ERP Education in China: The Tale of Two Paths

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Abstract. In the 1990s there **w**as 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 recognized 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 ERP skill shortage has reached an all time high especially in the Asian region. ERP vendors are investigating how to best address this shortfall and the role of universities. This paper outlines two approaches to the delivery of ERP (SAP) education in China.

Keywords: *Enterprise resource planning systems, ERP education, Asia*

1. ERP EDUCATION

The skill shortage for Enterprise Systems professionals; in particular related to SAP solutions have hit an all time high. In a recent article it was estimated that 23,400 SAP related vacancies exist in the USA [1]. However this skill shortage is not limited to USA. An Australian report identified skill shortages in security/risk management, enterprise resource planning (ERP) systems, data warehousing and customer relationship management (CRM) [2]. Accordingly the Department of Immigration and Multicultural Affairs in their Migration Occupations in Demand List [3] identified information technology specialists with SAP skills as people who would be encouraged to migrate to Australia.

Due to the laws of supply and demand this skill shortage has resulted in increased salaries to those with the relevant skill sets. This has a flow on affect. ERP implementation costs increase, eventually impacting on ERP vendor's sales.

Towards the end of the 1990's ERP vendors were faced with a similar dilemma in relation to the availability of skills. In response to this many established University Alliance programs. These programs provided universities with access to their solutions, training and support. The ERP vendor benefited 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. In addition

university graduates became familiar with vendor's solutions and the impact they could have on a company's performance.

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 [4-5]. 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 [6-7], 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.

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 a "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, established the largest ERP university alliance with more than 600 universities worldwide accessing their ERP solutions. They have introduced a number of initiatives to facilitate the incorporation of their solutions 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 on 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 functionality of the system and therefore were not comprehensive exercises illustrating end-to-end processes relevant in ERP education. Additionally materials were designed to introduce SAP functionality to trainees who were already working in the related area and were not designed to educate students about the business processes.

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

1 ERP training
2 ERP via Business Processes
3 Information Systems Approach
4 ERP systems and concepts
5 The Hybrid.

ERP Training

This approach is the least preferred by academic institutions. It 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. In the case of SAP, the Alliance specifies that specific training on SAP solutions is specifically the domain of SAP.

ERP via Business Processes

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.

Information Systems Approach

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

ERP systems and concepts

The final curriculum direction is related to teaching about ERP systems and concepts. This is different from the first curriculum approach as 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 a core of academics spends many hours working on the system. Unfortunately once these staffs leave a university or change direction, the curriculum usually flounders. Some universities have been able to develop and retain their ERP skills while others struggle.

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 be made aware of new product developments. The awards identified and financially rewarded exemplary programs, however there was limited sharing of 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. SAP established their education and research portal, "Innovation Watch"[1], 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 of SAP solutions 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 lessens the burden on SAP. This model has further been refined due to the level of support required to maintain these Hosting Centres. SAP is now in the process of establishing five "*Mega-Centres*" around the world to replace the numerous Hosting Centres. These will be located in Europe (2), America (2) and Asia (1).

[1] http://services.sap.com/iw

Many universities have committed considerable time and resources in modifying their curriculum to incorporate Enterprise Resource Planning Systems (ERP) [7-9]. 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.

2. ERP EDUCATION IN ASIA

The ERP skill shortage is impacting worldwide and especially within the Asian region. The adoption of SAP solutions within this region have been growing significantly with a 37% growth in software licences in 2004 with the strongest growth in India and China [10]. SAP has captured 67% of the ERP market within the Asian region.

SAP established the University Alliance program within Asia but really in name only. A number of universities joined the program (Table 1) but very few have been able to establish ERP related curriculum. In addition little priority has been given by SAP to the program. However, recently SAP has appointed a regional head of the program and a number of country specific positions in an attempt to reinvigorate the program.

Table 1. Members of the SAP University Alliance Program (2006)

Country	Number
Australia	10
China	13
India	25
Korea	34
Japan	18
New Zealand	1
Singapore	5
Taiwan	9
Thailand	5
Total	120

2.1 Case Study

The remainder of this paper adopts a case study approach to describe two different approaches to the development and delivery of ERP related education in the Asian region and in particular China. It discusses the merits and sustainability of each approach.

