

Towards the third-wave of higher enterprise system education: Three Scandinavian cases

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Abstract. With enterprise systems being a natural part of any business environment, they are becoming an integrated part of educational environments. With the systems having the potential to illustrate, visualize and simulate business and decision-making processes to students of both business and IT, they hold vast potential for playing a crucial role in future pedagogic innovation within higher education. Through accounts of previous experiences of enterprise system inclusion, the majority of examples have been single installations of large and highly complex enterprise systems. This has led to a high degree of failure and difficulties for academia to realize many of the potential benefits. This article reports from three cases from Scandinavian higher education, where a wide selection of different mid-market enterprise systems have been applied in the educational environment. These three cases are seen as examples of a third wave of enterprise system inclusion within higher education, relating the findings to what Hawking et al (2004) described as the second wave. This third wave is signified by a strong focus on introducing the systems as vehicles of pedagogic innovation rather than as a means in themselves, and through a focus on less complex systems from a multitude of different vendors.

Introduction

Enterprise systems in the form of standardized, commercial off-the-shelf software have during the last couple of decades been widely adopted by the majority of organizations. Regardless if they come in the form of systems for managing the relation to customers (Customer Relationship Management, CRM), the relation to suppliers (Supplier relationship management, SRM), the supply chain (Supply Chain Management, SCM) or more generally the entire value-chain of an organization (Enterprise Resource Planning, ERP), the systems have

become the infrastructure for business processes (Nicolau & Bhattacharaya, 2008).

With students within business and IT being trained for a future as business professionals, recent regulative developments (for instance the Bologna-process) have highlighted the need for increasing the fit between academic education and requirements from industry. In other words, the employability of the students has become one of the main measures of quality.

Since enterprise systems being process oriented and widely adopted, they hence become a potential actor within any educational environment. They are vehicles of pedagogic innovation, through offering a means to import the business environment in the form of the formalized processes and data of any organization into the educational environment.

This stance towards enterprise systems as part of the educational environment makes it possible to regard the systems themselves (installed together with example data from a real live company or organization) as *visualizations of enterprises*. Through this, we could hypothetically give the students the possibility to, as part of their academic training, actually work in their forthcoming roles with the forthcoming processes that they will be involved in.

In other words, we could give the student the possibility of applying their management accounting theories to real-live cases where they act as controllers in what-ever organization that we choose to use as an example. If we want them to be able to practice their theory in the setting of a large, industrial company, we could for instance mirror Volvo's installation together with all the relevant data and assign the students roles as accountants, controllers or chief financial officers.

Hence, the application of enterprise systems as vehicles of pedagogic innovation in this paper differs from their use as simply means to teach the students a particular product. Instead, we regard the enterprise systems as a means for really making academic education practical, or at least applied.

The purpose of this paper is to present and discuss three cases of enterprise systems inclusion within higher education in Scandinavia.

Previous research and experiences: Use of enterprise systems in IT/IS and business-oriented education

We reviewed previous reports on hands-on enterprise systems education with regard to the elements of *place of educational institute, vendor(s) involved, vendor co-operation mode* (if any), *curriculum modules and target audience, challenges and planning issues* and *lessons learned*. Hands-on education of enterprise systems in university curricula began in the second half of the 1990s (Hayen & Andera, 2005), e.g., in the US and Australia. (Watson & Schneider, 1999, Hawking, McCarthy & Stein, 2004). Among the reported experiences,

such U.S. universities as Louisiana State (Watson & Schneider, 1999), Florida International (Becerra-Fernandez, Murphy & Simon, 2000), Texas at Austin, and Penn State were highly profiled users of ERP systems in education as well as Victoria, Queensland University of Technology and Brisbane in Australia, Unitec in New Zealand, and Münster in Germany (Rosemann, Scott & Watson, 2001, Hawking, Foster & Bassett, 2002).

Watson & Schneider (1999) identified ERP education relevant for business, engineering and computer science schools, and gave an integrated view of potential curriculum modules. Since then, a number of reports which list experiences from hands-on ERP use in education with varying foci have been reported. University of Virginia reported experiences from the Teradata university network (Wixom, 2004), while representatives from Århus mainly reviewed Victoria's experiences from their tradition in ERP education and speculated for the future (Jensen et al., 2005). Technion in Haifa, Israel, had used a simulation tool for educating integrated business systems and processes (Parush, Hamm & Shtub, 2002, Shtub, 2001).

In our review of previous reports of ERP hands-on education, all the earliest reports and panels from the end of 1990s and the beginning of 2000s were based on experiences from the SAP university alliance (Watson & Schneider, 1999, Watson, Rosemann & Stewart 1999, Becerra-Fernandez, Murphy & Simon, 2000, Hawking & McCarthy, 2000, Rosemann, Scott & Watson, 2001, Hawking, Foster & Bassett, 2002, Nelson, 2002, Hawking, McCarthy & Stein, 2004, Jensen et al., 2005). In addition to this majority, we found only reports discussing about a simulation tool, operations trainer (Shtub, 2001, Parush, Hamm & Shtub, 2002), and the Teradata university network for educating data warehousing and business intelligence tools (Wixom, 2004). Theling & Loos mention no specific ERP software as the basis for their speculations of the viewpoints for ERP education.

