ERP Systems: The Route to Adoption

Dave Oliver  
*Central Queensland University, d.oliver@cqu.edu.au*

C. Romm  
*Central Queensland University, c.romm@cqu.edu.au*

Follow this and additional works at: [http://aisel.aisnet.org/amcis2000](http://aisel.aisnet.org/amcis2000)

Recommended Citation


[http://aisel.aisnet.org/amcis2000/209](http://aisel.aisnet.org/amcis2000/209)
ERP Systems: The Route to Adoption

Dave Oliver, Faculty of Informatics and Communication, Central Queensland University, d.oliver@cqu.edu.au
Celia Romm, Faculty of Informatics and Communication, Central Queensland University, c.romm@cqu.edu.au

Abstract
This paper outlines the significance of ERP systems and analyses the factors that lead to ERP adoption within organizations. This analysis concentrates on two major phases of the ERP adoption process. The first phase is an examination of the factors that precipitate a search for systems that will provide a solution to problems experienced with current information systems. This examination is structured around previous thinking on motivations for investment in information systems for business operations. The second phase considers the factors that apply to the decision to acquire an ERP system once it has emerged as a contender for adoption.

Introduction
Enterprise Resource Planning (ERP) systems have achieved considerable importance in the contemporary Information Systems arena. ERP systems are large and complex integrated software packages that support standard business activities. The scope of ERP systems, aligned with their numerous configuration alternatives and breadth of organizational impact, make the task of implementing them considerable, extending in many cases over several years. The extent to which ERP systems have shaped the IT industry are captured in the following comparison: "Twelve years ago, IT people identified their organizations as IBM or Digital shops, says Bruce Richardson, VP of Research at AMR Research Inc. They're now more likely to be SAP or PeopleSoft" (Sweat, 1998). The financial impact is correspondingly significant: "1998 ERP revenue hit 16.6 billion" (Electronic Buyers' News, 1999). This paper analyses the factors that lead to ERP adoption.

Since ERP systems are packages, reference was made to an earlier study that identifies the activities that are undertaken in order to acquire commercial off the shelf (cots) software. These are: "(1) acquisition and specification of requirements; (2) understanding the available packages; (3) assessment of package compatibility (with respect to the requirements); (4) selection of the "best" available package" (Finkelstein et al., 1996). However step (1) does not occur spontaneously but as a consequence of other prior considerations. This paper identifies the antecedents of step (1) above, these are the factors driving the investment search, and then we examine the factors that lead to ERP adoption, stage (4) and beyond.

Methodology
Data used for this study to identify the intentions of organizations that adopt ERP systems has been obtained from material published by universities in the USA and Australia over a twelve-month period. These sources were chosen for a number of reasons. Firstly, universities have formal approaches to action so consequently their activities are habitually documented. Secondly, because of their public accountability, universities are more open than private corporations, and some have placed detailed information relevant to this study on their Web sites. This includes Requests For Proposal (RFP) and general advice on both the rationale for, and implementation process of, their ERP project. Thirdly, universities are a specific vertical market targeted by ERP vendors, which enables market effects that might be uneven across industry sectors to be eliminated, as suggested in an earlier study of software make or buy decisions (Rands and Kambhato, 1996).

The documentation available was extensive (for example the University of Michigan Strategic Data Plan Report is over 30,000 words) and provided a good insight into the criteria used by universities to seek new software solutions and for their subsequent ERP investment. Published data may be regarded as of higher integrity than data obtained from interviews. Material of this nature represents a consensus view from an organization at the time the opinions were formed or the decision made.
A qualitative approach is the only feasible method of analysis for data of this type. "Thus, we are talking more the language of explanatory power than that of generalizability...We are not suggesting that a substantive theory (one developed from a small area of investigation and from one specific population has the explanatory power of a larger, more general theory" (Strauss and Corbin, 1998). Data from the universities of Michigan, New Orleans and Colorado in The United States and from Central Queensland University in Australia were analysed to determine whether the expectations relating to investment decisions in business operations outlined above, are confirmed in the case of ERP systems in universities. These universities were selected on the basis of their reputation, openness and context as ERP purchasers.

