERP-S and allow for smooth running after the system goes online. The reengineering process will be continuously done until the organization can fully benefit from the ERP-S implementation. The implementation of BPR is totally dependent on the organization's decision. There are three options for BPR activities: (i) to reengineer their process before

implementing ERP-S, (ii) to implement ERP-S without reengineering their process, and (iii) reengineering their process concurrently with the ERP-S implementation [12].

v. Project management

Project management is the second most mentioned critical factor for successful ERP-S implementation. ERP-S implementation is a high investment project and good project management is needed to ensure the implementation goes well during its whole life cycle. ERP-S implementation is complex as it relates to hardware, software and organizational issues, and it can also take a long time to implement the system [8, 10]. A good project management can overcome the complexities through methodological planning and the project can be delivered within a specified time and budget. Project management was remarked as an important factor to implement ERP-S so that the implementation will be in line with the organization's vision and mission [15]. A project team should include individuals acquainted with the business process, departments managers, IT staff, and, if needed, a consultant as the project advisor.

vi. Change management

Implementing ERP-S will cause the organization to face changes not only to the operating system, but to the business process, organizational culture, and organization structure including the employees' roles and tasks. If these changes are not carefully managed, it will cause the implementation of ERP-S to fail [6].

vii. Organization culture

Implementation of ERP-S will change the organizational culture and is one of the critical factors that can determine whether the implementation will be a success or failure [4, 10]. Organizational culture is considered as an element which consists of way of communication (either formal or informal), interaction method, and assumptions in the organization [15]. In addition, the impact of organizational culture towards an ERP-S implementation failure in China was carried out [6]. ERP-S implementation benefits its user by creating real time communication with others. Contrary to this, the

company in China preferred more face-to-face communication. Another example stated in the study was that local managers tended to make decisions based on their personal interest instead of relying on data provided by the system. These two examples show how organizational culture can lead to underutilization and failure to implement the ERP-S.

viii. ERP system

ERP-S development, testing, and troubleshooting are one of critical factors for ERP-S implementation success and counts the most at the beginning of the project phase [13]. ERP-S architecture must be established at an early stage with consideration to important requirements, or they must continuously reconfigure the system during its implementation. A proper and suitable selection of ERP-S package or module is also important in defining the ERP system implementation success [1, 7, 11, 16].

ix. Consensus

Consensus is required as an early step before ERP-S implementation [5]. Achieving consensus from the whole organization, especially from the top management, will motivate and ease ERP-S implementation.

x. User involvement

Users should be introduced and familiarized to ERP-S during the early implementation stage to obtain an early idea about the system. User involvement during the early stage can help the project team understand their needs to develop a better functioning system. In addition, user involvement during the implementation process can increase user satisfaction and their level of acceptance towards the new system.

xi. Implementation method and strategy

A proper implementation method and strategy is needed for successful ERP-S implementation [1, 8]. A proper strategy will not only contribute towards the ERP system implementation's success, but also to overcome employees' resistance towards the new system.

There are three main strategies that the project team must pay attention to: (i) pre-implementation, (ii) implementation, and (iii) post-implementation [8]. Appropriate plans and strategies are needed for all three stages.

xii. Goals and objective

Properly defined, clear and strategic goals and objectives with regards to the ERP system implementation are crucial for ERP-S implementation success [7-8, 10-11]. Goals and objectives are vital to be set prior to the top management's support [8]. In addition, there are five primary objectives behind ERP implementation, which are: achieving potential growth, increasing the return on investment (ROI), making information available on regular basis, better supporting the decision-making process, and increasing scalability of business operations.

xiii. Resource availability

The availability of organization resources is an important factor for ERP-S implementation success. In-house IT expertise is an important resource for the organization as they can support the ERP system implementation process [8, 17]. Without in-house IT expertise, the organization is likely to face issues and challenges during the implementation process. Furthermore, apart from IT expertise, a suitable hardware and infrastructure is also needed [1, 8]. Another important resource is financial backing [8]. It is important for the project to stay within the set budget and not to exceed it. Another important resource was remarked , which is the organization's technology readiness [6]. Most of the small Chinese companies face difficulties to implement the ERP system due to their obsolete technology and equipment. This caused the implementation of the ERP system to fail.

3.1.2 External factors

External expertise factors can be from both the vendor and the consultant. Effective and reliable external expertise will contribute to the ERP system implementation's success [8]. The ERP system vendor plays a big role in assisting their client's ERP system implementation

process as they have the most knowledge about the ERP system. However, the company needs to be careful when choosing the vendor as the wrong choice can lead not only to implementation failure, but also to investment loss. On the other hand, a consultant can support the ERP system implementation through coaching, training, teaching, and even advising to the hiring company [10].

