ERP in the Education Sector: Evidence from Portuguese Non-higher Education Institutions

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Abstract. Although there is a considerable body of literature on Enterprise Resource Planning (ERP) systems, the education sector has received little attention. This paper responds to calls for sector-specific research by investigating the adoption, implementation difficulties and post-implementation benefits of ERP systems in non-higher education institutions. To this end, it uses a multiple case study approach of three Portuguese small and medium-sized schools and develops a model based on the Technology-Organization-Environment (TOE) framework. The findings show that the TOE framework provides a useful explanation of ERP adoption, while many implementation difficulties and benefits are generally consistent with extant literature. Some unique, sector-specific insights also emerged. The findings are discussed, and avenues for further research are suggested.

Keywords: Enterprise Resource Planning · Education · TOE · Small and medium-size

1 Introduction

Enterprise Resource Planning (ERP) systems are being increasingly implemented in organizations, regardless of their size and type. They can be defined as customizable off-the-shelf software packages that integrate information and business processes within and beyond an organization's boundary [1]. Although ERP systems are quite common in the manufacturing sector, they are gaining prominence in the service sector, including educational institutions. According to King [2], educational institutions are using ERP systems to replace their legacy systems, improve processes and services. However, there is little empirical research about ERP systems in the education sector [3, 4]. There are a few works that investigate ERP adoption [5], implementation issues [4], and critical success factors [6], but they focus on large higher education institutions (HEI). Allen [7] is an exception to this in that it focuses on a large, non-higher education public district. Small and medium-sized, non-higher education institutions are generally neglected in the extant research. Addressing this void in the literature is important because it responds

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to calls for further sector-specific research [4], and because it helps to provide a better understanding of the assimilation of ERP in the education sector.

This paper aims to investigate the adoption motives, implementation difficulties, and post-implementation impacts of ERP systems in small and medium-sized, non-higher education institutions through multiple case studies. First, a discussion of the related literature is provided and the conceptual framework described. Next, details about the case study methodology are given, followed by a presentation of the key findings. Finally, conclusions are drawn and future work is proposed.

2 Literature Review

2.1 ERP in Education

The literature is prolific in studies about the adoption, implementation and post-implementation of ERP systems [8–11]. Although these studies have been conducted in various contexts and sectors, the education sector has received little attention. However, as with corporate businesses, educational institutions also face external pressures (from governments, students, parents and other stakeholders) to improve their performance, making them suitable candidates for potentially benefiting from ERP systems. Furthermore, educational institutions have a unique mission and information needs. Their mission is to promote the social, emotional, physical and intellectual development of people so as to become valuable members of the society. They need unique systems not found in other sectors to deal with e-learning environments, students and course management, classroom scheduling and management [4]. These systems also have to produce customized reports for governmental authorities and interface with their information systems. These reasons make the investigation of ERP systems in the education sector worth pursuing.

In addition, the few existing studies of ERP systems in the education sector have mainly focused on HEI. This is not surprising since these institutions have made significant investments on ERP systems and because they tend to be large, complex organizations. One of the earliest studies is King [2], who reports on the implementation of ERP systems on nearly 500 US HEI, concluding that the benefits include better information for management and better service to faculty, students and staff, while the main challenges consist of resistance to change and lack of external expertise. In a multiple case study research of US universities, Oliver and Romm [5] classify the motives for adopting ERP systems into four categories: technological, including desire for integration, dissatisfaction with existing systems, modernization and costs of maintenance of existing systems; procedural, namely improving information access, processes and standardization; organizational, involving the vision of integration, service and quality improvements, and enhancements to image; people, concerning greater employee satisfaction and empowerment, and improved teamwork. Pollock and Cornford [3] emphasize the unique features of universities to discuss the tensions while customizing an ERP package at an UK university. Similarly, Rabaa'i et al. [4] note the lack of literature on ERP in HEI and argue that their unique context requires sector-specific research. They go on to discuss the challenges of implementing an ERP system in an Australian

university. Lechtchinskaia et al. [6] conduct a meta-analysis of ERP studies in HEI, concluding that the main critical success factors are stakeholder participation, process redesign and communication. Other works investigate cultural [12] and political [13] issues.

