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**ERP SYSTEMS IMPLEMENTATION IN THE HIGHER EDUCATION SECTOR:
A CASE STUDY**

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ABSTRACT

In response to a range of contextual drivers, the worldwide adoption of ERP Systems in Higher Education Institutions (HEIs) has increased substantially over the past two decade. Though this demand continues to grow, with HEIs now a main target market for ERP vendors, little has been published on the topic. This paper reports a sub-study of a larger research effort that aims to contribute to understanding the phenomenon of ERP adoption and evaluation in HEIs in the Australasian region. It presents a descriptive case study conducted at Queensland University of Technology (QUT) in Australia, with emphasis on challenges with ERP adoption. The case study provides rich contextual details about ERP system selection, customization, integration and evaluation, and insights into the role of consultants in the HE sector. Through this analysis, the paper (a) provides evidence of the dearth of ERP literature pertaining to the HE sector; (b) yields insights into differentiating factors in the HE sector that warrants specific research attention, and (c) offers evidence of how key ERP decisions such as systems selection, customization, integration, evaluation, and consultant engagement are influenced by the specificities of the HE sector.

KEYWORDS: Case study, ERP systems, Systems Adoption, Higher Education, Information Systems.

INTRODUCTION

Advances in Information Technology (IT) regularly redefine business operations for many organisations, including Higher Education Institutions (HEIs). Duderstadt et al. [1] state that HEIs have always been advocates of IT, and proactive adopters of advances in technology. Rowley et al. [2] suggest that given the fundamental activities of HEIs are significantly affected by ever advancing technologies, HEIs need to stimulate innovation in research, teaching and learning and management through the aggressive application and use of IT.

Following the example of large corporations, HEIs are continuously reviewing and improving their management and administration systems. The concerns HEIs face are similar to those of a wide range of organisations. Hence, the standard tools of contemporary organisational analysis and institutional management are being adopted and applied in the HE sector. One of the prominent trends is the adoption of Enterprise Resource Planning (ERP) application software [3]. HEIs are making significant investments in ERP systems to improve institutional business processes [4]. According to [5], some HEIs spend over \$20 million USD to implement these complex software products.

This study is motivated by the rapid, recent growth of the ERP market in HEIs; the increasing pervasiveness of ERP in the HE sector; and the lack of scholarly publications discussing ERP implementations in HEIs. This paper derives from a larger research effort that aims to contribute to understanding the phenomenon of ERP adoption and evaluation in HEIs in the Australasian region. This paper aims to address different areas of emphasis, including: (i) ERP adoption decisions, (ii) ERP selection, (iii) customization procedures, (iv) integration aspects, (v) role of consultants, and (vi) ERP system evaluation; each of which has been raised in the literature as an important area of interest, and all of which are among the most commonly reported challenges.

Study findings summarise influences on ERP adoption in HEIs and confirm the unique nature of ERP adoption in the HE sector. Review of the literature suggests a dearth of related research, while the case study offers a rich contextual account of ERP adoption and influences of the surrounding context.

The paper is structured as follows. First, summary results from a detailed literature review are provided. Next, the single case study is introduced; first by presenting the research method, followed by an overview of the case site under investigation, and subsequently by synthesized findings. Finally, overall conclusions and implications for further research are outlined.

LITERATURE REVIEW

Klaus, Rosemann, and Gable [6] describe ERP systems as “comprehensive packaged software solutions seek to integrate the complete range of a business's processes and functions in order to present a holistic view of the business from a single information and IT architecture”. ERP systems can link different areas of an organisation, such as manufacturing, order management, financial systems, human resources, suppliers and customers, into a tightly integrated system with shared data and visibility [7]. ERP systems hold the promise of improving business processes and decreasing costs [8] [9], as these systems facilitate communication and coordination, centralise administrative activities, improve ability to deploy new information system functionality, and reduce information system maintenance costs [10] (Siau, 2004). A successfully implemented ERP system can be the backbone of business intelligence for an organisation, by giving managers an integrated view of the business processes [11] [12].

This section summarizes literature reviewed to understand the context of ERP in the HE sector; particularly, aspects that have influenced the rapid adoption of ERP in the sector, and any potentially unique aspects of the HE sector. It also includes a detailed review of studies on ERP specific to the HE sector; to better understand the gaps in this area.

ERP Systems in the HE Sector

Environmental pressures for change on Universities worldwide [13] and in Australia[14] have been many [15] [16]; including: continuing decline in per-student government funding and support, globalization and global competition, continuing growth in student numbers, changes in the nature of academic work, increasing competition between institutions, government pressure to improve operational efficiency, and generally diverse and shifting expectations of stakeholders. These substantial and continuing shifts in the sector, demand more efficient management processes [3] [17] and improved administrative operations [17].

