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Abstract—Enterprise Resource Planning (ERP) system is indeed crucial for service operations competencies in Higher Education Institutions (HEIs). Previous studies ascertain that ERP system improves an operational efficiency and enhance competitiveness. Though literature has indicated the importance of ERP system for enhancing a firm’s operational performance, there is only a small-scale of ERP adopters in HEIs; hence ERP application in HEIs are still at an embryonic level. Indeed, only few research exists and little is known about strategic resources acquired for achieving high operations competencies and issues how ERP system, innovative technology enables a better performance. This implies that ERP system has not been perceived as an emerging innovation capability that improves operational cost and service efficiency. To enhancing such crucial understanding, this study reviews the benefits of ERP's, further identifies challenges and issues in implementing ERP system in HEIs in particular Egyptian HEIs. The research contributes to the advance of concepts and dimensions for ERP system from HEIs' standpoint and grants practical verification to defend the innovation of service operations in HEIs.

Keywords—Benefit; Challenges; Egypt; Egyptian Education; Enterprise Resource Planning System; Higher Education; ERP; HEIs

I. INTRODUCTION

Enterprise Resource Planning (ERP) system has been acknowledged since 1970 that integrates information within and across the functional areas in an organization. It has been developed in the concept of materials requirement planning (MRP) from the production management to strategic and tactical decision making by integrating the functionality of sales, human resource management, accounting and financial services. Since 2000 onwards, ERP has extended version of ERP II systems that have enabled integration across supply chain such as transportation management systems (TMSs), advanced planning systems (APSs), analytics, warehouse management systems (WMSSs), business intelligence (BI), customer relationship management (CRM) systems, supplier relationship management (SRM) systems and e-business [1, 2].

Expanding knowledge and advance technology have brought new competitive landscape for the higher education sector to meet global customer requirements on quality and performance; government and stakeholder demands. These have forced higher education institutes (HEIs) to improve their service quality level and innovation by implementing ERP system which in turn enhance their performance and efficiency [3, 4, 5]. The ERP system has been adopted to replace the existing administration and management-related computer systems [3], in order to increase the performance of the end users by providing better managerial tools to enhance levels of efficiency and performance [4]. Therefore, ERP system plays a significant role in integrating information of an organization for the service operations competency of HEIs.

HEIs have been developing and integrating ERP system to automate and incorporate their business processes. This includes the processes of student recruitment, student admission, student records, financial aid for students as well as some of the universities’ administrative and academic services [5]. There is a notion that “ERP entails gaining the knowledge of the best business practices and applying these practices to improve or completely replace existing legacy practices” [6].
ERP systems have been defined as “configurable information system packages that integrate information and information-based processes within and across functional areas in an organisation” in accordance with [7]. An ERP system comprises marketing and accounting software (MAS), supply chain management (SCM), human resource management (HRM), customer relationship management (CRM), students and academic resources (SAR) and a library information system (LIS) [8, 9].

The ERP system is not simply an automation of an organisation’s business processes but enables an opportunity for an organisation’s business processes to be re-engineered and this can auger well for an organisation’s success in the long-term. A system of ERP provides a number of benefits. These include the capacity for better data analysis, improved levels of organisational performance and efficiency due to enhanced processes in place that allow for improved levels of customer service. Thus, the ERP system has emerged and enhanced the level of productivity and profitability as well as improved organization’s efficiency [13]. Such ERP advantages provide benefits and values to organisations and enable organisations to be more competitive in the market [10].

Due to substantial benefits of ERP system, some universities have allocated an investment of more than five billion dollars in the ERP system [15]. The adoption of the ERP system in universities is aimed to create improvement levels of efficiency and performance so that colleges, departments and schools have an improved capability for teaching and research at a low or at a practical cost [16]. Although universities have invested substantial resource, the ERP system still fails to deliver its expected benefits. Therefore, it is a robust desire by researchers to examine and explicate the causal factors that underpin good performance when a system of ERP is applied [17].

II. APPLICATION OF THE ERP SYSTEM

For decades, the ERP system has had a marked influence, worldwide, on the market. In fact, it is anticipated that the global market for ERP software would almost double from the sum of 28.88 billion dollars in 2006 to 47.7 billion dollars by 2011 [18]. The ERP system is the largest enterprise application in the software market in 2012, with a projected revenue of 24.9 billion dollars. In comparison, this is followed by the office suites which are projected to reach 16.5 billion dollars; a modest growth of 2.2 percent [19]. The rationale as to why organizations have chosen to adopt the ERP system; is that it enhances an organization’s ability for business process management (BPM) engagement [20].

