Factors affecting the Enterprise Resource Planning: Empirical Study of Higher Education Institutions in Oman

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**Abstract.**Enterprise Resource Planning (ERP) systems have become essential tools in Higher Education Institutions (HEIs) globally, aiming to streamline administrative, financial, and academic processes. In Oman, HEIs have adopted diverse ERP strategies, ranging from in-house developed systems to proprietary and open-source solutions. Despite this progress, implementation challenges persist due to high costs, lack of technical expertise, limited stakeholder engagement, and the need to comply with national regulatory standards, including data synchronization with the Ministry of Higher Education, Research and Innovation (MoHERI). This research investigates ERP adoption among Omani HEIs, analysing success factors and barriers through a structured survey. The study applies the Technology–Organization–Environment (TOE) framework and addresses data reliability using the Synthetic Minority Oversampling Technique (SMOTE) to enhance reliability. Findings indicate that while student management modules are the most developed, areas like financial integration and employee management lag. Correlation analysis reveals interdependencies between finance, HR, and scheduling modules, emphasizing the need for holistic planning. The study concludes that effective ERP implementation requires strong institutional policies, inclusive stakeholder engagement, and alignment with national strategies such as Oman Vision 2040. The insights aim to inform a unified ERP framework to enhance operational efficiency and data interoperability in Omani higher education.

# INTRODUCTION

Higher Educational Institutions (HEI) around the world have implemented Enterprise Resource Planning (ERP) to improve administrative efficiency to allow better decision-making. Some institutions in Oman have also followed suit, but implementations in Oman face challenges due to shortage of certified professionals, high cost of implementation, customization requirements to meet local regulatory standards and the emergence of new disruptive technologies such as AI. It is evident that ERP systems are essential for the growth of educational institutions [1] as they offer modularity, scalability and the possibility to integrate to emerging technologies. In Oman ERP implementations follow one of two main approaches: implementation of a custom-made ERP system to suit the institutional-specific requirements, or off-the-shelf systems such as Oracle or SAP which are customized to fit the intended institution. Both these approaches face challenges. For example, the Modern College of Business and Science, which uses the first approach, has a custom-built ERP system. This approach reduces vendor dependency but has instead the risk of dependency on institutional developers and nonconformance to standards. On the other hand, the National University of Technology and Science has implemented SAP, which has a significant cost for licensing and SAP developers [2]. A few institutions in Oman, for example, Muscat University, have employed a third approach using open-source ERP systems such as Odoo to manage some of the functionalities while using Microsoft Dynamics to manage other aspects. Such techniques pose challenges, especially because of the regulatory requirement for data exchange with the Ministry of Higher Education, Research and Innovation. The goal of this research is to study the current ERP implementations in Omani HEI and identify the factors affecting low implementation for Omani higher education.

# LITERATURE REVIEW

The ERP implementation is the major effort in digital information system transformation. Nevertheless, Abu Madi et al. [3] reflects HEI is a difficult process due to its in-depth academic settings, which are different from traditional ERP implementations in other sectors. They point out that whilst implementation is crucial, there are high chances of failure if not managed well. The authors examined the HEIs in Jordan and provide insight for challenges and solutions for ERP implementation in the academic environments. The findings are of particular interest to this research as they provide a regional context where resources can pose additional restrictions. The authors provide groundwork for creating ERP implementation models, enabling HEIs to enhance their administrative and institutional performance.

ERP solutions in higher education consist of modular applications integrated with each other to support administrative, financial and academic functions in a centralized platform [4], which aims to simplify operations and improve overall efficiency. Such systems provide real-time access to student data, employee data, financial data, scheduling requirements, quality assurance and research administrations [5]. These systems provide support to informed strategic decision making. The Collaborative-Development Enterprise Resource Planning (CD-ERP) model appears to be an innovative approach in overcoming the conventional ERP systems limitations. This is a hybrid model that combines closed and open-sourced models, plus a collaboration between institutions under a unified model. Almigheerbi et al. [6] provide insights on issues faced by HEIs in adopting ERP systems in developing countries like Libya. One of the major issues is the limited availability of resources and expertise for building Information Systems (IS) from scratch. On the other hand, reliance on standalone or legacy systems mostly results in inefficient operations. The study proposes a mixed model called CD-ERP with legal, regulatory and technological barriers challenges.

