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Investigating Enterprise Systems and SAP: A Case Study

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Abstract

This case is designed for use in a course that employs SAP at the introductory level. It contributes to the literature by providing an exercise which introduces students to the complex subject of enterprise systems without requiring them to have extensive prerequisite knowledge. This case is a good first step in helping students gain a general understanding of the benefits, costs and risks of enterprise systems and SAP. The purpose of this case is to present students with a set of open-ended questions for which they perform literature research and hands-on analysis with SAP to answer the case questions. While answering these questions, students utilize the lower-order and higher-order thinking skills in Bloom's taxonomy of educational objectives. To provide hands-on experience, the case is used in conjunction with the Pen Company SAP client developed by The Rushmore Group. A SAP configuration supporting the Pen Company is available to members of the SAP University Alliance as part of the University Alliance Curriculum Exchange. The case has been successfully used in an undergraduate Accounting Information Systems course, an undergraduate Management Information Systems course, and a graduate course entitled Integrated Business Systems.

1. Case Introduction and Background

James Youngblood just graduated from college with a degree in business and accepted a position at a large international consulting firm named Enterprise Systems Incorporated (ESI). This was his first assignment out of the Rochester office and he was feeling apprehensive about taking on a consulting job with no direct supervision. As he and the project team drove along the winding roads of the Finger Lakes region of New York State, James reflected on the dramatic changes that had recently occurred in his life. The transition from college student to professional consultant was rapid, and his new job was both challenging and stressful. In a short period of time he was expected to help his clients install a comprehensive enterprise system and become more productive and profitable.

One of ESI's privately owned clients asked the firm to brief them on enterprise systems in general and on SAP specifically. The client, Quality Pen, manufactures high end pens and wholesales them to retail outlets in the USA and several foreign markets. In addition, it sells the pens directly to individuals and organizations over the Internet at retail prices.

Tom Clickright was the third-generation sole proprietor of the 75 year old family company. He believed the production process was not as efficient as it could be since it has not been changed since his father's tenure as CEO of the company. James's task was to advise Tom Clickright on how an enterprise system could increase the efficiency of his company. As Tom gazed out at the factory floor with a worried look on his face he lamented: "In my father's day as head of the company we didn't worry much about efficiency. We were craftsmen not accountants. But that was before international producers increased competition and pricing pressure. We need to decrease our costs and speed up our production time to stay competitive. However, these changes cannot be implemented at the expense of reducing the quality that our customers expect. The company must maintain its traditional reputation as a purveyor of old-world craftsmanship!"

Quality Pen has one manufacturing location in the Finger Lakes region of upstate New York and buys components internationally. Its sales are approximately $250 million

with a net income of $50 million. It owns $500 million in assets, owes $300 million in liabilities, and employs 2,000 employees. It sells approximately 10 million units of finished goods per year. Below is a list that displays the standard business processes identified by the management of Quality Pen. Please review the business processes and their related functions:

- Revenue Process - Sales (order entry and accounts receivable), Cash Collection (billing, cash receipts and sales taxes).

- Expenditure Process - Acquisitions (purchase and accounts payable for all current assets including inventory), Payments (record bills and cash disbursements).

- Finance and Investment Process – Asset Acquisition (for all non-current assets), Depreciation, Disposition (gains and losses), Financing (borrow, payback and distributions to owners).

- Human Resource Management Process - Hiring, Compensation (payroll, benefits & payroll taxes) and Termination.

- Inventory Management Process – Receive Raw Materials Inventory, Ship Finished Goods Inventory, Store Finished Goods Inventory, Store Raw Materials Inventory.

- Production and Conversion Process - Manufacturing, Work in Process (includes tracking direct materials, direct labor, and manufacturing overhead).

- Reporting Process - Reconcile Accounts, Adjust Accounts, Issue Financial Statements, Close Accounting Period, Maintain General Ledger and Control Accounts.

After speaking with the owner and the departmental man-agers, it was agreed that James and his team would conduct their analysis and report the results at the next management meeting. Their goals are to brief management on enterprise systems and explain how such systems could speed up the production process and reduce cost without reducing product quality. James wondered if his youthful appearance would hinder his ability to communicate with the older management of Quality Pens.

2. Case Requirements

Your team must give a report and presentation to the management and board of directors. Quality Pen has asked you to specifically address the following questions:

Introduction to Enterprise Systems: Describe the history and background of Enterprise systems. Define enterprise systems and explain the nature of business processes. How do these systems integrate data and facilitate the value chain and supply chain of a company? List the advantages and disadvantages of these systems.

The Enterprise Systems Market: Identify the vendors in the Enterprise Systems market. Describe the Market position of the leading companies. Consolidation among enterprise software companies is occurring rapidly. Interpret how this will effect Quality Pen's potential systems investment decisions.

Introduction to SAP: Describe the history and background of SAP. Determine how large and old SAP is as a company. What is the size of SAP's market share and what companies are SAP's competitors? Compare and contrast SAP to its competition. How does SAP differentiate and distinguish itself from its competition? Categorize the types of companies and organizations that are using SAP (give some examples). What size companies usually implement SAP?

SAP Costs, Benefits and Implementation Issues: Formulate a way to estimate the costs related to a SAP

Exhibit 1: Educational Objectives of Case Study

Case Question No.	Content Objective	Thinking Skills
1	Define enterprise system and business processes.	Knowledge and Comprehension
2	Understand the enterprise systems market.	Comprehension and Application
3	Introduce SAP, its market and its competition.	Analysis and Knowledge
4	Analyze SAP implementation issues.	Analysis, Synthesis and Evaluation
5	Investigate the SAP user interface.	Comprehension and Analysis
6	Analyze SAP business processes and functions.	Comprehension and Knowledge
7	Analyze SAP's internal controls and security.	Analysis, Comprehension and Knowledge
8	Make client recommendations concerning SAP.	Evaluation and Knowledge
9	Review literature related to enterprise systems and SAP.	Application and Synthesis
10	Summarize findings in a professional presentation.	Comprehension

implementation (software, installation, training, and the total cost of ownership). How much time will an implementation take? Identify the phases or stages of how management would organize a SAP implementation (hint: check out the Systems Development Life Cycle, or SDLC). How would the phases of an SAP implementation compare to the SDLC? Can a client buy SAP in parts or modules?

User Interface: Discuss how the SAP user interface relates to your assigned business process. Is the interface easy to learn and use or will large amounts of formal training be required? Examine and describe the organization of the menu items related to your business process and take some screen shots of the menu items for your report.

Business Process and Functions: Explain the busi-

ness process assigned to your group. Identify the accounting, management and operational functions related to your business process. Describe how the business process relates to the companies value chain.

Internal Control and Security: Analyze the internal controls and security features of SAP related to your business process. Examine the internal controls from a PDC (preventive, detective, corrective) point of view. List and explain the controls and categorize them according to the PDC model.

Recommendation: Decide if Quality Pen should buy and implement SAP and justify your answer. List the critical success factors for a successful implementation of SAP at Quality Pen. Decide if the processes and functions in

SAP are flexible enough to be adaptable to Quality Pen or whether Quality Pen will be required to adapt to SAP. How will Quality Pen calculate the Return on Investment (ROI) for an enterprise system implementation?

References: Your research should include an investigation of current news reports, journal articles, books, experts and Web sites related to large enterprise systems. Find at least 10 references and integrate this information into the report. List your references at the end of the report.

Presentation: Summarize and present your finding to the Board of Directors of Quality Pen with a PowerPoint presentation. Turn in your PowerPoint presentation with your case study report.