2.1.1 Case 1

One of the leading universities in ERP education is Victoria University (VU) in Australia. This 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 subjects at both the undergraduate and postgraduate levels that incorporate SAP and related products. These subjects are form part of the master's degree program. This degree is conducted over semesters and involves twelve subjects (Table 2).

Similar to many other Australian universities, VU have realised the potential revenue generation of international students enrolled in the University's courses. This occurs either by students coming to Australia to study, or by the University forming partnerships with local educational institutions allowing students to study a VU course in their country or a combination of the two. In terms of students studying in their own country the University offers a range of courses in Hong Kong, Thailand, Malaysia, Singapore, People's Republic of China and Bangladesh involving more than 3000 students.

A number of the international partnering universities became aware of VU's expertise in the area of ERP education and indicated that they wished to include ERP related education to their students. Partnering universities have had difficulties in developing ERP curriculum due to lack of skilled staff and available resources. Many of theses issues can be overcome by forming partnerships with western universities with experience in ERP education. Clearly there are advantages to be gained by both parties in setting up a partnership to teach different aspects of ERP systems. The provider is able to derive income to recoup some of the cost of developing curricula and maintaining systems while the receiver obtains the benefits of their students acquiring ERP education without the need to invest in hardware, staff training and curriculum development. In 2002 VU commenced the Master of Business in ERP Systems in Singapore and in 2004 in China at Beijing Jiaotong University (BJU). The course is taught in English at all locations.

The delivery model is based on VU staff travelling to China to teach approximately 40% of each subject with the remainder being taught by BJU staff using VU materials. VU staff provides professional development and training for BJU staff to enable them to teach the materials in addition to moderating each subject. BJU students access SAP solutions located in Australia over the internet. A number of e-Learning technologies have been adopted to support the teaching.

The program has been successful with the Beijing Jiaotong University (BJU) graduates being sought after by industry; many receiving job offers before completion of the course.

2.1.2 Case 2

The second model of curriculum has only been recently developed as a reaction to the skill shortage. The SAP University Alliance Program has been established in China for a number of years which involved 10 universities. However these universities found it difficult to develop and implement ERP related curriculum due to

many of the reasons identified earlier. An additional barrier existed due to the lack of ERP curriculum developed in Mandarin.

In January 2007 the Ministry of Education of the People's Republic of China and SAP China signed an agreement to promote ERP education in Chinese Universities. As part of this process staff members from nine universities were sponsored to attend a forum at SAP headquarters in Germany.

The ERP education model was developed in partnership with a Chinese educational group and the result was the establishment of Master of Software Engineering: SAP ERP Consultant degree (Table 3). The degree is taught in Mandarin and is made up of a combination of general business subjects (20 credits), SAP training (30 credits), Internship (5 credits) and a thesis (5 credits). To overcome the lack of SAP curriculum materials and expertise the SAP component will be taught by outside consultants using SAP training materials. The course duration is 2.5 years. The universities involved in the program include; Shanghai Jiaotong University, Zhejiang University, Shanghai University, Southwestern University of Finance and Economics, Tsinghua University, Guangdong University of Technology, Xi'an Jiaotong University, Guangdong Jinan University, Neusoft Institute of Information Technology, Chinese Agricultural University, Beihang University, South China University of Technology, National School of Administration

3. DISCUSSION

Both course models attempt to address the need for skilled ERP (SAP) graduates in China. Additionally both courses offer a broad range of SAP skills which will be well sought after by industry. However there are doubts that the ERP Consultant course is sustainable from a number of perspectives. SAP training materials are the intellectual property of SAP and the delivery of educational course based on these materials provides SAP with a significant revenue stream. This is something they vigorously try to protect and prevent other parties from offering SAP training based on these materials. In China SAP have the situation whereby SAP training is being offered by third parties at a significantly cheaper rate than SAP offer. This has the potential for SAP to lose control of their intellectual property and a reduction in their training income.

