

Navigating Challenges in ERP Implementation within Higher Education: Insights from the Egyptian Context and Proposed Mitigation Strategies

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Abstract— The implementation of an ERP system in higher education institutions in Egypt is strongly advised as it presents a range of benefits. This comprehensive guide aims to provide practical advice on how to successfully implement ERP systems in the Egyptian higher education sector while addressing the unique challenges that may arise. The guide emphasizes the significance of enterprise architecture in supporting the implementation process. ERP systems have gained popularity in the education sector for their ability to effectively manage complex business processes and data. However, implementing an ERP system is a complex endeavour that necessitates careful planning and execution. The guide recognizes the challenges specific to the Egyptian higher education sector, such as a lack of process standardization, limited technical resources, and cultural differences. It stresses the importance of adopting an enterprise architecture approach to overcome these challenges and ensure a successful implementation. By employing enterprise architecture, institutions can align their business processes, IT systems, and data in a manner that supports the institution's objectives. This approach allows for a comprehensive understanding of the current state of the institution's processes and systems, enabling the identification of areas that require improvement. Furthermore, the guide addresses the significance of effective communication and collaboration between departments during the implementation process. It emphasizes the need for open dialogue and involvement from all stakeholders, including faculty, staff, and IT professionals, to ensure that the ERP system meets the institution's specific needs. The guide also highlights the importance of thorough training and support for end-users to ensure a smooth transition to the new system. It offers practical guidance on training strategies and emphasizes the need for ongoing support to address any issues or concerns that may arise after the implementation. In conclusion, this comprehensive guide offers valuable insights and practical advice on implementing ERP systems in the higher education sector in Egypt. By adopting an enterprise architecture approach and addressing the unique challenges, institutions can streamline administrative tasks, enhance resource and financial

management, improve communication, and make more informed decisions, ultimately improving overall efficiency and effectiveness.

Keywords— ERP (Enterprise resource planning); Higher Education (HE); LMS (Learning Management system); SIS (Student information system); Critical success factors (CSFs).

I. INTRODUCTION

Digital Enterprise resource planning (ERP) systems have become increasingly popular in the higher education sector in recent years. The implementation of ERP systems can help higher education institutions to streamline their business processes, improve efficiency, and enhance decision-making capabilities. In the Egyptian higher education sector, the adoption of ERP systems has been encouraged by the government's efforts to modernize the education system and promote digital transformation. However, implementing ERP systems in higher education institutions presents unique challenges related to integrating ERP with educational-specific systems such as learning management systems (LMS), student information systems (SIS), and research management systems.

This study aims to explore the challenges and opportunities associated with implementing ERP systems in the Egyptian higher education sector, with a particular focus on the integration of educational-specific systems, also By examining the role of EA in ERP implementation, This study will focus on identifying the specific ways in which EA can support the implementation process and enhance the overall success of ERP systems in the higher education sector. The study highlights the need for a comprehensive implementation plan that considers the specific needs of the institution, the capabilities of the ERP system, and the integration with educational-specific systems. The successful implementation of ERP systems in the Egyptian higher education sector

requires a strategic approach that addresses these factors and involves stakeholder engagement and communication to ensure user acceptance and change management. The implementation of Enterprise Resource Planning (ERP) systems in the education sector has gained significant attention in recent years. The integration of technology in educational institutions has become a crucial aspect of efficient management and administration. The use of ERP systems can assist educational institutions in automating and streamlining their administrative processes, improving the quality of education, and providing better services to students and faculty. According to Lavinia Barna and Enăchescu, the application of ERP systems in education environments can provide several benefits, including better data management, improved communication, and increased productivity [1]. However, the implementation of ERP systems in higher education institutions is not without its challenges. According to Abdulsalam et al., several factors influence the success of ERP implementation, including motivation, challenges, and success factors that include but are not limited to (Evolving Chief executives, Decision-making centralization and The success of key areas of the organization) [2]. One of the critical success factors identified by Rizkiana et al. is the management's commitment to the project [3]. Similarly, communication has been identified as an essential factor in overcoming ERP implementation challenges by Müller and Syed [4]. Critical success factors for ERP implementation in higher education have been studied by several researchers, including Vicedo et al. [5], Vargas and Comuzzi [6], and Setyawan et al. [7]. These studies have identified factors such as project management, user involvement, and system testing as essential for successful ERP implementation. Moreover, Soliman and Noorliza have highlighted the competitive advantage of ERP adoption in Egyptian higher education institutions [8]. Meanwhile, Fadelelmoula (2018) [9] investigated the effects of critical success factors on ERP implementation in the higher education sector, emphasizing the importance of organizational readiness and top management support. However, despite the wealth of research in this area, there is still a need for more comprehensive and empirical studies that can provide a deeper understanding of the specific challenges faced by different educational entities. understanding the CSFs for ERP implementation in HEIs is crucial for improving the success rate of ERP implementation in the higher education system. In conclusion, ERP systems have become an essential tool for efficient management and administration in higher education institutions. However, the successful implementation of ERP systems requires careful consideration of critical success factors and effective change management. Understanding these factors and how they influence the implementation process can help educational institutions achieve a successful ERP implementation. The next section of this paper will provide a comprehensive review of the existing literature on CSFs for ERP implementation in HEIs.