Although these studies provide useful insights about the implementation of ERP systems in the education sector, they rarely focus on small and medium-sized, non-higher education institutions. Allen [7] investigate the perceptions of employees about the ERP implementation in non-higher education, but it focuses on a large public school district. Fulfilling this gap would seem to be a useful endeavor as it would contribute to provide a fuller picture of the implementation of ERP in the education sector.

Contingency theory suggests that the successful implementation of ERP systems may be dependent on internal and external organizational factors such as size, type of activities performed, and other environmental constraints [14–16]. For example, [15] find out that there is a positive correlation between IT assets/resources and ERP success. Therefore, it is important to understand ERP adoption, implementation difficulties and benefits in different settings, including in small and medium-sized, non-higher education institutions, so that ERP projects can be properly aligned.

2.2 Non-higher Education Institutions in Portugal and ERP

Non-higher education in Portugal consists of regular basic and secondary education until the 12th grade, as well as special modalities of education such as vocational and recurrent education. Most of the schools are state-run but there are also many private schools. The vast majority of the public schools (around 90%) use standard software applications from a single vendor [17]. One of such applications, named as Integrated School Management System, interacts with other three applications, and includes features such as inventory management, personnel management, student management, social benefits, point-of-sales, consumption of goods and services, access control, and online account management. Given that it integrates in a common user interface the main processes of non-higher education institutions, this application can be considered an ERP system. On the other hand, private schools rely on a wider range of vendors, using either standard or bespoke software.

2.3 Technology-Organization-Environment Framework

The Technology-Organization-Environment (TOE) framework contends that there are three contextual factors that explain the adoption, implementation and post-implementation of innovations by organizations [18]: technological context, which consists of internal and external technologies available to the organization; organizational context, which refers to the characteristics of the organization such as size, resources, structure and processes; environmental context, which includes external factors (e.g. macroeconomic factors) and organizations (e.g. competitors) that may exert impacts on the organization. In this research, the innovation is ERP. This framework is generally recognized has having a firm theoretical basis and a consistent strong empirical support [19]. Furthermore, it has been used several times in the past to provide a comprehensive understanding about the assimilation of ERP at the organizational level [9, 20] and hence its selection for this work.

3 Research Methodology

In light of the above, this study addresses the following research questions:

RQ1. Why small and medium-sized, non-higher education institutions adopt ERP systems?
RQ2. What are the implementation difficulties of ERP systems in small and medium-sized, non-higher education institutions?
RQ3. What are the post-implementation benefits of ERP systems in small and medium-sized, non-higher education institutions?

From a methodological point of view, this study uses a qualitative multi-case study design. This is because the purpose is to make a thorough analysis, using multiple sources of data, of a current phenomenon in its real context [21]. When compared with the single case study, the use of multiple cases improves external validity. Furthermore, the emphasis is on interpretation and understanding, instead on testing causal relationships. This is also an exploratory study because it intends to make a contribution in an area that has been little investigated.

The unit of analysis is the small and medium-sized, non-higher education institution that has implemented an ERP system. To identify the institutions, consultations were made with various vendors of ERP systems, and the final choice followed a convenience criterion, focusing on three private schools.

Table 1. Contextual information about the three case studies.

	Cases		
	A	B	C
No. of students	160	200	180
No. of staff	23	31	35
Levels and type of education	Basic and secondary (vocational education)	From pre-school to secondary school (regular education)	Basic and secondary (vocational education)
Participants	A1–Head of the ICT department and of the ERP implementation project; A2–Clerical officer; A3–Vice-principal	B1–Senior clerical officer; B2–Principal; B3–General manager	C1–General manager; C2–Clerical officer; C3–Teacher and head of the ERP implementation project

The techniques used to collect data were interviews, observation and document analysis. The interviews were semi-structured, being the main data source. The interview protocol was previously tested with three people working in a school with the same features as those being the focus of this research. It consists of four thematic blocks: legitimization–organisational role, experience, participation in the ERP project; implementation motivations–previous systems used, motives; implementation difficulties–software customization, difficulties and challenges; post-implementation benefits–perceived positive and negative impacts. In each of the three schools studied, three informants were selected who were best placed to provide the necessary

information and who occupied different positions (school management, project implementation and end user). A total of nine interviews were conducted, which were audio recorded after the agreement and consent of respondents. Table 1 shows contextual information about institutions under study as well as the interviewees.

