

# Integrated Information Systems in Higher Education: Systematic Review and Research Opportunities

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**Abstract:** In Higher Education Institutions (HEIs), as in many other organisations, Information Systems (IS) started as in-house developments that tended to satisfy the immediate needs of the different departments and schools. More recently HEI make huge investments on integrated IS such as Enterprise Resource Planning (ERP) systems; however, they do not seem to achieve the full potential of these systems while these new systems significantly alter the way academia operates. This paper provides a systematic literature review to gain insights of the implementation of integrated IS in the HE sector besides highlighting some of the possible research directions. We have reviewed 50 articles published between 2000 and 2017 in 35 different journals following different methodological approaches and summarising a variety of findings in various countries. Our comprehensive review identified four themes that show the link between integrated IS and the HE environment. Three (out of the four) themes are related to the steps undertaken while implementing the integrated IS while the fourth theme is related to the impact of these complex systems at an organisational and stakeholder level. Our findings can make a significant contribution to researchers by signposting valuable areas for future research while it can be used as a guide for HEI while implementing integrated IS.

**Keywords:** Enterprise resource planning, Higher education, Integrated information systems, Literature review.

## I. INTRODUCTION

Universities nowadays are strongly affected by the overwhelming quantities and varieties of the data that they need to process for better decisions. This mass generation of data and the resulting information is due to the advancing level of technology, which consequently increases the need for coordination, communication, control and integration [1]. Additionally, universities have been undergoing a period of rapid transformation that has seen notions of academic

collaboration, knowledge sharing, and community engagement. However, this rapid transformation resulted in work intensification, degradation of working conditions, bureaucratization and power shifts for academics and administrators [2, 3]. Added to the changing values; is the more recent push towards reconceptualising universities as informational and more integrated organisations.

This introduction of complex IS has happened across the whole HE sector including the pre-1992 universities. Armstrong *et al.* [4] point out that technological advancements are transforming not just what happens in the classroom but also the full range of support services, from admissions and advising, to alumni developments and research production. IS enable managers and administration staff to improve the management of research activities, and this then compels members of staff to perform new tasks and develop new ways of doing things. These new processes facilitate the movement from a silo mentality to more integrated core functions. Accordingly, stockholders including academic staff have to learn new skills to make use of and cope with new technologies that they did not need before this shift. In addition, the loss of funding for many universities in the UK has forced them to operate more like their private counterparts in order to find new sources of income. All of this complexity and the subsequent squeeze on financial resources have resulted in the perceived need to have organisational IS, which can support the various activities within the HE environments.

Consequently, HEI have decided to implement complex technologies and invest in IS that can offer them the desired integration and control over their processes. However, even though HEI seem to make huge investments on integrated IS such as ERP systems, they often fail to achieve the full potential of these systems [5, 6].

Even though there is a vibrant literature on the HE sector and on integrated IS implementation separately; however, Abugabah [7] argues that the implementation of integrated IS in universities is still in its infancy and more research is needed for

a better understanding of how HEI can introduce these complex technologies successfully across their processes. Therefore, a comprehensive review that examines research which combines both HEI and integrated IS can aid researchers to have a clear view of the relationship between HE environment and the implementation of integrated IS. Accordingly, the goal of this paper is to review the prior HE and integrated IS research in order to understand the importance of integrated IS implementations (such as ERP systems) in the HE field and to provide substantive directions for future research.

The remainder of this paper is structured as follows: next section will outline the adopted research methodology, followed by a presentation of the proposed classification of the four themes that resulted from our systematic review. Then, a discussion regarding each theme will be presented with some recommendations regarding further research opportunities and direction at the end of each section. Finally, in the last section we will conclude the work done in this paper.