II. LITERATURE REVIEW

First, In this section, the authors will review the previous research that covers the same subject, L. E. Lavinia Barna and V. A. Enăchescu [1] provides a useful overview of the potential application of ERP systems in the education sector and highlights the benefits and challenges of implementing such systems. The authors' recommendations provide a useful starting point for educational institutions considering the

implementation of an ERP system. However, it is important to note that the article provides only a general overview, and educational institutions would need to conduct a thorough analysis of their specific needs and context before deciding whether to implement an ERP system. N. A. Abdulsalam, et al [2] provide a comprehensive review of the motivations, challenges, and success factors associated with the implementation of Enterprise Resource Planning (ERP) systems in higher education institutions. The authors present a thorough analysis of the current state of ERPs in higher education, highlighting the key benefits and drawbacks of implementing such systems. They also identify the main challenges that institutions face when implementing ERP systems and offer several success factors that can help overcome these challenges, the strength of the article is that the authors offer a detailed discussion of the benefits and drawbacks of implementing ERP systems which can help institutions make informed decisions about whether to invest in such systems. M. Soliman and N. Karia's [10] article provides valuable insights into the factors that influence ERP readiness in higher education institutions in Egypt. The authors offer several recommendations for institutions looking to improve their ERP readiness, such as developing a clear ERP strategy, involving all stakeholders in the implementation process, and providing adequate training and support to end users. The study contributes to the literature on ERP implementation in higher education institutions and can help inform future research in this area, there are also some limitations to the study. The sample size is relatively small, consisting of IT professionals from only a few Egyptian universities. This limits the generalizability of the findings to other higher education institutions in Egypt or other countries. D. Bamufleh, et al [11] The article proposes a conceptual model for understanding the factors that influence user acceptance of ERP systems in higher education institutions, based on an extensive literature review, however, The article does not provide empirical evidence to support the proposed model, which limits its practical application. Further research is needed to validate the proposed model and assess its usefulness in real-world situations. G. K. Aggrey, et al [12] provides a case study of ERP implementation challenges in a Ghanaian higher education institution, which can help other institutions in Ghana and other similar contexts understand potential challenges and ways to address them, the article is limited in scope as it only presents a case study of one institution, and the findings may not be generalizable to other contexts. Additionally, the article does not provide a comprehensive analysis of the factors that led to the implementation challenges, and further research is needed to fully understand these factors. M. S. M. Soliman and K. Noorliza [8] provide valuable insights into the potential competitive advantages of ERP adoption in the context of Egyptian higher education institutions. The study's findings can help inform decision-making processes regarding ERP adoption and highlight the importance of considering both technical and organizational factors, scope is limited to the context of Egyptian higher education institutions also further research is needed to validate the study's findings through empirical research. A. Setyawan, et al [7] The main value of the research is its identification and analysis of challenges and supporting factors for ERP adoption in higher education, using the University of Indonesia as a case study. The study's findings provide valuable insights for other higher education institutions considering ERP adoption to enhance success and address potential challenges. One potential disadvantage of

this research is that it is based on a single case study at the University of Indonesia, and therefore the findings may not be fully generalizable to other higher education institutions. Further research is needed to validate the findings in different contexts. Z. H. Khand and M. R. Kalthoro [13] propose DeLone and MacLean's IS model as a theoretical framework used to measure the success of information systems (IS) in organizations. The model identifies six factors that contribute to IS success: system quality, information quality, service quality, user satisfaction, use, and net benefits. It has been widely used and adapted in research related to various types of information systems, including ERP systems. The DeLone and MacLean IS model was tested and validated in the context of ERP system success in higher education institutions of Pakistan. The study provided insights into the factors influencing ERP system success, such as system quality, information quality, and user satisfaction. However, the study's focus on a specific country may limit the generalizability of the findings to other contexts. M. Albarghouthi, et al [14] The study presents a conceptual model for ERP adoption and acceptance in Saudi Arabian higher education, considering organizational, technological, individual, and cultural factors. However, the model has yet to be empirically tested, which is a limitation. M. S. M. Soliman, et al [15] provides a study that applies the Unified Theory of Acceptance and Use of Technology (UTAUT) to develop a model that explains the intention to use ERP systems in Egyptian higher education institutions. The results show that performance expectancy, effort expectancy, social influence, and facilitating conditions are significant factors that influence the intention to use ERP systems. A. Ullah, et al [16] The paper provides a comprehensive overview of ERP systems in higher education institutions (HEIs), discussing their benefits and challenges. It also highlights the critical success factors for ERP implementation and the factors that affect ERP adoption in HEIs. Fadelelmoula and Ashraf Ahmed [9] provide a study that examines the effects of critical success factors (CSFs) for ERP implementation on the comprehensive achievement of the crucial roles of information systems (IS) in the higher education sector. The research focuses on a conceptual model that integrates the CSFs and the roles of IS. The findings suggest that the identified CSFs have a significant impact on the achievement of the crucial roles of IS.