Factors driving the investment search

Improving the performance of existing activities

An awareness of new and better ways of doing things is an incentive for new investment. Also progressive organizations do not want to be branded as being technologically backward; in fact there is kudos in being perceived in the vanguard, at the so-called 'cutting edge'.

Developments in the sophistication of Personal Computers (PCs) since the mainframe era have added new dimensions to the human/computer interface. This new technology has had the effect of making legacy system terminal interfaces appear dated. Technological influences were discernible in a number of instances, for example current systems were assessed as "mainframe-based, none of the systems take advantage of 'point-and-click', 'drop-and-drag', state-of-the-art technology" (University of New Orleans, 1999). In addition new data transfer technologies offer the prospect of improved performance.

- "The University needs to increase the use of electronic documents internally and the exchange of information electronically with external organizations through the use of industry standards such as Electronic Data Interchange and Electronic Funds Transfer. These steps will simplify business processing, reduce costs, and leverage technology to provide quality services by the most effective means possible." (University of Michigan, 1995)

- "With age, IT systems develop symptoms which diminish their effectiveness as a vehicle for providing organizational support. Ageing technology is frustrating to users and difficult to adapt to changing requirements. Even though they do not "wear out" like physical systems, software systems become relatively more unserviceable with age. Legacy systems in most organizations have developed a reputation as an inhibitor to change because of the inflexibility inherent in 3rd generation software technology. These systems are both difficult and costly to adapt; characteristics that are well known and have received wide recognition. "Eventually an organization will reach the stage where it becomes almost impossible to enhance the existing systems further because they are too slow and uneconomic" (Kelly et al., 1999). When this stage is reached an organization is prompted to seek alternative systems. This issue was encountered in all sources examined:
  - "The majority of central administrative systems are 10 - 25 years old. In most cases, the systems are providing the foundation for institutional data. While many of these systems have had major modifications to adapt to changing requirements, the original design and intent of the systems remain a barrier for users." (University of Michigan, 1995)
  - "Systems, including the payroll system, are 20+ years old and are seriously outdated... User ad-hoc reporting capability is limited." (University of New Orleans, 1999)
  - "Our data environment is characterized by redundant data entry, cumbersome tools for data access, questionable data integrity, and unnecessary restrictions on access to information." (University of Colorado, 2000)

The Y2K issue provided an added incentive to address the inflexibility of legacy systems. Complete replacement of existing systems by Y2K compliant systems was one way of dealing with the issue. This was recognised by at least one university - "Some of the systems, particularly Student Financial Aid, will encounter significant year 2000 difficulties." (University of New Orleans, 1999)

In universities worldwide, an era of tight funding has focussed attention onto more streamlined administrative systems, to reduce costs with the intention of releasing resources for core activities. New technologies open possibilities of fresh approaches to business processes that offer greater efficiencies than existing systems.

- "To deal with the projected decline in state funding support and to reduce the pressure to increase tuition, costs need to be contained or reduced. Of particular importance is the need to focus on personnel costs, which are the largest component of the expenditure base, and the need to streamline processes and procedures which add to administrative costs." (University of Michigan, 1995)

- "A.S.P. flowcharted (or "mapped") the HR and Financial processes of over 360 University units. When analyzing those flowcharts, it was determined that over 50% of the steps that are completed for a transaction could either be handled efficiently through automation, simplified, or eliminated. …"
This approach attacks the inefficiencies in administration and provides an opportunity to save administrative costs without reducing service” (University of Colorado, 2000)

**Integration of data and systems**

The historical development of IT systems, firstly from discrete mainframe based application systems to distributed solutions, has resulted in a plethora of different systems to support organizational objectives. This has frequently led to the need to re-enter the same data in different applications, with consequent inefficiency and capacity for inconsistency. In some instances separate systems with duplicate functionality have emerged in the same organization.

