Cloud-based ERP systems for Higher Educational Institutes: A Review

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Abstract - **Enterprise Resource Planning (ERP) systems are information systems which are widely used in the industry to get over the old legacy practices by use of new and upcoming technologies. They are widely used in the business industry[1] for availing the benefits they offer like increased efficiency, decision-making, decreased expenses, etc. ERPs are used in multiple fields of the industry like supply chain management, project management, risk management, etc. One such field which has emerged as a new market for ERP vendors is Higher Educational Institutes (HEI). Several HEIs are implementing and adopting ERP systems to improve administrative convenience, reduce extra expenses and improve user experience. Though a significant part of the industry has successfully implemented ERP systems there are very few successful implementations in the higher education sector because of the differences between HEIs and business activities. ERPs if appropriately implemented can give awe-inspiring results but there are very few successful implementations of ERP systems thus it has a high failure rate. Cloud-based ERP systems can help overcome some of the challenges faced during the implementation of ERP systems. This paper is a review of the ERP systems in HEIs and also what the cloud can offer to ERPs in HEIs and industries.**

Index Terms - **Cloud-based ERP, ERP, ERP in the higher education sector, ERP in HEIs.**

I. INTRODUCTION

Enterprise Resource Planning (ERP) systems are management systems that help an organization or a business entity function efficiently and improve its productivity over the process. ERPs are everywhere in the industry like human resources, supply chain management, purchasing, warehousing, etc. [1, 2, 3, 6] ERPs are implemented to support business processes. The benefits and importance of ERP systems have increased rapidly. Today many sectors of the industry are investing a large amount of money in the adoption and implementation of ERP systems. Despite of success of ERP systems, there are significant problems in implementing them as the implementation of an ERP system needs business reorganizations [9]. Despite of high failure rate companies and organizations invest in ERPs as they have tremendous benefits once implemented correctly.

The origin of ERP systems has roots in the 1960s when IBM's IMPACT was intended to control stock levels for many items. At the end of the 1960s, Material Requirement Planning (MRP) was introduced [9, 7] In the 1970s two technologies online transaction processing and a modern database management system paved the way for Business Information Systems. These business information systems were manufactured as Manufacturing Resource Planning (MRP II) systems [7, 9]. In the 1980s MRP II was expanded in both functionality and new areas of manufacturing businesses like distribution, transportation, scheduling, control, etc. The problem with new systems as they could not incorporate customer-driven manufacturing. The introduction of two-tier client-server architecture lowered the cost of investment and operation. In the 1990s, the introduction of graphical user interfaces (GUIs) leads to a three-tier client-server architecture. In these systems, the client played a role of a server for user interaction programs with GUIs on PC.

II. ERP SYSTEMS AND CRITICAL SUCCESS FACTORS (CSF)

There are a lot of researchers that have studied the successes and failures of ERPs over time. It is estimated that around 60% to 80% of ERP systems fail to deliver the expected benefits [10]. Implementation of ERPs needs the investment of a significant amount of money and resources, which is only possible with the cooperation and support from the organization's top management. Adopting an ERP can be difficult as staff who are comfortable with the old legacy practices are forced to adopt new systems. It may also lead to business process re-

engineering (BPR) to support new business practices.

Anne N. Parr, Graeme Shanks, and Peta Darke (1999) discussed and listed down some common success factors which affect the success of an ERP system significantly like skilled staff, management support, user satisfaction, participation, etc. As a part of the research author also conducted a field study by interviewing 10 project managers who were part of 42 ERP implementations. These interviewees stated 4 factors that were not found in the literature those were best people full-time, smaller scope, adherence to scope, and deliverable dates. [12]

Meg Murray and George Coffin (2001) discuss various factors of success in a particular Enterprise resource planning (ERP) system like top management support, minimal customization, training, and expectations regarding return on investment (ROI). It also presents two case studies to identify factors of success in these cases. Top management support is one of the most emphasized factors in the success of an ERP system.[13] The users' role was missing as it provides a perspective of acceptance of the system.

Samwel Matende and Patrick Ogao (2013) focused on users' participation in an ERP system. A lot of research has been conducted on organizational or industry perspectives but very less research has been conducted on technology adoption at the user level [4]. User participates in two areas when an organization chooses to implement an ERP system. First in initial definition or requirements and system implementation [4]. Therefore, the user's role cannot be neglected in the performance of ERP systems in a practical world.