## II. RESEARCH METHODOLOGY

To proceed with the systematic literature review, we need to answer some questions that cover various aspects. These questions include *how* and *where* to search for the studies, and *which* studies to include. For answering how to find the relevant studies; we need to specify the phrases to use as the search keywords. The search keywords that we have used include “Information Systems,” “Integrated Information Systems,” “Enterprise Resource Planning,” “Higher Education,” “Universities,” “ERP” and “Information Technology”. Concerning where to search; this work considered the following databases and search engines: Wiley Online Library, Taylor and Francis, Elsevier – Science Direct, Emerald, Google Scholar, and Business Source Premier. The final question (Which Studies to Include?) enables us to set the required criteria to select the relevant research articles that focus on the implementation of integrated IS from the existing vast research studies. The selection criteria enabled us to gather a sample that is both manageable and relevant to the aim of our research. The selection criteria include the time of publication, the type of the article. For the time of publication, we have only chosen the papers published between 2000 and 2017. For the selected type of publication in IS in HE, we have decided to exclude conference papers and books to keep our research manageable. In an effort to ensure that we have not overlooked any other articles, we also reviewed the references from a number of key articles in our topic area.

In total, we have reviewed 50 articles, which came from 35 different journals; 37 articles were empirical, and 13 articles were conceptual, while 16 of them were in the UK and 34 were based outside the UK. Half of the papers were based on a case study while the other half were based either on a quantitative approach or they were theoretical paper with only two studies following a mixed methodology. In addition, half of those articles were published between 2000 and 2006; at the start

of the millennium when ERP systems were prevalent. In the period between 2007 and 2017; another 25 articles were published in relation to HEI and ERP. However, 10 of those were published during the last three years alone which shows a rise in the ERP and HE related research and signifies the importance of these sophisticated technologies for the education sector.

Our method of analysis of the selected literature helped us to propose a classification of the application of the integrated IS in HE environments into four main themes as shown in Fig. 1. These four themes are:

1. Planning an IS implementation in the HE sector
2. The implementation process in a HEI
3. Post-implementation evaluation of the new system
4. Impact of the new system in a HEI

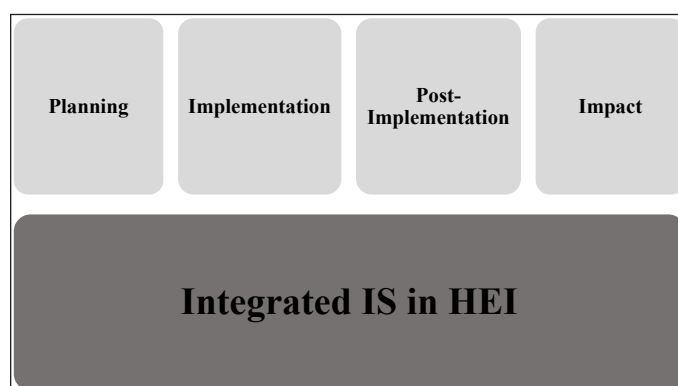


Fig. 1: The Four Themes of the Application of Integrated IS in HEI

The first three themes address the lifecycle of the implementation stages of the integrated IS by going from the planning and requirements gathering, followed by the actual implementation as well as the post-implementation processes. However, a new research topic is emerging about the adoption of integrated IS which is concerned with measuring the real impact of such sophisticated technologies on organisations and more specifically on HEI. Our analysis has shown that most studies were based on a case study while mixed methods is a methodology that is not often used by researchers. One of the articles was a literature review [7] but their investigation of the literature was not conducted in a systematic way, and their findings were predominantly relevant to the Australian HE sector. However, their conclusions did point out that research about ERP systems in the HE sector is still at the infancy stage and they called for more research efforts in this area since nowadays universities are either implementing or already using integrated IS such as ERP systems. The following section and its subsections discuss these four themes in more details.

## III. THE APPLICATION OF “INTEGRATED IS” IN THE HE ENVIRONMENT

In this section, we will discuss the application of integrated IS in HEI through the proposed four themes in more details.