In particular, ERP system plays a prominent role in integrating business function and facilitating information sharing and communication. Through the integration of ERP system, remarkable gains in speed and productivity can be attained. As an example, Cisco Systems utilised ERP to underpin their new global networking business model which allowed Cisco Systems to become the global networking industry market leader. Cisco’s business model utilises a platform of electronic communications to build knowledge-based and interactive relationships with its stakeholders, employees and suppliers. Since the application of an ERP system, each year Cisco has been able to double in size and has increased its revenue and cost savings in the order of hundreds of millions of dollars. As an example of increased levels of efficiency, a design software company, Autodesk, after implementing a system of ERP reported an astounding decrease in time required to fill orders from a two-week period to 24 hours [21].

In university, the system of ERP is frequently the single largest software application implemented with a considerable sum of money allocated for the implementation phase. Despite the fact that the majority of universities have implemented an ERP system or are in the process of applying one [8, 14, 22], there is a dearth of research examining ERP in the context of the environment of a university, in comparison to other environments. Accordingly, in this paper an examination and critical review of previous research relating to the ERP system in the higher education sector is made in the context of the country of Egypt. This critical review will evaluate previous research and will assist in determining the need for research in this area into the future and will ascertain the advantages of ERP in the higher education sector.

III. ERP SYSTEM FUNCTIONS AND CHARACTERISTICS

ERP system has been defined in diverse terminologies. It has been recognized as an integrated commercial package that supports 0 in real time and in an integrated way. Soliman and Karia [51] regard ERP characteristics and functions in line with higher education context that enable HEIs to rise their operational efficiency and to reduce the duplication of resources. Table 1 comprises all characteristics of ERP system and their benefits [52].

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Explanatory elements</th>
<th>Usefulness</th>
</tr>
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<tbody>
<tr>
<td>Integration</td>
<td>Interconnections between functions and hierarchical levels, and The interaction between the various processes.</td>
<td>Campus-wide integration on a common system. Increase data integrity, validity and reliability.</td>
</tr>
<tr>
<td>Completeness</td>
<td>A wide range of functions, Applicable to various</td>
<td>Create a more seamless integration between technology and education</td>
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IV. ERP IN THE HIGHER EDUCATION INSTITUTIONS (HEIS)

Though literature has indicated the importance of ERP system for enhancing a firm’s operational performance, there is only a small-scale of ERP adopters in HEIs; hence ERP application in HEIs are still at an embryonic level. Previously, the university has been viewed as a ‘unique’ organization which differs from other organizations in the corporate sector [6] because of differences in circumstances and environments. It utilises a system of ERP for academic purposes [23], but ultimately, the theory holds that both universities and corporations are similar principally in confronting challenges, such as survival in the competitive environment. Hence, ERP system is a needs to meet current demands and improve performance and efficiency in administrative services [24].

Currently, new business models and digital technologies affect the value proposition of existing services and goods, specifically in the dynamic of innovation in HEIs. The higher education sector today is heavily dependent on the global development of information technology (IT). Fast moving advances in IT have reshaped the way in which universities undertake their administrative practices [25]. For instance, researchers and scholarship holders are dependent upon IT such as digital libraries and virtual laboratories as part of their work. Due to a considerable influence of IT within universities, many universities have adopted the system of ERP for re-engineering and development of administrative systems as the pathway to improve levels of performance [15, 26]. Althonayan [53] describes the ERP system modules adopted by university, taking as an example SAP as the ERP application software for higher education as following in Table II:

TABLE II.  TABLE 3: PROCESSES AND BENEFITS IN SAP FOR HEI[53]