Ahmad Rabaai (2009) conducted a study based on the literature available and came up with the most cited critical success factors (CSF) for ERP systems. Top management commitment and change management were one of the most cited factors in the list which were cited 28 times whereas post-implementation evaluation was cited only 10 times. Top management support and change management affect an ERP system significantly as a lot of time and resources are required to implement an ERP system. If management fails to cooperate, the system might fail to fulfill the implementation and adoption of the system. According to estimation, 50% of an organization that implements ERP systems fail to achieve intended benefits because managers

undervalue the efforts required to manage the changes that take place [13].

Christy Angeline Rajan and Rupashree Baral (2015) studied factors influencing the ERP system. The technology acceptance model (TAM) is used to evaluate the effects of organizational and technical factors affecting the usage of the ERP system. TAM is a widely used model to explain user acceptance of the system [10]. Some important individual characteristics of the system's user are also

Sr. No.	Critical success factors (CSFs)
1	Top management support
2	Change management
3	Staff training
4	Business process re-engineering
5	Users' participation
6	Vision, planning and Scope of the project

TABLE.I Critical Success Factors

mentioned such as computer self-efficacy. Computer self-efficacy is the degree of confidence of a user to use a particular technology. The paper also mentioned organizational support to be an important factor in determining success. Adopting an ERP system sometimes needs major changes in old business processes which, if not supported by the organization's top management, may lead to adoption failure. The author also proposed a framework based on TAM to evaluate the usage of ERP systems in which they collected data based on the questionnaire from 181 users of ERP systems and demonstrated the usefulness of the framework. A main limitation of this paper is that the sample data size used is small for the calculations [10]

Željko Garača (2011) studies factors related intended use of ERP systems with help of an integrated model based on the Expectation Confirmation Theory (ECT) and the Technology Acceptance Model (TAM). The paper also involves 180 potential users of the ERP system who are university students. Based on the study author concludes that both perceived usefulness and perceived ease of use significantly contribute to the satisfaction of the user and indirectly affect the intended use of the ERP system.

III. ERP SYSTEMS IN HIGHER EDUCATION INSTITUTES

ERPs are used and studied widely by organizations and companies for the benefits they offer. ERP has played a significant role in HEIs but it was still far from the core principles of higher education [3]. The higher education sector has its own unique organizational model and processes which are

different from the businesses [3]. HEIs support academic processes such as learning, scheduling, examination processes, etc. whereas the sole aim of businesses is to earn money and deliver services. Many of the universities are funded by the governments or are either non-profit organization. In such cases, the project team can suffer from high work stress and workload to implement an ERP system [7]. High customization of an ERP system also proves fatal for its success as most ERP systems are built for companies. Over-tight schedules also lead to failure as the duration.

Sr. No.	Authors	Remarks
1	Meg Murray, and George Coffin (2001)	Author explained most of the important factors responsible for the success of an ERP but the user role was missing which is also crucial for an ERP to be productive
2	Samwel Matende, and Patrick Ogao (2013)	Explains user's role and participation in Enterprise resource planning. More research is required to study users' contribution as a critical success factor (CFS).
3	Rajan, Christy Angeline, and Rupashree Baral (2015)	Present a qualitative and quantitative study of factors influencing ERP systems usage. The paper also proposes a framework to study individual, organizational, and technological factors in ERP usage.
4	Željko Garača (2011)	The paper uses Expectation Confirmation Theory (ECT) and Technology Acceptance Model (TAM) to investigate perceived usefulness, perceived ease of use, and computer anxiety with respect to the satisfaction towards ERP system.
5	Anne N. Parr, Graeme Shanks, and Peta Darke (1999)	The paper identifies and lists common success factors in the successful implementation of an ERP system. It also consists of a survey based on interviews with industry professionals of 42 ERP systems.
6	Ahmad Rabaai (2009)	Presents critical success factors (CFS) of ERP systems in the higher education sector. The author performs a comprehensive survey of research papers and presents a list of the most important factors.
7	Ashwaq AlQashami and Mohammad Heba (2015)	The paper presents both challenges and CSFs for a successful implementation of an ERP system. It also discusses CSFs in the implementation of ERPs in HEIs. Users' participation in CSF was not mentioned.
8	Graeme Shanks (2000)	The paper studies cultural differences as a critical success factor in ERPs in HEIs. It collects data from 1 university in China and 1 university in Australia. The only limitation of this study is that the data is not generalized as only 1 university each was selected from both countries.
9	Arnoldina Pabedinskaitė (2010)	The paper states the problems related to the successful implementation of an ERP system. It also states CSF but users' participation was neglected in the paper.
10	Severin V. Grabski, Stewart A. Leech, and Bai Lu (2001)	The paper discusses the risk involved in the implementation of ERP and the problems an organization faces during the adoption process. It also presents a study and gives suggestions for improving processes.

