



Rai Technology University

ENGINEERING MINDS

Enterprise Resource Planning



SYLLABUS

Introduction to ERP

Evolution of ERP; what is ERP? Reasons for the Growth of ERP; Scenario and Justification of ERP in India; Evaluation of ERP; Various Modules of ERP; Advantage of ERP.

An Overview of Enterprise

An Overview of Enterprise; Integrated Management Information; Business Modeling; ERP for Small Business; ERP for Make to Order Companies; Business Process Mapping for ERP Module Design; Hardware Environment and its Selection for ERP Implementation.

ERP and Related Technologies

ERP and Related Technologies; Business Process Reengineering (BPR); Management Information System (MIS); Executive Information System (EIS); Decision support System (DSS); Supply Chain Management (SCM).

ERP System

ERP system: Introduction; Finance, Plant Maintenance, Quality Management, Materials Management.

ERP Market

ERP Market: Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.

ERP Implementation Lifecycle

ERP Implementation Lifecycle: Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluation; Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).

Selection of ERP vendors

Vendors; Consultants and Users; In-House Implementation - Pros and Cons; Vendors; Consultants; End User.

Future Directions in ERP

Future Directions in ERP; New Markets; New Channels; Faster Implementation Methodologies; Business Modules and BAPIs; Convergence on Windows NT; Application Platform; New Business Segments; More Features; Web Enabling; Market Snapshot.

Other Related Technologies of SCM

Relation to ERP; E-Procurement; E-Logistics; Internet Auctions; E-markets; Electronic Business Process Optimization; Business Objects in SCM; E commerce.

Suggested Reading:

1. Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: McGraw-Hill

2. The Impact of Enterprise Systems on Corporate Performance: A study of ERP, SCM, and CRM System Implementations [An article from: Journal of Operations Management] by K.B. Hendricks; V.R. Singhal; and J.K. Stratman, Publisher: Elsevier
3. ERP and Supply Chain Management by Christian N. Madu, Publisher: CHI
4. Implementing SAP ERP Sales & Distribution by Glynn C. Williams, Publisher McGraw-Hill

1.0 Evolution of ERP

ERP (Enterprise Resource Planning) is the evolution of Manufacturing Requirements Planning (MRP) II. From business perspective, ERP has expanded from coordination of manufacturing processes to the integration of enterprise-wide backend processes. From technological aspect, ERP has evolved from legacy implementation to more flexible tiered client-server architecture.

The following table summarizes the evolution of ERP from 1960s to 1990s.

Timeline	System	Description
1960s	Inventory Management & Control	Inventory Management and control is the combination of information technology and business processes of maintaining the appropriate level of stock in a warehouse. The activities of inventory management include identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances, and reporting inventory status.
1970s	Material Requirement Planning (MRP)	Materials Requirement Planning (MRP) utilizes software applications for scheduling production processes. MRP generates schedules for the operations and raw material purchases based on the production requirements of finished goods, the structure of the production system, the current inventories levels and the lot sizing procedure for each operation.
1980s	Manufacturing Requirements Planning (MRP II)	Manufacturing Requirements Planning or MRP utilizes software applications for coordinating manufacturing processes, from product planning, parts purchasing, inventory control to product distribution.
1990s	Enterprise Resource Planning (ERP)	Enterprise Resource Planning or ERP uses multi-module application software for improving the performance of the internal business processes. ERP systems often integrate business activities across functional departments, from product planning, parts purchasing, inventory control, product distribution, fulfillment, to order tracking. ERP software systems may include application modules for supporting marketing, finance, accounting and human resources.

ERP systems are now ubiquitous in large businesses and the current move by vendors is to repackage them for small to medium enterprises (SMEs). This migration has many consequences that have to be addressed through understanding the history and evolution of ERP systems and their current architectures. The advantages and disadvantages of the ERP systems will impact their penetration in this new market. The market position and general

strategy of the major systems providers in preparation for this push are described. The chapter concludes that the growth and success of ERP adoption and development in the new millennium will depend on the legacy ERP system's capability of extending to Customer relationship Management (CRM), Supply Chain Management (SCM) and other extended modules, and integration with the Internet-enabled applications.

The initials ERP originated as an extension of MRP (material requirements planning, later manufacturing resource planning) and CIM (Computer Integrated Manufacturing). It was introduced by research and analysis firm Gartner in 1990. ERP systems now attempt to cover all core functions of an enterprise, regardless of the organization's business or charter. These systems can now be found in non-manufacturing businesses, non-profit organizations and governments.

To be considered an ERP system, a software package must provide the function of at least two systems. For example, a software package that provides both payroll and accounting functions could technically be considered an ERP software package.

Examples of modules in an ERP which formerly would have been stand-alone applications include: Product lifecycle management, Supply chain management (e.g. Purchasing, Manufacturing and Distribution), Warehouse Management, Customer Relationship Management (CRM), Sales Order Processing, Online Sales, Financials, Human Resources, and Decision Support System.