Similarly, potential challenges with cloud-based ERP such as data security, privacy and compliance with regulatory standards [7] could cause implementation failure due to poor planning, poor change management strategies, and limited user involvement. The adoption of such functionalities has been slow for developing countries where there are major security and cost concerns [8]. Further resistance to change amongst many higher educational institutions is common due to entrenched administrative processes and reluctance amongst employee to use new technologies [9]. Some HEIs do not possess technical institutional readiness. Thus, this leads to poor ERP implementations [10].

The integration capabilities with other third party software could speed up ERP deployment [11]. Furthermore, Ibriwesh et al. [12] proposes that standardized and well tested off-the-shelf ERP systems had the ongoing support, maintenance upgrades and security patches benefits. However, Soliman and Karia [13] oppose off-the-shelf ERP implementation in HEI due to predesigned forms that limit their ability to adapt to specific institutional needs. Off-the-shelf ERP also lacks flexibility to satisfy cultural and regulatory standards. There is heavy reliance on vendors. ERP customization continues to pose significant challenges, particularly in the higher education sector, where systems must be tailored to align with institutional academic policies, grading structures, and localized context [14]. With this, custom-built ERP systems could allow HEI to be tailored according to their specific requirements. This allows better alignment to institutional strategy and local regulations [15]. However, this approach is associated with high development cost, longer implementation periods, and dependency on in house technical expertise as observed in Egyptian HEI [16] due to its prone to risk for noncompliance, system failures, plus upgrade challenges.

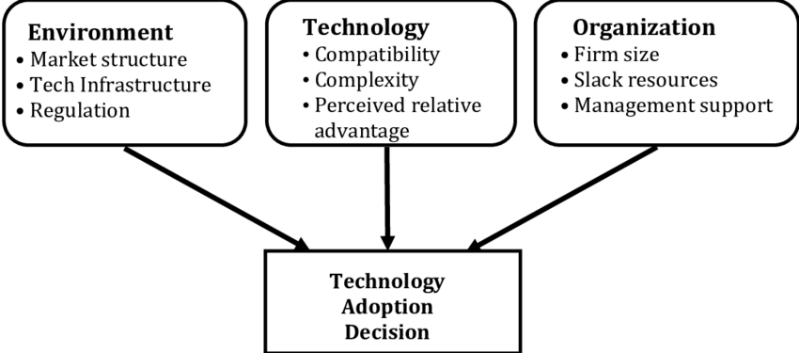
In contrast Open-Source solutions are either cheap or completely free of cost making them a good alternative to smaller institutions [17]. This paradigm provides greater flexibility to update or extend the ERP system. However, lack of dedicated support is a major challenge to implementing ERP. There is usually no automatic official update patch. Thus, HEI must maintain its own security and frequent upgrades. All the three approaches have both strengths and weaknesses, it’s evident that implementation of either mode provides better operational efficiency, and all modes have some similar drawbacks including organizational resistance, lack of technical expertise and poor management approaches. To overcome this, other stakeholder such as faculty members, administrative staff, IT staff must be engaged for successful implementations [18]. Effective management plans, involving the stakeholders from early on and transparency in communication could prevent resistance to change. ERP systems ease the flow of data across departments, reducing redundant work and coordination among departments [19]. Managing students’ records with tasks automation and central database with real-time reporting capabilities are important for service delivery.

User satisfaction is important to determine ERP success on institutional performance. The ERP user experience is determined by several factors [21]. Furthermore, ERP systems contribute to curriculum enhancements by promoting digital literacy [22]. ERP systems reduce administrative overhead and hence reducing overall costs [23]. In line with global trends, ERP adoption in Omani higher education institutions is driven by the need to improve administrative, financial, and academic functions, as well as to meet national standards. Oman Vision 2040 [24] and the Ministry of Higher Education emphasize IT systems as a tool to enhance governance and standardize infrastructure. Nevertheless, due to the high initial investment required many HEIs find it difficult to adopt.

Ministry of Higher Education, Research, and Innovation in Oman required all HEIs in Oman to synchronize their students, employee, research and some financial records to the ministry central database. Lack of a unified ERP system poses a challenge to this data transfer. Since there is no unified framework HEIs often face challenges in data exchange and compliance to ministry standards. The Ministry of Higher Education, Research, and Innovation often faces delays and data inaccuracies during these data exchanges. The future of ERP adoption in Oman and integration of emerging technologies in HEIs seems promising since its driven not only at institutional level but also at governmental level as evident in the Oman Vision 2040 [24]. HEIs can leverage benefits of ERP systems and align them with institutional and governmental strategies and thus improve efficiency and service delivery.