3.1.3 Overlapping factors

i. ERP implementation team

A competent ERP team and good composition are very important as they can define the implementation's success or failure [7]. A good ERP team composition should come from a combination of both internal staff and consultants [13]. In addition, it is necessary to combine staff from different departments such as IT, finance, HR, and production into one ERP team [5]. Another important factor in the ERP team is the role of the leader, who must become the project champion as their commitment is essential throughout the project life cycle [13].

ii. Communication

Effective communication contributes to the success of ERP system implementation. The level of communication defines how much the organization shares its decisions, expectations, and goals with other employees [4]. Effective communication will allow for an effective information flow throughout the supply chain [18, 19]. It also contributes to good cooperation between departments. The need for effective communication does not stop within the organization's internal level, but extends also to the external level. Collaborative activities between the ERP system vendor and client can be successfully accomplished with an effective communication between them [15].

iii. Training and education

It is important for users to be trained and educated about the ERP system as once the system go online, these users will be ready to operate the system efficiently. Training and education should not be limited to only the ERP system user, but should also include the

project's team members. Good team coordination needs training such as through team building to develop project management and IT skills which can lead to better results. The top management needs to aware of the importance of this factor and necessary financial support should be given for this purpose [11].

3.2 ERP system assimilation factor

Aside from the ERP system's critical success failure factor, the ERP system assimilation also influences the ERP system. Liu et al. [20] studied factors that influenced the assimilation of the ERP system on an individual level while Cereola et al. [21] discussed factors that influenced the assimilation of an open source ERP system in general. The direct supervisor, performance evaluation, job specification, user intrinsic motivation, perceived usefulness, absorptive capacity, IT knowledge, IT experience, and ERP system modification are the factors that can influence ERP-S assimilation. It was found that increasing the user's absorptive capacity, IT knowledge and experience, and modification will increase the level of the ERP system's assimilation [21]. In contrast, Liu et al. [20] outlined that different users will have different levels of assimilation, where the said individual levels are divided to the VIP user (highest level ERP assimilation), power user, and transaction user (lowest level of ERP assimilation).

3.3 Factor affecting ERP system user

The factors that affect the ERP system user was also studied. Sternad et al. [22] implemented the technological acceptance model (TAM) in their study to find the factors that influence the ERP system user. There are two factors that significantly affect the ERP system user, which are the ERP system's usefulness and ease of use. The findings showed that the ERP system's ease of use reflected the ERP system user's attitude towards the system, as the easier it is to use the system, the more positive the attitudes shown by its user. The ERP system's ease of use positively affects the ERP system's usefulness, which affects the user's attitude towards the ERP system. Al-Jabri [23] related the ERP system's usefulness and ease of use with training and communication and found that both training and communication will increase the ERP system's level on ease of use, which causes the user to become satisfied with the ERP-S.

4.0 CONCLUSION

As a conclusion thus, the objective of this paper was to provide a comprehensive review on factors that influence ERP-S success or failure. Through the literature studies, the factors were clustered into three categories, which were the CSFF, factors influencing the ERP-S user, and ERP-S assimilation factors. A total of 17 CSFF were outlined and grouped into internal factors, external factors, and a combination between them. The findings in this study provide a deeper understanding for both academicians and industrial practitioners regarding to the factors that influence ERP-S success. A strategic plan can then be developed from it to ensure the successful implementation of the system. For future research, a comprehensive study on factors influencing ERP-S implementation can be carried out with more detail based on the system's life cycle, with a larger scope and longer time frame.

ACKNOWLEDGEMENTS

This research was co-funded by Universiti Teknikal Malaysia Melaka (UTeM) under RACE Grant (RACE/F3/TK1/FTK/F00297) and Ministry of Higher Education Malaysia (MyBrain15).

REFERENCES

[1] M. Aarabi, M. Z. M. Saman, K. Y. Wong, A. H. Azadnia, and N. Zakuan, "A Comparative Study on Critical Success Factors (CSFs) of ERP Systems Implementation among SMEs and Large Firms in Developing Countries," *International Journal of Advancements in Computing Technology*, vol. 4, no. 9, pp. 226–239, 2012.

[2] J. I. P. Oguduvwe, "Nature, Scope and Role of Research Proposal in Scientific Investigations," *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, vol. 17, no. 2, pp. 83–87, 2013.

[3] P. Cronin, F. Ryan, and M. Coughlan, "Undertaking a literature review: a step-by-step approach," *British Journal of Nursing*, vol. 17, no. 1, pp. 38–43, 2008.