In response to government policy changes, and to various social and economic factors [18], universities have turned to IT as a core facilitator of new strategic directions. The Australian Vice Chancellor's Committee (AVCC), for example, created the Core Australian Specification for Management and Administrative Computing (CASMAC) steering committee in 1991. CASMAC followed the universities of UK initiative MAC (Management and Administrative Computing) [19], introduced in the late 1980's, when universities in the UK agreed that they were not in the business of software development, and decided to take a common approach to finding systems solutions that could be shared. CASMAC was created to develop a set of common management and administration systems across the Australian University Network [19].

More recently, ERP vendors have responded with products tailored to this relatively new market, with many universities, similar to large corporations, increasingly replacing their legacy administrative systems²⁰ with ERP solutions [14] [17]. According to [20], ERP systems were initially introduced into HEIs in the US in response to the same drives that encouraged private sector adoption. US HEIs viewed ERP adoption as a method of gaining greater integration of their management systems to better manage increasingly complex operations [21].

Thus, the main aim of ERP system implementations in HEIs has been to integrate different administrative functions into a more systematic and cost effective approach, and thereby gain a strategic advantage. The integration of administrative functions in the HE sector spans the integration of student administration, human resource management, facilities management, and financial systems that have in the past been supported by separate legacy systems [22]. These were “disparate and lead to duplication of resources and services” [17]. ERP systems were adopted to resolve this. The main advantages of ERP for HEIs are (1) improved information access for planning and

managing the institution, (2) improved services for the faculty, students and employees, (3) lower business risks, and (4) increased income and decreased expenses due to improved efficiency [23].

While ERP implementation in HEIs is often described as difficult, expensive and risky and has often been considered unsuccessful or ineffective [24] [25] [26] [27]; belief in the solution, and its adoption across the sector, has continued globally [28]. This belief is exemplified by the chief information officer at George Washington University, who believes that integrated information solutions give HEIs competitive advantage, stating that: "...institutions, which are unlikely to switch to integrated information solutions, will find it difficult to retain their market share of students. Students will, sooner or later demand services, offered by other institutions..." [29]. Vitale [19] suggests that the importance of administrative computing to the smooth, economical operation of a tertiary institution cannot be denied. In 2002, 86% of Australian universities were implementing or intended to implement at least one module of an ERP system [14]. At that time 38% of Australian universities had adopted ERP solutions from a single vendor, 48% had adopted a 'best-of-breed' approach entailing a range of modules from several vendors, and 14% had not implemented any type of ERP modules [14].

The Unique Nature of the HE Sector

The similarity and differences between HEIs and business corporations have been discussed in the literature for several decades [30] [3]. According to [3], it is tempting to see the HEIs as unique organisations that are different from other organisations. This uniqueness can be based on a combination of different characteristics, which, according to [30] could include:

- complexity of purpose,
- limited measurability of outputs,
- both autonomy and dependency from wider society,
- diffuse structure and authority, and
- internal fragmentation.

These characteristics have contributed to create an environment for the sector that has been described as turbulent [31] [32]. Pollock and Cornford [3] suggest that Universities share similarities with manufacturing organisations, but recognise that Universities have specific and unique administrative needs. Traditional ERP systems address basic business administrative functions such as HR (Human Resource), Finance, Operations & Logistics and Sales and Marketing applications. Yet, the HE sector requires unique systems for: Student Administration, Course/Unit Administration, Facilities (Timetabling) requirements, and other applications, not part of traditional ERP.

Though, research on ERP systems in the HE environment is emerging [33] [3], there has been relatively little specific attention to causes and measures of ERP success or failure in the HE sector. Concern with this inattention is being increasingly voiced in Australia [34] and abroad [35].

Brief Review of the Current Status of Studies on ERP in the HE Sector

Mahrer [36] investigated the antecedents and impact of a successful ERP system implementation in a Swiss university, and concludes that strong communication and coherence between the departments in the university was the main success factor. Oliver and Romm [37] studied why universities sought to adopt ERP systems. That study however was limited, as it reported findings only from secondary data collected through Web sites of ERP projects at universities in the United States and Australia. Chang et al, [38] highlighted the importance of knowledge management in ERP implementations in the Australian public sector (including HEIs), and concluded that organisations must have a lifecycle-wide ERP knowledge sourcing strategy. McConachie [39] found that university staff wanted a new system but were afraid of the complexity of an ERP system. Other researchers [16] [40] have reported on factors that limited the successful implementation of ERP system projects in the HE sector. Mehlinger [4] found that the organisational culture of 10 campuses in a university system that installed an ERP system had little or no impact on the successful implementation of an ERP system.