Although this previous research provides valuable insights and information about the challenges, success factors, and benefits of ERP adoption and implementation in higher education institutions. These studies can be used as a reference for decision-makers and stakeholders in higher education institutions to improve their ERP implementation strategies and achieve better outcomes. However, some common limitations could be the small sample sizes, the lack of generalizability to other contexts, the focus on only one aspect of ERP implementation, and the absence of empirical testing for some of the proposed models in which will try to overcome in our research. Overall, this study provides insights into the challenges and opportunities associated with ERP implementation in the Egyptian higher education sector and highlights areas for future research to further enhance our understanding of ERP implementation in this context. There are several potential areas for new contributions to the study of ERP implementation in the Egyptian higher education sector. Therefore, this study aims to contribute to the existing literature by conducting in-depth interviews with four

different educational entities to understand the critical success factors for ERP implementation and adoption in the higher education system. The findings of this study will provide valuable insights for decision-makers and practitioners in higher education institutions to overcome the challenges and ensure successful ERP implementation and adoption.

III. RESEARCH METHODOLOGY

A. Data Collection

The study relies on a variety of data sources, the primary one being four interviews conducted with individuals responsible for overseeing ERP implementation solutions in four different educational organizations in Egypt. During the interviews, which lasted between 30 to 60 minutes, All calls are recorded after taking the required permission and informing the other party, Notes were taken to capture the challenges encountered throughout the ERP implementation process, from the initial selection phase through to system deployment and ongoing support. The main goal of these interviews is to gain insight into the common challenges that arise during ERP implementation and to develop a comprehensive understanding of the factors that contribute to success or failure in this process. Potential areas of focus include organizational culture, technology infrastructure, project management, stakeholder engagement, and other factors that may impact the outcome of an ERP implementation project. By analyzing the data gathered from these interviews, the study aims to identify key patterns and themes that can inform best practices and recommendations for future ERP implementations in educational organizations in Egypt.

The second data source is one of the (Odoo software) open-source ERP vendors in the study country which provided the authors with technical proposals and main process charts that are being used on the high educational ERP implementations, The proposal provided by the ERP partner can provide valuable insights into the features, functionalities, and benefits of the proposed ERP system, as well as the vendor's approach to the implementation process and strategies for addressing potential challenges. To better understand the implementation process outlined in the proposal, it may be helpful to create process charts that map out the main processes involved, starting from the initial planning and scoping phase, and continuing through to system deployment and ongoing support. By creating these process charts, it is possible to gain a clearer understanding of the steps involved in the implementation process and identify potential areas of risk or inefficiency. This information can be used to develop more effective implementation strategies or to inform best practices for future ERP implementations in the educational sector. Overall, the proposal provided by the ERP partner is an important source of information for the study and can help to shed light on the implementation process as well as the benefits and challenges of the proposed ERP system.

B. Data Analysis

First, the authors will examine the common ERP implementation phases and then discover all the challenges identified during the interviews and the literature review on their experience with ERP implementation to suggest potential solutions or strategies for overcoming these challenges. By analyzing the data and identifying common themes or patterns based on each phase, the authors aim to

provide insights and recommendations that can help organizations successfully implement ERP systems. The second part of the analysis is the technical challenges related to the integration between the main modules of the ERP system and the specific systems used in the educational sector. The authors will explore and analyze this challenge in detail and propose potential solutions or strategies for addressing it, drawing on their experience and knowledge of ERP implementation. By addressing this challenge, organizations can ensure that their ERP systems are fully integrated with their existing systems, and that data can be seamlessly transferred and shared across the organization supported by the proposed integration way and process flow graph.

The next sections will provide an examination of the common ERP phases and then will provide the corresponding challenge for each phase and recommendations to overcome, last section will examine the integration challenges between the ERP system main module and the specific educational system expediting the same with a process flow for each integration point and finally will have an overview for how EA can support overcome the ERP implementation.

IV. ERP IMPLEMENTATION PHASE AND METHODOLOGIES.

According to the common ERP implementation phases, we have three main common activities. As shown in Table I identifies the main and sub-activity corresponding with each phase from a high-level view[17, 18].