Whenever implemented, the literature reports high student satisfaction on their hands-on experiences and learning results with ERP and other ES curricula (Rosemann et al., 2001, Hawking et al., 2002, Parush et al., 2002, Nelson, 2003, David et al., 2003, Wixom, 2004, Hayen & Andera, 2005). However, hands-on ERP education may have varying status in relation to particular educational programs. Victoria has its own master in enterprise systems education, targeted for information systems –oriented students, which integrates hands-on use and development issues with technology throughout the whole program (Hawking & McCarthy, 2000, Hawking, McCarthy & Stein, 2004).

In other information systems programs, such as Florida International (Becerra-Fernandez et al. 2000), ERP is used as a part of individual courses, such as an undergraduate business process and data management course and integration of operation management, accounting, and marketing management issues at the graduate level. These courses have focused on business school curricula, sometimes more or less specializations on IS. While ERP has been identified as a

relevant field for computer science programs in the early ideas (Watson & Schneider, 1999), the vendors, especially SAP, have typically adopted the role of in-depth technological education of the particular software and there are less reported examples of hands-on ERP-related computer science educations.

Researchers such as Katz (2001) and Hawkins (2000) are in agreement when it comes to the potential of new information technology to transform higher education, yet they are not specific in whether it will be done solely through enabling new forms of teaching (web-forums et cetera) or through the use of existing technology as a means of staging a virtual business environment. ERP, more particularly, has also been suggested to be taught from the “end-user” (Theling & Loos, 2005) or the “ERP capable business graduate” (Jensen et al., 2005) viewpoint. That is, ERP should be also taught for MBA students in general and in relation to specialized business domains of particular management curricula, such as accounting (David et al., 2003), human resources management, sales, production, procurement or marketing management (e.g., Nelson, 2002). An integrated view on business-processes is often desired also in the business-oriented studies (Cannon et al., 2004).

The literature has identified also a few challenges and lessons learned related to the adoption of hands-on ERP education. As the clear majority of the reports discuss about the SAP university alliance, the experiences need to be seen in light of that background. The SAP university network includes a fee for the universities to join. However, access to the system or software as such has been regarded less as the most important challenge. Rather, the main challenges relate to the subsequent support from the vendor side and the university-related internal challenges.

Firstly, one of the mostly addressed university-side challenge from the start has been the availability of academic faculty resources that would be skilled in ERP (Watson & Schneider, 1999, Hawking et al., 2004). Hands-on ERP education has often been dependent on particular enthusiast persons, which forms also a risk for the continuity in case of changes in personnel ensemble (ibid.). As well, the academia seldom can compete with the market with regard to the incentives provided for the necessary technical administration resources of ERP systems (Becerra-Fernandez et al., 2000). When ERP-training goes beyond a couple of individual courses, e.g. in Victoria’s whole master program, resources for ensuring comprehensive development and updates of curriculum along with technological advancements have shown to be scarce (Hawking et al., 2004).

Another set of challenges has related to the vendor, software product and vendor support –related issues. As e.g. SAP is an infrastructurally demanding system package, the very technical implementation and upkeep is a non-trivial issue (Nelson, 2002). Local sales organization may appear insufficient for some technical issues (Watson & Schneider, 1999). Moreover, the demonstration data has been experienced to be version-dependent causing problems while systems

installations have been updated. Vendor-oriented training material has also been regarded as a “snapshot” view highlighting often particular software functionalities rather than e.g. a holistic view to illustrate integrated business processes required in the academic curricula. (Hawking et al., 2004).

A few solutions and lessons learned from the above issues have been suggested. First of all, maintenance of technical and academic faculty requires incentives from the universities to keep them in-house and motivated to cultivate the curriculum and their expertise (Becerra-Fernandez et al., 2000). Moreover, especially in the training of business processes in particular management domains (Alavi & Gallupe, 2003), wide co-operation within the business school faculty and the ERP faculty is needed for curriculum development (Watson & Schneider, 1999, Becerra-Fernandez et al., 2000). Such co-operation may appear challenging both with regard to resource needs and cultural change required (Alavi & Gallupe, 2003).

In the IS-oriented ERP training, in turn, the wide variety of the issues has led some authors to suggest inter-university co-operation network to develop joint courses and curricula and exchange teaching resources of people who have been specialized in particular areas of ERP training (Rosemann et al., 2001, Hawking et al., 2004). Hawking et al. (2004), as perhaps the most prominent proponents of the SAP alliance, even suggest university networks to develop hosting centres specializing on particular ERP software, such as SAP, to get the most out of it. In addition to the inter-faculty and inter-university dimensions, co-operation with local industry and education is regarded as beneficial and motivating for students in the areas where hands-on experiences could be connected to real-life problem settings of accessible companies (Hawking & McCarthy, 2000).