TABLE II : Summary of research papers on CSFs of ERP systems

development and testing phases are reduced which leads to poor quality of the product.

Mohamed Soliman and Noorliza Karia (2015) discussed ERP systems in the higher education sector, ERP systems benefits in an organization and ERP systems benefits in the higher education sector. The main focus of the paper is the higher education sector the author listed down some important benefits of the ERP systems in higher education like better information access, improved service of universities and students, decreased expenses, secured data, etc. Though ERP systems have a lot of benefits it is a bit difficult for implement such systems as major changes are required to replace old legacy systems and adopt an ERP system. Once implemented properly administration and users can enjoy a pool of benefits from the system.

Ahed Abugabah and Louis Sanzogni (2010) stated ERP systems are the largest software applications that are implemented and adopted by universities[5]. Faculty and staff communicate with institutional activities through ERP, students get better e-learning environments through ERP systems. Therefore, ERP systems in higher education institutions are crucial as they are critical to the institution's mission. These ERP systems should not only meet the requirements

Sr. No.	Cases
1	High turnover rate of team members
2	Over-reliance on heavy customization
3	Poor consultant effectiveness
4	Poor IT infrastructure
5	Poor knowledge transfer
6	Poor project management effectiveness
7	Poor quality of Business Process Reengineering (BPR)

8	Poor quality of testing
9	Poor top management support
10	Too tight project schedule
11	Unrealistic expectations from top management concerning the ERP System

Table III: Higher education ERP software misfit.

of faculty and staff but also should improve users' experience and performance. However, very few higher education institutes have successfully implemented ERP systems due to the high failure rate of ERP systems. It has been claimed that around 60% to 80% of ERP systems fail to deliver the expected outcomes. Mohamed Soliman and Noorliza Karia (2016) studied processes and benefits in system applications and products (SAP) of ERP systems. Various modules and corresponding benefits have been listed like financial management, human capital management, performance management, student lifecycle management, etc. The author also tabulated the top ten risks associated with ERP systems like lack of senior management commitment, ineffective communication with users, ill-trained or insufficient training, lack of user support, etc. The author also stated some challenges in implementing ERP systems in higher education institutes but more research is required in this field.

Amin Y. Noaman and Fekry Fouad Ahmed (2015) studied the differences between ERP systems in business activities and ERP systems in higher education institutes. The author discussed higher education ERP software misfits in the following points:

Ahmad Rabaa'I, Wasana Bandara, and Guy G. Gable (2009) studied critical success factors (CSF) of ERP systems in higher educational institutes. The author listed down a number of times CSFs were cited in research papers. Most numbers of the citations were for top management support and change management as ERP needs extensive support from the management and it should also be able to adopt new changes in the real world for its successful implementation. The least cited factor was post-implementation evaluation. Research lacked users' participation as it is also important to factor in an ERP system.

Edward E Watson and Helmut Schneider (1999) define the university ERP alliance program as an academic entity to deliver a completely functional ERP system for administration and teaching. The paper suggests an approach for curriculum development known as "KnowDule" which stands for "Knowledge module" which is designed for online teaching and learning. In this approach, Alliance identifies a knowledge area that an ERP system can uniquely support. This knowledge area is developed as a KnowDule and then these KnowDules are then incorporated into a specific course. The courses are then made available to students. The paper also demonstrates and explains 10 KnowDules of an ERP and the cost components of implementing an ERP system.

IV. CLOUD BASED ERP SYSTEMS

With the emergence of the cloud, a lot of opportunities have emerged for ERP systems. The cloud can solve some of the disadvantages which are associated with traditional ERP systems like the high cost of configuration, maintenance, energy, etc. Cloud is generally defined as the on-demand delivery of processes like computing power, applications, resources, etc. Users can access clouds from any remote location in the world which makes it more suitable for ERP systems. Cloud has 3 types of service models which are known as IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service). ERP systems built as SaaS is known as EaaS (ERP as a Service) [14]. EaaS makes things convenient for both users and businesses to handle ERP systems as there is no requirement to install the applications on the systems, no need for frequent upgrades and updates, and easy maintenance.