Overview of ERP Solutions

Some organizations — typically those with sufficient in-house IT skills to integrate multiple software products — choose to implement only portions of an ERP system and develop an external interface to other ERP or stand-alone systems for their other application needs. For example, one may choose to use human resource management system from one vendor, and the financial systems from another, and perform the integration between the systems themselves. This is common to retailers, where even a mid-sized retailer will have a discrete Point-of-Sale (POS) product and financials application, then a series of specialized applications to handle business requirements such as warehouse management, staff rostering, merchandising and logistics.

Ideally, ERP delivers a single database that contains all data for the software modules, which would include:

- **Manufacturing:** Engineering, bills of material, scheduling, capacity, workflow management, quality control, cost management, manufacturing process, manufacturing projects, manufacturing flow.
- **Supply chain management:** Order to cash, inventory, order entry, purchasing, product configuration, supply chain planning, supplier scheduling, and inspection of goods, claim processing, and commission calculation.
- **Financials:** General ledger, cash management, accounts payable, accounts receivable, fixed assets.
- **Project management:** Costing, billing, time and expense, performance units, activity management.
- **Human resources:** Human resources, payroll, training, time and attendance, rostering, benefits.
- **Customer relationship management:** Sales and marketing, commissions, service, customer contact and call center support, Data warehouse and various self-service interfaces for customers, suppliers, and employees.

- **Access control** - user privilege as per authority levels for process execution
Customization - to meet the extension, addition, change in process flow.

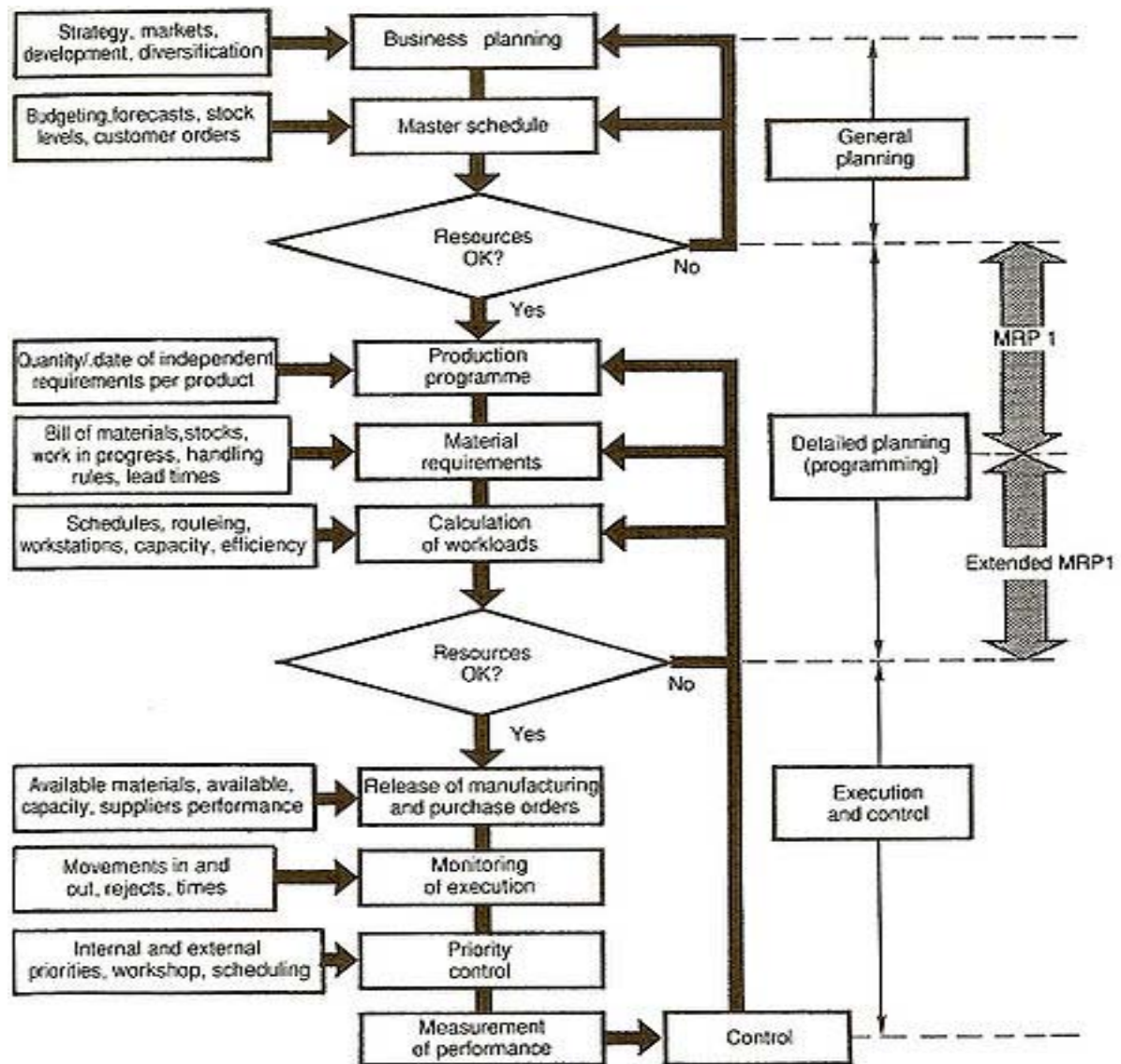
Enterprise Resource Planning (ERP) is a term originally derived from manufacturing resource planning (MRP II) that followed material requirements planning (MRP). MRP evolved into ERP when "routings" became a major part of the software architecture and a company's capacity planning activity also became a part of the standard software activity. ERP systems typically handle the manufacturing, logistics, distribution, inventory, shipping, invoicing, and accounting for a company. ERP software can aid in the control of many business activities, including sales, marketing, delivery, billing, production, inventory management, quality management and human resource management.