- "Shadow systems have developed resulting in increased information systems investment, duplicate data entry, inconsistent reporting results or output, and wasted time". In fact, during the A.S.P. Detailed Assessment, A.S.P. found that almost every department that was reviewed had a shadow system to track either human resource or finance data.” (University of Colorado, 2000)

**Avoiding business disadvantage or allowing a business risk to become critical**

The continued use of legacy systems may pose a business risk that could become critical. These systems can become unsound and erratic due to continued modification over an extended period. This awareness fuels the investment search.

- "The current Student System is unable to support core University functions (such as the management of student information) and must be replaced as a priority". (Central Queensland University, 1999a)
- "Do nothing - The University could choose to do nothing... and accept that significant improvements in how we conduct business will likely not occur...reduction of administrative expenditure is unlikely... In addition, increased demand for administrative services may actually cause reductions in the level of service provided.
- Update existing systems - an increased risk that investments in aging technology are not prudent or are difficult to implement because of the decline in the technology base...and continue to bear the burden of modifying and enhancing systems and processes to meet external requirements... and it is unlikely the information systems can provide the type of transaction and data integration the University seeks. " (University of Colorado, 2000)

**ERP adoption**

This section of the paper explores those issues relating to ERP adoption, which occur immediately prior to the decision to adopt is reached. ERP adoption is the outcome of an appraisal process, which is typically initiated once the issues discussed in the previous section become an active item on the organization’s agenda. It may take quite a long period of time before all the issues that have been identified as a problem are acted upon. For example, at one university various committees completed assessments of information systems over a four-year period. In May 1991 it was reported that "systems are not meeting the needs of financial users": in September 1992, that "significant improvements in... management information systems are needed". A further report in March 1994 endorsed the findings of the previous two and culminated in a RFP in April 1996 (University of Colorado, 2000). It is evident that for an ERP system to be considered as a solution it is necessary that an organization looks beyond its own software development resources to those available in the market. "Since designing and implementing integrated software packages is not the business of most companies, or a focus of their executives, the systems their internal personnel come up with will never equal the quality, scope, or technology of those created by software firms whose business this is." (Lozinsky, 1998) The market for software systems has matured since universities installed most legacy systems, reflecting the current preference for cots systems. "Building a cost-effective software application that rivals the functionality available in the marketplace would be nearly impossible." (University of Colorado, 2000) At this stage the factors that are germane to the decision to adopt an ERP system are:

- the qualities of the ERP system.
- the vendor profile.
- economics and financial risk.

**Qualities of the ERP system**

The properties of ERP systems which make them an attractive IT investment are wide ranging. In general the qualities of ERP systems broadly reflect the deficiencies that existing systems possessed which drove the investment search. These are:

- **Flexibility.** One of the main issues affecting university administrators was the inability of existing systems to keep pace with changing requirements. There is a clear expectation that the ERP product will maintain currency in the future.
  - "The University is able to acquire vendor provided maintenance which will ensure the University’s administrative information systems will be well tested, proven, and continually updated” (University of Colorado, 2000).
  - "Quicker development time for system enhancements". (University of New Orleans, 1999).
Usability. ERP systems are primarily based on the client/server architecture which provides a modern desktop user interface. This enables ERP systems to meet usability expectations.

- "Utilises a client/server architecture." (Central Queensland University, 1998)
- "Ability to make use of current technologies, for example, Web-enabled applications" (University of New Orleans, 1999).
- "An intuitive, easy, common look and feel across the entire product line. Users won't have to learn how to use different systems to accomplish daily administrative tasks." (University of Colorado, 2000).

Accessibility. ERP systems possess superior data retrieval capabilities partly because they are integrated and also because they are based on a common relational data model.