The implementation of ERP systems in HEIs has been described as challenging. Expenses and risks involved are high, whereas the return on investment is medium to long-term [41]. Feemster [42] described the difficulties experienced with an ERP system implementation in a US college as "merging a system of decades-old databases and re-educating campus employees" and causing "enormous cost and pain". Pollock and Cornford [3] argue that ERP systems are accompanied by "tensions in whichever setting they are implemented"; and that ERP systems are "refashioning the identity of universities" with the implementation of these systems in the higher education sector

raising new organisational issues. For example, these systems were initially designed for corporate organisations, with little initial effort to make them fit universities [27]. The packaged and modular nature of these systems is also problematic for universities, as they must adjust their business processes to fit the system, or customise the system to fit the organisation's business processes [28]. The academic culture in four UK universities, for example, made it particularly hard to implement ERP systems [17].

Research in Australian higher education has reported a complex of problems with ERP implementations that appear unique to universities [43] [28]. Such problems have not been isolated, with Australian newspapers reporting what might be broadly characterized as ERP project failures [44] [40] at the University of New South Wales (UNSW), Adelaide University, and Royal Melbourne Institute of Technology (RMIT). Dramatic, unsuccessful university ERP implementations have too been reported in the United States [45]. For example, Cleveland State University considered legal action against the ERP vendor, when their new system could handle only half their transaction volume. They regardless continued with the implementation despite rising costs, the final cost of \$15M exceeding initial forecast by \$10.8M. ERP implementation costs for Ohio State University rose from an initial estimate of \$53M to \$85M. The University of Minnesota had a similar experience, when projected costs of \$38M finally reached \$60m.

THE RESEACH METHOD

With the objective of developing a grounded understanding of ERP Systems in the HE sector, a single descriptive case study was conducted of a Queensland, Australia based university – Queensland University of Technology (QUT). The use of a single case study here is neither to generalise nor to test a theory. Rather, the case study was conducted with the aim of description. Descriptive case studies are generally used to provide the researchers with a rich description of the phenomenon being studied [46].

The data collection for the case study ran from September 2008 through March 2009. Data was collected through semi-structured interviews. The sampling method employed for the interviews might be characterised as 'elite interviewing' [47], "a specialized case of interviewing that focuses on a particular type of interviewee" (p: 94) "considered to be the influential, the prominent, and the well-informed people in an organization" (p: 83). The researcher commenced the data collection with the Associate IT director of the case site (QUT) as the key informant. He took part in the first series of interviews, and assisted with identification and access to other relevant respondents (consistent with intentions and goals of the elite interviewing approach employed). Thus, different IT and business managers representing different systems were contacted for data collection. The interviews questions were open ended in nature.

Fourteen interviews were conducted of 10 different interviewees; the interviews lasting 1-2 hours each. All interviews were audio recorded and transcribed to ensure data accuracy and to enable a better collection and analysis of evidence. Several interviewees were interviewed a second time to seek clarification or further information. These interviews were then analysed. A core list of themes related to ERP implementations were first identified from the literature. These themes were then used as the basic coding schema, where descriptive examples of how QUT dealt with these aspects were captured. Data analysis was predominantly done manually; using Excel spread sheets as a data management and summarizing tool.

INTRODUCING THE CASE STUDY: QUT

Located in Brisbane, Australia, Queensland University of Technology (QUT) traces its origin back to 1849, with the establishment of Brisbane School of Arts. Through the years, the institution morphed several times, eventually becoming "Queensland University of Technology" in January 1989. Its original goal was "To strengthen its distinctive national and international reputation by combining academic strength with practical engagement with the world of the professions, industry, government, and the broader community" [49]. This goal has inspired the University's dedication to the education of students, research in a broad range of disciplines, and service to the state's citizens. QUT is focused on being 'a university for the real world', delivering relevant and practical courses leading to excellent graduate outcomes.

QUT also has a reputation for adopting latest technologies that support their core and supporting functions. QUT is part of a four-campus system and now is home to several national research centres and research institutes supported by government and philanthropic bodies. At present, QUT has approximately 5,000 employees (Full time equivalent). QUT's enrolment is approximately 40,000 students who study in the university's nine faculties- Built Environment and Engineering, Business, Science and Technology, Creative Industries, Law, Humanities, Education, Health, as well as QUT International College. QUT's annual budget exceeded AU\$ 500 million in 2007.