Table 2. Master of Business in Enterprise Resource Planning Systems - Core Subjects

Subject	Description	Theory SAP Solutions/ Functionality	Practical SAP Solutions	Partner Solutions
Enterprise Resource Planning Systems	This unit allows students to develop an appreciation of the impact of Enterprise Resource Planning Systems on businesses and to understand the issues involved in the design, implementation and maintenance of these systems. Students also develop practical skills in the use of SAP solutions as an example of an Enterprise Resource Planning System.	ECC 5 – Production Planning, Materials Management, Sales and Distribution, Financials, Human Resources, Project Systems, Reporting	ECC 5 – Production Planning, Materials Management, Sales and Distribution, Financials, Human Resources, Project Systems, Reporting	
Business Process Engineering	Covers the strategic and organisational issues of process and workflow management and the use of Enterprise Resource Planning Systems (ERPs) to realise efficient processes. The subject describes the major strategic approaches, process modelling techniques, procedure models and the current possibilities offered by SAP R/3 as an example of ERPs software that students are likely to encounter in identifying, reorganising and implementing processes in a typical business organisation.	Workflow, Solution Manager, Netweaver Integration Technologies, Event Process Chains	Workflow, Solution Manager,	Aris Toolset
Supply Chain Management	The concept of supply chain management in the context of movement and storage of components and goods in the spheres of material management, physical distribution and transport and its practical business application.			
Organisation Change Management	Organisational design; organisational changes processes and organisational development and change; and skills and competencies in the diagnostic processes			

	evaluation of change strategies at all organisational levels.			
Enterprise Ecommerce	The integration of ERP Systems with E-Commerce and the issues involved. Many large organisations have implemented Enterprise Resource Planning Systems to integrate their business processes. These same organisations are now attempting to extend their supply chain via E-Commerce business solutions.	Enterprise Portal, Advanced Planner Optimiser, CRM, SCM, Netweaver, Internet Framework		
Enterprise Resource Planning Systems Implementation	The basic methodologies, techniques and tools that are used in the implementation of Enterprise Resource Planning Systems using SAP R/3 as an example. Many large organisations are making decisions to implemented Enterprise Resource Planning Systems but the implementation is complex and requires specific project management skills and knowledge.	ValueSAP, Security, Testing, documentation, Data Conversion, Administration, Solution manager	Solution Manager. Computer Aided Testing Tool, ITutor, Legacy Migration Workbench, ValueSAP, Profile Generator	Mercury, RWD Infopak
Strategic Use of Enterprise Resource Planning Systems	The strategic features of ERP systems and how these features can be utilised within an implementation. Many large organisations have implemented ERP Systems to integrate their business processes and are now attempting to gain further benefits by utilising the strategic features of these systems such as supply chain optimisation, customer relationship management, and data warehousing.	CRM, Business Intelligence, SCM, MDM, Csutomer Competency Centres, GRC, BPS		

Table 3 Master of Business in Enterprise Resource Planning Systems - Elective Subjects (5)

Subject	Description	Theory SAP Solutions/ Functionality	Practical SAP Solutions	Partner Solutions
Business Intelligence	Business Intelligence has been identified by analysts as one of the key drivers for companies' strategy. This subject covers both theoretical and practical aspects of Business Intelligence including data warehousing. Students use SAP's BIW in the workshops to reinforce many of the theoretical concepts.	Business Information Warehouse	Business Information Warehouse	
Computerised Accounting in an ERP System	Provides an integrated view on accounting, information management with SAP R/3, and intra and inter-company business processes. Examines impact of ERP systems and e-business models on accounting and other business functions, to understand the architecture and functionality of ERP systems in general and of SAP R/3 in particular, to model organisational structures and integrated business processes in order to implement the R/3 system or increase its value for accounting and e-business, and to understand the SAP R/3 FI and CO modules and their integration with logistics processes.	Financial Modules	Financial Modules	
Enterprise Project Systems	This subject aims to give students an understanding of Project Management as part of ERP systems and how the Project Management component enables users to manage the business aspects and content of a project with the components own functions and with integration with other components of these systems. It will also teach students the skills required to define, configure, plan and track different types of projects using the Project Management module of an ERP System.	Project Systems	Project Systems	
Human Resource Information Systems	Develops knowledge of concepts and issues related to the use of HRIS's in Human Resource management with particular reference to and practical workshops in to ERP systems.	Human Capital Management	Human Capital Management	
Planning & Control through ERP Systems	Examines the planning, control and operation of manufacturing and service businesses with particular reference to the use of an ERP System	Production Planning	Production Planning	
Applications Programming Techniques	Extends the knowledge of introductory programming techniques by providing a commercial application environment using SAP's ABAP language. Delivers an induction into the use of the ABAP Development Workbench facilitating the development of client/server business reporting applications.	ABAP, Webdynpro	ABAP, Webdynpro	