Results

Case 1: University of Gothenburg, Sweden

Background

In January 2005, the Board of Industrial Partners at the School of Business, Economics and Law made the need for information technology inclusion in the school’s curriculum very explicit. With representatives in the form of Volvo Cars current CEO, Hans-Olof Olsson and executives from SKF, KPMG, Stena and a couple of other strong organizations in the region, a need for a change was apparent. Or, in the words of one of the most active proponents, Kaj Thorén of SKF:

“Enterprise systems are a critical success factor for Swedish industry. Correctly applied they contribute in the creation of value and business

opportunities. Business students need a stable knowledge about IT, it should be part of their basic training.”

In parallel with these developments on the demand-side, faculty at the school had been involved in introducing enterprise systems into the curriculum in a smaller scale. With a couple of courses specifically focused on enterprise systems and accounting information systems, all the necessary contacts with potential vendors together with enterprise systems competence on a faculty level was in place.

After getting the go-ahead from the School's dean and Board of Industrial Partners, the Center for Business solutions (www.handels.gu.se/cfa) was formed in 2005. The annual budget was set to €350.000 with a staff of 3 full time employees. In the inauguration held in November 2005, there were 360 participants from mainly the industry. CEOs of Volvo, SKF and all the sponsoring enterprise systems vendors were all part of the three hour program.

The Centre is organized under the department of business administration as one of the school's six strategic initiatives. The Centre is governed by an advisory board where representatives from both industry (in the form of enterprise system users such as Volvo et cetera) vendors and consultants as well as the school are present acting as a means for securing relevance and additional funding for the activities conducted.

Apart from supporting education and research at the school, the Centre is also active in conducting executive education and organizing conferences regarding business related aspects of IT. In 2007, the Centre also staged an initiative striving for an inter-university alliance where all universities in Sweden could access a joint infrastructure and educational environment (Sante Academy, www.santeacademy.se). The first university to join this alliance was Umeå University and at present a majority of the larger universities are members.

Infrastructure and resources

At present, the infrastructure provided by the Centre runs eight systems ranging from Enterprise Resource Planning Systems (ERP) such as Agresso, Garp, Jeeves, Microsoft Dynamics (Ax and Nav), and Hogia, to Business Intelligence (BI) suites such as Business Objects and Winterheller Professional planner.

The technological backbone of this is individual application servers for each application, with one common database server running MS SQL on a Microsoft Server 2003 installation. Beside this, the environment is totally integrated with the School of Business, Economics and Law's environment using the same Active Directory service and positioned behind the same ISA server that the school uses.

On the presentation level, there are four ways for the students to access the solutions. First, there is the possibility of locally accessing the application servers while on the schools premises. Secondly the students could access the systems via

Remote Desktop, accessing the application servers through a Terminal Server. To further decrease the thresholds for usage, a web-based solution based on the use of an active-X component allowing for embedded access to the Terminal Server directly in the browser. The fourth solution is that of a number of Virtual PCs containing complete, tailorable packages of business solutions that the students download and run directly on their own or the school's computers.

The resources of the Centre have been brought together into a SharePoint site that all students at the school and at the collaborating universities have full access to. This environment also contains all the documentation regarding the different systems (including the vendors own exercises and training material), exercises and cases constructed by the universities involved as well as wiki's and interactive chat-boards for students and teachers.

Scope

The school of business, economics and law at the University of Gothenburg educates roughly 7000 students on a yearly basis. Of these, a majority is within business administration, but the school also houses education within Law, Economic History, Economics, Economic Geography and Statistics.

With the ambition of the initiative being to make IT an integrated part of all courses within business, the focus has shifted from primarily conducting courses on the advanced level, to a more introductory focus. The rationale behind this has been to reach the students as early on in their education as possible, before they have formed an opinion of what a business education would normally contain.

After introducing the inclusion of enterprise systems within initially all of the eight courses on the introductory level, the current level of involvement is 50%. This decline in penetration can be attributed to both a lack of resources in the form of funds for course development and a resistance to change within the courses themselves. In some courses, the direct benefits of applying enterprise systems are also not apparent (such as within Marketing planning, for instance).

On the advanced level, the primary involvement is within accounting, management accounting and logistics, where a number of systems for accounting, financial planning and simulation, fleet management, production planning and route planning are used.

The current level of involvement results in a total of 700 annual students at the school introduced to the use of enterprise systems as a naturally integrated part of their business education. The aggregated amount of time spent actively working with the systems (by the students of the school) is approximately 7100 hours a year.