FINDINGS

This section reports on key findings identified from the case study. While the interviews were far-ranging and insights rich and many, distillation of the evidence surfaced the following six main areas of emphasis: (i) ERP adoption decisions, (ii) ERP selection, (iii) customization procedures, (iv) integration aspects, (v) role of consultants, and (vi) ERP system evaluation at QUT; each of which has been raised in the literature as an important area of interest, and all of which are among the most commonly reported challenges [9] [24] [49] [50] [51].

The Adoption of ERP Systems at QUT

QUT's ERP implementation journey starts about 27 years ago when they first implemented the human resource (HR) components. In 1987, QUT had no automated processes to manage its functions; everything was paper-based.

"When I arrived at QUT in 1987, there was neither HR system nor Financials system at all; everything was in paper-based format"

(The associate IT director at QUT, Personal communication).

The consensus among QUT's executives was that the university's existing systems needed to be improved in line with rapid changes in the HE sector. There were also major concerns about being able to grow the university and become more global without integrated systems capability.

"In order to deal with the rapid changes in the higher education sector, <we> recognised that we had to do something about various QUT's systems that used separate databases"

(The associate IT director at QUT, Personal communication).

QUT decided that they would review the systems for Student Administration, Finance, and Human Resources. The review team consisted of primarily director-level executives and higher-level managers. Their recommendation was that QUT replace its legacy systems with common integrated systems. It was felt that the new system should at a minimum (1) seamlessly integrate QUT's Finance, HR and students functions, (2) be reliable and affordable and (3) have the flexibility to support QUT's unique business processes.

In the first six months of his appointment, the associate IT director at QUT along with other IS personnel, built an initial prototype based on QUT requirements. However, QUT's top management had come to the view that developing a new system from scratch was not an option. Though the IT services department had been in charge of setting up and maintaining different simple business packages in the past, it had never developed any of these.

"QUT's top management decided that this was not the place to be building Greenfield applications for the university and it should go out to tender and find a partner..."

(The associate IT director at QUT, Personal communication).

QUT came to realise that all of their requirements might be met by one particular type of package: ERP software. It was acknowledged that the implementation of ERP software would entail a substantial initial cost, yet QUT decision-makers were confident it would yield compensating benefits across time.

Whether to implement a standard ERP software packages from a single vendor, or select 'best-of-breed' modules from across multiple vendors, is a common decision at the early adoption phase of an ERP implementation. Another decision is, what modules to implement and when; organisations need not implement the full range of ERP functionality simultaneously [49] [52] [53]. Some organisations prefer to use a mix of ERP modules and legacy modules because they are unwilling to change their implicit business model [52], and concomitantly, they are reluctant to change the source code of the ERP module (customisation) to fit their business needs. This mixing of

modules is called the best-of-breed approach, whereby the organisation chooses to mix and match various software modules from different vendors, often in combination with legacy modules. Best-of-breed offers organisations more choice and flexibility with functionality, but can complicate integration and implementation [53].

“When we went out to tender we couldn't find one that had the student, finance, the HR, and all of the systems we needed at that time. As a result of that, we decided to go best-of-breed... use ALESCO as the preferred HR, use Oracle Financials as the preferred financial system and build the student system because it was not available. The strength of the best-of-breed approach is you get the richest functionality in each of the areas you are looking at.”

(The associate IT director at QUT, Personal Communication).

Broadly, QUT first looks to packaged ERP solutions whenever new or revised IT functionality is required. QUT sees in-house development as a risk and expense, and opts for best-of-breed solutions, recognizing that it will take time to realize overall net benefits.

ERP System Selection at QUT

The deployment of an ERP system entails two main issues, selection and implementation. ERP selection is a critical process [54]. According to Davenport [24], organisations often fail to consider whether the chosen system will fit their overall business processes and enable them to avoid or at least minimize software customization. It is important that the selected ERP package fit organisational needs, and support the organisation's business processes [9]. Thus, a detailed requirements specification for ERP software selection will increase the probability that the ERP system will meet the organisation's requirements and support the newly redesigned operational processes [50]. The various selection criteria for ERP systems are well-documented [7] [55]. In example, Siriginidi [55] suggests several factors to consider when selecting an ERP system, including: the stability and history of the ERP vendor, last 12-month track record of ERP sales, implementation support from the vendor, and improvement in ERP software packages.

