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Integrating ERP's Second Wave into Higher Education Curriculum

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Abstract

In the 1990s there was considerable growth in implementations of Enterprise Resource Planning (ERP) Systems. Companies expected these systems to support many of the day to day business transactions. The growth in ERP implementations had a resultant impact on the demand for ERP skills. Many universities recognised this demand and the potential of using ERP Systems software as a teaching tool, and endeavoured to incorporate ERP systems into their curriculum; however most universities have struggled in this task. The application of ERP in education is well documented in many papers on Information Systems education. ERP systems have now evolved to incorporate more strategic components and universities and ERP vendors are investigating ways in which curriculum can be developed to support these new solutions. This paper discusses the evolution of ERP systems and how universities are attempting to develop their curriculum to complement these changes. It identifies how one university is addressing this dilemma and how this approach could be adopted and expanded further.

Keywords: ERP Systems, Application Hosting, ERP education

1. Introduction

Many universities have committed considerable time and resources in modifying their curriculum to incorporate Enterprise Resource Planning Systems (ERP) (Hawking, Shackleton & Ramp, 2001; Lederer-Antonucci, 1999; Watson and Schneider, 1999). For many universities it has been a struggle even though ERP vendors have developed a number of initiatives to facilitate curriculum development. As companies' ERP system usage has become more strategic in nature, ERP curriculum needs to evolve to reflect and support this usage. Information Systems curriculum in universities has undergone rapid and continuous change in response to the evolution of industry requirements. Over a period of 40 years, the Information Systems (IS) discipline has become an essential component in the employment of information technology personnel in business and government organisations. In recent times there have been discussions by IS professionals on how to best respond to developments in the information and communications technology (ICT) industry. The industry now requires a broad range of skills that support the development, implementation and maintenance of e-business solutions. A recent Australian report identified skill shortages in security/risk management, enterprise resource planning (ERP) systems, data warehousing and customer relationship management (CRM) (ICT Skills Snapshot, 2003). Over the same period there has been a downturn in employment opportunities in this the ICT industry (ICT Skills Snapshot, 2003). Recent research indicates that many of the entry-level positions graduates traditionally go into have diminished due to the economic downturn and to companies outsourcing positions offshore. This paper discusses the evolution of ERP education and the issues it now faces. It provides an example of how one university is addressing the "second wave" of ERP education and the challenges that educators face in preparing students for rapidly developing software environments.

2. ERP Skills & Curriculum Approaches

The shortage of ERP related skills is not a recent phenomenon. A survey by Hewitt Associates (1999) found that people with ERP skills were in short supply, and consequently in high demand experiencing rapid changes in their market value. In Australia, an IT Skills Shortage study (ICT Skills Snapshot, 2003) commissioned by the Government, found skill shortages in enterprise wide systems, and more specifically SAP R/3 and PeopleSoft implementation and administration. The Department of Immigration and Multicultural Affairs in their Migration Occupations in Demand List (MODL 2000) identified information technology specialists with SAP R/3 skills as people who would be encouraged to migrate to Australia.

In accordance with this demand many universities identified the value of incorporating ERP systems into their curriculum. ERP systems can be used to reinforce many of the concepts covered in the business discipline (Becerra-Fernandez et al, 2000; Hawking et al, 2001). The ERP vendors argue that their products incorporate “world’s best practice” for many of the business processes they support, making them an ideal teaching tool (Hawking, 1999; Watson and Schneider, 1999), while at the same time increasing the employment prospects of graduates. Universities also realised the importance of providing students with “hands on” experience with particular ERP systems and formed strategic alliances with ERP system vendors to gain access to these systems. ERP Systems have relevance in many areas of university curriculum including Information Systems, Business and Computer Science as they are the dominate Information Systems infrastructure for large companies worldwide and underpin corporate strategy in many of these companies. The ERP vendors benefit from these alliances by increasing the supply of skilled graduates that can support their product thereby enhancing its marketability and lowering the cost of implementation.

Universities who decided to introduce ERP related curriculum were faced with a number of barriers. For many universities getting access to an ERP system to provide “hands on” learning environment was not a major issue, however, the lack of ERP related skills of academic staff and accordingly the development of appropriate curriculum material was and still is a major hurdle. SAP, the leading ERP vendor has established the largest ERP university alliance with more than 400 universities worldwide accessing their ERP system (SAP R/3). They have introduced a number of initiatives to facilitate the incorporation of their system into university curriculum. Initially when universities joined the alliance they were provided with free training for academic staff and access to training materials. The amount of training made available and the restrictions how the training materials could be used varied from country to country and to a certain extent from university to university within the same country.