The students use the systems in exercises ranging from procedural administrative tasks where they are asked to simply go through the motions of for instance hiring or firing an employee or handling a complaint, to more advanced exercises. After initially focusing solely on visualizing and simulating business

processes, the exercises have since 2005 become more and more advanced and now include more elements of analysis.

Experiences and reflections

With the basic idea of the Centre being to introduce elements of IT as naturally integrated parts of the basic training offered at the school, the primary focus was to include exercises into all courses at the introductory level of Business administration. The motive for this was to introduce the students as early on as possible to the use of IT as a naturally integrated part of Business administration.

For this to work, a substantial amount of work would have to be conducted within course development, in creating specifications for the exercises (that the consultants tied to the Centre as partners had agreed to develop) and in streamlining the current content of the different courses with the new possibilities of the business solutions.

Due to a lack of funding for the faculty, this was however not sufficiently managed, and the initial experiences of introducing the use of business solutions into the curriculum of the courses was in many aspects negative. The new elements were seen as existing in parallel with the course and not as a natural element, and the students often expressed a feeling that the relevance of inclusion was not fully established.

On the advanced level, the experiences were the complete opposite with a highly positive attitude from the students and a high sense of relevance reported through the course evaluations. For instance, in a course held in Applied Enterprise Systems for a joint group of 60 students within management accounting or logistics and a course in Business Intelligence, the quantitative evaluation ranked the courses as two of the most popular courses within the school. The main argument for this high score was in particular the sense of industry relevance that was achieved.

In 2007, the Centre for Business Solutions received Microsoft Customer Excellence Award, for outstanding work within Education in Europe, Middle-East and Africa. This was seen as a major recognition of the work conducted within the Centre, and a measure of quality in respect to the infrastructure and solution created through SANTE Academy. Currently, the Centre has also been nominated for the University of Gothenburg Pedagogic Award 2008.

To summarize, the initiative is seen as highly successful, despite the initial difficulties with inclusion on the introductory level. There is a consensus at the school regarding the necessity of introducing enterprise systems as a means for pedagogical innovation, yet the modes of initiating a pull from the demand side has been contingent on funds for course development. The centre is now formalizing the process of inclusion and creating a more formal interface between itself as internal supplier and the professors responsible for the individual courses as representatives for the demand side.

Case 2: Royal Institute of Technology, Sweden

Background

In the second half of the 90's the Royal Institute of Technology (KTH) and IBM cooperated to establish a SAP R/3 training environment for enterprise systems. The training environment was used in a few courses at the department of computer and system sciences. In 2000, a full bachelor programme in "Business Engineering" was established at the department of Applied IT. The aim was to create an applied engineering education for "business architects" with the ability to design competitive business processes by the use of enterprise systems. The curriculum was designed together with representatives from banks and manufacturing companies as well as the Swedish Government (IT-kommissionen) and ERP vendors. The curriculum combined the field of industrial engineering with hands-on training in installing and using ERP packages, mainly Oracle E-business suite. It also included advanced programming skills in Java. In 2003, the National Agency for Higher Education criticized the program (Högskoleverket, 2003). The agency found the program to be too similar to the discipline of informatics and to lack sufficient technical depth. The program underwent substantial changes during 2003 and 2004 to include advanced courses in logistics and supply chain management, increase the number of ERP packages used in the training (MS Dynamics Nav and Ax as well as Compiere) and to establish courses to configure and integrate such software. It also became possible for graduate students to take an applied master in enterprise systems based on the core courses in the curriculum. In 2007, the programme was renewed again. Together with leading vendors and ERP consultants, the departments of computer and systems sciences and applied IT adapted the programme to better fit the requirements of the Bologna-process. The programme is now located at the Department of Computer and System Sciences and the core ERP courses are now used to improve the business process knowledge in the department's other bachelor programmes: Market Communication and IT, Economy and IT as well as Computer and System Sciences. In addition the fundamentals course is offered as distance training, attracting about 100-200 IT professionals each year.

Infrastructure and resources

Today, the infrastructure is virtualized, using both Microsoft virtual PC and VM Ware. The ERP applications are installed on virtual pc's made available over the Internet using Virtuozzo. Each student group has their own virtual pc located on a server hosted by the department. This eliminates the need for maintaining a separate training database since each student group can manage their own company without interfering with other student groups. The servers are dimensioned based on the RAM required by the virtual pc's which ranges from 256 MB up to about 2 GB for the more advanced ERP applications. This solution

has quickly replaced the old solution with three servers dedicated to different ERP installations and a classroom with clients on a separate intranet. Apart from an ERP installation the virtual pc also includes training resources such as user manuals, instructional videos, lecture slides and exercises. In the integration course the students actually integrate between two virtual PC's. The easiest way to integrate is to run both on the same physical computer since the naming of com ports otherwise becomes complex. However, the student's perception of actually communicating information between two separate systems becomes clearer if the virtual pc's run on sperate physical computers.