<table>
<thead>
<tr>
<th>Modules</th>
<th>Advantages</th>
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<tbody>
<tr>
<td>Financial management</td>
<td>Improved efficiency of budgeting and planning processes through cross-organizational financial control and visibility.</td>
</tr>
<tr>
<td>Enterprise asset management</td>
<td>Reduced break and fix repair work and equipment downtime. Improved capital expenditure management. Increased equipment and asset utilization. Maximized efficiency for work-order processing.</td>
</tr>
<tr>
<td>Human capital management</td>
<td>Reduced cost for common HCM processes such as recruitment, administration, payroll, time management, and legal reporting.</td>
</tr>
<tr>
<td>Performance management</td>
<td>Efficient storage of business intelligence data from across the organization for reporting and analysis. Enhanced security of access to integrated data. Improved decision making by providing real-time, accurate, consolidated data and tracking status against specific KPIs and metrics.</td>
</tr>
<tr>
<td>Procurement</td>
<td>Reduced purchasing expenses without compromising supplies for researchers, instructors, administrative staff, and asset maintenance employees.</td>
</tr>
<tr>
<td>Compliance, security, and risk mitigation</td>
<td>Improved protection of sensitive student, financial, and operational data and increased data consistency through master data management functions.</td>
</tr>
<tr>
<td>Business process integration</td>
<td>Enhanced efficiency of workflow processes through integrated systems. Reduced need for custom integration. Increased cost savings through reduced integration and maintenance.</td>
</tr>
<tr>
<td>Grants and funds management</td>
<td>Improved effectiveness of grant administration from pre-award to post-award, across multiple fiscal years, with enhanced accuracy of spending tracking. Reduced manual processes and workload in planning, managing and reporting grants.</td>
</tr>
<tr>
<td>Relationship management, institutional development and enrollments and management</td>
<td>Enhanced institutional responsiveness to all stakeholders. Streamlined enrollment management process. Improved end-to-end customer relations, from applicant to alumni.</td>
</tr>
<tr>
<td>Student lifecycle management</td>
<td>Minimized administrative paperwork through real-time faculty access to student data and automated functionality. Improved advisory services through consolidation of real-time student data. Automated fee calculations and billing processes for improved cash flow.</td>
</tr>
</tbody>
</table>
The increased level of expectation from domestic and international students have increased the demand for HEIs, hence force HEIs to improve their quality service and innovation [4]. Indeed only few research exists and little is known about what are acquired for achieving a high operations competencies and issues how ERP system, innovative technology enables a better performance. Recognizing the deficiency of HEIs to meet these global requirements, most governments have urged universities to improve their overall efficiency and performance [3, 27] by implementing ERP system. HEIs have applied ERP system to assist them to cope with these increasing demands of a changing university environment [6] by discarding the standalone application designed for administrative and academic departments. The ERP application provides greater capacity for HEIs to provide education and research [16]. With a significant sum of money invested in ERP system, it is challenging for HEIs to understand what and how the adoption of ERP system can provide the benefits of profit for HEIs and value for customers. Currently, only a modest amount of research has been undertaken in relation to the application of the ERP system in the university environment in comparison to other environments [27].

V. HIGHER EDUCATION INSTITUTIONS (HEIS) IN EGYPT

In Egypt, the higher education sector encompasses universities and also technical and professional training institutions in accordance with the study conducted by [14]. As noted by [15] this system is comprised of:

- 21 public universities including Alazhar University and four branches which will soon develop into independent universities;
- 13 non-university based institutions which are public and made up of 8 technical institutions;
- 19 universities which are private;
- 11 institutions which are non-university based and were established under special agreements or by other governmental entities (i.e. not the Ministry of Higher Education);
- 96 private institutions; of which 8 are two-year Middle Technical Institutes (MTI). Four of these institutions offer both four-year and two-year degrees, whilst 88 institutions offer four-year degrees; and
- Eight private foreign institutions.

VI. THE STATUS OF ERP IN EGYPT

Globalisation, privatisation and liberalisation have made a marked change in the business world and trade in Egypt in the early 1990s. IT and communication solutions emerge as a means to conduct business efficiently and effectively. In order to gain a competitive advantage, organisations in Egypt became aware of the increasing importance of utilising IT to gain a competitive advantage in the market. Recently an ERP system, as an extremely complex information system (IS), has been recently transferred by multinational companies into the local environment in Egypt [30]. Despite this, recent studies have indicated that the rate of success of the application of ERP systems in Egypt is extremely low in comparison to western enterprises, and approximately fifty percent of Egypt’s ERP applications are considered fail and not meet expectations. Most of the Egyptian businesses that implement ERP system have failed to deliver its expected benefits and goals, due to the challenging culture in Egypt, which differs from the other cultures from where the system of ERP is originated. Such failures identified are a schedule or cost over-runs, an inability to deliver objectives and a delay or cancellation of projects [31].

The challenge in the context of the organisational culture in Egypt is that information is considered to be a personal asset rather than an organisational resource. Therefore, most of an organisation’s information system (IS) outputs have been restricted to the level of managers. Further, some of the managers are dependent upon their level of experience, and use intuition rather than relying on the accurate information. Instead of sharing the information widely across the organisation, only a selected portion of information has been transferred to the selected employees.

In addition, an organisational culture in Egypt is viewed as the major reason for high rate of failure of the ERP project [30]. The success of ERP implementation is associated negatively with the Egyptian organizational culture. Organizations in Egypt are managed in a centralised, highly authoritarian and hierarchical way and this prevents the ready exchange of information between managers and between managers and employees. Moreover, in the Egyptian culture, the employee is a collective in nature, meaning that they have a preference to convene personal meetings and make telephone calls rather than use communication technologies.