Cloud-based ERP system is something that can be used in HEIs to boost administrative convenience. As the main objective of HEIs is to provide education to the students they don't need to spend much amount on EaaS as it is required on traditional ERP systems. Moreover, cloud-based ERP systems can become a bridge to facilitate communication between the administration, faculties or staff, and students. It can also be used to provide distance education to students. The infrastructure required to set up an ERP system is reduced exponentially as the hardware of the cloud provider will be used in order to support the system. C. M. Navaneethakrishnan and Mamoun Hadidi discussed the differences and similarities between traditional ERP systems and cloud-based ERP

Sr. No.	Author	Remarks
1.	Mohamed Soliman, and Noorliza Karia (2015)	paper presents a study of the benefits of ERP systems in the Higher Education Sector. More study is required to analyze the differences between HEIs and other businesses.
2.	Ahed Abugabah, and Louis Sanzogni (2010)	The paper reviews ERPs in HEIs. Extensive research is required for CSFs in ERPs in the Higher education sector.
3.	Mohamed Soliman, and Noorliza Karia (2016)	The paper listed some general modules and their benefits if implemented in an ERP system. It also stated some challenges but more research is required based on challenges faced by HEIs in implementing and adopting ERP systems.
4.	Amin Y. Noaman, and Fekry Fouad Ahmed (2015)	This paper studied some important factors which can be a possible reason for the failures of ERP systems. Differences between ERPs in HEI and ERPs in businesses are necessary to look after.
5.	Ahmad Rabaa'I, Wasana Bandara, and Guy G. Gable (2009)	This research listed down CSFs for ERPs in HEIs. Users' participation was missing as it is an important factor for the adoption of a system.
6.	Edward E. Watson, and Helmut Schneider (1999)	This paper gave a concept of KnowDules and demonstrated its use in the ERP system.
7.	Brenda Scholtz, Charmain Cilliers, and André Calitz (2012)	Explains ERP systems in education and presents a level of adoption depth and level of adoption breadth which gives 5 and 4 levels respectively of ERP adoption in university's curriculum. This matrix is used to present a case study.
8.	Gheorghe Sabau (2009)	This paper discusses the business and technological benefits of incorporating ERP systems in HEIs. It also performs a SWOT analysis and proposes an evaluation framework for ERPs in HEIs.
9.	Prof. Bhamangol (2011)	This paper suggests a checklist before and after the procurement of ERP systems. It also gives measures of customization.
10.	Paul Hawking, Brendan McCarthy, and Andrew Stein (2004)	The paper focus on the second wave of the ERP systems i.e., post-2001. It also provides the problems and solutions of the universities in adopting ERP systems.

TABLE IV: Summary of research papers on ERP systems in HEIs.

systems. They also discussed the advantages and disadvantages of cloud-based ERP systems. Some advantages include easy implementation, and cost reduction in terms of energy, maintenance, configuration, etc. Some disadvantages include security, confidentiality, reliability of the network, etc. The paper also discusses improving efficiency. However, problems related to cloud-based ERP and its adoptions were not discussed.

Fumei Weng and Ming-Chien Hung focused on the adoption of cloud-based ERP systems. The paper discussed problems in deploying cloud ERP. The Paper suggests.

a. Organisations should ensure that the policies regarding protecting confidential data are properly met.

b. Organisations should check the security status with the cloud provider before sharing any data.

c. Organisations should expand beyond traditional IT approaches to protect their businesses.

Makkar G. D. and Meenakshi Bist described a cloud-based ERP system as a new service model known as EaaS. EaaS stands for ERP as a Service.

ERP system is provided on SaaS (Software as a Service) model. This integrates ERP vendors with cloud service providers. There are multiple advantages of this service which are listed in the paper like minimized initial investment, reduced implementation time, increased ROI, etc. The paper also made a comparison between EaaS and traditional ERP systems with the process flow diagram of both approaches to develop an ERP system. The paper also discussed an important problem related to the ERP systems which EaaS can solve i.e., customization. Cloud is based on a multi-tenant architecture which allows it to provide multiple instances of a process to different clients.