ERP systems saw a large boost in sales in the 1990s as companies faced the Y2K problem in their legacy systems. Many companies took this opportunity to replace their legacy information systems with ERP systems. This rapid growth in sales was followed by a slump in 1999, at which time most companies had already implemented their Y2K solution.

ERPs are often incorrectly called back office systems indicating that customers and the general public are not directly involved. This is contrasted with front office systems like customer relationship management (CRM) systems that deal directly with the customers, or the e Business systems such as eCommerce, e Government, e Telecom, and e Finance, or supplier relationship management (SRM) systems.

ERPs are cross-functional and enterprise wide. All functional departments that are involved in operations or production are integrated in one system. In addition to manufacturing, warehousing, logistics, and information technology, this would include accounting, human resources, marketing and strategic management. ERP II means open ERP architecture of components. The older, monolithic ERP systems became component oriented.

EAS — Enterprise Application Suite is a new name for formerly developed ERP systems which include (almost) all segments of business, using ordinary Internet browsers as thin clients.



Around 1980, over-frequent changes in sales forecasts, entailing continual readjustments in production, as well as the unsuitability of the parameters fixed by the system, led MRP (Material Requirement Planning) to evolve into a new concept : Manufacturing Resource Planning or MRP2

Source : "CIM: Principles of Computer Integrated Manufacturing", Jean-Baptiste Waldner, John Wiley & Sons, 1992. Reproduced with author's authorization

Introduction

The unprecedented growth of information and communication technologies (ICT) driven by microelectronics, computer hardware and software systems has influenced all facets of computing applications across organizations. Simultaneously the business environment is becoming increasingly complex with functional units requiring more and more inter-functional data flow for decision making, timely and efficient procurement of product parts, management of inventory, accounting, human resources and distribution of goods and services. In this context, management of organizations needs efficient information systems to improve competitiveness by cost reduction and better logistics. It is universally recognized by large and small-to medium- size enterprises (SME) that the capability of providing the right information at the right time brings tremendous rewards to organizations in a global competitive world of complex business practices. Starting in the late 1980s and the beginning

of the 1990s new software systems known in the industry as enterprise resource planning (ERP) systems have surfaced in the market targeting mainly large complex business organizations. These complex, expensive, powerful, proprietary systems are off the- shelf solutions requiring consultants to tailor and implement them based on the company's requirements. In many cases they force companies to reengineer their business processes to accommodate the logic of the software modules for streamlining data flow throughout the organization. These software solutions, unlike the old, traditional in-house-designed company specific systems, are integrated multi-module commercial packages suitable for tailoring and adding "add-ons" as and when required. The phenomenal growth of computing power and the Internet is bringing ever more challenges for the ERP vendors and the customers to redesign ERP products, breaking the barrier of proprietorship and customization, and embracing the collaborative business over the intranet, extranet and the Internet in a seamless manner. The vendors already promise many "add-on" modules, some of which are already in the market as a sign of acceptance of these challenges by the ERP vendors. It is a never-ending process of reengineering and development bringing new products and solutions to the ERP market. ERP vendors and customers have recognized the need for packages that follow open architecture, provide interchangeable modules and allow easy customization and user interfacing.

Evolution of ERP Systems

The evolution of ERP systems closely followed the spectacular developments in the field of computer hardware and software systems.