Observation and document analysis were used as secondary sources of data collection. The observation was direct and unobtrusive focusing on the behaviour and non-verbal language of the actors and interviewees, and on viewing the operation of the ERP system in the various departments of the schools. The information of the schools' websites as analysed as well as some supporting documentation of ERP systems implemented in the schools.

After transcription, the data was analysed using the software NVIVO 8. First, three categories were defined corresponding to the three research questions. After a process of successive refinement of horizontal and vertical analysis, two additional levels of categories were defined to which text fragments have been associated. Finally, comparisons were made between cases.

4 Findings and Discussion

4.1 ERP Adoption

Technological Factors. The need to replace obsolete systems by others more technologically advanced was a factor that determined the adoption of ERP systems. For example, A1 mentions that "the previous system was very limited… hence the need to change". C3 states that "we had obsolete systems and there was a need to evolve". Similarly, schools sought to obtain various benefits with the implementation of ERP systems, determining its adoption. All schools wanted to improve and automate their manual processes, which were time consuming, error prone and cumbersome. In particular, school A intended to achieve a more effective standardization and control of the processes that were scattered across several locations and received an increasing number of requests. Similarly, school B wished to get better control of their activities which were dispersed across several countries, but also to obtain timely information to enable decision-making. Also, school C desired to improve control and streamline decision-making, thus freeing up staff to improve the quality of education. Other expected benefits included the possibility of eliminating redundancies in data entry (C1), integrating multiple applications into a single, transversal application (B2), accessing to data from any location (A1), and obtaining standardized information (A2). Another key factor in the adoption is the flexibility of the ERP systems to adapt to the schools' processes and work routines. A3, teacher at school A, explains that her school already had a failed implementation of an ERP system in the past which, in her view, was due to its rigidity. C3 supports the key role of flexibility by stating that the ERP system "has a very high versatility which allowed us to adjust it to the internal procedures already used".

Organizational Factors. The principals of schools B and C had backgrounds in computer science, which influenced the adoption of ERP systems. In view of the problems and needs of the schools, they used their knowledge to seek appropriate software

solutions. As B1 asserts, "this came from the school principal; he found this software and brought it to us". Another factor that played a key part in the adoption by schools A and B is their multiple geographic locations. A3 explains that "there're distant schools from the central school, there was a need to link all this". School B has locations overseas, and since "school's management couldn't be in all places at the same time, we had no way of seeing what was going on" (B2). Thus, there was a need to provide an integrated view of the schools. It should be pointed out that none of the schools had a proper IT infrastructure to implement the ERP systems, which required them to make investments to upgrade servers, the network infrastructure and Internet access. School A had two standalone applications, one for managing students and another for managing accounting processes; Excel was used in the remaining areas. School B had three applications for billing, treasury and human resources, while Excel was used in the remaining areas. School C used an accounting application and an Access database. All schools complemented these applications with a physical system of records and files, and whenever it was necessary to obtain information that was not in an application or that was scattered across various applications, the information was collected and processed manually. Therefore, IT readiness played no role in the adoption of ERP systems.

Environmental Factors. An environmental factor that influenced the adoption in schools A and C was the requirements from funders. These schools offer vocational courses financed by the European Social Fund (ESF), an organization that required the preparation and submission of maps in digital format on the attendance of teachers and students, attended training units, among other information. With the increasing availability of these courses and number of students enrolled, these tasks, which were carried out using manual processes, had become more complex and time-consuming, often originating errors: "prior to ERP [the maps] were made in Excel and sometimes contained errors and were returned… These reports gave much work, we had to check all papers, consult different files" (C2). The recent trends in information systems was another environmental factor that contributed, albeit to a lesser extent, to adoption. In this regard, C1 states that "with the evolution of technology we felt a need for change". Two interviewees mention a difficulty in finding specific ERP systems to address the needs of small and medium-sized educational institutions. In Portugal, this market tends to be served by small software development companies, which often adapt their ERP solutions for SME to this market. B2 states that "there're many offerings to companies… but it's very difficult to find an ERP with for educational institutions". Indeed, the existence of a short availability of ERP systems tailored to the type of organizations examined in this study may be an inhibiting factor of a more widespread adoption.