TABLE I. ERP MAIN IMPLEMENTATION PHASES

Main Phase	Corresponding activity
Pre-implementation	Analysis of the current business processes, define the scope of the ERP system, create a project high-level plan, identify key stakeholders, selecting of an ERP vendor, negotiating contracts, and setting up the necessary infrastructure
During-implementation	Configuring and customizing the ERP system to meet the organization's specific needs, data migration, system testing, training end-users, and preparing for the transition to the new system
Post-implementation	Ongoing monitoring, troubleshooting, and maintenance of the ERP system, evaluating the success of the project, identifying areas for improvement, and planning for future upgrades or modifications

Each ERP system has its specific methodology to be used during the implementation process as shown below table II expedites the different methodologies for the main four reputed ERP solutions in Egypt (SAP, Oracle, Microsoft and Odoo).

TABLE II. IMPLEMENTATION METHODOLOGY

system	Methodology	Phases
SAP	SAP Activate	Prepare, Explore, Realization, and Deploy and Go Live
Oracle	Oracle Unified Method (OUM)	Stage 1: Engage, Stage 2: Drive, Stage 3: Enable, and Stage 4: Convert.
Microsoft	Rapid Implementation Methodology (RIM)	Stage 1: Initiate, Stage 2: Implement, Stage 3: Prepare, and Stage 4: Operate
Odoo	Odoo Implementation Methodology (OIM)	Business Need Analysis (15%), Full Featured Prototype (15%), Data Import and Specific Development (50%), Validation and Training (10%), and Deployment: Go Live (10%).

While the specific phases may vary depending on the methodology being used, some common elements are typically included in an ERP implementation project below table III shows the detailed common implementation phase and corresponding activity for each phase from a detailed view.

TABLE III. COMMON ERP DETAILED IMPLEMENTATION PHASES

Main Phase	Corresponding activity
Planning Phase	Define the project scope, objectives, high-level requirements, project timeline, budget, and resource allocation, and creates a detailed project plan.
Analysis Phase	Analysis organization's current processes, analysis of current systems, identifying gaps, identifying areas for improvement, business process mapping, requirements gathering, and data analysis.
Design Phase	Software configuration, custom development, and integration with other systems
Testing Phase	comprehensive testing of the ERP system typically includes several types of testing (unit testing, integration testing, and user acceptance testing)
Deployment Phase	Deploys system to the production environment, conducts user training, data migration and system cutover activities
Maintenance and Support Phase	System monitoring, bug fixes, and upgrades.

Overall, the goal of an ERP implementation project is to successfully deploy a system that improves the organization's business processes and enables it to achieve its strategic objectives. The phases of the project are designed to ensure that the system is properly designed, tested, and deployed and that ongoing support and maintenance are provided to maximize the system's value to the organization, certainly. Each phase of an ERP implementation project has the potential to present a unique set of challenges that can be caused by various factors such as organizational resistance to change, lack of user adoption, technical issues, or unforeseen problems that emerge during the project. The identification of factors leading to the success or failure of ERP systems is an issue of increasing importance since the number of organizations choosing the ERP path keeps growing [19]. These challenges will be discussed in more detail in the next section.

V. ERP IMPLEMENTATION CHALLENGE

A. ERP phases implementation challenge and possible way to overcome.

After conducting interviews that we refer to in the data collection part and conducting a review for [3, 5, 6, 8, 12, 18, 20-29]. A range of challenges emerged that must be carefully considered throughout the ERP implementation process. The following sections delve into potential obstacles for each phase of ERP implementation and provide strategies to overcome them.

1) Planning phase implementation challenge:

Table IV expedites the planning phase implementation challenge and possible ways to overcome it.