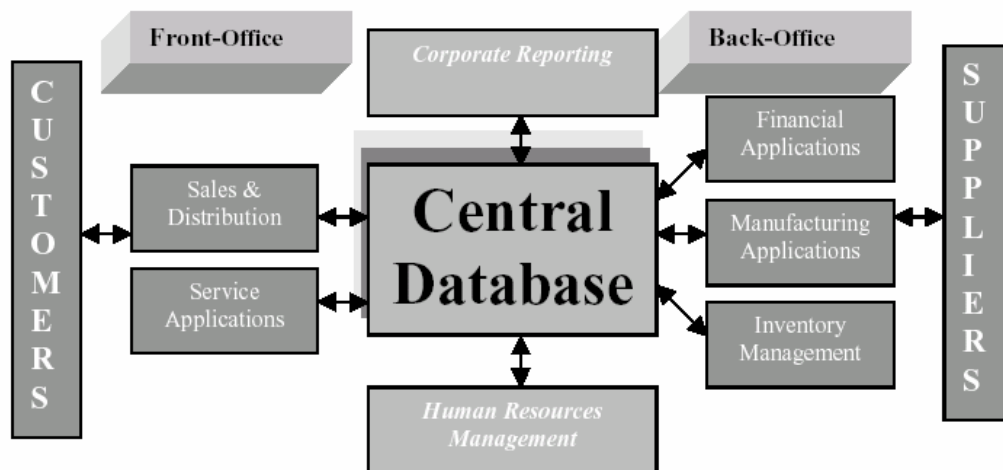


Figure 1.1: ERP systems concept

1960s most organizations designed, developed and implemented centralized computing systems, mostly automating their inventory control systems using inventory control packages (IC). These were legacy systems based on programming languages such as COBOL, ALGOL and FORTRAN. Material requirements planning (MRP) systems were developed in the 1970s which involved mainly planning the product or parts requirements according to the master production schedule. Following this route new software systems called manufacturing resources planning (MRP II) were introduced in the 1980s with an emphasis on optimizing manufacturing processes by synchronizing the materials with production requirements. MRP II included areas such as shop floor and distribution management, project management, finance, human resource and engineering. ERP systems first appeared in the late 1980s and the beginning of the 1990s with the power of enterprise-wide inter-functional coordination

and integration. Based on the technological foundations of MRP and MRP II, ERP systems integrate business processes including manufacturing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, and transportation, providing accessibility, visibility and consistency across the enterprise. During the 1990s ERP vendors added more modules and functions as “add-ons” to the core modules giving birth to the “extended ERPs.” These ERP extensions include advanced planning and scheduling (APS), e-business solutions such as customer relationship management (CRM) and supply chain management (SCM). Figure 2 summarizes the historical events related with ERP.

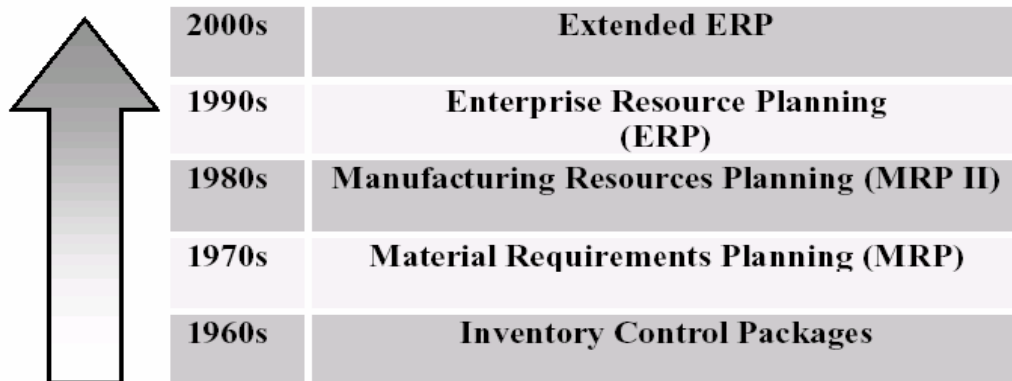


Figure1.2: ERP Evolution

1.1 What is ERP?

Enterprise resource planning systems or enterprise systems are software systems for business management, encompassing modules supporting functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-business. 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. Corporate computing with ERPs allows companies to implement a single integrated system by replacing or re-engineering their mostly incompatible legacy information systems. American Production and Inventory Control Society (2001) has defined ERP systems as “a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company.” We quote several definitions from the published literature to further explain the concept: “ERP (enterprise resource planning systems) comprises of a commercial software package that promises the seamless integration of all the information flowing through the company—financial, accounting, human resources, supply chain and customer information” (Davenport, 1998). “ERP systems are configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization” (Kumar & Van Hillsgers berg, 2000). “One database, one application and a unified interface across the entire enterprise” (Tadger, 1998). “ERP systems are computer-based systems designed to process an organization’s

transactions and facilitate integrated and real-time planning, production, and customer response” (O’Leary, 2001).

ERP is the acronym of Enterprise Resource Planning. ERP utilizes ERP software applications to improve the performance of organizations' resource planning, management control and operational control. ERP software is multi-module application software that integrates activities across functional departments, from product planning, parts purchasing, inventory control, product distribution, to order tracking. ERP software may include application modules for the finance, accounting and human resources aspects of a business.

ERP vs. CRM and SCM

CRM (Customer Relationship Management) and SCM (Supply Chain Management) are two other categories of enterprise software that are widely implemented in corporations and non-profit organizations. While the primary goal of ERP is to improve and streamline internal business processes, CRM attempts to enhance the relationship with customers and SCM aims to facilitate the collaboration between the organization, its suppliers, the manufacturers, the distributors and the partners.

ERP Definition - A Systems Perspective

ERP, often like other IT and business concepts, are defined in many different ways. A sound definition should serve several purposes:

- It provides a base for defining more detailed concepts in the field - ERP software, ERP systems, ERP implementation etc.
- It provides a common ground for comparison with related concepts - CRM, SCM etc.
- It helps answer the basic questions in the field - benefits of ERP, the causes of ERP failure etc.

A definition of ERP based on Systems Theory can serve those purposes. ERP is a system which has its goal, components, and boundary.