Overall, the adoption of ERP systems by small and medium-sized, non-higher education institutions has been influenced technological, organisational and environmental factors. These findings are partially in accordance with the ERP literature [4, 5, 9, 20]. However, it is surprising to note that the lack of IT readiness and sector-specific ERP did not act as adoption deterrents. Perhaps this can be explained by the fact that these institutions viewed the implementation of ERP systems as necessary investments.

4.2 Implementation Difficulties

The most cited difficulty is the long implementation time, which was due to several reasons. In school A, the information requirements analysis took several iterations (A1). Data migration was also very time consuming, especially for school A and B, where data was entered from scratch. A2 mentions "it started from scratch… We had a lot of information on other programs… it had to be introduced into the system". In addition, the student management modules were developed from scratch in all schools and there was a need to make adjustments in the remaining modules. Educational organizations in Portugal have to periodically send data in digital format to the ministry of education, funders, social security systems for civil servants, among others. These features also had to be custom-built. Thus, the process of development and adaptation involved several iterations between users, the person responsible for the system in schools, and the software vendor. A2 stresses that "the platform itself has to adjust to our needs and the errors have been corrected".

Resistance to change was also a difficulty in all schools. C1 explains that "there're old habits, the routines of other programs, and change generates resistance". A3 confirms that "there was a great resistance from some teachers" not only because some were little familiar with new technologies, but also because their work (e.g. absences, summaries) was controlled more effectively. Resistance to change can become more problematic when the organization had negative experiences with the implementation of ERP systems in the past, as was the case of school A: "When we thought implementing this new system… people were quite reluctant at first" (A1). To overcome resistance to change, respondents reveal that motivation, communication and training techniques were used.

The strong dependence of schools in ERP vendors constitutes a difficulty for several interviewees. A2 confirms that "there's a need to have these people with us, especially when it's necessary to make certain adaptations", revealing the concern that "if they leave it would be chaos". In this level of education, it is common every year for governmental authorities to make legislative changes, demanding schools to incorporate them in their reports. A3 adds that school management must address this problem by assessing vendors' reputation and financial health, and negotiating service level agreements. Given the above, it can be concluded that the adoption of ERP systems is influenced by the ability of software vendors to provide high levels of after-sales service and continuous product development.

Another difficulty is the complexity of ERP systems. B3, for example, reports that "the degree of complexity and the number of modules required a large investment of time from the people involved in the project and some deceleration in the processes in the weeks immediately after the go-live date". C3 corroborates this view: "it's complex and has many options, many features that require time to learn".

Although the aforementioned difficulties are generally consistent with extant literature [4, 11], there are some sector-specific issues. The lack of specific ERP solutions for this type of schools meant that the educational modules had to be custom-built from scratch along with interfaces to produce custom reports for governmental agencies. Given the frequent regulatory changes in this sector, long-term partnerships

between software vendors and educational institutions are essential to successfully incorporate them in the ERP systems.

4.3 Post-implementation Benefits

All interviewees consider that the integration of information is a benefit. Access to information has, thus, become easier: "I can manage all processes without physically being at school" (A3). On the other hand, it is possible to reduce information search time (B3). Also, it provides an integrated perspective of the schools, which in some cases have facilities in diverse geographic locations (C1). Finally, one interviewee states that the integration fosters teamwork: "everyone works on that platform, we feel that the work is much more integrated and ultimately makes more sense" (A2).

Seven interviewees identify improvements in information quality, especially in terms of error reduction: "there was an incredible reduction of errors; no longer exists contradictory information" (B1). An interesting result emerged in school A, which implemented ISO 9001. For A3, the implementation of the ERP system facilitated compliance with the standard's requirements by reducing the number of non-conformities: "Now I'm unlikely to be using outdated [document] templates… This platform supported 100% the implementation of quality".

All interviewees mention that the improvement and standardization of processes is a benefit. B3 states that there was process improvements "at the teachers level (who can manage all their information and students), employees level (many processes have been automated) and especially management level (who can in real-time and off-campus access all information and monitor all processes)". A2 adds that "we can all… use the same type of procedures". Duplication of procedures resulting from the use of various programs also ceased to exist (B3).