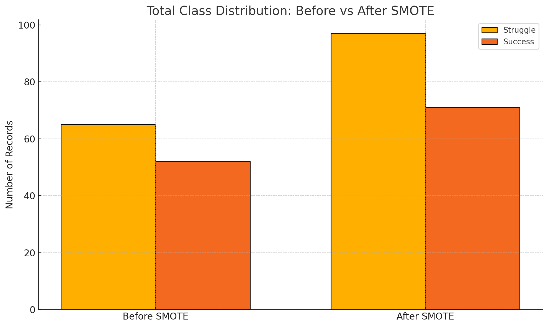
# RESEARCH METHODOLOGY

This research allows a sound overview of challenges and opportunities related to ERP adoption in Omani Universities and Colleges. Hand-on exercises were designed to collect quantitative data from IT staff, IT Managers, decision makers and other teaching staff to comprehend ERP system adoption, usability and challenges. The authors use Likert-scale evaluations, and multiple-choice exercises. The exercise instrument consisted of four main sections, i.e. respondent and institutional demographics, ERP system characteristics, adoption challenges and usability, plus user satisfaction and readiness. A total of 117 responses were collected from higher education institutions across Oman, ensuring representation across public and private sectors and various institutional sizes. This leads to systematic structured data with four main sections to capture different ERP adoption aspects. Firstly, this work captures HEI and respondent characteristics such as the respondent’s role, institution type, and the number of students and employees. Secondly, the ERP characteristics are recorded into open-source database like PostgreSQL. These characteristics include the type of ERP system used, its usability, and its alignment with institutional goals. Furthermore, the authors explore implementation factors, addressing areas such as change management practices, adequacy of training provided, and stakeholder involvement during ERP deployment. Finally, challenges encountered such as technical limitations, policy gaps, and cultural compatibility issues are as examined as summarized in Figure 1. Most instruments were designed using five-point Likert scales, allowing participants to express varying degrees of agreement or disagreement. The hands-on ERP exercise would allow them to have the flexibility to complete it easily on their mobile phones, tablets and computers. Following the review of relevant literature, this study adopts the Technology–Organization–Environment (TOE) framework to contextualize ERP adoption among Omani HEIs.



**FIGURE 1.** ERP adoption framework

The Synthetic Minority Oversampling Technique (SMOTE) [25] [26] is used to handle the imbalance in our dataset. The authors sample both ERP Success and ERP Failure classes uniformly. Figure 2 illustrates the distribution of pre-SMOTE and post-SMOTE. The original Oman HEI data was collected. Next, data preprocessing addresses the class imbalance of their institutions in ‘ERP alignment success’ versus ‘struggle to align’ groups. This process makes the data set more balanced and strengthens and reduces bias in future statistical analysis and predictive modelling. The number of observations in the dataset increased to 168 from 117 after applying SMOTE as shown in Figure 2.



**FIGURE 2.** SMOTE results

Although the numerical gap between classes increased after SMOTE, the technique significantly improved the representation of the minority class by increasing its size by 36%, success grew from 52 to 71. The initial data cleaning, tabulation and basic organization of the collected results was initiated with automated spreadsheets. Next, the authors used Python library, namely SMOTE imbalanced machine learning technique [27]. To further validate the data preprocessing steps, Google Colab notebooks were used for scripting and visualization purposes. For supporting inference insights, SPSS software was utilized to conduct various statistical analyses as the complementing approach.

# RESULTS AND DISCUSSION

The analyses were conducted on the dataset post-SMOTE application to reduce biases due to class imbalance. The survey respondents consisted of a diverse group who are stakeholders of HEIs. About 28.0% of respondents were IT staff or IT managers while 25.6% were administrative or support staff. Of the sample, 23.8% were management and decision makers, and 22.6% were in the other roles. This distribution shows that responses in the institutes were obtained from operational, technical, and strategic levels, and overall, this contributed to the comprehensive nature of the findings on ERP system adoption and usability experiences.