Scope

KTH offers approximately 40 different engineering programmes on bachelor and master level to 12,000 full-time students. KTH is organized in nine schools where the programme in Business Engineering is located at the School of Information and Communication Technology. Five ERP-centered courses make up the core of the programme. The fundamentals course is also included in the bachelor programmes: Market Communication and IT, Economy and IT as well as Computer and System Sciences.

The overall objective of the core courses is to train the students in business process establishment and development through the application and integration of ERP software. The learning strategy is to gradually present the students to more complex business situations. By doing so, the students need to develop more advanced knowledge and skills in fundamental disciplines like mathematics, economics, logistics and programming.

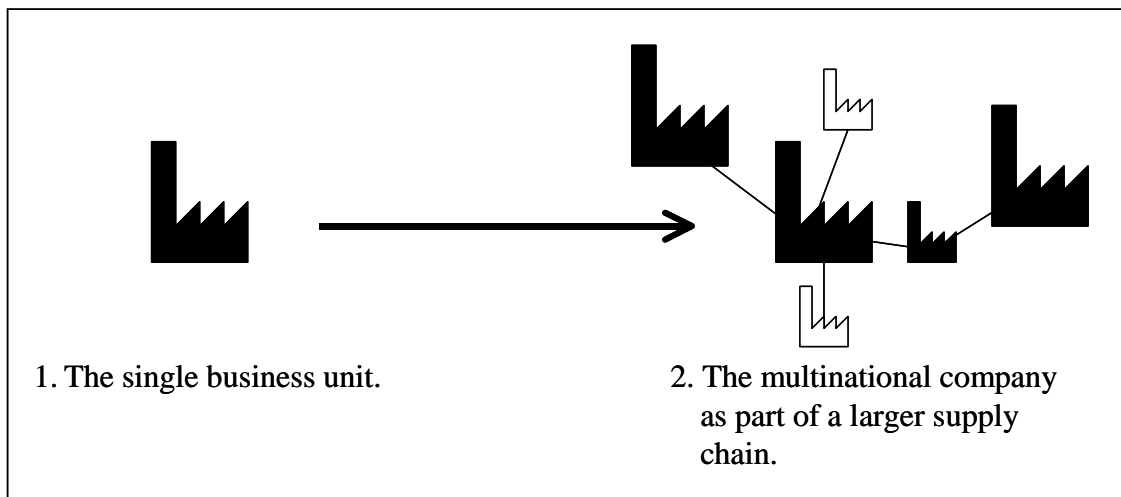


Figure 1. The learning strategy is to gradually present the students to more complex business situations.

These knowledge and skills are applied to business problems, where complexity gradually increases. From the single industrial business unit, to the integrated multinational company, which in turn is part of a larger supply chain.

At the first level the student establishes a company in an ERP package for a single business unit. At this level an ERP package developed for small- and medium sized companies is used. On the advanced level, students are trained in modifying and configuring a comprehensive ERP package for a multinational company as well as integrating several companies in a larger supply chain, where several ERP packages are exchanging business information using an “integration engine”. Finally students perform an ERP project at a company. Groups of 4 to 6 students are engaged in real assignments such as selection, implementation or integration of enterprise systems. Some student groups even attempt to develop new ERP packages.

Enterprise Systems - Selection and Use

The purpose of the course is to build general knowledge about enterprise systems and ERP packages. The students learn to apply methods for mapping processes and specifying selection requirements. They investigate, through exercises, how the business transactions along the order fulfillment process are realized in an ERP package. The final exercise is to set up a new company and to carry out simple design modifications. The course gives 7,5 ECTS credits and corresponds to five full-time weeks. Currently the course is undergoing changes to better reflect the development in the areas of service oriented architecture and software as a service.

Enterprise Systems - Configuration and Modification

The purpose is to build advanced knowledge about a more comprehensive application of ERP packages. The students carry out a full implementation based on a requirements specification, performs test and set up critical processes like supply chain management and materials requirements planning. The course gives 7,5 ECTS credits and corresponds to five full-time weeks.

Enterprise Application Integration with ERP Systems

The purpose is to build knowledge about how companies can integrate processes over company borders involving several different ERP packages. The students configure and modify ERP packages as well as “integration engines” to execute critical processes such as e-business and purchase order-to-invoice. The course gives 7,5 ECTS credits and corresponds to five full-time weeks.

Enterprise Systems, Project

Groups of 4-6 students perform real ERP projects in companies which usually cover selection, set-up, and implementation of ERP packages. One example is the company “Mercatus”, a small manufacturing company that engaged a student group to select and prototype an appropriate enterprise system. The students worked over nine months for the company covering many aspects of selection,

configuration, testing, training and operation of enterprise systems. The project included the selection phase but continued as degree projects (see below) during set-up and time-limited employments during the implementation and training phases. After a while, the students became the real super users at Mercatus and represented the company in many discussions with third parties.