The transporting of SAP training materials into a university environment, as many universities attempted to do, was not a simple process. The training materials were often version dependent and utilized preconfigured data that was not readily available in the universities’ systems. The SAP training exercises were often just snapshots to reinforce particular features of the system and therefore were not comprehensive exercises illustrating end-to-end processes relevant in ERP education. For example, staff soon came across the problems associated with opening and closing posting periods that often prevented certain transactions from being completed in the system. This concept is rarely covered in training courses even though it impacts on many processes.

The curriculum developed by universities could be classified into one of four different curriculum approaches or a fifth, being a hybrid of the four:

1. ERP Training;
2. ERP via Business Processes;
3. Information Systems Approach;
4. ERP Concepts; and
5. The Hybrid.

The first, which is least preferred by academic institutions, focuses on the instruction or training in a *particular* ERP system. There has been increasing pressure from both students and industry for universities to offer subjects based on this type of curriculum direction, particularly if the ERP system used has been widely adopted in industry. In the case of SAP, the Alliance specifies that specific training of SAP R/3 is the domain of SAP.

The second curriculum approach retains the focus on business processes but uses the ERP system to assist in the presentation of information and skills development. Most ERP system vendors argue that their particular system incorporates *best business practice* and, as a consequence, students use the system to enhance their understanding of the processes and their interrelationships, especially in the area of supply chain management.

The third approach is the use of ERP systems to teach and reinforce information system concepts. ERP systems provide students with the opportunity to study a real world example of a business information system, often incorporating *state of the art* technology.

The final curriculum direction is to teach about ERP systems and concepts. This is different from the first curriculum approach outlined above in that it deals with *general* ERP issues and the implications for an organisation for implementing this type of information system rather than training in a specific system.

No matter which model universities adopted, the acquired knowledge of academics involved in ERP education is difficult to encapsulate and therefore the curriculum is often dependent on relatively few staff. Usually there is a core of academics who have spent many hours working on the system; once these staff leave a university or change direction then the curriculum usually flounders. This has been evident in Australia where from the original thirteen universities involved in the SAP alliance only seven remain. Some universities were able to develop and retain their ERP skills while others struggled. SAP (Americas) established the SAP Curriculum Awards and Curriculum Congress in an attempt to facilitate the problems many universities were facing. The Congress was designed to bring together academics involved in ERP education where they could share their experiences and to be made aware of new product developments. The awards identified and financially rewarded exemplary programs, however there was limited sharing of the curriculum. Some universities considered the curriculum their competitive edge and intellectual property or conversely it was not documented to a level that made it accessible to others. Recently SAP has established their education and research portal, "Innovation Watch", to facilitate collaboration between universities. The site includes a range of "plug and play" curriculum materials; however not all university alliance members have access to it or are even aware of it. The quality of the curriculum varies enormously and some is far from "plug and play".

Due to escalating demands associated with administering new versions SAP R/3 and to facilitate the entrance of new universities into the alliance, SAP established a number of

application hosting centres around the world in universities with established ERP curriculum offerings. The hosting model varied from country to country with some only providing access to systems rather than curriculum. However SAP considered that the increasing support universities required could be provided by the hosting centres and therefore lessen the burden on SAP.

3. Second Wave ERP

A question that must be asked relates to the relevance of current ERP curriculum to industry requirements. The SAP University Alliance, established in the mid nineties, followed closely the growth in ERP usage in industry. Originally ERP systems were adopted as complex transaction processing systems responsible for handling millions of transactions from the various business areas within a company. Their strength came from their integrative nature including the standardised definition of master data items across the system and the efficient flow of data between its various components. The definitions and flow were based on “best business” practice and thus often provided a catalyst for organisational change and standardisation within an organisation. Additionally for many companies the implementation of this type of system was a technological solution to the Y2K issue (Deloitte, 1999; Davenport et al 2002).

To facilitate an effective implementation within a company, business process engineering was initiated for the purpose of “gap analysis”. This was designed to determine what changes were needed in the company or in the ERP system. Underestimating the impact the system would have on their organization, companies initially struggled with their ERP implementation due to lack of skilled resources and inexperience with projects of this scope. For some companies these barriers became insurmountable (Calegero, 2000). For many companies the urgency to achieve Y2K deadlines and the lack of understanding of the complexity of these types of implementations resulted in a failure to optimize their business processes during implementation (Davenport et al 2002). Although companies solved their Y2K issues the majority of companies did not achieve the additional benefits they had expected from their ERP system (Deloitte, 1999; Davenport et al 2002). For some companies the additional benefits only became obvious once they had been using their ERP system for a period of time and became aware of its potential.

This lack of benefit realization has resulted in companies revisiting their ERP implementation in an attempt to leverage their investment by attaining the purported benefits. A study by Davenport et al (2002) identified the top ten benefits that can be gained from an ERP implementation (Table 1).