Among the ERP systems currently in use across Omani HEIs in Figure 3, 29.2% of respondents reported using open-source platforms like Odoo. Another 28.0% indicated they use internally developed systems, while 20.8% rely on off-the-shelf solutions such as SAP and PeopleSoft, and 22.0% mentioned other types. This distribution shows that ERP usage is relatively balanced across proprietary, open-source, and in-house systems. In terms of institutional size, 36.9% of institutions reported student enrollments between 1,001 and 3,000. In terms of ERP usage duration, 64.9% have used ERP systems for more than three years, 19.6% between one and three years, and 15.5% had early or historical implementations, suggesting that many institutions have meaningful experience for evaluating long-term ERP effectiveness. Figure 3 assesses the institutional perceptions of ERP adoption success, most construct scores averaged around the midpoint, reflecting neutral to slightly positive views. Change management scored the highest (Mean = 3.08), indicating that institutions view their management processes during ERP implementation as moderately effective.

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Description automatically generated with medium confidence

**FIGURE 3.** ERP success factors

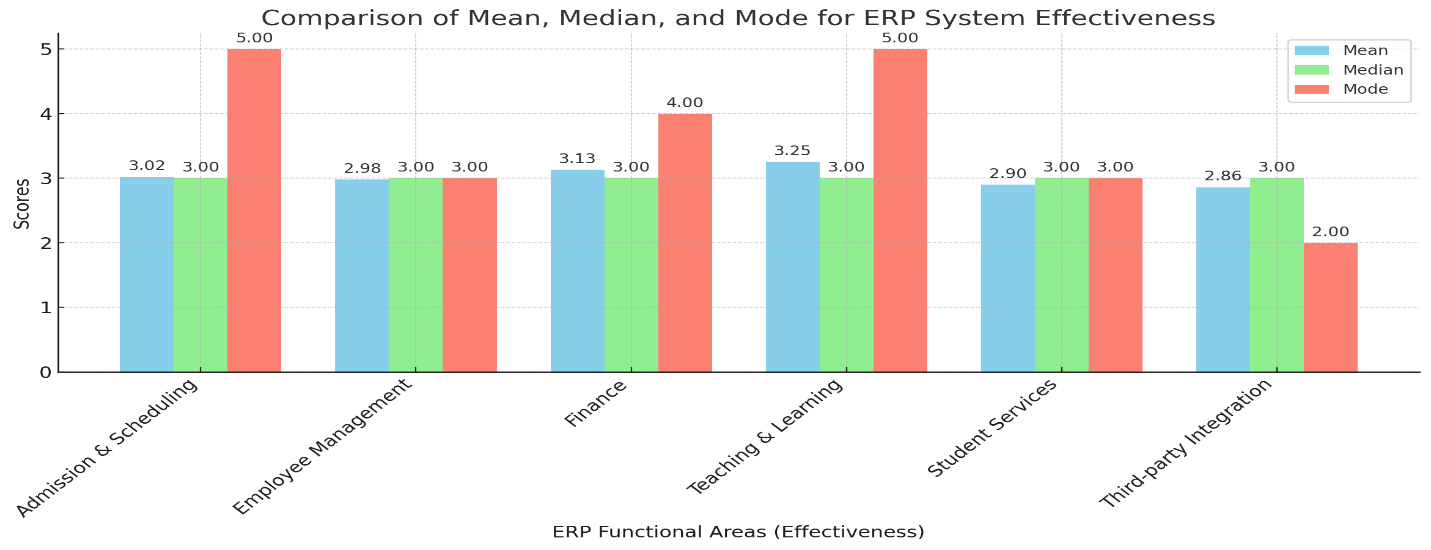
Overall, the results suggest that while HEI’s in Oman are making efforts toward successful ERP adoption, targeted improvements are needed in cultural compatibility, stakeholder involvement, and training programs to maximize system effectiveness. Student Management received the highest mean score (Mean = 3.18), suggesting that processes related to student admissions, registration, and scheduling are the most fully implemented aspects of ERP systems. This was further supported by a median value of 3.00 and a mode of 4, indicating that a significant number of respondents agreed that most or all student management functionalities are implemented.