Sr. No.	Author	Remarks
1.	C.M.Navaneethakrishnan (2013)	The paper presents a comparison between cloud-based ERP systems and traditional ERP systems. It does not include the challenges an organization may face while adopting a cloud-based ERP system.
2.	Mamoun Hadidi (2020)	The paper compares cloud-based ERP with traditional ERP systems. It also lists its advantages and disadvantages.

| 3. | Fumei Weng and Ming-Chien Hung's (2014) | paper studies the competition and challenges related to the adoption of cloud-based ERP systems. It also explains problems in deploying cloud ERP systems. |
| 4. | Makkar G. D. and Meenakshi Bist (2012) | This paper defines ERP as a Service as EaaS. This is the integration of ERP vendors with cloud service providers. It presents and compares the process workflows of the EaaS and traditional ERP systems. It addresses the customization problem of ERP systems. |

TABLE V: Summary of research papers on cloud-based ERP systems

V. CONCLUSION

ERPs are very beneficial when implemented by an organization in a correct manner but scenarios for higher educational institutions are somewhat different from other sectors like businesses. The mission of HEIs and businesses is different from one another. Thus, both need to be treated differently. More research is required in the field of HEIs and ERPs. Extensive research is required to determine the critical success factors (CSF) for ERPs in the higher education sector. The drawbacks and shortcomings of a traditional ERP system can be overcome by a cloud-based ERP system. Issues like initial cost, infrastructure cost, maintenance, configuration, etc. are handled by a cloud-based ERP system. There is a need for a study in the field of cloud-based ERP systems in HEIs and their implications on the administration and on the end user.

REFERENCE

[1] Murray, Meg, and George Coffin. "A case study analysis of factors for success in ERP system implementations." AMCIS 2001 Proceedings (2001): 196.

[2] Shang, Shari, and Peter B. Seddon. "A comprehensive framework for classifying the benefits of ERP systems." (2000).

[3] Soliman, Mohamed, and Noorliza Karia. "Enterprise resource planning (ERP) system as an innovative technology in higher education context in Egypt." International Journal of Computing Academic Research (IJCAR) 5.4 (2015): 265-269.

[4] Matende, Samwel, and Patrick Ogao. "Enterprise resource planning (ERP) system implementation: a case for user participation." Procedia Technology 9 (2013): 518-526.

[5] Abugabah, Ahed, and Louis Sanzogni. "Enterprise resource planning (ERP) system in higher education: A literature review and implications." International Journal of Human and Social Sciences 5.6 (2010): 395-399.

[6] Soliman, Mohamed, and Noorliza Karia. "Enterprise resource planning (ERP) systems in the Egyptian higher education institutions: Benefits, challenges and issues." International Conference on Industrial Engineering and Operations Management, Kuala Lumpur, Malaysia. 2016.

[7] Noaman, Amin Y., and Fekry Fouad Ahmed. "ERP systems functionalities in higher education." Procedia Computer Science 65 (2015): 385-395.

[8] Rabaa'i, Ahmad, Wasana Bandara, and Guy G. Gable. "ERP systems in the higher education sector: a descriptive case study." (2009).

[9] Wortmann, John C. "Evolution of ERP systems." Strategic Management of the manufacturing value chain. Springer, Boston, MA, 1998. 11-23.

[10] Rajan, Christy Angeline, and Rupashree Baral. "Adoption of ERP system: An empirical study of factors influencing the usage of ERP and its impact on end user." IIMB Management Review 27.2 (2015): 105-117.

[11] Garača, Željko. "Factors related to the intended use of ERP systems." Management: journal of contemporary management issues 16.2 (2011): 23-42.

[12] Parr, Anne N., Graeme Shanks, and Peta Darke. "Identification of necessary factors for successful implementation of ERP systems." New information technologies in organizational processes. Springer, Boston, MA, 1999. 99-119.

[13] Rabaai, Ahmad. "Identifying critical success factors of ERP Systems at the higher education sector." Proceedings of the Third International Symposium on Innovation in Information and Communication Technology. British Computer Society, 2009.

[14] Gd, M. A. K. K. A. R., and Meenakshi Bist. "EaaS-ERP as a Service." Journal of Information Operations Management 3.1 (2012): 141-145.