TABLE IV. PLANNING PHASE IMPLEMENTATION CHALLENGE

Num	Challenge	Way to overcome
1	Unclear project scope and objectives	Establish a clear scope of the project, define objectives and outcomes, and communicate them effectively to all stakeholders involved
2	Lack of alignment with organizational goals	Ensure that the ERP implementation aligns with the organization's overall strategy and goals and identify how the system will support and improve current processes.
3	insufficient budget and resources	Develop a realistic budget and allocate resources effectively, identifying areas where cost savings can be made without compromising on quality.
4	Lack of executive sponsorship and stakeholder buy-in	Engage key stakeholders and executive sponsors from the outset of the project, communicate the benefits of the ERP implementation, and involve them in decision-making processes.
5	Inadequate knowledge of the organization's business processes and requirements	Conduct a thorough analysis of the organization's business processes and requirements, involve subject matter experts, and identify areas for improvement
6	Inefficient project governance structure	Establish a robust project governance structure, with clear roles and responsibilities, decision-making processes, and regular reporting and monitoring.
7	Inadequate risk management plan	Develop a comprehensive risk management plan, identifying potential risks and mitigation strategies, and regularly review and update the plan as necessary.
8	Poor project planning and scheduling	Develop a detailed project plan and schedule, with clear timelines, milestones, and dependencies, and ensure that progress is regularly reviewed and reported.
9	Insufficient communication and collaboration between stakeholders	Foster a culture of communication and collaboration, establishing regular channels of communication, involving stakeholders in decision-making, and ensuring that all stakeholders are aware of project progress and changes.
10	Unclear roles and responsibilities of project team members	Clearly define roles and responsibilities for all project team members, establish clear lines of reporting, and ensure that all team members are aware of their responsibilities.
11	Poor project management skills	Ensure that the project is managed by experienced and qualified project managers, provide training and development opportunities to improve project management skills, and establish a culture of continuous improvement.
12	Unrealistic project timelines	Develop a realistic project timeline, considering potential delays and contingencies, and ensure that progress is regularly reviewed and adjusted as necessary.
13	Lack of technical expertise	Ensure that the project team includes individuals with the necessary technical expertise, provide training and development opportunities to improve technical skills, and involve technical experts in decision-making processes.
14	Insufficient knowledge of regulatory and compliance requirements	Conduct a comprehensive analysis of regulatory and compliance requirements, involve subject matter experts, and ensure that the ERP system is designed and implemented in compliance with relevant regulations and requirements.

2) *Analysis phase implementation challenge:*

Table V expedites the analysis phase implementation challenge and possible ways to overcome it.

TABLE V. ANALYSIS PHASE IMPLEMENTATION CHALLENGE

Num	Challenge	Way to overcome
1	Poor requirements gathering and analysis	involve all stakeholders in the process, including end-users, managers, and IT staff. Requirements should be documented, and there should be a

		focus on understanding the business processes and goals that the system will support.
2	Insufficient data analysis and modelling	take a data-driven approach to system development, which involves analyzing and modelling data to identify trends, patterns, and relationships. This requires a strong understanding of the data sources and a focus on data quality and integrity
AC3	Difficulty in defining business processes	To overcome this challenge, it is essential to work closely with stakeholders to understand their business processes and goals. This involves identifying key workflows, pain points, and areas for improvement, and designing the system to support these processes.
4	Inefficient data management practices	To address this challenge, it is important to establish best practices for data management, including data quality control, data cleansing, and data integration. Additionally, data governance policies and procedures should be put in place to ensure data security, privacy, and compliance.
5	Inadequate understanding of industry-specific requirements	It is important to research and understand the high education-specific requirements and regulations of the industry the system will be used in. This involves staying up to date with high education trends in Egypt, attending conferences and events, and collaborating with experts.
6	Difficulty in balancing customization and standardization	It is essential to strike a balance between customization and standardization, to ensure that the system meets the specific needs of the organization, while also minimizing complexity and reducing costs. This involves identifying critical areas for customization and weighing the benefits and costs of each customization against the standard functionality provided by the system.
7	Inadequate documentation and traceability	It is important to document all aspects of the system development process, including requirements, design decisions, testing results, and user feedback. This helps to ensure that the system is fully traceable and that any issues or defects can be easily identified and resolved.
8	Poor change management practices	To address this challenge, it is important to establish effective change management practices, including clear communication, stakeholder engagement, and a focus on managing risks and issues. Additionally, it is important to establish a clear process for managing changes, including review and approval procedures.
9	Insufficient knowledge of project risks and issues	To overcome this challenge, it is important to conduct a thorough risk assessment and establish a risk management plan that addresses potential risks and issues. This involves identifying key risks and issues, assessing their likelihood and impact, and developing mitigation strategies to minimize their impact.
10	Difficulty in defining system interfaces and integrations	It is important to work closely with stakeholders and external vendors to understand their requirements and limitations, and to design system interfaces and integrations that meet their needs. This involves identifying key data flows and touchpoints and designing a system architecture that supports these interactions.
11	knowledge of data security and privacy requirements	the project team should engage with relevant experts in the field and conduct thorough research to ensure compliance with all regulatory and legal requirements.
1Y	Inefficient system architecture design	To address this challenge, it is essential to work closely with stakeholders to understand their needs and requirements,

3) *Design phase implementation challenge:*

Table VI expedites the design phase implementation challenge and possible ways to overcome it.