### A. Planning an IS Implementation in the HE Sector

The main discussion here is around the main factors that HEI need to consider when they embark on their implementation journey and thus, the main findings of these studies can help universities in their planning process if/when they adopt these complex systems. More specifically, Gorgan [8] points out that nowadays universities in order to be efficient and effective they need systems that support their decision processes and offer highly accurate information. From his analysis; it is evident that HEI are under pressure to analyse and report on various aspects of their student population but currently the systems available do not offer sufficient analysis capabilities. Aldayel *et al.* [9] identified 10 main Critical Success Factors (CSFs) for a successful implementation of an ERP in a university with project management, ERP system selection and department/stakeholder participation being the most critical ones in a HE environment. Likewise, Ali [10] discusses 9Ss that are important for the planning of an IS project in HEIs. These are: Specification, Structure, Style, Stakeholders, Strategy, System, Skills, Staff and Specific Information for Institution/Country. It appears that the inclusion of the various stakeholders who will be affected by the new system as well as clear understanding of the system are very critical factors for success.

A major issue that university often face with the implementation of complex technologies is that the role of academics and administrators is changing significantly. However, Bamel's *et al.* [11] research which was set in an Indian university and was examining the university's staffs' perceptions about the functions of a Human Resource IS (HRIS) found that the perceived benefits and barriers of the HRIS do not vary according to the different groups and stakeholders.

This area will benefit from more studies, which can explore relevant CSFs of IS for the education sector and can prepare institutions in their effort to respond to today's challenges and increased demand for accountability. It will also be interesting to explore if the factors of success differ according to the country that the HEI is based in and therefore more cross-cultural comparisons are needed in this area. Furthermore, university staff needs to have a better understanding of how these systems can help them in their everyday roles and responsibilities. Therefore, it is essential for future studies to investigate the benefits that can be realised in universities when integrated IS are used and how these can be communicated more effectively to the various stakeholders.

### B. The Implementation Process in HEI

This was the most popular area of research with our review discovering 28 articles that concentrated on the implementation process. After 2000 there is a noticeable increase in authors, who investigate the use of integrated IS in the HE sector, exactly because these complex systems started becoming a norm and a necessity for universities.

It is often highlighted that stakeholder/end-user involvement is critical for any integrated IS implementation while for a HEI it has been signposted as an essential factor for success as it was discussed in the earlier theme. However, in the implementation case studies conducted, HEI do not follow the same principle when implementing complex integrated IS. For example, Fowler and Gilfillan [12] attempted to develop a framework which could aid institutions to improve the implementation and development of large and complex ERP type IS. The main outcome was an IS project management framework providing general guidance and a bridge for cooperation between the very different stakeholder groups involved in IS implementations. They identified that these different stakeholders include senior university management, project team and system vendors. However, they omitted the views of the two most important stakeholders forming a HEI, academics and administrators. Similarly, Okunoye *et al.* [13] examine the influence of stakeholders during an ERP implementation in a HEI. Their study highlights the importance of managers to pay particular attention to the IS users that will be significantly affected of the new system and they conclude that the active involvement of all stakeholders is extremely important towards the successful implementation of an ERP system in a HE environment. However, it is not clear if the HEI examined did involve the relevant stakeholders or not.

Scott and Wagner [14] analyse how an ERP implementation reordered the organisational working life in a university. The changes that came due to the ERP implementation resulted into changes to the working rhythms of the university's actors. This seems to be a common aspect of IS implementations in HE [15, 16, 17, 18]. It appears that even when universities have the opportunity to be actively involved in the design of complex IS such as ERP they still do not realise the full benefits expected. This is apparent in Wagner's *et al.* [19] research that analysed the strategic partnership between a software vendor and a university who together designed a "best practice" ERP package for the HE sector. They argue that in a complex environment such as a university where a number of diverse user group coexist, a single industry solution is not going to be "best" from all perspectives. The university where the project took place had to put a lot of effort in order to create a local IS that enabled both the administrative and academic cultures to coexist. Wagner *et al.* [19] also reveal that there are a lot of politics involved in the construction, marketing and dissemination of the best practice claims. Their case study showed that the new system changed the ways that the university was operating and once the collaboration with the vendor finished, the university decided to amend the original system in order to make it more effective and efficient for themselves.