The Goal of an ERP System - The goal of ERP is to improve and streamline internal business processes, which typically requires reengineering of current business processes.

The Components of an ERP System - The components of an ERP system are the common components of a Management Information System (MIS).

ERP Software - Module based ERP software is the core of an ERP system. Each software module automates business activities of a functional area within an organization. Common ERP software modules include product planning, parts purchasing, inventory control, product distribution, order tracking, finance, and accounting and human resources aspects of an organization.

Business Processes - Business processes within an organization falls into three levels strategic planning, management control and operational control. ERP has been promoted as solutions for supporting or streamlining business processes at all levels. Much of ERP success, however, has been limited to the integration of various functional departments.

ERP Users - The users of ERP systems are employees of the organization at all levels, from workers, supervisors, and mid-level managers to executives.

Hardware and Operating Systems - Many large ERP systems are UNIX based. Windows NT and Linux are other popular operating systems to run ERP software. Legacy ERP systems may use other operating systems.

The Boundary of an ERP System - The boundary of an ERP system is usually small than the boundary of the organization that implements the ERP system. In contrast, the boundary of supply chain systems and ecommerce systems extends to the organization's suppliers,

distributors, partners and customers. In practice, however, many ERP implementations involve the integration of ERP with external information systems.

Enterprise resource planning (ERP) is the industry term used to describe a broad set of activities supported by multi-module application software that helps a manufacturer or other business manage the important parts of its business. These parts can include product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. ERP can also include application modules for the finance and human resources aspects of a business.

Some of the bigger players in the ERP outsourcing market are SAP, People soft, and J. D. Edwards. New comers include Oracle, IBM, and Microsoft.

ERP stands for Enterprise Resource Planning ERP is a way to integrate the data and processes of an organization into one single system. Usually ERP systems will have many components including hardware and software, in order to achieve integration, most ERP systems use a unified database to store data for various functions found throughout the organization.

The term ERP originally referred to how a large organization planned to use organizational wide resources. In the past, ERP systems were used in larger more industrial types of companies. However, the use of ERP has changed and is extremely comprehensive, today the term can refer to any type of company, no matter what industry it falls in. In fact, ERP systems are used in almost any type of organization - large or small.

In order for a software system to be considered ERP, it must provide an organization with functionality for two or more systems. While some ERP packages exist that only cover two functions for an organization (QuickBooks: Payroll & Accounting), most ERP systems cover several functions.

Today's ERP systems can cover a wide range of functions and integrate them into one unified database. For instance, functions such as Human Resources, Supply Chain Management, Customer Relations Management, Financials, Manufacturing functions and Warehouse Management functions were all once stand alone software applications, usually housed with their own database and network, today, they can all fit under one umbrella - the ERP system

Integration is Key to ERP

Integration is an extremely important part to ERP's. ERP's main goal is to integrate data and processes from all areas of an organization and unify it for easy access and work flow. ERP's usually accomplish integration by creating one single database that employs multiple software modules providing different areas of an organization with various business functions.

Although the ideal configuration would be one ERP system for an entire organization, many larger organizations usually create an ERP system and then build upon the system and external interface for other stand alone systems which might be more powerful and perform better in fulfilling an organizations needs. Usually this type of configuration can be time consuming and does require lots of labor hours.

The Ideal ERP System

An ideal ERP system is when a single database is utilized and contains all data for various software modules. These software modules can include:

- Manufacturing: Some of the functions include, engineering, capacity, workflow management, quality control, bills of material, manufacturing process, etc.
- Financials: Accounts payable, accounts receivable, fixed assets, general ledger and cash management, etc.

- Human Resources: Benefits, training, payroll, time and attendance, etc
- Supply Chain Management: Inventory, supply chain planning, supplier scheduling, claim processing, order entry, purchasing, etc.
- Projects: Costing, billing, activity management, time and expense, etc.
- Customer Relationship Management: sales and marketing, service, commissions, customer contact, calls center support, etc.
- Data Warehouse: Usually this is a module that can be accessed by an organizations customers, suppliers and employees.

ERP Improves Productivity

Before ERP systems, each department in an organization would most likely have their own computer system, data and database. Unfortunately, many of these systems would not be able to communicate with one another or need to store or rewrite data to make it possible for cross computer system communication. For instance, the financials of a company were on a separate computer system than the HR system, making it more intensive and complicated to process certain functions.

Once an ERP system is in place, usually all aspects of an organization can work in harmony instead of every single system needing to be compatible with each other. For large organizations, increased productivity and less types of software are a result.

Enterprise resource planning (ERP) is a company-wide computer software system used to manage and coordinate all the resources, information, and functions of a business from shared data stores.

An ERP system has a service-oriented architecture with modular hardware and software units or "services" that communicate on a local area network. The modular design allows a business to add or reconfigure modules (perhaps from different vendors) while preserving data integrity in one shared database that may be centralized or distributed.

1.2 REASONS FOR THE GROWTH OF ERP

Growth Reasons for a New Manufacturing ERP System

There are lots of reasons that might make you consider implementing a new manufacturing ERP system. If you're having problems with the following growth situations than it is definitely time for new ERP software that better fits your needs.