3. Case Teaching Notes

Case Objectives: This case is designed to be used in an accounting or MIS course that employs SAP at the introductory level. It contributes to the literature by presenting questions which introduce students to the complex subject of enterprise systems without requiring them to have extensive prerequisite knowledge. This case is a good first step to help students gain a general understanding of enterprise systems and SAP. A specific list of content-related objectives is displayed in Exhibit 1. The exhibit maps the case questions and content objectives directly to Bloom's taxonomy of thinking skills.

The case presents students with a set of open-ended questions for which they perform literature research and hands-on analysis with SAP to answer the case questions. While answering these questions, students utilize the lower-order and higher-order thinking skills in Bloom's taxonomy of educational objectives.

Teaching Experience: This case was used in three classes taught at a private school in the northeast. It was assigned in an Accounting Information Systems (AIS) course which was taught at the upper division level (junior and senior accounting majors). The AIS course was offered in the 2004 fall semester, and the enrollment was 17 students which resulted in 5 groups. The case was also used in an undergraduate level Management Information Systems (MIS) course which was offered in the 2004 winter semester. Enrollment was 23 students with 6 groups performing case analysis. In addition, the case was used in a graduate level course entitled Integrated Business Systems (IBS). The IBS course had 3 students who formed one group and was cross-listed with the undergraduate MIS course. The students in all three courses responded well to the case. No data was collected since the case is still a work in progress. However, Appendix I contains a student survey instrument that could be used in the future.

This case is fictional. However, the issues are based on the consulting and management experiences of the authors. One of the authors was the director of North American information strategy for Xerox Corporation before he started his teaching career. During that time he led strategic planning, vendor selection and project initiation for a multimillion dollar implementation of Oracle Applications at Xerox. He also served as a member of the steering committee for the data warehouse and business intelligence development aspects of the project.

Bloom's Taxonomy of Educational Objectives: The case requires students to utilize the broad spectrum of thinking skills that are represented in Bloom's taxonomy (Gainen and Locatelli, 1995). Accordingly, the case questions are organized around Bloom's taxonomy. Conspicuously absent from the literature are accounting and MIS cases that conform to Bloom's taxonomy. Therefore, we believe that this case makes an original and significant contribution to the literature.

The case is useful for evaluating student responses to questions arranged around lower-order and higher-order thinking skills (Gainen and Locatelli, 1995). Bloom's taxonomy of educational objectives is grouped into

Exhibit 2: Bloom's Taxonomy of Thinking Skills
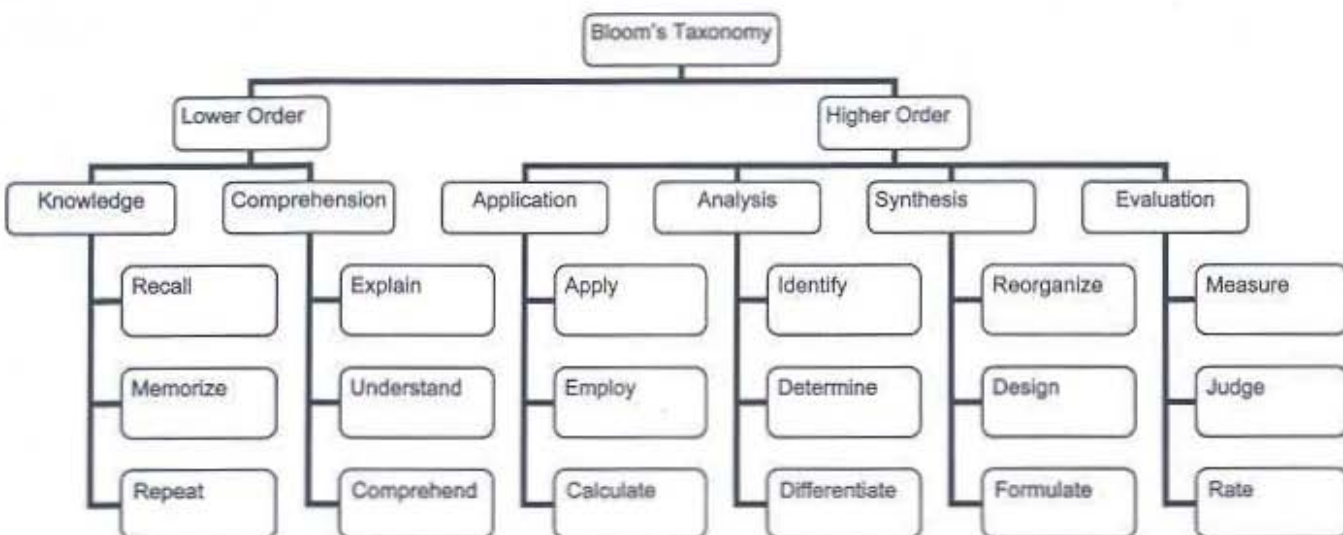
lower order skills, such as knowledge and comprehension, as well as higher-order skills such as application, analysis, synthesis, and evaluation. Exhibit 2 displays the organization of Bloom's taxonomy. The Exhibit is followed by a brief explanation of the components of Bloom's taxonomy (Bloom, Engelhart, Furst, Hill, and Krathwohl, 1956).

Knowledge

Knowledge involves simple recall and memorization and includes bringing to mind appropriate facts or definitions. Key words in knowledge-related questions include: define, list, name, repeat, record, relate, state, and underline.

Comprehension or Understanding

Comprehension requires students to put definitions into their own words and is a lower-order skill that includes knowledge of principles and theories. Key words in comprehension-related questions are: describe, discuss, explain, express, identify, locate, recognize, report, restate, review, tell, and translate.

Application

Application requires students to employ concepts or principles, including the selection and use of general rules, procedures, and methods for specific situations. Application involves the process of manipulating information to obtain a particular result. Key words in application-related questions are: utilize, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, use, compute, calculate, format, compile, and apply.

Analysis

Analysis is the decomposition of an organized structure to identify its parts, their relationships, and their organizational principles. It involves the ability to reorganize the structure. Key words included in analysis questions are: analyze, appraise, categorize, draw, diagram, compare, contrast, critique, debate, determine, differentiate, distinguish, examine, experiment, inventory, inspect, link, question, solve, and test.

Synthesis

Synthesis involves putting together elements and parts to form a new whole. This includes working with pieces, principles, rules, and organizing them into a new structure. Key words in synthesis questions are: arrange, assemble, collect, compose, construct, create, design, formulate, manage, organize, plan, prepare, propose, and set up.

Evaluation

Evaluation involves judgments about the value of data, materials, results or methods. It includes quantitative and qualitative judgments in relation to both obvious and obscure criteria. Key words related to evaluation questions are: appraise, assess, choose, compare, decide, estimate, evaluate, grade, judge, measure, rate, review, revise, score, select, and value.

4. Suggested Case Answers

Introduction to Enterprise Systems

The functional business model was formalized in the work of Pierre DuPont and Alfred Sloan in the 1920's. This model decentralizes corporate functions into divisions which specialize in business functions such as sales, operations, finance and human resource management, each with its own expertise and specific processes. With the transition to the Information Age, it was natural to align information systems with each of these functional divisions. However, this alignment resulted in difficulties in integrating information and processes across divisional boundaries.

The view of an organization as a collection of business processes grew in usage in the 1980's and 1990's. A business process is "a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs" (Davenport, 1993). This model is inherently cross-functional rather than separated. The integration implied by this cross-functional model is difficult, given the historical alignment of information systems with individual business functions. A number of issues exist including untimely and asymmetrical availability of information, incompatible data and an asymmetry toward functional processes rather than high-quality and efficient cross-functional processes.

Enterprise systems, or enterprise resource planning (ERP) systems, evolved from cross-functional planning applications in manufacturing and production. ERPs are software systems for business management, encompassing modules supporting functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, finance, human resource management, project management, inventory management, service and maintenance, transportation and e-business.