TABLE VI. DESIGN PHASE IMPLEMENTATION CHALLENGE

Num	Challenge	Way to overcome
1	Inadequate system design	Involve subject matter experts and conduct thorough analysis before designing the system.
2	Poor customization decisions	Stick to standard system features and avoid excessive customization.
3	Incomplete integration plan	Develop a detailed integration plan and ensure that all necessary systems are connected.
4	Lack of scalability	Plan for future growth and ensure that the system can accommodate expanding needs.
5	inefficient workflow design	Involve end-users in the design process and conduct thorough workflow analysis.
6	Inadequate UI/UX design	Involve end-users in the design process and ensure that the system is user-friendly.
7	Poor system performance design	Conduct thorough performance testing and ensure that the system can handle therequired workload.
8	Difficulty in defining system configuration	Involve subject matter experts and ensure that the system is configured to meet organizational needs.

4) Testing phase implementation challenge :

Table VII expedites the testing phase implementation challenge and possible ways to overcome it.

TABLE VII. TESTING PHASE IMPLEMENTATION CHALLENGE

Num	Challenge	Way to overcome
1	Inadequate testing plan	Develop a comprehensive testing plan that covers all system modules and scenarios.
2	Insufficient data quality	Implement data quality controls and perform data cleansing and enrichment.
3	Technical issues/bugs	Perform thorough testing and debugging and prioritize and address critical issues first.
4	Poor user acceptance	Involve end-users in the design and testing phases and provide user training and support.
5	Insufficient testing resources	Allocate sufficient testing resources and prioritize testing based on business criticality.
6	Difficulty in defining test scenarios and cases:	involve business stakeholders in defining test scenarios and cases, and leverage industry best practices.
7	Inefficient test data management practices	Implement test data management tools and processes to efficiently create, maintain, and refresh test data.
8	Inadequate testing environment setup	Ensure that the testing environment accurately reflects the production environment and allocate sufficient resources for environment setup and maintenance.
9	Poor testing documentation and traceability	Document test cases, results, and defects thoroughly and accurately, and ensure traceability throughout the testing lifecycle.
10	Difficulty in balancing testing and production environment	Ensure that production environment changes do not impact testing, and schedule testing and production releases appropriately.
11	Insufficient knowledge of user acceptance testing	involve end-users in user acceptance testing and ensure that user acceptance testing criteria are clearly defined and agreed upon.
12	Difficulty in defining testing acceptance criteria	Define acceptance criteria in collaboration with business stakeholders and ensure that acceptance criteria are documented and understood.

5) Deployment phase implementation challenge:

Table VIII expedites the testing phase implementation challenge and possible ways to overcome it.

TABLE VIII. DEPLOYMENT PHASE IMPLEMENTATION CHALLENGE

Num	Challenge	Way to overcome
1	Poor system rollout	Develop a comprehensive rollout plan and conduct a pilot phase before rolling out the system to the entire organization.
2	Insufficient training/education	Provide comprehensive training to end-users, IT staff, and other stakeholders, and develop training materials and documentation
3	Inadequate change management	Develop a change management plan and communicate changes to all stakeholders.
4	Data migration issues	Develop a data migration plan and validate data migration before going live.
5	Difficulty in defining acutover plan	Develop a comprehensive cutover plan and test it before going live.
6	Poor system documentation and handover	Develop comprehensive documentation and ensure that it is properly handed over to stakeholders.
7	Difficulty in defining system performance baselines	Develop performance baselines and conduct regular performance monitoring.
8	Poor vendor management practices	Develop a strong vendor management strategy and communicate expectations to vendors
9	Inefficient user provisioning and access control	Develop a user provisioning and access control strategy and regularly review and adjust it as needed
10	Difficulty in defining system audit trails and logging	Develop a comprehensive audit trail and logging strategy and regularly review and adjust it as needed

B. ERP Integration Challenge

Enterprise Resource Planning (ERP) systems have been widely adopted in educational institutions to integrate business processes across different departments and provide a unified view of the institution's data. Hence, implementing ERP systems in higher education also presents some challenges, However, it simplifies the integration process of legacy systems with ERP and reduces the risk of data duplication [7], especially when integrating with specific educational systems. Some of these challenges are:

Integration with learning management systems (LMS): ERP systems are typically designed to manage administrative processes such as finance, human resources, and procurement. However, when integrating with an LMS, challenges arise in terms of data integration, synchronization, and sharing between the two systems. This requires careful consideration of data mapping, data governance, and data security.

Integration with student information systems (SIS): SIS is an essential system that manages student data, including admission, registration, and academic records. Integrating ERP with SIS can present challenges related to data quality, data consistency, and system compatibility. It is important to ensure that data is accurately shared between the two systems and that changes made in one system are properly reflected

in the other. Integration with research management systems: Research management systems are used to manage research data, grants, and funding. Integrating ERP with research management systems can present challenges related to data privacy, security, and compliance with regulatory requirements.

As per our interview and investigation and data collected from ERP partners that work specifically with the educational sector as industry-specific, we found that there are two main integration points represented as follows:

The first point: Integration with SIS systems when we create or deactivate an academic employee in the ERP system this will reflect automatically in the SIS by creating the same employee with the same id and including all data for the instructors include (actual credit hours and registered number of students for each instructor from SIS and reflect on the ERP system. This information will appear in the ERP payroll module and affect pays lip of employment. As shown in Figure 1 process is low for this integration process.