The reduction of working hours is identified by eight interviewees as another positive impact. For example, A2 asserts that the ERP system "reduced working time and increased people's productivity". In addition, some interviewees indicate a reduction in the decision-making time: "with the ERP we get all indicators we need in a rapid and timely manner" (B2); "It's a tool that helps us manage and provide answers almost immediately to certain situations" (A2).

Cost reduction also emerges as a positive impact, although with a weaker empirical support (three respondents). A1 mentions considerable reductions in costs with paper and ink. In turn, B3 asserts that "We've reduced costs about 30% through staff savings. We allocated people to other tasks".

Seven interviewees perceive improved control of schools as a benefit. A1 indicates that there are no longer problems to register the level of "attendance, whether of teachers or students, number of training units. All this entailed costs since the information has to be correct, especially in cases of funded courses". A3 highlights that "through the integrated system, the headquarters can check whether or not teachers have been writing summaries or whether or not they've been using a tool", adding that "it has everything, say organized, in case it appears… an inspection, an audit". B3 mentions other advantages at the control level: "the record of staff attendance allows faster payroll". C1

emphasises the importance of financial control improvements: "I know, at any time, the status of financial expenditure approvals".

All respondents consider that schools benefited from improvements in services as a result of the impacts mentioned above. As regards A3, "if everything is interconnected, also improves the service". In a similar vein, B2 declares that "Admit that a certain task must be done. Through the ERP, I can check if it's done or not. This leads undoubtedly to improved services". On the other hand, ERP systems also fostered improved services in terms of information access by employees, teachers and students. C1 states that "Through this module [packweb]… students can request certificates, have access to their accounts, etc.".

Respondents were also asked about the educational impacts on schools. A1 highlights some impacts that facilitate the learning process: "Teachers can put contents online for students… the program director has a series of alerts with deadlines, summaries, training hours". Alluding to the evaluation process, A3 reports that "Teachers can grade students online, have access to classes data, etc.". B2 stresses that the ERP system produces various reports that are useful to the educational process: "The ERP returns many reports, compares the classes' grades." According to B3, there is also an improvement in the planning of educational activities: "The provision and organization of courses' contents allows teachers a better planning of the subject matters".

The benefits just described are mostly in line with the ERP literature [4, 8]. While the benefits on the teaching and learning processes are specific to the education sector, this research shows that they can also apply to non-higher education contexts. Figure 1 shows a conceptual model summarizing the main findings of this study.

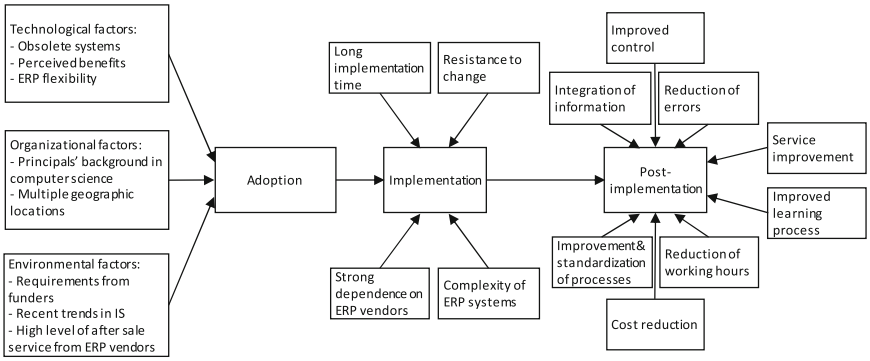

Fig. 1. Conceptual model of the adoption, difficulties and benefits of ERP in small-non higher education institutions

5 Conclusion

This research bridges a gap in the ERP literature as it focuses on small and medium-sized, non-higher education institutions as opposed to large HEI, which have been the main center of attention of the extant research. It contributes to the literature by investigating the factors affecting the adoption of ERP systems by these institutions and by

uncovering their implementation challenges and post-implementation benefits. Software vendors, managers and IS specialists can use the findings to develop strategies to increase the adoption of ERP systems, to overcome challenges, and to ensure the realization of post-implementation benefits in small and medium-sized, non-higher education schools.

This study is not without limitations. First, it is restricted to private schools. Second, the case studies were conducted in a single country. Hence, the findings are not statistically generalizable. Finally, it investigates the underlying phenomena at a given point in time. Future studies could address these limitations by examining both private and public non-higher education schools in different countries and by considering longitudinal research designs.

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