The key integration feature of an ERP is a shared, centralized database accessed by a set of functional business applications as shown in Exhibit 3. This database is the hub for data and information being processed by the enterprise. All applications use the same data. Thus asymmetries in data, incompatibilities in the data and a lack of cross-functional focus for business processes are eliminated. As data is created, updated and deleted, these changes flow from the functional module where the change originates into the database. In turn, these changes are fed in real-time to all other modules.

Specific business functions are implemented in each functional component. The functional modules are process oriented and implement the various functional steps of cross-functional business processes. Incorporated in the functional modules are thousands of "best practices" (O'Leary, 2000), assuring that processes are performed efficiently, adhere to local customs and support relative legal regulations, such as local tax codes and accounting practices. The architecture of the software facilitates transparent integration of modules, providing flow of information between all functions within the enterprise in a consistently visible manner.

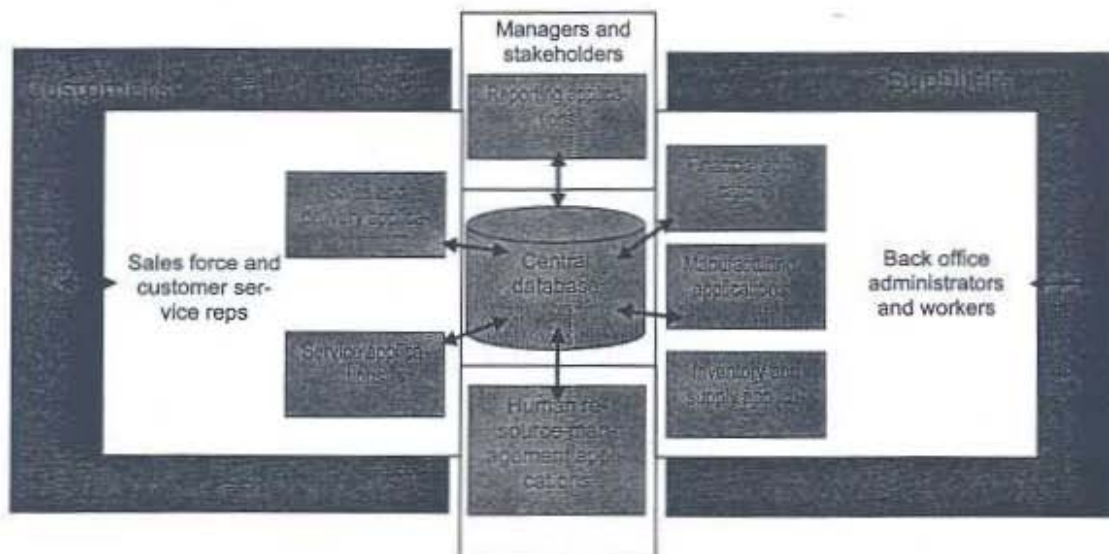**Exhibit 3: The Relationship between Enterprise Systems and Business Processes**

Exhibit 4: Advantages and Disadvantages of Enterprise Systems

Advantages	Disadvantages
Reliable information access	Time – consuming
Avoid data and operations redundancy	Expensive
Delivery and cycle time reduction	Conformity of the modules
Cost Reduction, e.g. Inventory, Personnel	Vendor dependence
Easy adaptability	Features and complexity
Improved scalability	Scalability and global outreach
Improved maintenance	
Global outreach	
Elimination of legacy systems and improved standardization of IT infrastructure	
Improved interactions with customers, suppliers and employees	
Improved financial close process	

Exhibit 5: Key Vendors and Their Market Positioning

Company	Market Position
SAP	ERP across broad range of industries
Oracle	Enterprise software managing data, operations and application integration
Siebel Systems	Customer Relationship Management
I2	Supply Chain Management
Manguistics	Supply Chain Management
SSA Global	Industry-specific ERP solutions for manufacturing and services industries
Lawson	ERP focused on mid-sized companies

The advantages of an ERP system shown in Exhibit 4, relate directly to the process orientation and cross-functional integration they provide. The disadvantages relate to the size, scale and complexity that are inherent in an "enterprise" application.

How do these systems facilitate the value chain? Enterprise systems support a great majority of processes of a company, such as accounting, sales, logistics and human resources in the following ways:

- Enterprise systems provide a structure for work similar to that in process thinking: the flow of activity and information across the organization is orchestrated by the system.
- Enterprise systems are integrated and link different business functions or sub-processes together.
- The modules of enterprise systems correspond to how organizations divide up their work into major processes.
- Enterprise systems allow the performance of processes to be measured (primarily in the metrics of time and cost) as they are carried out.
- Enterprise systems link process design and implementation through business process design aids, e.g. templates and roadmaps, which guide an organization in best-practice process design and configuration based on the underlying ERP software.

- The documentation of enterprise systems and of the specific configurations of the systems selected by a company force a certain level of awareness of that company's business processes. This level of discipline is not often found in companies prior to the implementation of an enterprise system.

The Enterprise Systems Market

The ERP software industry includes companies that design, develop, market, and support software for automating the process of managing enterprise functions such as accounting, human resources, order processing, scheduling, distribution, and inventory management (Hoovers, 2005).

Growth in this industry peaked in late 1998 with sales driven by the Y2K issue. Sales then declined as part of the "dot.com Bust". With the maturation of the market, consolidation is occurring rapidly. In August 2003, PeopleSoft completed its acquisition of J.D. Edwards. On December 13, 2004, Oracle Corporation announced that it

had signed a merger agreement to acquire PeopleSoft, Inc. Also in July 2004, SSA Global, an ERP vendor focused on the manufacturing and service industries, acquired Marcam, an ERP vendor specializing in process manufacturing (SSA Global, 2004). The key vendors in this market today are shown in Exhibit 5.

From the customer viewpoint, these merger activities cause uncertainty and doubt. Decision makers worry about continued support for the products they purchase and worry about the probability of having to make an expensive and time-consuming technology transition.

Introduction to SAP

SAP is the leading supplier of ERP software and is the world's fourth largest software vendor. For fiscal 2003 SAP generated revenue of $8.8 billion (Hoovers, 2005). Net income was nearly $1.4 billion compared with the 2002 total of $ 534 million. As announced by SAP AG's company profile issued July 2004, its worldwide share of the market against its four largest competitors was 59% at the end of the fourth quarter of 2003. While 2003 was another difficult year for the software industry, SAP continued to strengthen its global market leadership position. Compared with 51% at the end of the fourth quarter of 2002, SAP's worldwide share of the market grew by 8%. In the United States, SAP became the market leader in 2003 with an increase in market share of 14%. SAP has announced continued revenue growth in 2004 of 7% and a 4% increase in market share to 57% market share worldwide at the end of 2004 (SAP, 2005).

SAP was founded in 1972 by five former IBM employees who focused on developing a system that would integrate a corporation, rather than automate individual functions. Their first product, R/1, addressed accounting transaction processes and was introduced in 1973. SAP R/2, a mainframe-based integrated application, was introduced in 1979. As the client / server architecture became established in the marketplace, SAP introduced a client/server version of its integrated business applications, SAP R/3 in 1992. Today SAP applications are utilized by 21,000 customers in over 120 countries.

As many of its competitors were looking internally to their own operations and faced self-induced challenges created through mergers and acquisitions, SAP has sharpened its focus on meeting customer needs. Its commitment to innovating for customers was recognized by Wall Street Journal Europe, which gave its European Innovation Award to SAP (Brandt, 2004).

A partial list of SAP application-based modules available in the R/3 system is provided below (O'Leary, 2000).