Other projects become more technically oriented and include programming and test of integrations between enterprise systems. Some students even try to develop niche enterprise systems for industries not yet covered by the common ERP suppliers in the market. One example is “Lumbago”, an enterprise system developed for chiropractor clinics. It includes a graphical representation of the human spine, which makes it possible for the chiropractor to document and communicate treatment. The application also included support for the core processes of the clinic such as customer files, reservation and billing. The application was later packaged made available to the market. The course gives 9 ECTS credits and corresponds to six full-time weeks.

Degree Project in Enterprise Systems

The students finalize their bachelor studies with a degree project. This project is often a direct sequel to the ERP project described above. However, the degree projects are performed in pairs and tend to become more specialized than the ERP projects where the students work in larger teams. The degree project corresponds to 15 ECTS credits. The topics range from selection, implementation and integration to investigations on management issues such as adoption, benefits and methods.

Experiences and reflections

Since the start in 2000, the programme has graduated approximately 250 bachelor students in six classes and 10 master students. Two formal evaluations of the programme has been carried out. In addition, the dean of studies has performed one survey of graduated students in 2006 as well as several ad-hoc interviews with former students and major employers, such as Accenture, System and Connecta. Based on the above several interesting observations are made:

First, the business process view in combination with the use of ERP systems in the education support students in understanding financial accounting and business control. By executing the core processes of a demonstration company the students learn the important transactions, informational as well as financial, that take place along the workflows. By monitoring changes in the table of accounts the students also learn how these transactions build up the financial statements. The students develop an understanding of the different processes and functions of a company and how IT can be used to improve these. This in turn helps the students to understand how a company can be managed and what data can be used in

controlling the company. Concepts like the balanced scorecard (Kaplan and Norton, 2004) are put in an applied context.

Second, it is clear that the initial vision for employment referred to as “business architect” has been successful. The knowledge built through the use of and development with ERP systems seems to be more profound than sheer application knowledge. One graduated student who now works as a business consultant described this as a good understanding of how she can design a business processes and what solutions that are available and feasible to implement. Employers have also found that students easily transform from the ERP packages used in training to other packages such as SAP.

Third, student recruiting is difficult. High school students do not understand what ERP systems are and what kind of careers that are associated with them. The programme competes with hundreds of IT related educations and the concept of enterprise systems seem to be hard for a high school student to grasp compared to for example computer game development. Bachelor programmes and the bologna process is not fully established in Sweden yet and in addition, KTH is not promoting bachelor programmes in favor of the traditional five-year programmes in civil engineering.

Case 3: University of Agder, Norway

Background

In 2005 people at the Department of Information Systems came aware of the Centre for Business Solutions at the University of Gothenburg and their work. UoA, Dept. of IS, started a dialogue with the Centre for Business Systems to build up a similar centre in Agder. It was recognized that neither the programs in economics and in information systems had labs with enterprise systems. Furthermore, contacts with local industry indicated that such hands-on experience would be highly desirable qualities among graduates.

During 2005 the initiators developed plans and built support among faculty and commitment from the Dean of the Faculty of economics and Social sciences. Subsequently an application for partial funding was submitted to a competence fund (Sørlandets Kompetansefond). It eventually decided to fund approximately half of the annual budget of €250,000, for three years, starting in 2007. The rest was to be covered by the Faculty. The inauguration was in November 2007, with participants from a small number of companies. The centre was named Centre for Enterprise Systems (Senter for Forretningssystemer). In Agder, companies are typically SMEs, which gives its own flavour to the useful selection of potential systems which make sense in the regional business context.

Infrastructure and resources

The presently centre runs Microsoft Dynamics Ax and provides the ARIS modeling tool. Microsoft Dynamics Nav, Visma Global and Business Objects will be installed during the spring 2008. Microsoft provides educational licenses for all Dynamics products free of charge. New systems will be considered continuously. It was also decided to buy an extra VM-Ware server to run the applications, for which software was sponsored by the server vendor (Ementor). In addition, the centre has used an open-source software for teaching content management (eZ) and it has joined the Teradata University Network utilizing free-of-charge resources for teaching hands-on business intelligence and data warehousing.

The centre consists of several of the faculty on part time and two of the IT-staff at part time. In addition, two people from the Centre for Business Systems at the University of Gothenburg were hired in on part time in 2007. One CFO of a local company was hired in 20% position.

Scope

The Faculty of economics and Social sciences has more than 2000 students, whereof the majority is in Business Administration. The Faculty also gives education in Information Systems, Management, Development Management, Political Science and Social Science.

The *raison d'être* for centre, and the primary sales argument, was that hands-on experience with enterprise systems are highly appreciated by employers of graduates. Thus, the primary focus of the first course modules has been courses in Business Administration. Here, ERP systems should naturally come into different business courses to illustrate how the theoretical ideas take shape in the systems. For example, how CRM is used in marketing, business intelligence in decision-making and managerial coordination, ERP in accounting etc.