A number of learning lessons can be summarised for HE when they are implementing complex and contested IS. An ERP system can enable academics, researchers and administrators to deal more effectively with the rising numbers of home as well as international students. An integrated university is seen as a strategy for coping with the increasingly diverse student body

and enable the university to respond more effectively to new global markets and to meet the requirements of increasingly onerous national regulations [20]. However, there are a number of prerequisites if the universities want to fully benefit from such systems. First of all, building an integrated IS does not involve only the underlying technology but it must also consider the people involved because they must make it work both at the development stage as well as at the end user side [21]. Secondly, as Cramer [22] discusses the roller coaster ride of implementing IS, is a unique experience for every university but she highlights that collaboration across faculties cannot be optional but it must be essential. Thirdly, building communities of innovation, process change and technology tools that can encourage innovation in a university can be a source of satisfaction and success [23]. Fourthly, Ahmed *et al.* [24] found that by setting clear priorities for investing IS institutions can increase their overall performance. They also identified that the main issues of concern in such complex implementations were aspects such as training and resistance to change. Additionally, aspects such as the requirements of data and information, tools and technology, skill development and the overall system design are essential factors for the successful implementation of IS in HEI [10]. Also, in order for an IS to have a significant impact on the organisational performance from a cost saving perspective, organisational characteristics of information processing capacity must suit its information requirements [25]. Furthermore, Noaman and Ahmed [26] argue that ERP systems for HE should be tailored specifically to address the functionalities relevant to the academic environment. They point out that for an ERP system to be successful in the HE sector it should consider the institutional structure and strategy/policy as well as look into the academic functionalities since they are different from any other sector.

### C. Post-Implementation Evaluation of the New System

Although very few studies were looking into evaluating a new system once introduced in HEI; the studies reviewed here made an effort to assess how the new system was seen once it become a permanent feature of the university's everyday life.

Guan *et al.* [27] summarise that when HEI invest in technology this requires significant financial, human resources and management contributions. However, what universities and their stakeholders need to comprehend is that such technologies would entail a "paradigm shift" in the way that the university operates. Despite this many institutions fail to seriously consider the consequences of these systems and this is often a cause of dissatisfaction and resistance. In a study based in the UK, Gemmell and Pagano [28] discuss how the new system was not accurate and therefore the users did not trust the new system. Additionally, the system was not easy for users to use and this highlighted the need to perform a user skill assessment in order to ensure that end users know how to use the new system. Also, the end users were not appropriately informed of the benefits

and reasons behind this new system implementation which brought resistance and negativity towards the new system.

An interesting piece of research which looks into the management and evaluation of an IS in the HE from a different perspective is a study by Kettunen and Kantola [29]. The authors used the balanced scorecard as the basis for managing a campus wide IS and their research found that by developing a portal the new IS reads the data from the basic data sources and combines it in with the data warehouse. This decentralised system enables academics and others to access information across the institution while it supports the re-use of data, which increases effectiveness across the HE organisation. This is a novel idea of attempting to integrate the new system in the university's processes and more research is needed in order to better understand its application.

Integrated IS are nowadays a necessity for all organisations as well as for HEI especially since they have to be able to control and report on various aspects regarding their student population. However, as Sabau *et al.* [30] argued an integrated IS such as an ERP system is not the one that provides an institution with a competitive advantage. Instead the main focus of a university should be the type of services it provides to its students and the IS should play the role of a facilitator and not a driver in a university's processes. Listening and involving the end users is an important factor that can often make the difference between success and failure. Vathanophas and Stuart [31] found that age, prior knowledge of systems and education were significant factors that influenced the staffs' perceptions and satisfaction towards a new system. Their research also concluded that because end users often feel uncertain about new systems it is very important for universities to spend time and effort to educate their staff prior to any implementation. Future research can look in greater detail how universities educate their staff when new systems are introduced.