- FI (financial accounting) includes general ledger, accounts payable, accounts receivable and legal consolidations.
- SD (sales and distribution) includes sales order processing, inventory sourcing, delivery, billing and payment.
- CO (controlling) includes cost center accounting, product cost controlling and activity-based costing.
- MM (materials management) includes inventory management, invoice verification and warehouse management.
- PP (production planning) includes sales and operations planning, MRP and capacity planning.
- AM (fixed-asset management) manages information pertaining to depreciation, property value, insurance, etc.
- HR (human resources) includes personnel administration and planning and development.

While a key competitive position for SAP is integrated business functionality, not all businesses require the same functionality. Recognizing that there are common requirements for various industries, SAP has configured its software into packages that focus on 25 industries. Each industry package contains a recommended set of application modules and pre-configured business processes targeted at the operational needs of companies in a particular industry. SAP offers solutions for a number of industries as shown in Exhibit 6.

Exhibit 6: Industries Supported by SAP

Aerospace and Defense	Automotive	Banking
Chemicals	Consumer Products	Engineering, Construction and operations
Financial Services	Healthcare	High tech
Higher education and research	Industrial machinery and components	Insurance
Media	Mill products	Mining
Oil and gas	Pharmaceuticals	Professional services
Public sector	Retail	Service providers
Telecommunications	Utilities	

Firms of all types and sizes have implemented SAP. Initially, the focus was on providing a solution for large organizations, such as the Fortune 500 companies. As the market for large firms became saturated, SAP and others have begun to address small and medium-sized businesses (SMB's) to achieve growth through "vanilla" versions of their larger enterprise packages (Whittle, 2003). SAP offers Business One, specifically targeted at SMB's. While it offers a broad range of functionality, it is aimed at organizations that will benefit from implementing a standard version in a short time.

Numerous companies have implemented or are implementing SAP including: Bayer, BMW, BP, Contrinex, Deutsche Bank, Dresdner Bank, Eastman Kodak, Lipo-Nova, PepsiCo, P&G, Roland Berger Strategy Consultants, Vestas and Volkswagen.

SAP Costs, Benefits and Implementation Issues

Given its enterprise-wide scope, implementation of SAP is a significant undertaking. The first steps in the process are the decision to implement an ERP and selection of a vendor. The rationale for implementing an ERP can be grouped into four categories (O'Leary, 2000):

- Strategic Rationale: ERP provides capability to implement a strategy that the organization's current software does not support.
- Competitive Rationale: Implementation of an ERP is undertaken because the organization's competitors have implemented an ERP.
- Business Process Rationale: An ERP will address a number of business process rationales such as personnel reductions, IT cost reductions, productivity improvements or improvements to the financial close cycle.
- Technology Rationales: Various rationales include disparate systems, poor quality legacy systems and difficulty integrating acquisitions.

Two primary approaches are used for vendor selection: Requirements Analysis and Gap Analysis. In Requirements Analysis, an organization reviews and documents its internal requirements.

Exhibit 7: Adaptation of ERP Life Cycle from SDLC

SDLC Phase	ERP Phase	Activities
Feasibility Study	Planning	Conduct a needs assessment; provide a business justification, based upon the difference between the existing system and the proposed system
Systems Analysis	Requirements Analysis	Conduct a needs assessment; provide a business justification, based upon the difference between the existing system and the proposed system
Systems Design	Design	Analyze current business processes and specify the processes to be supported select the ERP system
Detailed Design	Detailed Design	Re-engineer business processes around the best practices model of the ERP system or customization of the software
Implementation	Implementation	Configure the system; migrate data from the old system to the new system; develop interfaces; implement reporting systems; conduct testing; implement controls, security; train end-users
Support	Maintenance and continuous improvement	Provide technical support; provide upgrades and enhancements

These requirements are documented and distributed to vendors who respond with an assessment of how well their product offering supports the requirements. After review of the vendor input, a vendor is selected.

Gap Analysis begins with creation of the "As-Is", or current, model of the organization, its business processes and its systems. The organization then creates its "To-Be" or future model. Gap analysis compares the "As-Is" model against the "To-Be" model and determines the capability of software from various vendors to support the "To Be" model.

Following vendor selection, the implementation project for an ERP is generally adapted from the Systems Development Life Cycle (SDLC) as shown in Exhibit 7 (Sumner, 2005).

It is important to note that implementation activities in the SDLC are replaced with configuration activities in the ERP Life Cycle. Configuration is the process of defining systems settings and switches to establish the enterprise structure and related environmental data (Sanhoe, 2004). The process of configuring a module in SAP includes defining three entities (The Rushmore Group, 2004):

- Organizational Structure: A hierarchy in which the organizational units in an enterprise are arranged according to tasks and functions
- Master Data: Data that is shared across modules of SAP, is always used in the same way and remains unchanged over an extended period of time
- Rules: Definition of the parameters that determine the functionality of Master Data and transactions

Costs for a specific SAP implementation are highly correlated to characteristics of the organization:

- Training requirements to enable existing personnel to utilized the SAP software.
- Breadth of business processes, number of SAP modules licensed and number of users.
- Volume and quality of legacy data to be migrated into the SAP system.
- Management support for migration of business processes to those processes supported within SAP.

The most obvious costs of implementation for an ERP are the software and hardware costs for a system. The full costs for an SAP implementation include the following components:

- SAP software licenses
- Hardware
- Consulting: consultant resources who are skilled at the configuration and installation of SAP
- Implementation Team: Internal business and technology project members, who define the new business processes to be implemented within SAP, manage the steps of implementation and migration of existing data into the new SAP system.
- User Training

A midsize company can typically expect to spend $10-$20 million and up to two years on a full implementation (Brady, Monk and Wagner, 2001). The most effective way to compare the cost of implementations is in terms of Total Cost of Ownership (TCO) with per user TCO ranging between $15,000 and $50,000 per user (O'Leary, 2000).

User Interface

User interfaces are a critical system component, since they are the user entry point into the functions provided by a system. The design of user interfaces has transitioned from text-oriented to graphical user interface or GUI. Product releases from SAP have followed this evolution to the current SAPGUI.

SAP R/3 is implemented using three-tier client/server architecture:

1. User Interface
2. Application server (one or many)
3. Database server (one single location)

SAP R/3 was introduced in 1992, prior to the wide spread usage of the Internet and the World Wide Web. To work efficiently with the network technology available at that time, SAP provided a specific user interface module called the SAP Graphical User Interface (GUI), or SAPGUI, that was installed on the user's personal client. The SAPGUI is a front-end program used to access SAP systems. Subsequently, a version of the user interface utilizing web technology has been introduced.

The SAPGUI uses similar concepts and techniques found in Microsoft or Apple operating systems including multiple windows, icons, menus, etc. Business functions are selected by navigating menus; data is entered by filling in forms or tables. Reports are presented as tables that can be scrolled through.

The SAP Easy Access screen is the default initial screen in SAP systems (Exhibit 3). The left side of the screen contains a tree hierarchy of the menus available in the SAP system. There are two formats to display menus. The first is the standard SAP menu which is a complete list of all possible transactions and all possible reports offered by the system. The second format uses role-based menus which customize the menu to the set transactions, reports and applications based upon business scenarios and user role.