[4] D. Hwang and H. Min, "Identifying the drivers of enterprise resource planning and assessing its impacts on supply chain performances," *Industrial Management & Data Systems*, vol. 115, no. 3, pp. 541–569, 2015.

[5] S. Y. Huang and A. Chiu, "ERP System Case Study for Accessory Industry," *Journal of Convergence Information Technology*, vol. 6, no. 11, pp. 390–399, 2011.

[6] Y. Li, "ERP adoption in Chinese small enterprise: an exploratory case study," *Journal of Manufacturing Technology Management*, vol. 22, no. 4, pp. 489–505, 2011.

[7] R. Basu, P. Upadhyay, M. C. Das, and P. K. Dan, "An approach to identify issues affecting ERP implementation in Indian SMEs," *Journal of Industrial Engineering and Management*, vol. 5, no. 1, pp. 133–154, 2012.

[8] F. A. Goni, A. G. Chofreh, M. Mukhtar, S. Sahran, and S. A. Shukor, "Segments and elements influenced on ERP system implementation," *Australian Journal of Basic and Applied Sciences*, vol. 6, no. 10, pp. 209–221, 2012.

[9] S. Rouhani and A. Zare Ravasan, "ERP success prediction: An artificial neural network approach," *Scientia Iranica*, vol. 20, no. 3, pp. 992–1001, 2012.

[10] H. M. Beheshti, B. K. Blaylock, D. A. Henderson, and J. G. Lollar, "Selection and critical success factors in successful ERP implementation," *Competitiveness Review*, vol. 24, no. 4, pp. 357–375, 2014.

[11] B. Ozorhon and E. Cinar, "Critical Success Factors of Enterprise Resource Planning Implementation in Construction: Case of Turkey," *Journal of Management in Engineering*, vol. 31, no. 6, pp. 04015014, 2015.

[12] P. Garg and D. Agarwal, "Critical success factors for ERP implementation in a Fortis hospital: an empirical investigation," *Journal of Enterprise Information Management*, vol. 27, no. 4, pp. 402–423, 2014.

[13] A. Aldammas and A. S. Al-Mudimigh, "Critical success and failure factors of ERP implementations: Two cases from kingdom of Saudi Arabia," *Journal of Theoretical and Applied Information Technology*, vol. 28, no. 2, pp. 73–82, 2011.

[14] L. Shaul and D. Tauber, "CSFs along ERP life-cycle in SMEs: a field study," *Industrial Management & Data Systems*, vol. 112, no. 3, pp. 360–384, 2012.

[15] J. Soltanzadeh and M. Khoshsirat, "How can technology transfer concepts lead to a successful ERP implementation?," *Research Journal of Applied Sciences, Engineering and Technology*, vol. 4, no. 23, pp. 5222–5229, 2012.

[16] R. Saravanan and C. Sundar, "Derivation and validation of a conceptual model for ERP implementation success factors – An Indian context," *Journal of Theoretical and Applied Information Technology*, vol. 78, no. 1, pp. 132–146, 2015.

[17] P. Ifinedo, "Examining the influences of external expertise and in-house computer/IT knowledge on ERP system success," *Journal of Systems and Software*, vol. 84, no. 12, pp. 2065–2078, 2011.

[18] W. H. Wan Mahmood, M. N. A. Rahman, and B. M. Derosa, "Green supply chain management in malaysian aero composite industry," *Jurnal Teknologi (Sciences and Engineering)*, vol. 59, no. SUPPL.2, pp. 13–17, 2012.

[19] W. H. Wan Mahmood, N. Mat Tahar, M. Nizam Ab Rahman, and Baba, "Supply chain enhancement through product and vendor development programme," *Journal of Modelling in Management*, vol. 6, no. 2, pp. 164–177, 2011.

[20] L. Liu, Y. Feng, Q. Hu, and X. Huang, "From transactional user to VIP: how organizational and cognitive factors affect ERP assimilation at individual level," *European Journal of Information Systems*, vol. 20, no. 2, pp. 186–200, 2011.

[21] S. J. Cereola, B. Wier, and C. S. Norman, "Impact of top management team on firm performance in small and medium-sized enterprises adopting commercial open-source enterprise resource planning," *Behaviour & Information Technology*, vol. 31, no. 9, pp. 889–907, 2012.

[22] S. Sternad, M. Gradisar, and S. Bobek, "The influence of external factors on routine ERP usage," *Industrial Management & Data Systems*, vol. 111, no. 9, pp. 1511–1530, 2011.

[23] I. M. Al-Jabri, "Antecedents of user satisfaction with ERP systems: mediation analyses," *Kybernetes*, vol. 44, no. 1, pp. 107–123, 2015.