In addition it was decided that there should be a parallel development for courses in Information Systems. This would greatly improve internalizing and spreading knowledge of the chosen enterprise systems, such as installation and configuration. Microsoft AX was used in two graduate courses in Enterprise Systems, one mandatory and one elective, at the master's level. The elective has focused on ERP systems and the system was used to illustrate the integrated business processes in AX, the administration module of AX, and finally the possibilities to tailor AX through its concept of the "application object tree". Future plans for IS students involve giving more in-depth insight into the tailoring possibilities and skills needed and better overview of system integration issues. The mandatory, introductory, course of enterprise systems includes brief examples of how and why to use different enterprise systems. Here, AX is used to illustrate the concept of a holistic order-production-delivery business process. In addition, the introductory course includes labs on an enterprise content

management software (eZ Publish) and data warehousing/business intelligence (Teradata university network). The business partner, Hennig-Olsen, has provided real-life cases for IS student groups to discuss about their infrastructure and further development for ERP. Faculty members and students have also considered open-source alternatives as potential future prospects of interest. In addition to the graduate courses, the center has supported implementation of an undergraduate course named “practical e-business for entrepreneurs”. Here, the goal is to provide a lab environment and application support for mixed groups of entrepreneurs and IS students, who want to implement a prototype system for a new e-business-related business idea. In this case, needs for installing and testing applications cannot be fully predicted beforehand.

A number of course modules will be developed and run to gain and internalize experience. This will be the basis for a gradual development of yet new modules. In the next phase, beyond 2009, the centre will evaluate the feasibility of offering course modules to other faculties at the University. The most immediate venue would probably be the Faculty of Health and Sport.

In addition, an important objective is to create a competence arena for local enterprises. The centre would assess experiences with installed systems, and hopefully eventually be a valued competence source. The centre has started a dialogue with a few local enterprises, and plans to involve a broader range of enterprises eventually.

Experiences and reflections

A few challenges surfaced during the process. Firstly, it takes time and effort to sell the concept to the teaching staff of varying branches of business administration, and particularly to get access to some of the business courses. This meant that we needed to postpone several course modules for one year, as the organizational friction hindered joint development of business administration course modules. Eventually, we have managed to achieve a fairly good buy-in to the concept from the faculty.

Second, we experienced that developing course modules and lab exercises together with the business faculty is a very complex and difficult task. Especially, since it requires access to good demonstration data, and that the applications runs as planned. Both turned out to be difficult in practice, leading to little or no lab classes in the Business Administration courses in 2007/2008. Even though most systems providers provided the systems free of charge, getting access to support was very limited, leaving the staff to waste much time in finding out things on their own.

In the IS-courses, the lab sessions worked quite well, especially with the Microsoft-related materials as well as the materials provided in the Web by the content management software vendor (eZ) and Teradata university network. A key issue here is that a few vendors, especially Teradata and its university

partners in the field of data warehousing and business intelligence, have begun to develop more holistic demonstration materials in the facilitated academic network. However, also in our ERP case the demonstration data with AX Dynamics was version-dependent and we thus needed to use an older version of the software to get the demonstration data into use. For demonstrating the integrated process ideas, we needed to install local-PC-based demonstration versions with demodata in the lab, whereas we needed a server installation to demonstrate the manipulation of the application object tree and tailoring of the data structures. However, the local installations could be easily done by the students themselves, taking about 5-10 minutes. The lecturer needed still to go through the inconsistencies between the laboratory exercise documentation and the version-in-use, as e.g. some navigation menus differed from the documented version. As an anecdote, it took 2 days from the lecturer to realize that the demo version required a set-back of the computer's clock, after which the demodata began to work. The demo was fully jammed without that "trick".

A student group which was competent with another ERP software from their previous work experience, delved into installation of an open-source ERP system named Compiere. This issue demonstrated clearly challenges related of mixed open-source and proprietary software ensembles – the installation did not work out in the end of the day, and documentation and community responsiveness did not solve the problems. (Hecker & Sender, 2007) If open-source software is to be used, it would require clearly a centralized effort in a dedicated network of faculties and universities sharing the competence to become feasible – as the educational materials would still to be created.

Third, the coordination with the IT-service of the University could have been smoother. Getting the right permissions and installing a new server took very long time, delaying the installation of several systems considerably. The internal IT-staff did also have to balance the needs of the centre with other, and usually more urgent, tasks. One of the assigned IT-staff did also leave. Having experienced and devoted IT-personnel is a crucial asset. Hiring such personnel with experience in installing, configuring and supporting enterprise systems would be very difficult.

Fourth, the centre was assigned a doctorate position. In two rounds of announcements there were no qualified applicants. The position is currently being announced again.