Students will provide further details based upon the business process they have selected. For example, user interface functions for the Production and Materials Planning process falls under the menu of Logistics. Examples of specific functions are shown in the exhibits:

- Creation of a Bill of Materials (Exhibit 9)
- Creation of a Purchase Order from the MRP Stock Requirements (Exhibit 10)
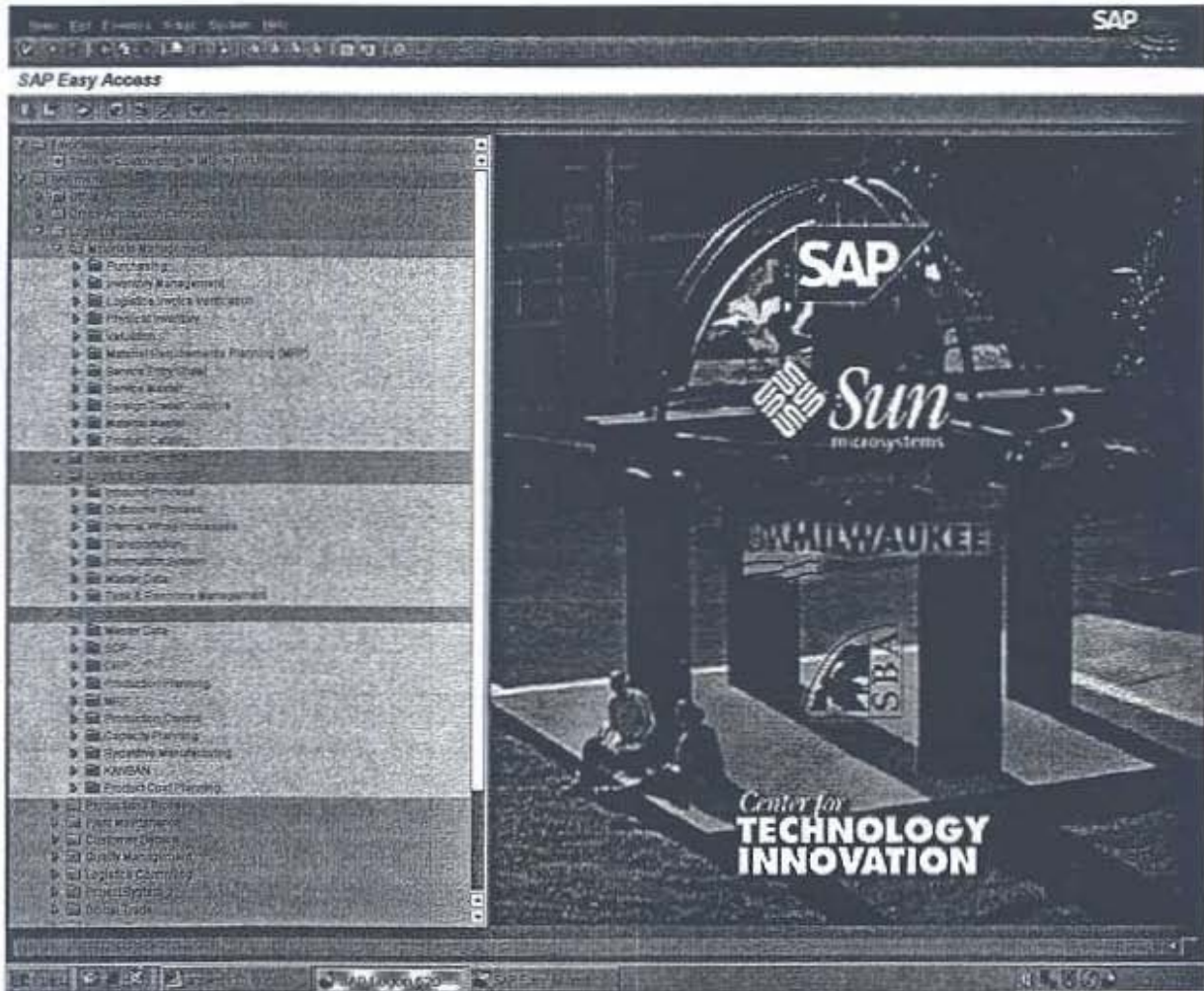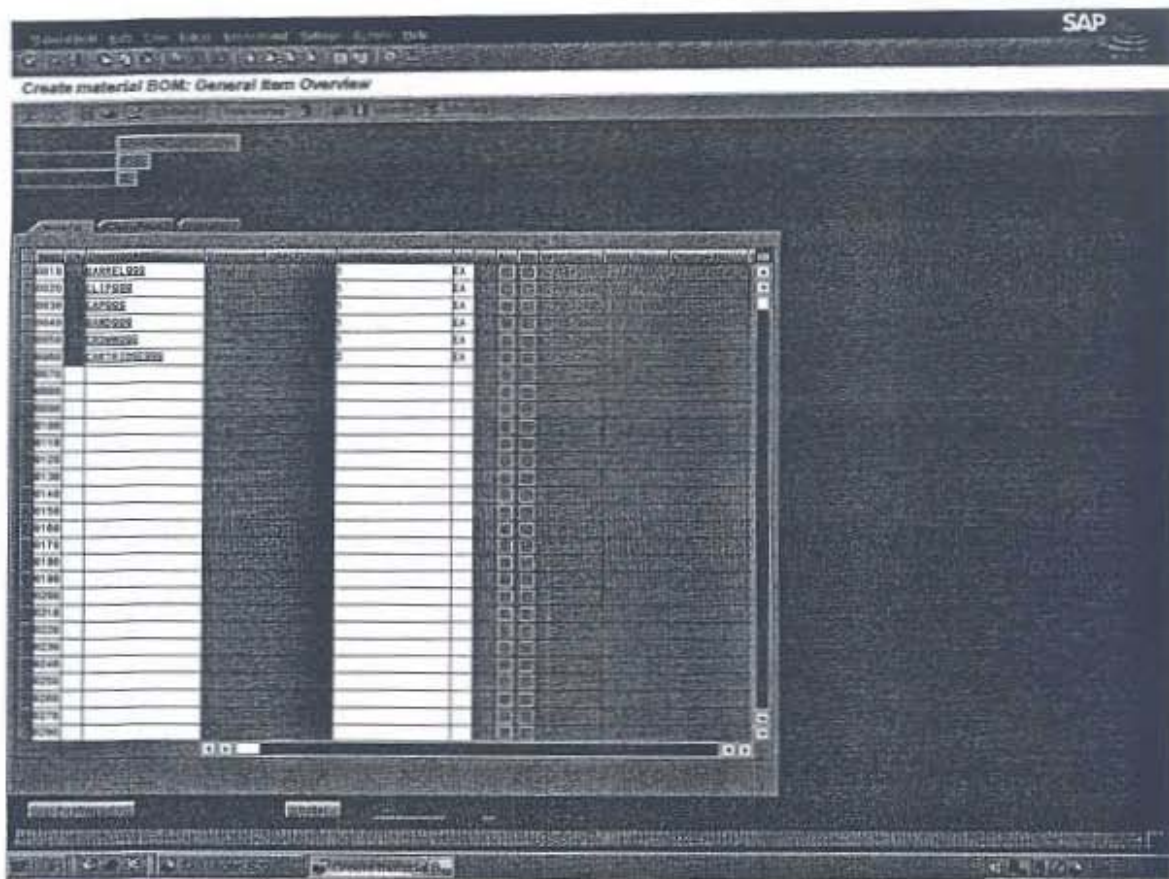
Exhibit 8: SAP Easy Access Menu

Exhibit 9: Creation of a Bill of Material

Students will have a variety of comments on the ease of use of the SAPGUI. All will recognize the process orientation of the workflow within SAP and the detail orientation of transactions. Both of these factors impact the level of training required in an implementation project. Students should be encouraged to include the help features in their analysis.

Advanced students may use methodologies such as the Nielson Attributes to assess the user interface (Nielson, 2003). Students should be encouraged to explore the SAP usability assessment approaches and design practices (SAP Design Guild, 2005).

Business Processes and Functions

Answers in this section will vary depending upon the spe-

cific business process that students select for analysis. The following example examines the Production and Conversion process. Production and Conversion processes include all activities necessary to achieve production and support the following objectives (Sumner, 2005):

- Producing the production plan.
- Acquiring raw materials.
- Scheduling equipment, facilities and personnel to process these materials.
- Designing products and services.
- Producing the right quantity of products at the right time at the right quality level to meet production re quirements.