Literature indicates that the application of ERP systems in Egypt have solely placed a focus on two phases; pre-implementation and implementation [32, 33]. Some scholars investigate factors affect the success of ERP [34] and others identify factors contribute towards the relationship between business performance and ERP [35]. In Egypt, for instance, the pharmaceutical industry is a significant market for ERP due to the complex manufacturing processes involved according to...
[30]; and Egypt’s pharmaceutical sector comprises large-sized enterprises (either state-owned enterprises, private-owned enterprises, or foreign-owned subsidiaries) that have the capacity to financially support such information systems (ISs) on a large scale. Despite ERP system is being widely studied, there is still a lack of empirical understanding in the application of ERP system in the Egyptian context and market [36].

VII. BETTER OUTCOMES FOR HEIS BY USING ERP AS AN INNOVATIVE TECHNOLOGY

Previous studies ascertain that ERP system improves an operational efficiency and enhance competitiveness [16-20]. There is a number of studies in implementing ERP in HEIs, indicating a significant development in the information communication technology (ICT) industry with a noted increase in investment in ERP systems in the education sector. This study holds that HEIs could achieve the competitive advantage through ERP system such as the following:

1) Increases the capability to access a wide range of information sources in order for an institution’s members to work seamlessly with data derived from different sources;
2) Provides flawless integration of business processes and data flow as well as improving the sharing of information throughout an institution;
3) Allows the capability of a centralised data storage that can aid in increasing the levels of control, providing optimal storage and management of information;
4) Can increase the workflow and internal efficiency, such as the process of online student registration;
5) Can assist in developing learning and teaching pedagogies whereby, for example, a lecturer teaches a given tutorial in the normal setting of a classroom and afterwards utilises a system of ERP to express that which is being taught;
6) Allows for optimal use of hardware resources, by enhancing efficiency and reducing the institution’s overhead costs;
7) Effectively manages program alerts and communication, for instance, the system can keep watch over alerts and e-mail flows;
8) Effectively undertakes new business processes, such as e-commerce, e-procurement, e-learning, e-portfolio and e-government;
9) Allows for an improvement in operations’ planning within institutions through the provision of relevant information sought by managers to support strategic decision-making;
10) Allows for an easily understandable web interface system that supports interactivity. Furthermore, wide-ranging administrative functions can be provided through the interface by way of enhanced integrated portals and one-stop shopping;
11) Can increase the level of information sharing, leading to increased levels of efficiency, enhanced workflow, by minimising the reliance on printed material and paper.

VIII. CHALLENGES AND ISSUES IN ADOPTING ERP

A. Risks Associated with ERP Implementation in Business

The existing literature signifies that the application of an ERP system has sometimes failed to achieve an organisation’s desired objectives and outcomes. In fact, much of the research indicate that the failure of implementation of an ERP system is not as a result of the ERP software in itself; rather it could be attributed to a high level of complexity of the significant number of changes that ERP causes within organisations [42-44]. These ERP failures can be accounted for by the fact that in most of the successful organisations, the implementation requires companies to follow the principle of ‘best practice’ and form appropriate reference models; however, in doing so organisations are still facing challenges and problems [45].

In accordance with Helo, Anussornitisarn [43] unlike other information systems, the major problems of ERP implementation are non-technologically related issues e.g. technological complexity, compatibility, standardisation, etc. but mostly [about] are organisation and human related issues e.g. resistance to change, organisational culture, incompatible business processes, project mismanagement, top management commitment. The study of Huang [46] outlines the top ten risk factors attributable to the failure of implementation of an ERP system as shown in Table III.
TABLE III. TOP TEN RISK FACTORS OF ERP RISK [21]

<table>
<thead>
<tr>
<th>Priority</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of senior manager commitment</td>
</tr>
<tr>
<td>2</td>
<td>Ineffective communications with users</td>
</tr>
<tr>
<td>3</td>
<td>Insufficient training of end-users</td>
</tr>
<tr>
<td>4</td>
<td>Failure to get user support</td>
</tr>
<tr>
<td>5</td>
<td>Lack of effective project management methodology</td>
</tr>
<tr>
<td>6</td>
<td>Attempts to build bridges to legacy applications</td>
</tr>
<tr>
<td>7</td>
<td>Conflicts between user departments</td>
</tr>
<tr>
<td>8</td>
<td>Composition of project team members</td>
</tr>
<tr>
<td>9</td>
<td>Failure to redesign business process</td>
</tr>
<tr>
<td>10</td>
<td>Misunderstanding of change requirements</td>
</tr>
</tbody>
</table>

These identified risk factors demonstrate a number of organisational considerations such as organisational fits; project management and control; skill mixed; user involvement and training; design of the software system; and technology planning. As any implementation programme, the implementation of an ERP system also will cause organisational changes, thus requires support from the organisation’s senior level of management in the process and ensure they are able to resolve any conflict. In the absence of commitment from the senior-level management, the implementation of an ERP system is at a high risk of failure.