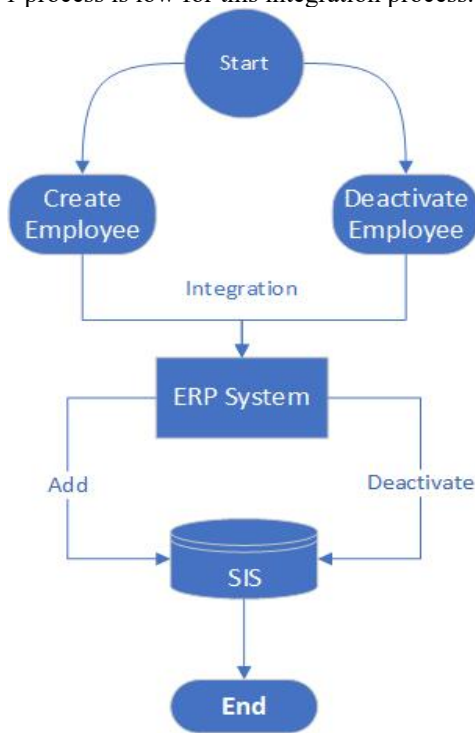


Fig. 1. ERP HR integration Points with SIS

The second point is Integration with the Accounting part, when a student makes a payment to the university through SIS integration the financial data goes through the ERP system to reflect the related invoice and related financial documents, as shown in Figure 2.

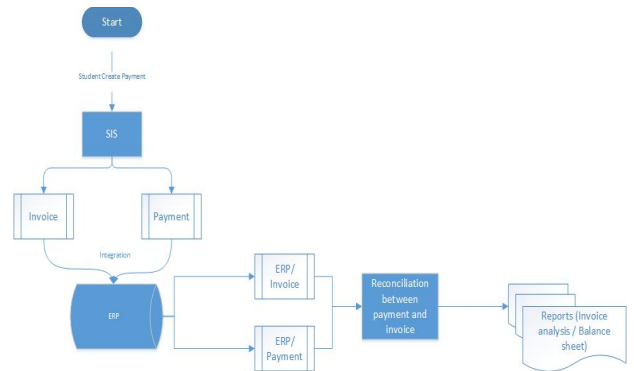


Fig. 2. Student information system (SIS) Integration with ERP financial system

As shown in Figure 2 the integration of the student information system (SIS) keeps all the student records and manages the student fees and payments; it is integrated with the core financial and controlling (FICO) module in the ERP system. SIS system provides the payment/invoice transaction to be integrated with ERP financial transaction to be part of the whole accounting system and it is managed by reporting.

As study fact the proposed integration cycle is still not implemented in those education entities however it is the target vision for them, however, the main core ERP business cycle that is related to the ERP core part is already implemented on most of the covered entities, In summary, implementing ERP systems in higher education presents unique challenges when integrating with specific educational systems such as LMS, SIS, and research management systems. It is important to address these challenges through careful planning, data governance, user acceptance, and change management.

VI. HOW EA CAN SUPPORT ERP IMPLEMENTATION

Enterprise Architecture (EA) can support the successful implementation of Enterprise Resource Planning (ERP) systems in several ways, Although Enterprise Architectures (EA) and Enterprise Resource Planning (ERP) systems are not the same concepts, they share numerous related and complementary characteristics. Enterprise architecture (EA) is an integrated strategy, business, and information systems approach for analysis, governance, and information technology (IT) alignment[30].By offering a clear understanding of the current and future business and technology operating environments, as well as identifying how the ERP system(s) can (or cannot) assist in meeting the enterprise's strategic goals and business requirements, Enterprise Architectures (EA) can aid in reducing the risk of ERP implementation failure. Consequently, it is essential to plan ERP implementations in the context of EA management and transition plans and conduct risk assessments before, during, and after implementation to identify potential obstacles to success [31] Below are some examples of how Enterprise Architecture (EA) can aid in ensuring the successful implementation of ERP systems:

Business Process Alignment: EA can help align an organization's business processes with the ERP system's capabilities. By analyzing the organization's current processes and identifying areas of improvement, EA can recommend changes that align with the ERP system's best practices. This alignment ensures that the organization

maximizes the benefits of the ERP system and minimizes the need for customization [32].

IT Infrastructure Alignment: ERP systems require a robust IT infrastructure to support their operation. EA can help identify any gaps in the organization's IT infrastructure and recommend changes to ensure it meets the ERP system's requirements. This alignment ensures that the ERP system operates smoothly, and that the organization can take full advantage of its capabilities.