The diagram in Exhibit 11 documents the integration of

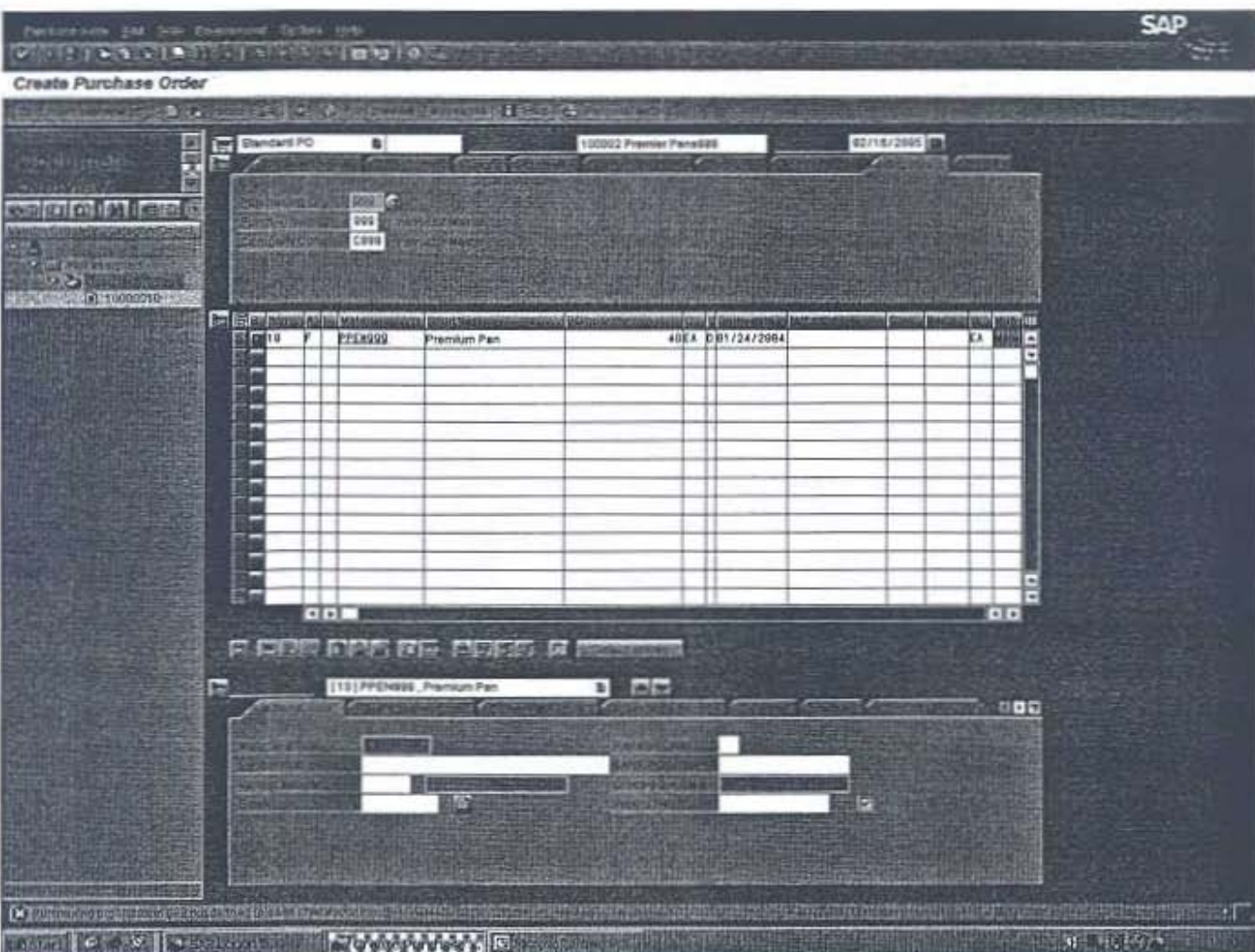# Exhibit 10: Creation of Purchase Order from MRP Stock Requirements List
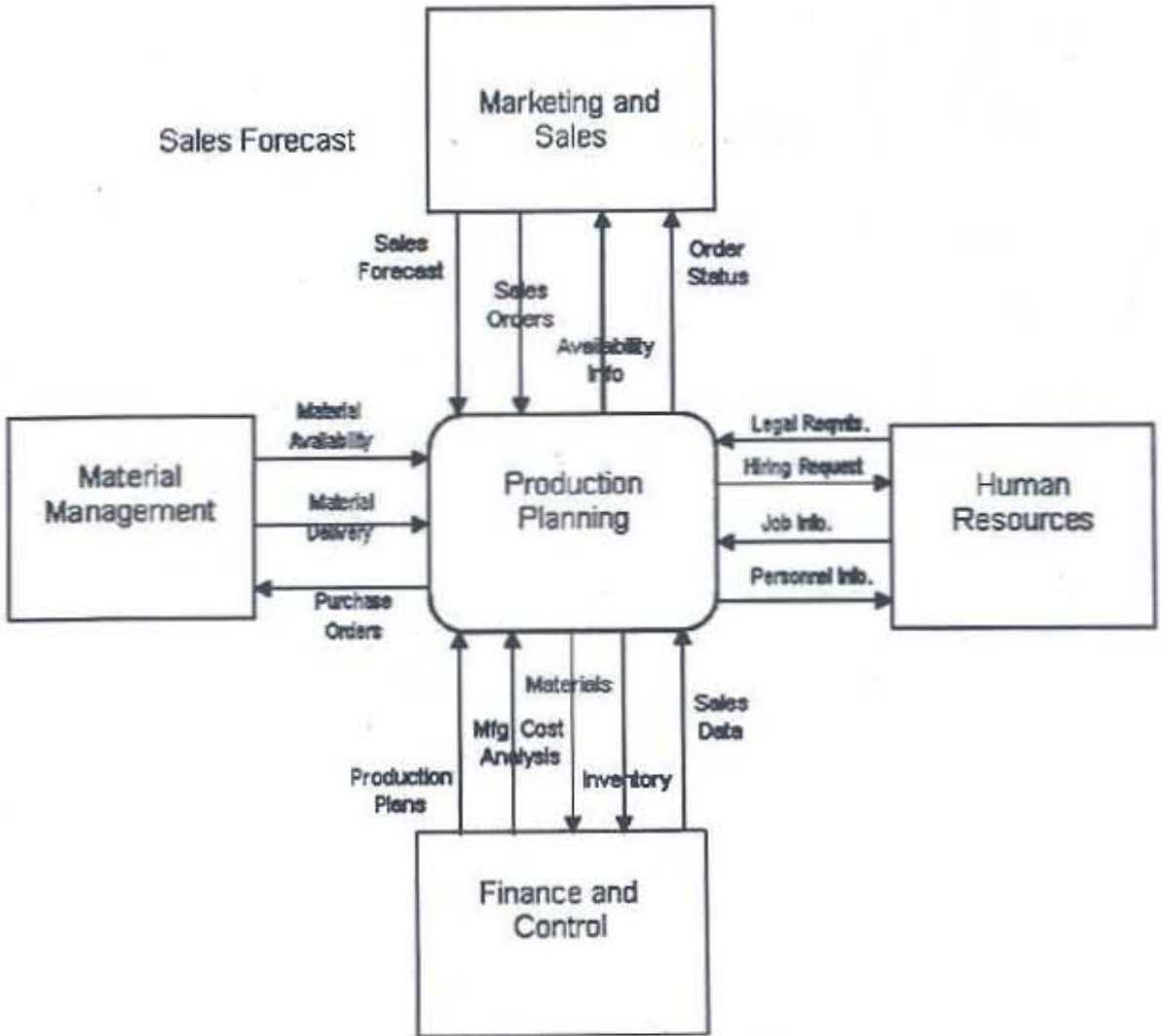
EXHIBIT 11: SAP Production Planning Process Context Diagram
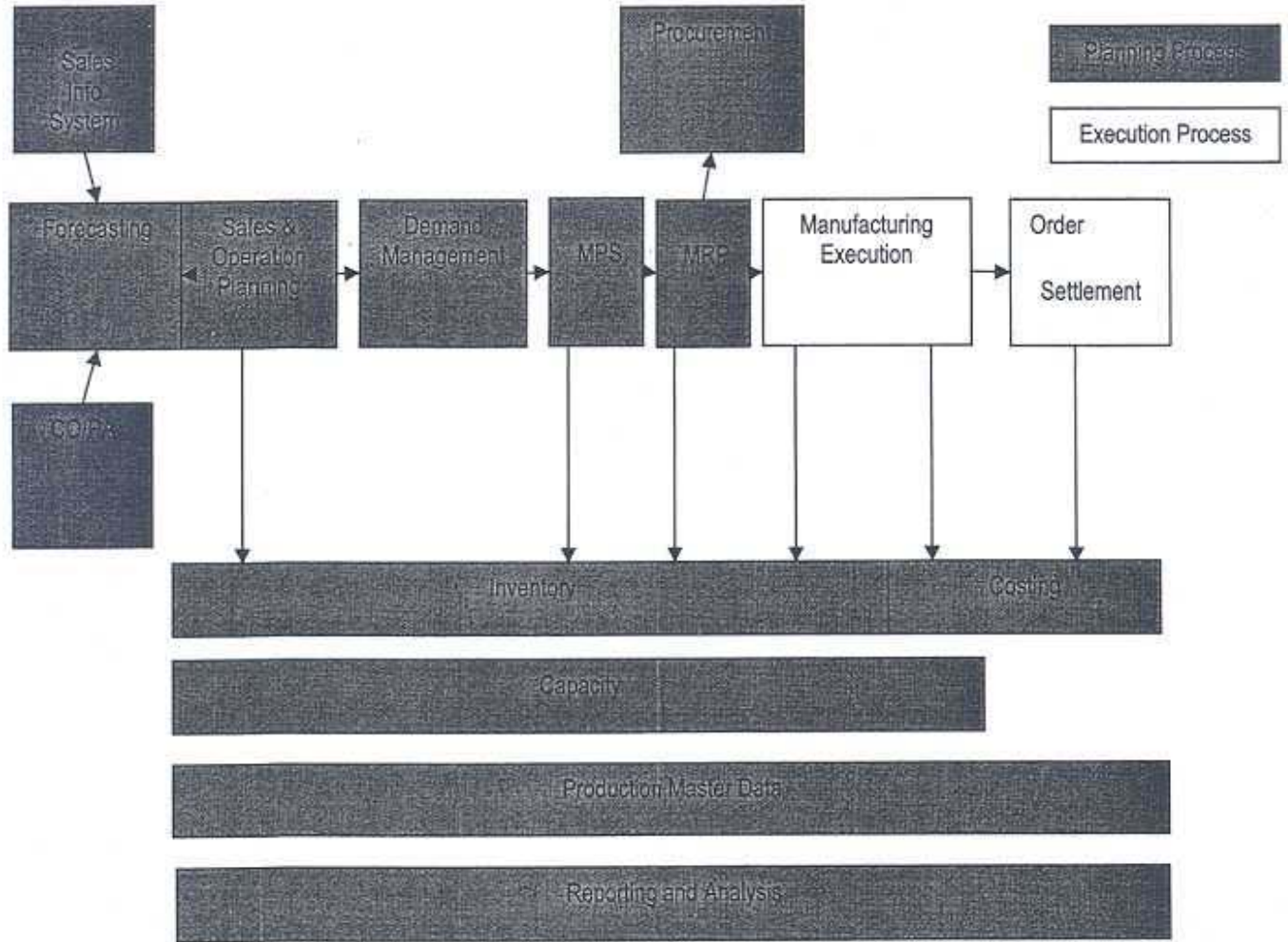
Exhibit 12: Manufacturing Planning and Execution Process