Does your ERP solution offer simple implementation options for more efficient new technologies and functionality, such as barcodes, warehouse management, and fixed asset tracking?

Customers are attracted to easy solutions to their business needs and technology is developed based on that need. If your ERP software doesn't allow your functionality to keep pace with current technology and business options, then new customers will be hard to find.

Does your vendor still support your ERP software solution?

Many manufacturing and distribution ERP software solutions are no longer being supported by their vendors. If you are not receiving the support to keep up with the market and if the ERP software itself is not expanding to support your needs, then it's time to shop for a new solution.

Are your business needs outrunning your ability to create your own custom solutions and the standard ERP solutions are just not enough?

Sometimes business demands outweigh the ability to create your own custom ERP software solutions. Often, a new ERP system will have the solutions that you need or will be willing to

work with you to develop supported solutions in the standard product that will fit the demand for less than the cost of doing it yourself.

Do you have multiple locations and can your manufacturing ERP solution handle them?

If you have added or are planning to add additional locations to your business, and your current ERP system can't handle multiple plants, locations, or distribution centers, then it's time for you to find an ERP system that will allow you to easily coordinate and execute the business procedures across your company.

Are you expanding into multiple countries?

When businesses grow, they often expand into multiple countries. Many ERP systems can't handle the globalization of the supply chain or business procedures. If this is the case, you should be shopping for a new one.

1.3 SCENARIO AND JUSTIFICATION OF ERP IN INDIA

Having ERP in India is like an investment that most business houses look up to. ERP or enterprise resource planning can be defined as an integrated, multi-module system that assimilates all the data and processes of an organization into a unified system. To attain this goal, it is essential to strike a successful combination of both hardware and software.

The whole concept of enterprise resource planning originated in the large industrial types of companies where the system was used to simplify their processes and workflow. However, with the passage of time, ERP has evolved as a more comprehensive system and now it is largely available to companies of all types and sizes. It serves and supports a wide range of business functions like manufacturing, order entry, accounts receivable and payable, general ledger, purchasing, warehousing, transportation and human resources.

The ERP Scenario in India

There are several positive and negative factors as far as the ERP scenario in India is concerned. Though having ERP in companies of India mostly provides a profitable source of income and quality customer service, there are several challenges to the introduction of ERP in India. This includes change management, organizational intervention, replacing outdated software, shifting from function view to process view, hiring ERP-literate staff and faith in package software in the place of custom-built software.

Certain concerns that have never used ERP software are intimidated whereas some view ERP as a takeover to their IS professionals. Most of the Indian corporations have large in-house IS shops and they consider ERP as a threat to their very existence. Moreover, ERP places more value on the domain knowledge of functions rather than IT skills. The communication infrastructure needed to implement ERP are lacking in some of the indigenous companies.

In spite of all these, the growth of ERP in India is quite promising. Several well-known business houses in India like Cadbury India, Mercedes Benz India, Siemens, Haldia Petrochemicals, L&T, TISCO, and UTI use SAP while Kellogg's India Ltd., Maruti Udyog Ltd., Sony India Pvt Ltd. and CESC are Oracle users. India's most valuable contribution to ERP came in 1980s when the country launched the world class ERP product Marshall from Ramco Systems, by using the technology of the 80's. Marshall is the first successful large scale software from India and several companies like HDFC Bank, Hyundai, Nestle Limited and Standard Chartered Bank use this ERP package. Actually, this product is a formative ERP called virtual splat. A virtual splat enables merging of accounting and manufacturing practices in an easy-to-use, implemented package and is used by small start-up companies.

The benefits of ERP in India

ERP will provide the companies in India the facility to have information available freely, thus making the generation of enquiry or report easier. These systems automatically adhere to most of the standard company rules and compliances, making it easier for the organization to follow. The developed performance modules help the businesses to develop refined analysis, insights, and innovative schemes for improvement. ERP systems in India will also produce more dynamic jobs and improved customer care service and it will also enhance product values. As more and more Indian companies become accustomed to ERP, they can develop a successful broader scale of products for consumers. Last but not the least, having ERP in India implies not having to go and develop software products in foreign countries and distributing them back to India.

Justification of ERP

The expected return on investment provides the cost justification and motivation for investing in ERP. There are quantifiable benefits as well as intangible benefits in the ERP investment decision. The quantifiable benefits have a bottom-line impact on profitability, asset turnover, and a potential effect on stock value. This section discusses the quantifiable and the intangible benefits of an ERP system, which compares firm performance before and after implementing ERP. Other scenarios are encountered in justifying ERP investments. For example, a firm may be considering replacement versus upgrade or re-implementation of an ERP software package. There are significant costs for not successfully implementing an ERP system. Manufacturers often pay more for the lack of systems than they would have paid for improved systems. They carry excess inventory or provide poor customer service, for instance. And manufacturers may invest in ERP without gaining the benefits because the systems are partially implemented, unsuccessfully implemented, or usage deteriorates over time. This is Part One of a four-part article reprinted from *Maximizing Your ERP System* by Dr. Scott Hamilton. Bridging the theory and realities of current ERP systems, *Maximizing Your ERP System* provides practical guidance for managing manufacturing in various environments. Drawing on case studies from Dr. Hamilton's first-hand experience in consulting with more than a thousand firms, it covers common problems and working solutions for how to effectively implement and use ERP systems. The book can be ordered on amazon.com.