Data Integration: ERP systems require data from various sources, including financial systems, HR systems, and supply chain systems. EA can help integrate these disparate data sources into a single, unified view, ensuring that the ERP system has access to accurate and complete data. This integration enables better decision-making, improved efficiency, and reduced errors [32].

Customization Management: Customizing an ERP system can be costly and time-consuming. EA can help manage customization by analyzing the organization's needs and identifying where customization is necessary. This analysis ensures that customization is kept to a minimum, reducing costs, and ensuring that the system remains easy to maintain and upgrade.

Integration Management: EA can support integration challenges in ERP implementation by defining system interfaces and integrations, ensuring data security and privacy requirements, and designing efficient system architecture.

Overall, by leveraging the EA approach, organizations can better manage the challenges that arise during an ERP implementation project, including insufficient technical expertise, poor project management skills, inadequate documentation and traceability, and poor user acceptance. EA can provide a holistic approach to overcome these challenges and deliver a successful ERP implementation project.

VII. STUDY LIMITATION

As with any research study, several potential limitations should be considered when interpreting the findings of this study. Some of the possible limitations of this study include **Generalizability:** The findings of this study may not be generalizable to other countries or higher education systems outside of Egypt. The implementation of ERP systems may vary depending on contextual factors such as culture, institutional structure, and technology infrastructure. **Data availability:** The availability of data on ERP implementation in the Egyptian higher education sector may be limited, which could impact the quality and scope of the analysis. **Sample size:** The number of studies reviewed for this literature review may be limited, which could impact the breadth and depth of the analysis. These limitations should be taken into consideration when interpreting the findings of this study, and future research can aim to address some of these limitations to provide a more comprehensive understanding of ERP implementation in the Egyptian higher education sector.

VIII. FUTURE PROPOSED WORK

Based on the literature review and challenges identified in implementing ERP systems in the Egyptian higher education sector, there are several areas for future work: Study the impact of ERP systems on the performance of higher education institutions in Egypt: While there is evidence to suggest that ERP systems can improve business processes, it is important to conduct empirical research to assess the impact of ERP systems on the performance of higher education institutions in Egypt. This can involve using quantitative measures such as efficiency, effectiveness, and quality of services, as well as qualitative measures such as user satisfaction and organizational culture.

Investigate the role of enterprise architecture in facilitating the implementation of ERP systems: Enterprise architecture can play a critical role in ensuring the successful implementation of ERP systems in higher education institutions. Future research can explore the use of enterprise architecture frameworks such as TOGAF [33] to facilitate the integration of ERP systems with educational-specific systems and business processes.

Overall, these areas of future work can contribute to a better understanding of the implementation of ERP systems in the Egyptian higher education sector and provide insights into how to address the challenges associated with integrating ERP with educational-specific systems.

IX. CONCLUSIONS

In conclusion, the implementation of ERP systems in the Egyptian higher education sector presents both opportunities and challenges. On the one hand, ERP systems can provide a unified view of the institution's data and streamline business processes across different departments. On the other hand, integrating ERP with educational-specific systems such as LMS, SIS, and research management systems can present challenges related to data integration, synchronization, sharing, and system compatibility. To address these challenges, a comprehensive implementation plan that includes data governance, user acceptance, and change management is essential. The implementation plan should also involve stakeholder engagement and communication to ensure that all parties are aware of the benefits and challenges of the ERP system. EA can play a critical role in supporting the successful implementation of ERP systems. By providing a framework for aligning an organization's business processes and IT infrastructure, EA ensures that the organization maximizes the benefits of the ERP system and minimizes the need for customization. Additionally, by integrating data sources and managing customization, EA ensures that the ERP system operates smoothly, enabling better decision-making, improved efficiency, and reduced errors.

The study represents common ERP implementation phases and gets the most important implementation challenge categorized by ERP implementation phase to be considered during the implementation and prevent failures in the high education entities, educational entities can consider this as a guidance checklist that can support their implementation process, the study also provides a way to overcome for each

challenge to take the precaution action and mitigate the failure risk. The study aims to address the challenge of integrating the main ERP module with educational-specific modules. It focuses on creating a technical process flow graph that illustrates the main integration points between these modules realistically. On the other hand, the study represents the EA and its role to cover the presented challenges and how it can support the implantation as long EA and ERP has some common concerns to be addressed to support organization digital transformation, the overall study can support decision maker and play guidance role for Egyptian educational entity that adopting the ERP as part of its supported solution. Overall, the successful implementation of ERP systems in the Egyptian higher education sector requires a strategic approach that considers the specific needs of the institution, the capabilities of the ERP system, and the integration with educational-specific systems. By addressing these factors, the implementation of ERP systems can help to improve the efficiency, effectiveness, and transparency of business processes in higher education institutions in Egypt.

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