Exhibit 13: SAP Modules within Production Planning

Module	Function
Sales and Operation Planning	Determines the rate at which the company provides manufacturing, engineering and financial resources to support the sales plan
Demand Management	Links sales forecasting to Master Production Schedule (MPS) and Materials Requirement Plan (MRP)
Master Production Schedule (MPS)	Creates plan for quantities and dates for finished products that are required to meet demand
Materials Requirement Plan	Determines which materials are required at which times based on MPS and material information such as Bill of Material and purchasing lead times
Manufacturing Execution	Creates production orders from planned orders; production orders contain data on production objectives, material components, required resources and costs. This data is integrated with Shop Floor systems as appropriate
Order Settlement	Confirms production operations; collects data on quantities produced and completion dates

the SAP R/3 Production Planning module with other modules of SAP. The Production Planning module primarily interacts with four modules: Sales and Distribution, Human Resources, Accounting and Control, and Material Management.

Exhibit 12 shows an overview of the Manufacturing Planning and Execution processes in SAP (SAP, 2002).

Exhibit 13 describes the functions provided within each SAP module within Production Planning.

Internal Control and Security

Answers to this question will vary based on the background of the students. Students in AIS are likely to focus on internal controls, while MIS students are more likely to focus on security.

Internal controls are practices that protect or make more efficient use of an organization's assets. Typically, management is responsible for developing an appropriate system of internal controls, but every employee is responsible for following and applying those practices (Internal Controls, 2005). Internal controls can be preventive, detective or corrective in nature. Preventive controls are designed to discourage or pre-empt errors or irregularities from occurring. Detective controls are designed to search for and identify errors after they have occurred. Corrective controls are designed to prevent the recurrence of errors.

Preventive controls are the most cost effective form of controls.

Detective controls are more expensive than preventive controls but are essential since they measure the effectiveness of preventive controls and are the only way to effectively control certain types of errors. Corrective controls address improper outcomes that have already occurred and focus on putting in place corrective controls so that those outcomes do not re-occur.

Within SAP, automated credit checks and data entry checks are examples of preventive controls. Students should be encouraged to identify specific examples that can be set during configuration for the business process they are studying. To support both detective and corrective controls, for each transaction SAP records an audit trail for each transaction in a document including the time, user ID and description of all data. There are also a number of reports which can be used in detective controls.

Role-based access control has become the predominant model for advanced access control and is implemented in SAP R/3. In role-based access control, each user is assigned one or more roles, and each role is assigned one or more privileges that are permitted to users in that role (Sandhu, 1996). SAP authenticates users at login using user id's and passwords. After a user is authenticated SAP has a set of roles stored in the SAP master record to determine which accesses or privileges are allowed for a particular user.

SAP maintains privacy and integrity of information when it leaves the system by "wrapping" R/3 data in secure formats based on public and private key cryptography algorithms before the data is transmitted over insecure communication lines and takes advantage of digital signatures added to the appendixes of digital documents to verify authenticity of the origin and integrity of those documents (Hernandez, 2002). A number of logging, auditing and alert capabilities are also part of SAP security architecture.

Recommendation

Given the background in the case on Quality Pen, students will generally recommend that Quality Pen license and implement SAP. They should specifically address how SAP will decrease costs, speed up production and maintain or improve quality. Students will have a range of detailed recommendations depending upon the business process that they analyzed in depth. They should be encouraged to include recommendations for the structure of the implementation project as well as whether Quality Pen should utilized a big bang or phased transition methodology.

Critical Success Factors (CSF) in ERP systems have been examined in many studies. Research findings usually fall into several categories. The list displayed below was adopted from Umble (Umble, 2003).