- "Strong query and reporting abilities. Unlike our current systems, the ability to access and query the data elements is greatly expanded." (University of Colorado, 2000)
- "Easier, quicker access to data for reporting and decision-making" (University of New Orleans, 1999).

Integration. The ability to integrate different applications into a single software product simplifies the management of IT.

- "The products are structured to share data elements and allow users to link finance and human resource information." (University of Colorado, 2000)
- "Better, integrated desktop tools" (University of New Orleans, 1999).

Workflow. ERP systems incorporate increased capacity for electronic processing of data. The introduction of an ERP system provides an opportunity to effect change that might not otherwise occur. Some ERP purchasers have identified processes that they wish to re-engineer (see the University of Colorado above) and purchase ERP systems because they deliver this functionality. Alternatively, others realise the adoption of an ERP system provides an opportunity to introduce new procedures that will eradicate existing inefficiencies. This then provides additional justification for the investment.

- "Users will be able to take advantage of electronic forms, entry, and authorization through the use of worklists in the initial product. New releases of the product will provide broader workflow capabilities. (University of Colorado, 2000)
- "Implementing the software includes 'streamlining' (or reengineering) the way we do business" (University of New Orleans, 1999).
- "Many of the savings that are part of the pay-off of new systems arise because their imminent arrival disciplines us to review the processes and transactions through which the organization conducts its internal and external business. (These are reviews we should be conducting in any case.) We must conform our processes to the systems we are purchasing, and not the other way round." (Central Queensland University, 1999b)

The desire to conform to the ERP with zero or minimal adaptation reflects a concern to minimise upgrade costs as any special purpose adaptations will need to be re-engineered every time there is a new release of the software thus adding to the cost of ownership.

Vendor profile

One obvious factor that needs to be considered in the context of ERP investment decision making is that of external market influences. The ERP phenomenon is driven by both software vendors and adopting organizations. ERP systems could not be a solution to the problems identified above for adopting organizations, were it not for the fact that software companies are selling ERP systems. "Many of the events in these studies suggest a mating theory of search. Not only are organisations looking for alternatives; alternatives are looking for organisations."(Cyert and March, 1963)

Although the vendor's perspective is extremely important, this paper confines itself to the purchaser's view of the vendor. "We liked their strategy of focusing one of their marketing groups on the education and government markets." - Helen Mohrmann, director of administrative systems and distributed technology, Cornell University, Ithaca, N.Y. (Connolly, 1999).

Ongoing maintenance of the product, the use of proven technology, relevant functioning reference sites and seven day support are illustrative of the expectations purchasers have of vendors. (Central Queensland University, 1998)

The vendors perceived strength and stability is very important to purchasers. This is connected to the issue of risk. Clearly universities are not likely to make an investment in an ERP system that is intended to provide institutional support for many years unless they are convinced that the vendor is totally reliable. Continued enhancement of the ERP product is less likely to be achieved by a supplier of dubious stability. "We would not have made this major commitment to PeopleSoft if we had not been convinced of the company's long term viability" (University of Michigan, 1997)

**Economics and Financial Risk**

Installing an ERP in a university may cost $65 million or more US dollars, which represents a substantial financial commitment. The scope of ERP adoption is subject to variation as ERP systems are comprised of different modules, not all of which may be implemented
in a particular university. However any ERP implementation includes a range of cost items:

- Hardware including Servers, Workstations and Network infrastructure
- The ERP software package
- Consultancy
- Replacement cost of staff seconded to the ERP project

Financial benefits include quantifiable factors such as reduced staffing costs and superior financial control as well as non-quantifiable factors such as better information. Data obtained from the planning phase at the University of Colorado in Figure 1 is indicative of relative costs.