There may be resistance throughout an organisation to adopt the ERP system due to the difficulty in accepting changes in business processes. As an ERP system connects and integrates an organisation’s business functions, it is crucial that the staff of management-level have a high level of commitment to the success of the ERP implementation. In particular, an organization furnish employees to embrace ERP business functions that influence clear pathways for communication. Risks are also created with the insufficient or ineffective end-user training that leads to inaccuracy and creating a layer of confusion, thereby leading to user dissatisfaction and ultimately affecting the integrity of the system[26].

For the success of the ERP implementation, a first-rate project management is required. In order to effectively implement an ERP system, project teams ought to be given clear guidelines outlining the objectives of the project and be given a work plan that integrates with a resource allocation plan. In fact, in the absence of effective project management, ERP implementation projects, particularly those which are large-scale and take place over longer periods of time, may ultimately end in failure. In addition, the composition of the members of the project team plays a significant role in the implementation of an ERP system. As an ERP system integrates a varied range of business functions across an organisation into a single system; this requirement dictates that an integrated and complex software package is required to meet these needs. In the event the changes in its organisational structure are not clearly understood by all the members of the project team, including the processes and strategies of the ERP implementation, then, the organisation will not be best positioned to benefit from the competitive advantage provided by the system of ERP. In order for ‘best practice’ of implementation ERP system, the project team members ought to be chosen by ensuring there is a balance between the members with business acumen within the organisation as well as external experts who specialise in ERP [26].

B. Challenges of Implementing ERP in HEIs

The research demonstrates that there are some challenges and issues in implementing an ERP system. According to Heiskanen et al., [47], the ERP system may not appropriate for universities if they have a unique decision-making processes and structures. However, the implementation of an ERP system can encourage universities to adopt a more business-like approach to education. Another consequence of this could be cultural changes which include “the use of managerial language and techniques” [48]. In addition, HEIs may also face the resistance of ERP implementation as it involves not just the implementation of a novel information system, but a holistic modification in an organisation’s culture.

Further, the implementation of an ERP system supports more on an administrative authority model of governance [49]. Accordingly, for academics this model may lead to concerns that the ERP system would result in a loss of academic control that increases the transparency of academic transactions. Meanwhile, the administrative staff may have concerns for their job security when work functions are automated across the university and processes become redundant and are eliminated [48].
Meanwhile Pollock and Cornford [50] argued that ERP system is a generic type of solution, but not a specific solution, hence it is a high-risk strategy for universities to adopt it. In spite of the need for HEIs to have business functions which are unique, the ERP system can confine universities’ choices and support the HEIs adoption of any type of solution.

Another challenge is that ERP system is a dynamic and complex large integrated packaged solution, therefore, it may create problems for the IT staff and management during the implementation phase, even, for those who might have a detailed understanding of their own organization. This may be due to the fact that universities possess an expanded array of systems; many of which may have competing functions whenever there are a specific needs. In the worst case scenario, universities may not have IT staff or management who are sufficiently well-trained to understand the complexities of organisational functions.

The key features of an ERP system are integration and standardisation, thus may reduce the flexibility within a university’s systems. This limited flexibility may lead staff members to carry on the previous processes rather than applying new and more efficient processes. In responding to an emerging ERP system, it may eventually increase staff workload and cause a data gap between reality and the system [26].

IX. CONCLUSION

Overall this paper advances the theoretical ERP system of HEI’s efficiency and competitiveness. The review finding of this paper indicates the impact and advantages of implementing an ERP system. HEIs need to implement ERP system—new technology and processes to increase their performance and efficiency. Accordingly, the motive to prompt studies on ERP in the higher education sector in the Egyptian context is to increase the level of understanding of ERP systems, to get a better appreciation of the substantial change required, as well as considering the adoption and use of the ERP system itself. As the Egyptian HEIs are being met with significant challenges, the system of ERP introduces new techniques and tools that can provide solutions to the problems confronting Egypt’s HEIs. The ERP characteristics and functions or modules leads to enhance HEIs operational performance along with improving the quality of educational services provided. Future research is suggested to examine the impact of ERP system on HEI’s performance.

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