Finally, Fryling [32] debated that there is a high demand for system maintenance even after an ERP implementation. She argued that actually organisations spend a lot of time on corrective and adaptive maintenance, that they do not have enough time to perfect the new system. This can be even more complicated in a university environment where a number of different processes exist. Again more research is needed in this area as no other study has explored the maintenance that is required for integrated IS in the HE sector.

### D. The Impact of the New System in a HEI

Early research by Pollock [33] and Kvavik and Handberg [34] discuss what happened when the old system was replaced. They both identified what they call the "transformation" that takes place and they debate how the new system altered procedures and processes. What comes out of these is that by bringing together people disciplined enough to manage the change then a difference between the two systems can be seen. It is evident

that once the new system is in place then everything is measured against it and that can cause dissatisfaction among the various stakeholders.

Also, Lewis *et al.* [3] discuss how the universities were trying to get used to the organisational changes that were caused due to the introduction of networked technology. They found that although managers were interested in strengthening the centralised control through the new technology the academics were looking into the distributed and collaborative possibilities of it. They argue that managers were using the new technology as a driver for organisational change while on the other hand academics were negotiating the different interpretations and implications of the potential uses of that same technology.

Jackson [35] in fact talks about the different groups and sub-groups that exist in a university in greater detail. His research found that the ongoing social interaction between the various groups/stakeholders, overwhelming power and control aspects, the fatalistic tendencies of the academic staff and the individualistic nature of the user champions resulted to the overall failure of the IS adoption.

More research in this area by Waring and Skoumpopoulou [36, 37], Skoumpopoulou and Nguyen-Newby [38] shows that the new integrated IS resulted in centralised power in the HEI and has an impact on the organisational life within it. The introduction of integrated systems has as a result of the creation of a strict instrumental policy and power while there is a power shift to central non-academic departments at the expense of academics. Similarly, Abugabah *et al.* [7] mentioned the new system characteristics have a strong impact on the perceived usefulness of an ERP system and therefore have an effect on user performance. This means that system designers should pay more attention to what users require in order to clearly determine their expectations for the content of an ERP system. They highlighted that although HEI are investing a lot of money on ERP systems, however, there is little empirical research in this environment especially on how these implementations impact the various users involved. This is in line with Gunawardhana's and Perera's [39] research where they conclude that there is a difference of how these systems are used and are affecting universities in developing and developed countries.

#### IV. DISCUSSION AND IMPLICATION

Based on our systematic review highlighted above; it was discussed earlier that the shift towards a more widespread education [22, 5] and away from traditional models has seen new organisational forms emerging in HE. Also as these institutions grow they are faced with an increasing volume of data and information that must be used in a variety of ways for a number of stakeholders. This has led to the establishment of institution wide processes and dependencies in universities and the introduction of an integrated IT infrastructure [12, 19]. However, often HEI seem to make huge investments in integrated IS but they do not seem to achieve the full potential of these systems [5].

One reason why this might happen is because the use of IS can have crucial political and policy implications as well as generating unintended consequences in terms of institutional and individual behaviour throughout HE which in turn will have a negative effect on collaboration and team work [2]. Agee and Holisky [40] acknowledge that the key to highly effective organisations is to build relationships while they argue that successful collaboration opens up new possibilities for achievements that are not available when people are working alone.

However, achieving effective communication in the HE environment can be a challenging endeavour since many diverse groups of stakeholders exist in a university setting. Academics usually have their own agendas [36] and they see education from a different perspective from that of an administrator who is part of the institution in a supporting role. Academics are on the front line with students and any substantial changes in the HE sector can influence them especially because after all any new policies or new technologies significantly change the way they are expected to operate and perform their jobs as academics and researchers. As it is evident from our review a number of studies did highlight the changing role of academics and the altering environment of the HE sector due to the extensive use of IS [34, 3, 7].

Academia is no longer the holy grail of education but another consumerised industry for making money and offering education en-masse. This power shift [38] means that on the one hand HEI view themselves just as another organisation with their students being the customers and on the other hand they are still fighting to keep the ideal of offering the valuable service of educating people and shaping students' future achievements.