This excerpt on "Justification of ERP Investments" is presented in four parts:

- Quantifiable benefits from an ERP system
- The intangible effects of ERP
- Costs of implementing an ERP system
- Replacing or re-implementing an ERP system

Quantifiable Benefits from an ERP System:

Studies that surveyed manufacturers about the impact of ERP systems on firm performance indicate that company size and industry do not affect the results. Benefits have been indicated for large and small firms, whether they make standard or custom products or are in discrete or process manufacturing environments. This section explains the quantifiable benefits in terms of several areas of improvement.

Typical Benefits:

The most significant quantifiable benefits involve reductions in inventory, material costs, and labor and overhead costs, as well as improvements in customer service and sales.

Improved planning and scheduling practices typically lead to inventory reductions of 20 percent or better. This provides not only a one time reduction in assets (and inventory

typically constitutes a large proportion of assets), but also provides ongoing savings of the inventory carrying costs. The cost of carrying inventory includes not only interest but also the costs of warehousing, handling, obsolescence, insurance, taxes, damage, and shrinkage. With interest rates of 10 percent, the carrying costs can be 25 percent to 30 percent.

ERP systems lead to lower inventories because manufacturers can make and buy only what is needed. Demands rather than demand insensitive order points drive time phased plans. Deliveries can be coordinated to actual need dates, orders for unneeded material can be postponed or canceled. The bills of material ensure matched sets are obtained rather than too much of one component and not enough of another. Planned changes in the bills also prevent inventory build up of obsolete materials. With fewer part shortages and realistic schedules, manufacturing orders can be processed to completion faster and work-in-process inventories can be reduced. Implementation of JIT philosophies can further reduce manufacturing lead times and the corresponding inventories.

Material cost reductions. Improved procurement practices lead to better vendor negotiations for prices, typically resulting in cost reductions of 5 percent or better. Valid schedules permit purchasing people to focus on vendor negotiations and quality improvement rather than on expediting shortages and getting material at premium prices. ERP systems provide negotiation information, such as projected material requirements by commodity group and vendor performance statistics. Giving suppliers better visibility of future requirements helps them achieve efficiencies that can be passed on as lower material costs.

Labor cost reductions. Improved manufacturing practices lead to fewer shortages and interruptions, and less rework and overtime. Typical labor savings from successful ERP are a 10 percent reduction in direct and indirect labor costs. By minimizing rush jobs and parts shortages, less time is needed for expediting, material handling, extra setups, disruptions, and tracking split lots or jobs that have been set aside. Production supervisors have better visibility of required work and can adjust capacity or loads to meet schedules. Supervisors have more time for managing, directing and training people. Production personnel have more time to develop better methods and improve quality and throughput.

Improved customer service and sales. Improved coordination of sales and production leads to better customer service and increased sales. Improvements in managing customer contacts, in making and meeting delivery promises, and in shorter order to ship lead times, lead to higher customer satisfaction and repeat orders. Sales people can focus on selling instead of verifying or apologizing for late deliveries. In custom product environments, configurations can be quickly identified and priced, often by sales personnel or even the customer rather than technical staff. Taken together, these improvements in customer service can lead to fewer lost sales and actual increases in sales, typically 10 percent or more.

ERP systems also provide the ability to react to changes in demand and diagnose delivery problems. Corrective actions can be taken early, such as determining shipment priorities, notifying customers of changes to promised delivery dates, or altering production schedules to satisfy demand.

Improved accounting controls. Improved collection procedures can reduce the number of days of outstanding receivables, thereby providing additional available cash. Underlying these improvements is fast accurate invoice creation directly from shipment transactions, timely customer statements, and follows through on delinquent accounts. Credit checking

during order entry and improved handling of customer inquiries further reduces the number of problem accounts. Improved credit management and receivables practices typically reduce the days of outstanding receivables by 18 percent or better.

Trade credit can also be maximized by taking advantage of supplier discounts and cash planning, and paying only those invoices with matching receipts. This can lead to lower requirements for cash-on-hand.

ERP System Benefits on the Balance Sheet

Benefits from improved business processes and improved information provided by an ERP system can directly affect the balance sheet of a manufacturer. To illustrate this impact, a simplified balance sheet is shown in figure 1.3 for a typical manufacturer with annual revenue of \$10 million. The biggest impacts will be on inventory and accounts receivable.

In the example, the company has \$3 million in inventory and \$2 million in outstanding accounts receivable. Based on prior research concerning industry averages for improvements, implementation of an ERP system can lead to a 20 percent inventory reduction and an 18 percent receivables reduction.