QUT set up a cross-functional team in early 1988 to select an ERP package. This team consisted of director-level executives, managers and selected operational staff from the different business areas. The selection team commenced collecting the necessary information on which top management could base a sound decision for a particular package. In particular, they wanted to understand how well the various systems could support QUT's needs and what resources (e.g. time, money and expertise) it would take to install them.

Several ERP packages were evaluated in depth. Representatives from the various business areas participated in walkthroughs of specific modules, and the selection team also visited several different vendors' customers. The strengths and weaknesses of each package were mapped into an evaluation matrix, including: the vendor reputation, the stability and history of the ES vendor, previous record of ERP sales, implementation support from the vendor, and improvement in ERP software packages. Though QUT paid attention to all of these factors, their ability in the late 1980's to be selective was constrained by the then limited market offerings.

Back in 1988, given the relatively recent interest from Universities in packaged ERP solutions (e.g. compared to the manufacturing sector) and the concomitant relatively recent interest from ERP vendors in the sector (a chicken-and-egg scenario), it is not surprising that few full-scale solutions were available, and those available yet evolving. In these circumstances, it is reasonable to assume that most University's application portfolios included some mix of packaged and custom systems. It is also relatively more likely in these circumstances that ERP solutions will be best-of-breed (BoB), whereby client organisations (universities) selectively choose different modules from different vendors, as the various major vendors and more established (in this sector) niche vendors jostle for position (no single solution having achieved ascendance).

In regards to the ERP HR component, for example, it was resolved that QUT would adopt the 'ALESCO' HR system:

“When QUT selected its systems, <we> look at the functional requirements we want to fulfil, compatibility with existing systems and previous implementations in other organisations... If you go back to the 1980's there were few options that we considered, Oracle was one of these options, but because Oracle didn't have their own HR product at that time, they recommended ALESCO HR product,.... This system was built on Oracle relational database. So that influenced

our decision to which HR system to select, and since 1990 we are using Alesco product as our HR/Payroll systems."

(The associate IT director at QUT, Personal Communication).

The established international client base and the perceived fit with requirements were central considerations in QUT's choice of Oracle Financials, for example, in 1995.

"Oracle Financials was the one selected in those early days and there would've been 8 or 9 universities that went that way and implemented Oracle Financials, there were a number of different organisations including universities overseas using Oracle Financials and that was one of the main reasons we went there. In fact, we found Oracle Financials set to be a strong fit with our needs."

(The associate IT director at QUT, Personal Communication).

Thus, at QUT systems selection is a result of careful research. They review in detail their functional requirements, what the vendor systems can offer, vendor reputation and compatibility with existing systems, when making systems selection decisions. Additionally, Best-of-breed ERP Systems implementations were seen and treated as, a long term investment.

ERP System Customization at QUT

Like other organisations, Universities must decide how much customization should be done to the ERP system for it to fit the organisation's needs, or conversely, to what extent the University should change its practices to suit the so-called 'best practices' of the ERP [3]. One approach to implement an ERP system is to customize the ERP system package to fit the existing business processes [49]. However, customization of the ERP software package should be avoided or at least minimized in order to achieve the full benefits of the ERP system (Light, 2001; Bajwa et al. 2004). ERP system customization can increase the project time, introduce new bugs into the system, and complicate future upgrades to new versions from the vendor [49].

According to Davenport [24], ERP systems are based on "best business practices" which are "defined structures of doing business operations" that the implementing organisation can choose to exploit. Further, Lozinsky and Wahl [56] claim, ERP vendors promote these packages as having "Universal Applicability". These views argue for adapting the organisation to the ERP. However, [57] observe that ERP design assumptions do not always fit with university operations. Heiskanen et al., [58] concur with Cunningham et al. and suggest that industry best practice standards in ERP packages are inappropriate for universities, due to the unique and impossible-to-model structures and decision-making processes that most of these institutions possess.

Historically, QUT had done much custom development in parallel with running packaged software (workarounds, as QUT did not have access to package source code).

"We got a lot of customisations done for our various systems ... but the last thing you want is too many customisations; it makes your life a nightmare"

(The IT manager of BEIMS, Personal Communication).

With the ERP implementations, QUT sought to move away from customization, and work with the vendor to modify the generic package whenever possible. While this did incur a cost, it minimized errors and also eased upgrades.