Summarization of results

| | CASE 1: Gothenburg | CASE 2: Stockholm | CASE3: Agder |
|-------------------|--|--|---|
| Background | Industry demand Centre foundation 2005 Open for other | IBM cooperation on SAP R/3 Bachelor in Business | Industry demand Centre foundation 2007 Benchmarking from |

| | | | |
|-----------------------|---|---|--|
| | universities 2007 (SANTE Academy) | Engineering | Gothenburg, need for IS students as well |
| Infrastructure | Centre, 8 enterprise systems, Virtual PC, Terminal Server and Sharepoint access (SANTE Academy), full access to Gartner | Program, 4 enterprise systems, Virtual PC and VM-ware, Virtuozzo. | Centre, 2 enterprise systems, utilization of Web-resources, VM-ware for dynamic installations |
| Scope | Business Administration, Human Resource Management, Logistics | Programme in Business Engineering | Business Administration, Information Systems |
| Experience | Strong support from industry High employability Awards and media coverage Initial resistance from faculty | Successful programme. Student recruitment is difficult | Strong support from industry Cultural and organizational hindrances, resistance to teach MBA students, Technical support challenge “Takes time to start” Choose the lightest, even vendor-implemented web-, applications with best demonstration data to illustrate the principles – no need for heavy software infrastructures for teaching use. |

Discussion

As the competition sharpens, many vendors have become more aware of the need to provide their software and educational partnerships for universities. Here, the key issue from the faculty viewpoint is availability of demonstration data connected to business cases, which illustrate the concepts to be taught. For demonstrating plain use of the systems for managerial courses and IS introductory

courses, one light server installation of ERP would be good enough, while there may be no obstacles to share such installations even in a university network. Such examples as AX dynamics, where a demo version can be installed in 5-10 minutes to illustrate an integrated business process, perhaps contradict to the previously visioned needs to specialize in SAP and to build heavy infrastructural, vendor-dependent networks on such applications. Moreover, vendor-initiated demonstration environments with university co-operation for curricula development, such as the Teradata University Network, greatly diminish the threshold to teach the basics of system use.

Needs for the technical ES infrastructure seem to be two-fold in the long run. Firstly, a robust “business-oriented” server installation may be needed for ERP and ES modules which are used by business students and in the introductory IS courses. As the use of existing data, and update of the data are the only operations needed, 1-2 system installations would do the trick for all users for such purposes taken that demodata is available. This would cover the needs for “ERP capable business graduate” and perhaps even “CIO” –type (Jensen et al., 2005) of educations. Of course, this line of education also makes it possible to share such “use environments” of ERP and ES over the Web. We thus predict that this type of solutions are to be delivered in university networks after some time.

However, for more technological curricula, targeted for engineering, computer science, and “ERP directors” and “superusers” in general, the administration and tailoring of ES systems themselves requires more advanced infrastructures. Here, a key issue is to build a flexible server structure and the technical capability to take new systems into test. We predict that such infrastructure is less easy to be shared across geographical university locations. This may lead to the situation where technically oriented IS programs and schools would become natural partners also to host the business-oriented academic installations, in addition to developing their own IS/IT programs.

The greatest obstacles, however, seem to be the faculty awareness of available and useful applications, especially in the business administration programs, while the IS specialists lack the insight into the managerial disciplines. The broad collaboration is required, but it may still meet the cultural challenges and change resistance issues – or even structural challenges of how to organize and reward the lecturers for their teaching efforts.

Industry partners are extremely useful to demonstrate a real ERP-in-use and to give insight into contemporary ERP-related challenges and decision situations, which IS and MBA students will meet.

We conclude that wide collaboration will surely be needed to cultivate hands-on teaching of enterprise systems for both business and IS students. Such collaboration need to be three-fold:

- Collaboration between IS/IT faculties, university IT units, and faculty members responsible for particular business area courses.

- Collaboration between universities specializing in varying niches of curriculum and developing hands-on exercises for those with accessible tools.
- Regional collaboration between industry and academia to get insight into contemporary practical issues of ERP use, maintenance, and further development.

Deviating from the previous predictions which highlight wide-scale, heavily ERP-vendor-oriented, and multi-university alliances around particular technologies, such as the SAP university alliance (Hawking et al., 2004), we predict that a few vendors will begin to offer more light-weight demonstration environments for academic use for free. Such versions would be quick to install, or even hosted by the vendors themselves (such as the Teradata University Network). Technical faculties may have an incentive to lead the increasing use of enterprise open-source tools for teaching. Hence, the key issue would really be the curriculum development for the part of the universities, instead of getting a lock-in situation to one vendor, let alone using many resources to run vast infrastructures. If Hawking et al. (2004) visions of the SAP university network was “the second wave”, perhaps a third wave is already in its way (taken that the organizational and cultural challenges, which still remain, would be overcome)?

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