Table 1: Top Ten ERP Benefits

| Benefit |
|--|
| Improved management decision making |
| Improved financial management |
| Improved customer service and retention |
| Ease of expansion/growth and increased flexibility |
| Faster, more accurate transactions |
| Headcount reduction |
| Cycle time reduction |
| Improved inventory/asset management |
| Fewer physical resources/better logistics |
| Increased revenue |

A Computer Science Consultant's (CSC) study (2001), which surveyed 1009 IS managers from around the world, identified "optimising enterprise wide systems" as their main priority. In the landmark Deloitte's study (1999), 49% of the sample considered that an ERP implementation is a continuous process, as they expect to continually find value propositions from their system. This is a reasonable expectation as companies attempt to realise previously unattained benefits and additionally, as companies evolve, their ERP system must also evolve to support new business processes and information needs. Davenport et al (2002) believes that the potential of ERP systems can be classified under three groups; *Integrate*, *Optimise*, and *Informate*. *Integrate* is where a company is able to integrate their data and processes internally and externally with customers and suppliers. While *Optimise* benefits include the standardization of business processes incorporating best business practice and *Informate* is the ability to provide context rich information to support effective decision making.

This evolutionary nature of ERP usage is reinforced by CAP Gemini, Ernst and Young (2002) who believe that a company's ERP system can form the foundation for increased collaboration between business partners and assist in a company becoming an "*Adaptive Enterprise*" (Figure 1).

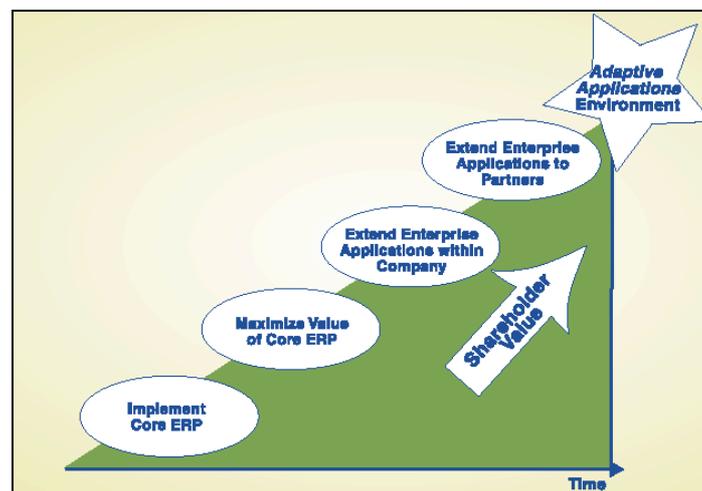


Figure 1: CAP Gemini et al (2002) Adaptive ERP

This type of enterprise and its business processes can quickly adapt to both internal and external factors. Accordingly the emphasis on increased integration and collaboration both internally and externally has resulted in ERP vendors releasing a range of products to support these goals. CAP Gemini et al (2002) produced an Adaptive ERP Index to assist companies to determine their progress towards an "*Adaptive Enterprise*". The index was made up of four components:

- Improved applications functionality,
- Improved use of current applications to increase collaboration with business partners,
- Improved applications integration, and
- Improved use of current applications to increase internal process effectiveness.

The notion of differing evolutionary maturity stages of ERP implementation is espoused in the work by Nolan and Norton (2000). They argued that when evaluating costs of an ERP implementation, the company's previous experience with ERP systems should be considered. Their maturity classifications were:

- Beginning – implemented SAP in the past 12 months;

- Consolidating – implemented SAP between 1 and 3 years; and
- Mature – implemented SAP for more than 3 years.

Accordingly ERP vendors have extended the functionality of their ERP systems beyond transaction processing. The release of mySAP.com highlighted this evolution with SAP R/3 being only one component of this solution. MySAP.com was a consolidation of many of SAP existing products under one umbrella. It was based on extending the functionality and reach of the ERP system. It provided the ERP system with an external focus in terms of business partners and customers. The components of mySAP.com included; Business Warehouse (BW), Advanced Planner Optimiser (APO), Strategic Enterprise Management (SEM), Knowledge Management (KM), Customer Relationship Management (CRM). SAP has since changed the name and shape of the umbrella to MySAP Business Suite, but still offers similar solutions with the addition of portal technology and an integration framework (NetWeaver).