"We're starting to move away from custom development because every time we go through an upgrade or the vendor releases a new version you've got to get all your custom work checked out and it's an additional load. Nonetheless, if we do need any custom modules or something is done a bit differently for QUT, we now try to work with the vendors themselves, so that they will actually develop a custom module or form for us and therefore when we do an upgrade they take on that responsibility. We pay obviously each time but we're not breaching or risking that we're doing something wrong. If we ran something that broke or didn't work or caused a problem elsewhere because we wrote it, then it would be our responsibility, whereas if they've written it they will make sure their local customisations work at QUT."

(The IT manager of ALESCO HR system, Personal Communication).

Sometimes the changes QUT requested ended up a core feature of the systems' next version.

“For example, to be able to see your payroll pay-slip online and on time was properly done several years ahead of the vendor doing it in their own core product. The reason is, we saw this functionality as of strategic importance and a differentiator for QUT. But it has equally been our strategy to do the work and then to expose the work that we have done to the vendor, with the attitude of the vendor then taking that on and incorporate it in their own core product and we have therefore no longer required maintaining it, they will maintain, let them take this lead. So we do the research and development and in fact we do the production and Go Live with it for a period of time, then the vendor will pick the idea up and incorporates it in their own core product but we are no longer required to maintain it or pay the vendor to maintain it for us.”

(The associate IT director at QUT, Personal Communication).

Another example is the Building and Engineering Information Management System (BEIMS), a facilities management system that supports corrective maintenance work orders and maintenance and capital works project activities, which was implemented at QUT in 2005. QUT was one of the first universities to implement BEIMS and the system required much customisation to fit QUT's needs. These customisations eventually became core functionality of the basic BEIMS system, as the vendors saw that a product with such features would be valued by other universities.

“As a large multi-national client, QUT have some influence over the direction of the software. So you can actually influence how they're going, ... what we'd really like is a lot of these customisations rolled into the core system eventually, and there's a process that we go through. Like for instance one of the projects was built specifically for QUT, but the vendor is finding that it's of use at other universities, so that will become shortly core functionality in their core product.”

(The IT manager of BEIMS, Personal Communication).

More recently, QUT has been regularly, strategically co-developing new functionality with the vendors, and if the vendor is not interested or capable of developing such features (for whatever reason), QUT has joined forces with other HEIs and Government bodies to develop software functionality that addresses QUT's needs.

“However, in recent times, once we have proven that we are good at what we are doing, what we are trying to do now is not to create new functionality by ourselves, but creating them in partnership with the vendors. So that has not been something that just happened by accident, it has been our strategy that we have had in place. So any good idea that we have here at QUT, explore it, unpack it, determine what it is, get out to other universities to support it, and when there is sufficient support then the vendor will do something about it. If the vendor does not want to build it at their own cost, then look at how to share it amongst the universities; each university wants to have this new idea can contribute, or we may get the Federal Government to fund it; we have done both, and we have been very successful.”

(The associate IT director at QUT, Personal Communication).

QUT's view on customization contradicts in some sense the conventional wisdom that organisations should adopt vanilla (un-customized) ERP and adapt the organisation to the implicit 'best practices' [24] [26] [59]. QUT is convinced there is value in periodically seeking to adapt the system to their specific needs, then and manage customization strategically. They try to get the vendor to manage the customization so that ongoing maintenance and upgrade of the changes is the vendor's responsibility. QUT exerts its influence to make their customization requests standard features in future versions. They lobby with other HEIs of the region for these changes, and when the vendor does not oblige, QUT uses their network of HEIs to jointly built software that fits their common needs.

ERP Systems Integration at QUT

According to a Deloitte and Touche's survey [60], one of the main intangible benefits of ERP systems is their ability to provide tighter integration across different business functions. ERP are based in an organisation-wide, process-oriented design [60], which must be tightly integrated into an organisation's daily operations to achieve full benefit

from the system. Moreover, the integration of organisation-wide data is essential to ensure the successful implementation of an ERP system [61]. If successfully implemented, ERP systems can provide seamless integration of processes across functional areas with improved workflow, standardization of various business practices and access to real-time up-to-date data [62].

However, as suggested earlier, a best-of-breed approach has limitations, an obvious potential complication being integration of different vendors' modules and legacy modules.

"... So, systems integration is working well at QUT, but I'm not totally satisfied as a number of our systems are still using batched or cycling run integration rather than using real-time integration."

(The associate IT director at QUT, Personal Communication).

For example, the business manager of the Archibus/FM system, a space management system that creates and maintains accurate and up-to-date records of all buildings and current usage at QUT, which was implemented at QUT in 2000, stated that:

"I believe, from my point of view that the way our systems are integrated is working nicely. However, the integration can be done better; what we really would like to see is a real-time or immediate integration between the various systems."