<table>
<thead>
<tr>
<th>Figure 1 A Relative Cost Example</th>
<th>Cost Component</th>
<th>Cost (000’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor Cost, including implementation partner labor</td>
<td>$ 20,757</td>
<td></td>
</tr>
<tr>
<td>Software Costs</td>
<td>4,316</td>
<td></td>
</tr>
<tr>
<td>Hardware and Network Costs</td>
<td>3,793</td>
<td></td>
</tr>
<tr>
<td>Training Costs</td>
<td>2,025</td>
<td></td>
</tr>
<tr>
<td>Operating Costs</td>
<td>1,753</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$ 32,644</td>
<td></td>
</tr>
</tbody>
</table>

This data supports those studies that show costs associated with the implementation process, in terms of both employees and staff contracted from consulting firms are considerably more than the cost of hardware and software.

The importance of financial guidelines is unclear with respect to IT investments. It has been suggested that universities do not always mount a financial case for IT investments. "Where the system is fundamental to running the organisation and delivering services, there may be no choice but to invest…This may cause some universities to neglect the cost-benefit analysis of proposed IT projects. Some of these will be operational or competitive necessities, which will not give you any competitive advantage, but will keep you in the game and thus are necessary for survival." (Vitale et al., 1997) Also the method of data collection used in this study could have been inhibiting with respect to uncovering the financial issues, since some universities may have decided not to place financial data on the Internet.

As ERP system are replacement systems, it should be possible to provide an economic rationale: "It is possible to argue that a 'technology' investment cannot strictly give a return on investment unless it replaces an older technology and carries out the same functions more efficiently” (Ward, 1996). To justify a $35million investment in an ERP project, one university used payback and Internal Rate of Return (IRR) calculations. The IRR of circa 9% was above the university's hurdle rate of 5% but does not suggest the ERP adoption was an overwhelming financial imperative. Also the timescale envisaged for the investment is reasonably long "at least a decade" but probably realistic in the light of the longevity of current legacy systems (University of Colorado, 2000).

Economics tests the resolve of the organization to adopt an ERP system. Funds for this investment must be allocated from the adopting organization's budget. “An organization's economic intent is largely expressed through the budget which exercises control over allowable behaviour within the organization. Budgets are allocated to departments or divisions which exercise control functions in which the organization desires to engage.” (Cyert and March, 1963) Unless the organization is motivated to allocate sufficient funds from the budget to acquire an ERP system, the investment cannot occur.

A risk assessment is a vital component of any substantial investment decision. Aspects of risk assessment relating to the investment search were addressed earlier in this paper. When the decision is made to invest in an ERP system, financial risks must be considered. Financial risks depend on the magnitude of the ERP investment relative to the organization's resources. These are important for ERP systems, as the size of the investment required is quite substantial for a university. "A significant up-front investment will need to be made and amortized over future periods. The overhaul of the University’s business processes and technology will require a large commitment from the University community as current systems and processes have to be maintained until the solution is in place." (University of Colorado, 2000)

**Conclusion**

This paper has analysed the process of ERP adoption within universities. It has outlined those factors driving the search for a solution to problems concerning the effectiveness of the information systems function as a support to core business activities. It then examines the justifications for the adoption of an ERP system as the solution to these problems. These are the critical factors that influence the final investment decision. Whilst the paper does not offer prescriptive advice on adopting a specific ERP system it outlines issues which may be applicable in other settings. This may provide guidance to other organizations both in the public and private sector who are experiencing problems with existing information systems or are considering adopting an ERP solution.

**References**

Central Queensland University. Request For Proposal Administrative Information System 1998
Central Queensland University *UniNews WEEKLY* #256 1999a
Connolly J, "ERP: Corporate Cleanup", *Computerworld*; Mar 1, 1999
*Electronic Buyers' News*. Manhasset, May 31, 1999
Lozinsky, S. Enterprise Wide Software Solutions, Addison-Wesley 1998
Sweat J. "ERP: The corporate Ecosystem" *InformationWeek Online* Oct 12 1998
University of Colorado, www.cusys.edu/~asp/busplan/Master.html, (Current 22/02/00)
University of New Orleans www.uno.edu/~ucc/projects/PeopleSoft/web.html (Current 9/6/99)

1044