4. Second Wave ERP Education

The Managing Director of SAP Australasia (Bennett 2000) identified a number of factors that are important to the implementation of effective ERP curriculum into the future. The curriculum would move from transactional to strategic and focus on mySAP.com components. It would focus on the role the ERP system has in e-business and would closely be aligned to technology and market trends. Davenport et al (2002) believes for a company to achieve “second wave” benefits that there are three essential factors. Firstly, the organisation must have had several years experience with enterprise wide systems; secondly, the systems need to be used extensively throughout the organization and thirdly, significant resources should be allocated to future implementations.

These same prerequisites are just as applicable to ERP curriculum development. This is a dilemma for SAP and other ERP vendors if they want students to develop more strategic ERP skills, as many universities are still struggling at the operational level. To incorporate these products into curriculum requires a solid understanding of the underlying ERP system in addition to the “second wave” solutions as well as providing the necessary technological infrastructure to support the solutions (Rosemann et al, 2000). It was envisaged by SAP that Application Hosting Centres could provide the necessary infrastructure. However the complexity of these new wave products makes it difficult for the hosting centres to implement all the solutions and make them available to their client universities.

5. Possible Solution

Victoria University has been a member of the SAP University Alliance since 1998. It adopted a faculty approach to the introduction of ERP curriculum as the solution was seen as a tool that could reinforce many of the business and information systems concepts taught across the faculty. The university now has approximately twenty-five subjects at both the undergraduate and postgraduate levels that incorporate SAP and related products. These subjects form part of master degree program that is taught in Australia, Singapore and China. Even though the university has well-established curriculum, it also faced with the dilemma of how it could take advantage of the educational potential of SAP’s “second wave” components. It was felt that existing staff were stretched to the limit, and time and effort to develop this new curriculum would be insurmountable. As a pilot program in 2002, the university identified academics from around the world that had the skills, curriculum, and access to systems to teach the specialist solutions. An academic was invited to teach their curriculum at Victoria University through a concentrated mode (one or two weeks). This also

relied on Victoria University students accessing the visiting lecturer's ERP system and any "add on" solutions in their university via the Internet.

The pilot had a number of obvious benefits. Firstly the visiting academic provided access to the curriculum skills and system. Secondly resident staff received professional development as they assisted in the class. Thirdly students gained access to education they would not readily receive. Finally the pilot provided the foundation for future collaboration between the participating universities. Due to the success of the pilot in the ERP program, three subjects were offered via this method in 2003. The collaboration has resulted in Victoria University staff being invited to other universities to teach curriculum that was unavailable in these universities.

This initiative could form the basis of similar specialist programs around the world to address "second wave" education. SAP would identify key personnel around the world and commission them to develop comprehensive curriculum. SAP would establish a curriculum review committee which would establish guidelines for the developed curriculum materials including templates and would also review submitted materials. The curriculum developed would include both theoretical and practical components as well as support documentation for common problems. These teaching materials would be based on versions of the solutions readily available from a particular hosting centre or specialist university. Initially universities could employ the specialist academic to conduct a course and or provide professional development to the local staff. The following semester the local staff could conduct the class with the supplied course materials and remotely supported by the specialist academic. Once the local staff became proficient in the solution they could contribute to the curriculum development and support. As the skills of academics in "second wave" products developed, they could develop new curriculum or extend the original curriculum and in turn support other universities. This would relieve the demand on the specialist academics.

Hosting centres and specialist universities would need to become solution specific and thus alliance universities would access a network of universities for solution provision. This would alleviate the pressure on hosting centres to have the necessary infrastructure and expertise to offer a comprehensive range of solutions. This also enables staff in these universities to specialize in a particular solution.

Even though the visiting academic initiative has potential to address the problems with "second wave" education there are a number of prerequisites for its success. Firstly the specialist academics need to be carefully selected and reimbursed for the curriculum development, visiting teaching and ongoing support. Secondly a template and guidelines for the curriculum needs to be developed and adhered to by the specialist academics to ensure quality curriculum and true "plug and play" and consistency. Thirdly hosting centres would need to develop flexible service level agreements and affordable access fees to enable universities to easily and quickly to access their solution.

If this solution was implemented then research would need to be undertaken as to its success. This would include an evaluation of skills covered and their relevance to industry. Research would also need to identify any other barriers which may be hindering the incorporation of "second wave" products into the curriculum.

6. Conclusion

Universities who have worked very hard to develop ERP curriculum are now faced with the dilemma of evolving their curriculum to reflect the evolution of ERP systems and industry

requirements. The evolution of ERP systems from an operational to a more strategic focus requires a different skill set to support this transition. The visiting lecturer delivery method could be further extended whereby a directory of specialist academics could be established by SAP and distributed to alliance members. These academics could be provided with additional support from SAP to assist them to further develop their curriculum with the goal of making it portable to other universities. Universities and ERP vendors need to develop strategies on how to best address the new skills deficit. For this to occur, there will need to be more collaboration than exists at present.

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