(The business manager of Archibus/FM, Personal Communication).

The business manager of BEIMS said:

"You'll find that QUT is the only university where BEIMS is actually talking or integrated with Archibus system. Also, BEIMS is integrated with our Oracle Financials system. Even though I think that the integration process between these systems can be done better, but I believe that our integration process is running smoothly."

(The business manager of BEIMS, Personal Communication).

Also, the business manager of the Syllabus Plus, a system that prepares QUT's class and examination timetables, which was implemented at QUT in 1998, said:

"Syllabus Plus is actually integrated with many systems at QUT, ERP packages and in-house built applications, which make the integration between these systems a bit problematic. However, QUT is moving towards improving the entire integration processes between its systems."

(The business manager of Syllabus Plus, Personal Communication)

This discrepancy might be a result of QUT's choice for selecting multiple systems through their best-of-breed strategy, however it is not a decision that QUT regrets

"As I said before, QUT had chosen to go with the best-of-breed. The main difference between the best-of-breed approach and an ERP suite is that when you buy Oracle-PeopleSoft or TechOne suites, for example, someone else has done the integration for you or at least has done some amount of the integration for you. However, the strength of the best-of-breed approach is you get the richest functionality in each of the area you are looking at, but the problem with that you then need to do your own integration."

(The associate IT director at QUT, Personal Communication).

The IT manager of Syllabus Plus and Archibus/FM commented on systems integration:

"QUT have implemented different applications from different vendors. So, it's actually QUT's business to manage the integration, which most of the times built in-house by internal staff."

(The IT manager of Syllabus Plus and Archibus/FM, Personal Communication)

The associate IT director at QUT commented on systems integration at QUT by saying:

"...When we started, the systems were completely separate and here was nothing in between. It then decided that we want the systems integrated. So this was the first stage of our integration process, where, for example, the Payroll system is interfaced with the Financials system. The second phase of the integration process we followed, is that you want the integration to be a bit more active, and therefore instead of interfacing the systems; you actually have some form of a tool, that's called a transformational tool, that allows to perform the integration in an active way. We've bought a product called Constaller Hub; it's a tool that you can run nightly, hourly or every five minutes, to achieve that kind of integration, we have been using this product for more than five years"

(The associate IT director at QUT, Personal Communication).

The associate IT director at QUT gave more examples in regards to systems integration at QUT, including:

"As part of the new student implementation, we've decided that batched or cycling run integration is not sufficient. For example, if a student just got his student card, he expects that all the systems should recognise him as a student, so he wants to go to the library and borrow a book, that implies that you have real-time integration as an oppose to cycling run integration. So, QUT have decided to implement the real-time integration. We have purchased a Service Oriented Architecture (SOA) that uses Web services system from Oracle after careful consideration and evaluation. Now every touch point with our new student system will run Web services both ways to communicate with that system."

(The associate IT director at QUT, Personal Communication).

Systems integration at QUT is an area that needs improvement. They acknowledge that this is predominantly a result of their best-of-breed software selection strategy. However, QUT is looking at means to better improve system integration and have dedicated projects/ resources working on this issue.

The Role of Consultants at QUT

Consultants often play an essential role in ERP system selection, customization and integration. ERP implementation consultants must be familiar with the business process capabilities of the software products being implemented, and must be able to align those capabilities with the desired business process requirements of the implementing organisation [63]. Bingi et al. [64] argued that one of the main challenges organisations face when implementing ERP systems is the use of external consultants and integration of their knowledge with the organisation's experience. Markus and Tanis [26] suggest that ERP system consultants are a key player in each phase of their four-phase ERP implementation framework.

Nevertheless, the literature reveals examples where the consultant's involvement has been questionable. FoxMeyer Drugs, a large pharmaceutical distribution corporation, went bankrupt in 1996 and lost a US\$ 500 million lawsuit against SAP and the consulting firm [24] [62]. In their study of four ERP implementations in UK universities, Allen and Kern [17] found that the ERP projects placed the universities in complex relationships with ERP vendors and implementation consultants. In Australia, RMIT in Melbourne have almost reached breaking point, while other universities are engaging in legal actions against the vendors and consulting companies [65].

The associate IT director at QUT commented on the role of consultants at QUT:

"There is a difference between QUT's mode of implementation and other universities. We never really relinquish control of our projects, we didn't bring consultants in to tell us what to do; we employed consultants to supplement where we don't have the required expertise. But the authority, the project management, the control points and the governance points of any project are kept under QUT's control. So if you look at a whole project and you say we have enough expertise here we can do that, and we have enough expertise in here to do that, but in this area we don't have the expertise or we don't have the people to do the appropriate work, then we ask how can we supplement that? So we are always supplementing where don't have the required expertise"

as oppose to bringing an implementation partner who says you don't know what to do, so follow my lead...."