Transaction Programming Techniques	Extends the knowledge of applications programming techniques by providing a commercial application environment using SAP's ABAP language. Examines data dictionary maintenance, transaction processing using dialog programming techniques, advanced reporting tools, function modules, BAPIs and object-oriented programming methods.	ABAP	ABAP	
Client Server Technology	Considers client server concepts in relation to ERP systems. Examines the design, implementation and maintenance issues of such technology using SAP R/3 as the model.	ECC, Solution Manager	ECC, Solution Manager	
ERP Systems Administration	This subject aims to give students an advanced treatment of client server theories and models, and enhance their knowledge of systems administration of ERP systems. The subject will examine major ERP system areas including transport systems, database systems and operating systems. Upon completion of this subject, students will have an advanced knowledge of client server models, software support technologies, standards and their application in an ERP systems context. Students are expected to develop advanced skills and knowledge to support and administer an ERP system.	ECC, Solution Manager	ECC, Solution Manager	
Enterprise Applications Integration	This subject aims to provide students with an understanding of information systems integration in regards to standards, infrastructures, data, applications, people and business process issues. The subject provides coverage of EAI methodologies, technologies and solutions and provides students with practical skills in this area. SAP NetWeaver will be used as an EAI example to help understand the integration concepts at practical levels. Technical topics covered in this subject also include Java, XML, SOAP and Web Services..	Netweaver, SAP Exchange Infrastructure	Netweaver, SAP Exchange Infrastructure	IBM Web Sphere
Management Information Technology	A framework for the management of information technology. Management issues may include: the strategic use of information technology; information technology architectures; information systems planning; information technology investments; and security and privacy and outsourcing.			ITIL

The barrier many universities have faced in converting SAP training materials into educational curriculum has been ignored. It has been assumed that the SAP training materials will provide the necessary knowledge to understand the business processes. This will further be exacerbated with the course at a number of universities being marketed to students with undergraduate computing degrees and no requirement for previous work experience. Students may graduate with very specific SAP skills but lack the understanding how these skills are used in a business environment and the business processes they are based on.

Table 4. Master of Software Engineering: SAP ERP Consultant Structure

	Subjects	**Credits**
General Education	• Physics • English • Accounting Basic, • Marketing • Human Resources • Supply Chain Management, • Management • Management Information Systems	20 credits
SAP Training (level 1)	• SAP Product Module Introduction • SAP consultant guidance & method research of implementation • SAP implementation • SAP BASIS & NetWeaver • Financials • Supply Chain Management • Production Planning • Materials Management • Sales and Distribution • Human Resources • Project Systems • Business Solutions and best business practices	12 Credits of optional subjects
SAP Training (level 2)	• Financials • Material Management and Production Planning • Customer Relationship Management • Human Resources	18 Credits of only one selection
Internship	• SAP related employment	5 credits – 3 to 6 months
Thesis	•	5 credits 6 to 12 months

It appears that there is an expectation that eventually university staff will be able to teach the SAP training and therefore reduce the reliance on external consultants and reduce costs. To achieve this level of expertise without continually working in an SAP environment is very difficult. Experience has shown that if an academic staff member can achieve the skill level to offer level 2 SAP training, as per the SAP Consultant course, then there is the temptation to seek employment in industry where the remuneration is far greater than that offered by the university.

There is no doubt that this course will evolve to survive. However an added complication that the education consulting group who assisted in the development of the course has a financial interest in each enrolled student. This may result in developments which are not educational sound in favour of maintaining a revenue stream.

It is unfortunate that when the course was being planned that numerous research on best practices for ERP education was ignored. Even a greater concern for SAP was that the course was developed in contrary to University Alliance Program global policies. SAP will benefit by a large number of graduates becoming familiar with SAP solutions but at what cost. Industry in the end will be the best judge of the value of this type of education.

4. CONCLUSIONS

It is often said that desperate time results in desperate measure. SAP is faced with a dramatic skill shortage throughout the world. This is especially evident in China. This skill shortage results in increased consultant costs and thus increased project costs. This situation was predictable however strategies were slow in being developed. It will be interesting to watch the developments in SAP University based education in China and the successes of the different models. SAP Asia Pacific Japan is in the process of implementing a new strategy based on a ten day training course which will be made available to universities throughout the region. University staff will be subscribing to the program will be provided with training and resources to enable them to teach the SAP training materials. Students on completion of the course will be able to sit SAP certification exams. SAP partners and customers will be encouraged to employ these graduates in entry level positions.

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