Student Services and Third-party Integration also showed relatively favorable mean scores (Mean = 2.96 and 2.90, respectively), reflecting moderate levels of implementation for functions such as library services, career services, alumni management, and external integration with bodies like the Ministry of Higher Education, Research, and Innovation. Employee Management had a mean score of 2.89, suggesting a moderate but slightly weaker perception of implementation compared to student-related functions. The Teaching and Learning processes (including LMS and grading systems) followed with a mean of 2.73, reflecting that some institutions face challenges fully implementing these academic functions into their ERP platforms. Finance, Accounting, and Procurement recorded the lowest mean score (Mean = 2.66), indicating significant gaps in ERP system implementation for financial management (see Table 1).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 1.** ERP functional areas | | | | | | |
|  | Student Management | Employee Management | Finance | Teaching and Learning\_ | Student Services | Third party integration |
| Mean | 3.18 | 2.89 | 2.66 | 2.73 | 2.96 | 2.90 |
| Median | 3.00 | 3.00 | 2.00 | 3.00 | 3.00 | 3.00 |
| Mode | 4 | 3 | 1 | 1 | 3 | 3 |

Overall, while the median score remained 3.00 for most functional areas, indicating moderate implementation, there is clear evidence that student-focused processes are more advanced in ERP adoption compared to academic, HR, and finance functionalities. These findings highlight critical areas requiring further investment and development to achieve full ERP system integration across HEI’s in Oman.

Respondents were asked to evaluate how ERP systems have improved key functional areas within their institutions, and the results in Figure 4 shows moderate effectiveness across most domains. Teaching and Learning processes received the highest mean score (3.25), indicating strong improvements in areas such as learning management, grading, certification, and research. Admission, registration, and scheduling also saw positive feedback (mean = 3.02), while employee management scored slightly lower (mean = 2.98), highlighting potential gaps in HR and professional development processes. Student services and third-party integration received the lowest mean scores (2.90 and 2.86), pointing to less perceived improvement in areas like library services and integration with external entities such as the Ministry of Higher Education, Research, and Innovation. Despite differences in mean scores, the median remains consistent at 3.00 across all areas, reflecting an overall moderate perception. Overall, ERP systems are contributing to institutional effectiveness, though improvements are still needed in certain support and integration functions.



**FIGURE 4.** ERP effectiveness

A Pearson correlation analysis was conducted to explore relationships between key ERP outcome areas. Results revealed a significant positive correlation between Improved Finance and Improved Admission/Registration Scheduling (r = .233, p < .01), and between Improved Employee Management and Admission/Registration Scheduling (r = .193, p < .05). These findings suggest potential synergies between finance, HR, and operational modules in ERP implementation. Other relationships, such as those involving teaching and learning, student services, and third-party integrations, showed weak or no statistically significant associations.

The ANOVA results (F = 2.068, p > .05) indicate no statistically significant difference between groups in their perception of ERP alignment with strategic goals. It can be interpreted that the type of ERP has no role to play in ERP alignment with institutional goals. On the other hand, ANOVA results show significant differences between institutions of different sizes in perceptions of Employee Management (*F* = 13.125, *p* < .001) and Student Services (*F* = 3.683, *p* < .001), indicating that institutional size has a measurable impact on how these ERP functions are perceived. There is a difference between small institutions compare to medium and large institutions, whereas there is no difference between medium and large.

Respondents identified several challenges affecting successful ERP implementation in their institutions. In terms of alignment with institutional strategy, 25% reported no major issues, but others cited budget constraints (17.3%), unclear strategy (13.1%), and limited top-management involvement (11.9%). About 33% selected ‘Other,’ indicating institution-specific concerns. Stakeholder engagement was another area of concern. Furthermore, 16.7% said stakeholders were fully engaged, while many highlighted poor communication (23.2%), lack of user feedback (17.9%), and resistance from faculty and staff (14.3%). Policy-related issues included weak enforcement (19.0%) and unclear data governance (15.5%), with only 19.6% indicating that clear policies were in place.

# CONCLUSION

The successful adoption of ERP system implementation in higher education institutions (HEIs) in Oman is largely dependent on several factors. Through a systematic survey method with the implementation of SMOTE for data balancing, the research offered meaningful insights into the current level of ERP systems, their effectiveness, issues faced by the organizations and areas for improvement. The results showed that despite the moderate improvement of administrative, academic and financial processes of Omani HEIs by ERP systems, several systemic challenges remain. Several factors were identified that impede the effective adoption of ERP. Among these, resistance against change, limited stakeholder engagement, cultural and regulatory misalignment, weak institutional policies, and inadequate training. Additionally, financial management and external integration were less successfully implemented. Even with these problems, the research has shown that ERP systems are assisting institutions with productivity, making decisions and putting strategies into action.

The finding confirms several studies at regional and international levels that suggest successful adoption of ERP requires involvement, change management, governance and capacity building. By tackling these issues, Omani HEIs can reap many benefits from ERP systems, work smarter, and create an environment for dynamic, fact-based and global competition in the higher education sector.

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