(The associate IT director at QUT, Personal Communication).

QUT takes pride in its in-house capabilities seeking consultant input only where QUT lack the required skills, expertise or experience. The consultants' task and expected deliverables are made clear upfront and are managed throughout. QUT believes this approach to engaging consultants allows QUT to maintain control, ownership, and championship of the project.

ERP systems Evaluation at QUT

Investments in contemporary Information Systems (IS), such as ERP, are particularly complex and costly, warranting close scrutiny [66]. Executives worldwide consider the evaluation of IS investments as a key issue [67]. Gable et al., [51] suggest value from methodical evaluation of IS and their impacts on both the organisation and individuals; to justify their value and contribution to the productivity, quality, and competitiveness of the organisation.

Assessing the impacts of ERP systems is difficult, as the impacts of ERP systems are often indirect and influenced by human, organisational, and environmental factors [51] (Petter, DeLone, and McLean, 2008). Yet DeLone and McLean have argued since [68] (p.61) "if information systems research is to make a contribution to the world of practice, a well-defined outcome measure (or measures) is essential." Given the size of ES investments and uncertain related benefits [69] there is need for an economical and valid approach to the measurement of their impacts [70] [51].

QUT, like many other organisations, do not employ a systematic approach to evaluate the success of systems they deploy. When asked "Is there any procedure or method to evaluate the impacts of the systems you are using?", the responses across several QUT managers (i.e. The business manager of Syllabus Plus, the business manager of BEIMS, the business manager of Archibus/FM and the business manager of ALESCO) were similar. e.g.

"Actually no. we are not using any method to evaluate our systems. As long as we don't hear any complaints from the systems' users; then we believe that the system is working well"

(The business manager of Syllabus Plus, Personal Communication).

Nonetheless, the business manager of Syllabus Plus further stated

"We are keen to measure the impacts of our systems if there is a well-defined approach"

(The business manager of Syllabus Plus, Personal Communication).

The business managers of BEIMS, Archibus/FM and ALESCO responded similarly. Broadly, like most organisations, QUT does not effectively evaluate their ERP implementations post-systems- deployment, but sees the need for and value from doing so. The main hindrance they report is the lack of a systemic and economical evaluation method. The interviewees also pointed to the diverse and sometimes unique stakeholders in relation to ERP systems at HEIs, and the need to identify these stakeholders and know who to canvass when a system is evaluated.

CONCLUSION AND FUTURE RESEARCH

The unique context of HEIs suggests unique challenges and risks of ERP implementation and evaluation, demanding sector-specific research. The descriptive case study of Queensland University of Technology (QUT) provided details of the: (i) ERP adoption decisions and alternatives, (ii) ERP selection, (iii) customizations procedures, (iv) integration aspects, (v) role of consultants, and (vi) ERP system evaluation perceptions. The insights gained here align well with many issues raised in relation to ERP adoption in Higher education, globally, and provides some real life examples that other universities may opt to follow.

This case study is a part of a larger study to better understand ERP adoption and evaluation in HEIs. In addition to providing rich descriptive details of the QUT experience, the case sought to explore underlying issues warranting further attention that would benefit from systematic investigation.

Study findings suggest potentially valuable future research in attention to such questions as ‘How can ERP systems be effectively evaluated in the higher education sector?’; ‘Who are the relevant ERP stakeholders in the higher education context, for systems evaluation?’; and ‘What are the systems integration implications of best-of-breed and customization – and how will these influence eventual system impacts?’. The larger study aims to address these questions through a series of planned further research activities. More qualitative data will be gathered through literature and accessible secondary data to identify ERP systems evaluation methods; identify and classify ERP systems users, and to document potential relationships between best of breed solutions, customization and systems impacts. An open-ended survey, targeting a larger pool of relevant stakeholders from HEIs, is too planned, with the intent to collect a salient set of systems evaluation dimensions and measures from the higher education context, to further specify the stakeholder groups, and to identify possible causal relationships with selecting best of breed, customization, integration and systems impacts. The results from these studies will be used to operationalize a conceptual model for ERP evaluation in Higher education and will also assist in the derivation of a conceptual theoretical framework that shows the interrelationships between best of breed systems, systems customization, integration and overall systems success.

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