- Clear understanding of strategic goals
- Commitment by top management
- Excellent implementation project management
- Great implementation team
- Successful coping with technical issues
- Organizational commitment to change
- Extensive education and training
- Data accuracy
- Focused performance measures
- Multi-site issues resolved

The Return on Investment (ROI) for enterprise systems is difficult to determine. Usually the investment component of the ROI equation is determined by estimating the Total Cost of Ownership (TCO). However, the return portion of the calculation maybe difficult to estimate. Enterprise systems usually generate cost saving through efficiency rather than directly producing increased revenue. These cost saving can be derived by re-engineering business processes during the system implementation.

Enterprise systems such as SAP have many configuration options. However, SAP has decided what those configuration options will be. As a result, many organizations find

that they must adopt their business processes to conform to SAP configuration options. Organizations with highly structured internal controls and processes will adopt the SAP more readily.

References

The following is a list of suggested resources that will help the students with this case:

Vendor Resources:

- Oracle home page: www.oracle.com
- SAP home page: www.sap.com
- SAP help page: help.sap.com
- Peoplesoft home page: www.peoplesoft.com
- Microsoft Business Solutions home page: www.microsoft.com/BusinessSolutions

Applied and Professional Journals:

- *Harvard Business Review*
- *California Management Review*
- *Sloan Management Review*
- *Communications of the ACM*
- Chief Financial Officer Magazine: www.cfo.com
- Chief Information Officer Magazine: www.cio.com
- The CPA Journal Online: www.cpaj.com
- Journal of Accountancy Online: www.aicpa.org/pubs/jofa/joaiss.htm
- Info World Online: www.infoworld.com
- Computer World Online: www.computerworld.com

News:

- Business Week Online: www.businessweek.com
- *Wall Street Journal*

Internet Sites:

- diretory.google.com/Top/Computers/Software/ERP/
- ERP home page: www.erpcentral.com
- ERP Hub home page: www.erphub.com
- ERP Assist home page: www.erpassist.com

Academic Journals:

- *Journal of Information Systems*
- *MIS Quarterly*
- *Decision Sciences Journal*
- *International Journal of Accounting Information Systems*

Presentation

Group presentations are an effective method for students to practice their communication skills, learn to work in groups, and display their knowledge to the course instructor. Presentations will vary greatly, since different groups will emphasize the importance of various parts of the case. Our experience is that the groups present interesting and informative material, and they reinforce the related case knowledge by summarizing, explaining, and presenting the material to their peers. We believe that retention is enhanced by the students engaging in active participation by applying and presenting the case material (Johnson, 1996).

5. Class Management Issues

An SAP Example: Introducing the Pen Company

This case has been used in conjunction with the Pen Company developed by the Rushmore Group and incorporated in the Business Process Integration I course available to members of the SAP University Alliance (UA) through the UA Curriculum Exchange. A package of PowerPoint slides is made available to students through the course web site. Students are then asked to read and work through some of the PowerPoint slides related to SAP until they are able to navigate around the system. The following instructions are provided to students: *"In the slides you will work extensively with Pen Incorporated. Pen Inc. is an example company used by the SAP University Alliance for educational purposes. It is a small company that sells promotional pens. After you work through some of the PowerPoint slides you should have a basic understanding of this company, its business processes and the SAP menu."*

Graded Deliverables

Students were instructed to submit the case Word file and PowerPoint files electronically to the instructor. The written case reports were completed using MS Word and were approximately 20 to 25 pages (double spaced) in length. The case reports contained the following sections: cover page, table of contents, executive summary, a body containing answers to the case questions and references.

In addition, the students were required to present the results of their analysis to the class. The PowerPoint presentations contained approximately 10 to 20 slides, and the oral presentations lasted for 15 to 20 minutes.

Group Management Issues

Two or more groups could not report on the same business process, and business processes were assigned on a first-come, first-serve basis by the course instructor. The students were instructed to break up into teams of two to four students. Students were instructed to notify the instructor immediately if a group member did not participate on the case study. Groups were allowed to terminate a group member for non-participation after consulting with the instructor.

6. Conclusion and Future Research

The preliminary results are promising, since the case was used in three classes with no major problems. The students responded well to the case. They enjoyed the blend of feasibility analysis and hands-on interaction with SAP. In spite of the classroom success, there is still much work to be done.

The next step is to collect data from students and practitioners. The case should be reviewed by practitioners and other faculty before student data is collected. Practitioners could add a more realistic feel to the case before it is used again in the classroom. We should receive some student feedback. A survey instrument for student feedback has been developed and is displayed in Appendix I. Furthermore, objective exam questions could be developed to test the concepts introduced by the case. The exams question could be used to verify the survey results.

Cases, such as the one introduced in this paper, are an important tool for bridging the gap between practice and theory. As enterprise systems spread throughout industry, it will be important for universities to find efficient and effective methods for preparing student to use these systems.

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Appendix I
Student Survey for Case Study

Your participation in this survey is voluntary. If you choose to participate you will earn 3 bonus points on your final course grade. The professor will use this survey to evaluate the effectiveness of the Quality Pen Case that you recently submitted as a group project.

Instructions:
- Please indicate your answers to the case evaluation questions listed below by entering a single score (a, b, c, etc...) per question.
- Feel free to make additional statements about the case after your answer the survey questions.
- Your answers will not be graded, feel free to express your opinion. Your honesty and insights will help to improve the case in the future.
- Each question allows for 1 response, various choices are listed below each question.

Case Understandability

1. The case study was clear.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

2. I was able to understand the case without significant difficulty.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

3. The case was well organized.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

Case Grading and Fairness

4. The grade percent allocated to the case study was an appropriate weight given the work required.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

5. The level of difficulty of the case was appropriate.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

6. The case should continue to be used in this course.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

Case Educational Impact

7. The use of this case supplemented my understanding of enterprise system concepts.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

8. Using the case made coverage of enterprise system concepts more interesting.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

9. The project gave me useful experience with enterprise systems.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

10. Because of the project I better understand the relationship between enterprise systems and business processes.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

11. After working with the case I am more competent at using enterprise systems.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

12. The case increased my knowledge related to enterprise system terms and definitions.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

13. The case required me to describe and explain enterprise system principles and theories.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

14. The case required me to apply business process thinking to a specific situation.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

15. The case gave me practice at decomposing a business process and reorganizing its structure.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

16. The case enabled me to formulate and design a more efficient business processes based upon the concepts of enterprise systems.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

17. The case helped me to make evaluations and judgments business process functions and activities.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

18. Overall, I think the Quality Pen case study is a useful project.

    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

19. The amount of work on the case was justified based on the learning derived.
    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree

Student Demographics

20. Indicate your gender.
    a. Male
    b. Female

21. Are you a Graduate or Undergraduate student?
    a. Graduate
    b. Undergraduate

22. What is your major?
    a. Accounting
    b. MIS
    c. Finance
    d. Business (international business, leadership, manufacturing mgt., tech. mgt.)
    e. Marketing (sales, e-commerce, entrepreneurship, media)
    f. Statistics or Quality
    g. Other

23. How many years of professional work experience do you have?
    a. 0
    b. 1 to 3
    c. 4 to 6
    d. 7 to 9
    e. 10 or greater

Group Information
24. What was the total time in hours that you personally spent on this case study?
    a. 0 to 3

    b. 4 to 6
    c. 7 to 9
    d. 10 to 12
    e. 13 or more

25. Estimate the totally time in hours that all the members of your group spent on this case study?
    a. 0 to 6
    b. 7 to 12
    c. 13 to 18
    d. 19 to 24
    e. 25 or more

26. How many students, including yourself, were in your group?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

Other Comments: