Teaching Business Processes Integration with ERP In Enterprise Architecture/Systems Courses

Ming Wang

***Abstract*—Information Systems (IS) education is being transformed from the development of applications towards implementation and configuration of the integrated enterprise-wide system software - Enterprise Resource Planning (ERP). Teaching *business* processes integration has become an important issue in IS education. To meet the challenge, the author presents a comprehensive approach to teach business processes integration with ERP. The paper emphasizes on teaching business processes integration with ERP as the whole process in the Enterprise Architecture and Enterprise Systems courses. SAP ERP is utilized as an ERP software tool for illustration purpose.**

***Index Terms*—Business processes, enterprise resource planning, ERP, IS curriculum, SAP.**

I. Introduction

The wide spread of Enterprise Resource Planning (ERP) technology has made information systems (IS) education shift its focus from applications development to business processes integration. In order to catch the industrial trend, IS educators have made significant changes on IS cores and elective courses in the Information Systems (IS) 2010 Curriculum Guidelines [1]. The Application Development course is no longer included in the core of the IS 2010 Curriculum. Instead, the Enterprise Architecture course has become as a new core and the Enterprise Systems course is recommended as an elective course. To meet the challenge, the author proposes a comprehensive approach of teaching the Enterprise Architecture course and Enterprise Systems course with emphasis on business processes integration based on her years of ERP research and teaching experiences. The paper specifies the course topics, objectives and corresponding ERP hands-on activities and also presents a framework which can be used by students to learn business processes integration. The paper is intended to serve as useful teaching resources for those information systems (IS) educators who are interested in teaching business processes integration using ERP in the two courses. The remaining paper is organized into five sections: 1) ERP Business Processes Integration, 2) ERP Data Integration, 3) Enterprise Architecture Course, 4) Enterprise System Course, and 5) Conclusion.

II. Business Processes Integration

An ERP system is large and complex and learning curve is steep. Unlike other computer applications, ERP includes the multidisciplinary scope of enterprise system concepts that requires internal cross-disciplinary coordination. To understand them, students must acquire the concept of business processes integration which is the theme in both operational and analytical systems of ERP.

Business process is a list of related activities to produce an outcome. Business processes integration means multiple business processes are inter-related to each other. Fig. 1 illustrates the inter-relationship of the integrated business processes in ERP.

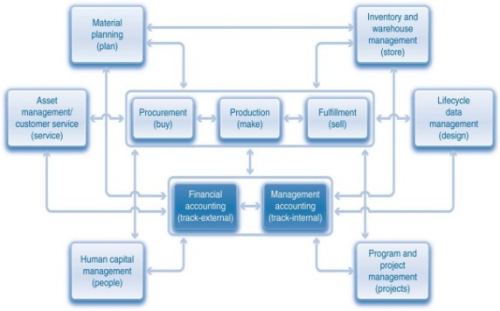

Fig. 1. Business processes integration [2]

III. ERP Data Integration

ERP has the centralized data repository that integrates all the business processes in the enterprise. This section specifies how the organization data shared across different business processes in the enterprise system. Fig. 2 shows how master data occur in major business processes in the value chain.

	Customer data	Vendor data	Material data
Materials Management		x	x
Production Planning	x	x	x
Warehouse Management	x	x	x
Sales & Distribution	x		x

Fig. 2. Master data shared in business processes

Four types of data in the ERP system are organizational data, master data, situational data and transaction data.

- Organizational data are used to represent the structure of an enterprise include client, company, plant and business area data.
- Master data represent entities associated with the business processes such as buying materials from vendors and selling materials to customers. Master data are referenced more frequently than others across ERP systems in both operational systems and analytical systems.

Manuscript received July 22, 2012; revised September 2, 2012.

Ming Wang is with the Department of Information Systems, California State University, Los Angeles (e-mail: ming.wang@calstatela.edu).

- Situational data are specific to where and when the task being executed.
- Transaction data are combination of organizational data, master data and situational data. Transaction data reflect the consequences of process execution. Transaction data include dates, quantities, prices payment and delivery terms.

Fig. 3 shows the relationship between transaction data, organizational data, master data and situational data as well as transaction documents and post transaction documents.

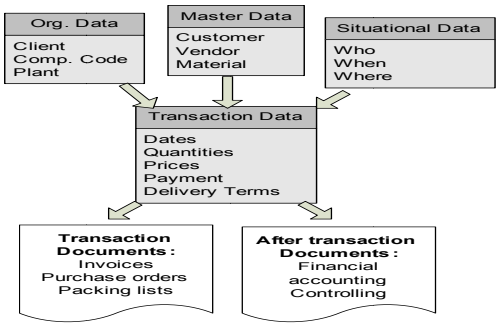

Fig. 3. ERP data integration [2].

Transaction documents record transaction data during the transaction as the process is being executed. Transaction documents are purchase orders for vendors, packing lists for shipping and invoices. Post transaction documents record data after the process is finished. Post transaction documents include financial account (FI) document, controlling (CO) document and material documents. FI and CO documents record the financial impact of process steps. Account receivable documents are created after the company receives the payment from the customer. Materials documents record material movement from a vendor to a customer.

IV. Enterprise Architecture

The Enterprise Architecture course focuses on concepts at a higher level of IT Infrastructure abstraction [1]. This Enterprise Architecture course explores the design, selection, implementation and management of enterprise architecture. ERP software can help students visualize the enterprise infrastructure, organizational structure and understand the business processes integration of enterprise systems with inter-organizational partners such as suppliers and customers. This section specifies how to teach business processes integration in the Enterprise Architecture course. Fig. 4 illustrates topics, objectives and activities of the enterprise architecture course.

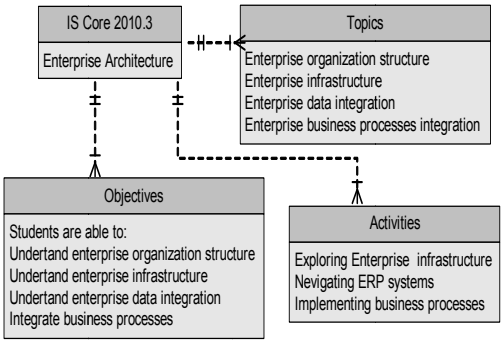

Fig. 4. Enterprise architecture course

A. Organization Structure

The organizational diagram represents the organizational structure implemented within the ERP System. The organizational elements are the same whether the ERP System is being implemented for manufacturing or service related industry. The enterprise structure can be represented by an organizational diagram in Fig. 5, which is a model of the relationships among various ERP system organizational elements.

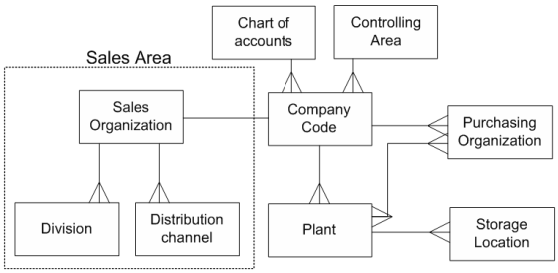

Fig. 5. Organization diagram.

B. Infrastructure and Components

Infrastructure consists of application modules that are accomplished via a very comprehensive set of business process procedures (BPPs). Major business processes are composed of application modules. The application modules in Figure 6 are organized into the following four categories.

- The financial management application modules include Financial Accounting (FI), Controlling (CO), Fixed Asset Management (AM) and Project System (PS).
- The logistic modules include Sales & Distribution (SD), Material Management (MM), Production Planning (PP), Quality Management (QM) and Plant Maintenance (PM).
- The Human Resources (HR) module supports human capital management (HCM), payroll and the planning and control of personnel activities.
- Workflow (WF) and Industry Solutions (IS) are known as the Common Systems. The remaining modules are known as primary application modules, and WF integrates the functionality of these application modules.

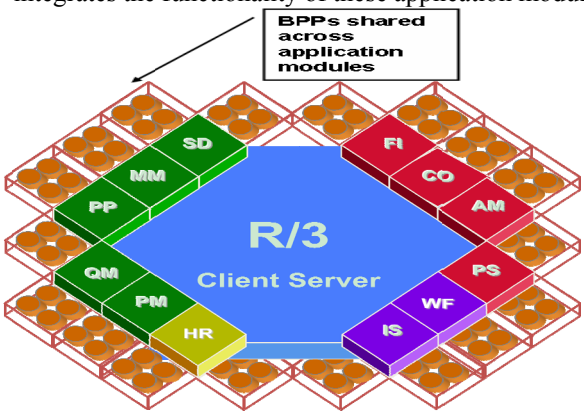

Fig. 6. BPPs Shared across application modules [3].

Each application module is a collection of a number of related business process procedures (BPPs), as illustrated in Fig. 6. BPPs are the smallest program units that provide the functionality of the ERP System. Many of these BPPs are used by more than one of the application modules. Business processes found in the organization are built with these application modules and BPPs.

Each core business process consists of business application modules. Enterprise software integrates the core business processes found in an organization. The following business processes can be used to illustrate the arrangements of the supply chain management processes.

- Manufacturing Planning and Execution.
- Procurement (purchasing).
- Financial/management accounting and reporting
- Customer Sales Order Management (sales)

R/3 Application Module \ Business Process	Manufacturing	Customer Order Management	Procurement	Financial Management
Sales & Distribution (SD)	X	X		
Materials Mgmt. (MM)	X	X	X	
Production Planning (PP)	X	X	X	
Quality Management (QM)	X			
Plant Maintenance (PM)			X	
Human Resources (HR)	X			
Financial Accounting (FI)	X	X	X	X
Controlling (CO)	X	X	X	X
Fixed Asset Mgmt. (AM)				X

Fig. 7. Application modules and business processes [3]

Fig. 7 shows FI and CO application modules occurred in all the listed business processes.

C. *ERPSIM Simulation Games*

The ERPSIM simulation game [4] provides the environment for students to experience an integrated enterprise system. Students are divided to teams. Each team operates a make-to-stock manufacturing plant that interacts with the suppliers and customers by sending and receiving orders, delivering their products and completing the whole cash-to-cash cycle. Students get the opportunity to make strategic decisions for recipe (product design), sale forecasts, production improvements, production release.

At the end of the game, raw materials and finished goods inventory will be sold out at a reduced price. Team members may renegotiate their bank loan with the bank at the end of each quarter. Interest is calculated quarterly and will be charged automatically at the end of a quarter. Customers do not change throughout the game, hence you may learn from past their behaviour. The company (team) displaying the highest equity value (shareholder capital) at the end of the simulation wins the game.

As a make-to-stock manufacturing company, there are four of processes that must be performed (i) the planning process, (ii) the procurement process, (iii) the production process, and (iv) the sales process. Each process can be decomposed into transactions. To complete the four operational processes mentioned above, a total of fourteen transactions must be performed. Most of the transactions involved in these processes are operational in nature, such as to purchase materials or to deliver finished products.

V. Enterprise Systems

The Enterprise Systems course is recommended by IS 2012 Curriculum Guidelines [1] as an elective course for teaching technical ERP implementation and configuration. This section describes how to teach business processes integration in ERP re-engineering and configuration. The focus is to teach students to transforms ERP business procedures to organization wide requirements. Based on the given business requirements, students will reengineer business processes and configure a simple and workable integrated enterprise operational system. Students will create an enterprise structure, financial system and relevant master data using ERP that demonstrates the integration of information from several modules, such as accounts receivable, sales, manufacturing production, procurement, account payable, and general ledger. Fig. 8 illustrates course topics, objectives and class activities of the Enterprise Systems course.

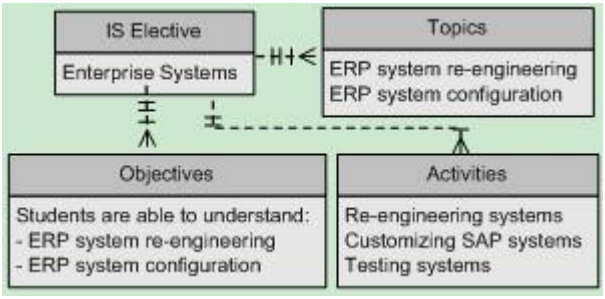

Fig. 8. Enterprise systems.

A. *Business Process Reengineering (BPR)*

Business Process Reengineering (BPR) is the analysis and design of workflows and processes within an organization. Re-engineering is the basis for many recent developments in management. The cross-functional team, for example, has become popular because of the desire to re-engineer separate functional tasks into complete cross-functional processes. Also, many recent management information systems developments aim to integrate a wide number of business processes. Business Process Reengineering transforms organization operations to entirely new and more effective business processes. BPR is usually utilized in the Blueprint Phase of ERP Implementation Methodology. BPR is also known as Business Process Redesign or Business Transformation.

There are numerous BPR approaches and they each differ according to the magnitude of the change and the change effort involved. Selecting the right model to teach BPR is thus a difficult task. We adopted the model developed by Guha et.al. [5] in the course. This BPR model consists of six phases: 1) Envision new processes, 2) Initiating change, 3) process diagnosis, 4) process redesign, 5) reconstruction, and 6) process monitoring.

B. *ERP Implementation Methodology*

Accelerated SAP (ASAP) is a System Development Life Cycle (SDLC) methodology that has been created to guide the rapid implementation of the ERP Enterprise System. The Solution Manager is the SAP platform that delivers the ASAP methodology. It is a computer systems analysis and design methodology and tools provided by SAP AG. This methodology seeks to standardize and expedite the typical ERP implementation. It has proven to be effective when implementing the SAP ERP solution across industries and different customer environments. In practice, ASAP makes it easier to assign consulting tasks among different projects effectively and to provide an increased level of consistency.

Fig. 9 illustrates the SAP Implementation Methodology Road Map [3].

Fig. 9. SAP implementation methodology phases.

- Project Preparation defines the project's scope and organizes the team, the vendors and hardware.
- Business Blueprint defines the business process requirements and discusses configuration and data migration.
- Realization configures the system, writes middleware interfaces and develops ABAP code.
- Final Preparation includes testing and training.
- Go Live begins using the system.

C. SAP Configuration

ASAP Roadmap and Solution Manager drive ERP configuration. The completed reference model is known as the Enterprise Model when the configuration activities have matched the business requirements to the processing available in the Reference Structure.

The Implementation Guide (IMG) is a SAP system tool for actually making the settings that configure the R/3 System to meet a company's requirements. The SAP IMG is an integral part of the R/3 System that is used in the configuration of the R/3 System. About 80 percent of a typical SAP system installation is handled by the IMG configuration setting. Another 10 percent are enhancement of ABAP tools and appended structure, while 10 percent are customer developed via ABAP tools.

A Project IMG is a subset of the Reference IMG that contains the documentation for selected IMG components that are implemented as part of the specific configuration project. The Project IMG facilitates the establishment of the organization arrangement during a company's configuration by using SAP IMG [6].

VI. Summary

The proposed ERP business processes integration (BPI) learning framework shown in Figure 10 summarizes the important BPI components students supposed to learn from the Enterprise architecture and enterprise Systems courses. It is a good tool to use for teaching business processes integration with ERP in Enterprise Architecture/Systems Courses. Filling out the form can be the benchmark to measure whether students have grasped the six major business processes in the ERP operational system. Students need to this framework in their mind through both courses.

ERP systems, by their multi-dimensional integrative nature, offer the depth of functionality and breadth of integration to demonstrate how global operations of organizations are managed. The learning curve is steep. The contribution of the paper is to provide IS educators a comprehensive approach and a new BPI learning framework for teaching business processes integration with ERP in the Enterprise architecture and Enterprise systems courses recommended in IS 2010 curriculum. The goal is to teach students to understand business-centric information system and be able to implement and configure business processes.

	FI	MM	SD	PP	IWM	MP
Organization level data						
Master data						
Process triggers						
Steps in process						
Process outcomes						
Financial impacts						
Material impacts						

Fig. 10. BPI learning framework.

The paper intentionally does not specify any ERP software in most context of the paper. Institutions have to make the decision of whether and how to provide students with hands-on use experience with actual ERP software such SAP, JD Edwards, Oracle, PeopleSoft, SSA Global and Microsoft Dynamics (Axapta, Great Plains and Solomon) etc. Enterprise system software is in place in a majority of large organizations and increasing in use in small and medium-sized organizations.

Acknowledgements

The author would like to thank Professor Hayen, Magal, Monk, Wagner and Word for their SAP ERP textbooks. We are also grateful to the SAP University Alliance Program for providing us SAP software, server hosting and high quality SAP laboratory materials.

References

[1] H. Topi, J. Valacich, S. Wright, and T. Ryan, IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems, Association for Computing Machinery (ACM) and Association for Information Systems (AIS). Retrieved from the web site. [Online]. Available: http://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf

[2] S. Magal and J. Word, *Integrated Processes with ERP Systems,* Wiley, 2011.

[3] R. Hayen, SAP R/3 Enterprise Software: an Introduction, McGraw-Hill, 2007.

[4] ERPsim 2012 Web Site. [Online]. Available: http://erpsim.hec.ca/

[5] S. Guha, W. J. Kettinger, and T. C. Teng, "Business process reengineering: building a comprehensive methodology," *Information Systems Management*, Summer, 1993.

[6] D. Monk and B. Wagner, "Concepts in enterprise resource planning," *4th Edition, Course Technology*, 2013.

Dr. Ming Wang is a professor of Information Systems, California State University, Los Angeles. She is SAP faculty Coordinator, At Cal State LA. She received her Ph. D. from Southern Illinois University in 1993 and taught previously in the Department of Computer Science at Embry-Riddle Aeronautical University, in Daytona Beach, Florida.