Universities are under a lot of pressure to perform in order to be able to have a share of the government funding. However, their performance is strictly monitored and they have to be fully accountable for their student population [8]. This raised need for accountability also intensified the need for more centrally controlled information as well as highlighted the gaps that existed in institutions and their different faculties. Thus, universities have been forced to automate, integrate and closely monitor their processes in order to be able to have a share of the student market as well as the government funding.

This situation has of course caused a lot of resistance [23] from academics who have seen their role and position diminishing, highly depending on what the management decides. However, nowadays the managers are not academics and their main interest is how to reduce costs and maximise profit.

It is evident that more research is needed in the area of IS implementation in a HE environment in order to gain a deeper understanding on how these contentious IS can be successfully implemented in a complex university setting. We recommend further research to be conducted in the area of planning for an IS implementation as well as the post implementation evaluation in the UK HE sector. An effort perhaps needs to be

made to explore the impact of integrated IS in the HE sector through a mixed method approach. This might enable us to gain a clearer idea what people think and feel when a new system is introduced and then use a qualitative approach to gain an in-depth knowledge of how to approach any potential issues.

Although the discussion and findings of the study are valuable but few limitations have been recognised which might be useful to be considered in the future. For example, the literature review focuses on papers that investigate the implementation and introduction of integrated IS but it does not include disruptive technologies such as cloud computing. Cloud computing enabled the provisioning of computing resources as elastic, on-demand, metered, self-services over networks [41]. Currently, most of the companies offer their applications as a software-as-a-service (SaaS) over the cloud. Therefore, there are many Cloud-based ERP systems which enable the users (such as HEI) to avoid the upfront financial and technical cost and reduces the cost of the systems' maintenance and support. There is not enough research that measures the real impact of the adoption of such cloud-based integrated IS compared to the traditional ones. Therefore, we think that investigating such area might lead to significant insights that will have a practical impact for all sorts of organisations including the HEI.

## V. CONCLUSION

The studies reviewed in this paper provide us with rich information regarding the planning, implementation and impact of integrated IS in the HE sector. The HE sector is a complex environment that differs from the other sectors. Although there is a lot of research in the area of integrated IS in organisations, a lot of this research is not applicable in a university setting. Additionally, in a HEI many diverse stakeholders co-exist. These stakeholders have different aspirations and different requirements hence the new system needs to take into consideration all the different elements involved. This often is either not possible or it is overlooked and thus it leads to staff resistance, system incompatibilities and expensive implementations that do not realise the benefits that are expected or promised.

Moreover, research to date has reported that integrated IS have an effect on a university. It is also clear that the education environment has been revolutionised in the last 20 years. This transformation has come and continues to come predominantly due to the amazing technological advancements of our time. The question perhaps remains what does the future hold for universities? Our review shows that despite all the research already conducted; still some institutions do not seem to learn from the mistakes of others or from the past and IS applications continue to fail or cause issues and dissatisfaction.

Our research signposts that there is no research addressing the project management topic of IS implementation in the HE sector as well as a lack of mixed methods studies. Accordingly we recommend conducting a survey first to identify some main

points and then gain a more in-depth understanding of these aspects will be beneficial in a complex environment such as the HE sector. But most importantly in order to be able to achieve the required outcomes and maximise the benefits gained from these systems it is also essential to look in greater detail into the changes that these systems bring in the working life of a HEI and all its stakeholders. Moreover, it would be in fact be unreasonable to assume that all tools and technologies are the same in all HEI, as each institution has such diverse goals, systems, tools and operations.

Our review reveals the importance that academics and practitioners are starting to show into the impact that integrated IS have on organisations while highlights the eminence to look in greater detail into the changes that "Integrated IS" bring in the working life of HEI and all its stakeholders. Our findings can make a significant contribution to researchers by signposting valuable areas for future research while it can be used as a guide for HEI while implementing integrated IS.

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