	Typical Current	Improvement	Benefit
Current assets			
Cash and other	500,000		
Accounts receivable	2,000,000	18%	356,200
Inventory	3,000,000	20%	600,000
Fixed assets	3,000,000		_____
Total assets	\$8,500,000		\$956,200
Current liabilities	xxx,xxx		
Non current liabilities	xxx,xxx		
Stockholder's equity	xxx,xxx		
Total liabilities and equity	xxx,xxx		

Figure 1.3: Summarized balance sheet for a typical \$10 million firm

Inventory Reduction. A 20 percent inventory reduction results in \$600, 000 less inventory. Improved purchasing practices (that result in reduced material costs) could lower this number even more.

Accounts Receivable. Current accounts receivable represent seventy-three days of outstanding receivables. An 18 percent reduction (to sixty days' receivables) results in \$356, 200 of additional cash available for other uses.

ERP Benefits on the Income Statement

A simplified, summary income statement for the same \$10 million manufacturer is shown in figure 1.4. For many manufacturers, the cost of sales ranges from 65 to 75 percent of sales (the example will use 75 percent). Using industry averages for each major benefit, the

improved business processes and associated information system almost double the current pretax income.

Inventory Reduction. A 20 percent reduction in the current inventory of \$3 million results in ongoing benefits of lower inventory carrying charges. Using a carrying cost of 25 percent results in \$150,000 in lower carrying charges each year, identified here as part of the administrative expenses.

Material Cost Reductions. A 5 percent reduction in material costs because of improved purchasing practices results in annual savings of \$225,000.

Labor Cost Reductions. A 10 percent reduction in labor costs because of less overtime and improved productivity results in annual savings of \$100,000.

Increased Sales. Improvements in customer service typically lead to a 10 percent sales increase, this is not shown in figure 1.3

Annual benefits totaling \$475,000 in this example almost equals the current pretax income of \$500,000.

		Typical		
		Current	Improvement	Benefit
Sales		\$10,000,000	10%	
Cost of sales		7,500,000		
Material	4,500,000	60%	5%	\$225,000
Labor	1,000,000	13%	10%	\$100,000
Overhead	2,000,000	27%		
Administrative expenses	2,000,000			\$150,000
Pretax income		\$ 500,000		\$475,000

Figure 1.4: Summarized income statement for a typical \$10 million firm

ERP Impact on Key Financial Ratios

Ration analysis provides another way to look at the impact of an ERP system. Three ratios illustrate the effect---two related to liquidity and one to operating performance.

Inventory turnover (Cost of Sales/Inventory). Low inventory turnover can indicate possible overstocking and obsolescence. It may also indicate deeper problems of too much of the wrong kind of inventory which can create shortages of needed inventory for production and sales. High turnover indicates better liquidity and superior materials management and merchandising. Given the example \$10 million company, the current number of inventory turns is 2.5. With a 20 percent inventory reduction, the number of inventory turns increases to 3.1.

Days of Receivables ($365 * 1 / (\text{Sales}/\text{Receivables})$). This ratio expresses the average time in days that receivables are outstanding. It is a measure of the management of credit and collections. Generally, the greater the number of days outstanding, the greater the probability of delinquencies in accounts receivable. The lower the number of days, the greater the cash availability. With an 18 percent reduction in receivables, the current days receivable of seventy-three days can be reduced to sixty. This means \$356,200 is available for other purposes.

Return on Assets (Profit before Taxes/Total Assets). This ratio measures the effectiveness of management in employing the resources available to it. Several calculations are necessary to determine the return on assets. In this example, the return on assets can be improved from 5.9 to 12.9 by effectively implementing an ERP system.

Performance evaluation based on ratio analysis can also use comparisons between one's own company and similar firms in terms of size and industry. The Annual Statement Studies provide comparative ratios for this purpose. This use of comparative ratio analysis will use the same three ratios for inventory turnover, days receivable, and return on assets. To perform the analysis, you identify the median and upper quartile ratios for firms in the same industry. These roughly correspond to average and good performance. By comparing the ratios with your firm's current performance, you can calculate how much better your company should be performing to be competitive. The same analysis can be performed using the "BenchmarkReport.com" website.

Using the inventory turns ratio for the example \$10 million manufacturer, assume the Annual Statement Studies indicate that the median and upper quartile are four and six turns for other firms in the same industry. Average performance of four inventory turns translates into an expected inventory of \$1.875 million (\$7.5 million divided by four). If the example firm had this ratio, it would have had \$1.125 million less in inventory. With inventory carrying costs at 25 percent, this would produce savings of \$281,250 each year.

For the days receivable ratio, assume the Annual Statement Studies indicate that sixty and fifty days are the median and upper quartile. The days receivable in the example \$10 million manufacturer is currently seventy-three days, an improvement to sixty days would reduce receivables by \$356,200 (using a daily sales rate of \$27,400 and a thirteen day reduction). This means that cash is available for other purposes.

Note that the return on assets ratio is 5.9 for the example company. Assuming the Annual Statement Studies indicate the return on assets is ten and fifteen for firms in the same industry at the median and upper quartiles, improving the return on assets to equivalent levels would mean increased profits or asset turnover.

ERP Impact on Stock Price

If the integration and improved information of an ERP system results in a better balance sheet and increased profits, these improvements should impact stock price for the company. Although stock price is affected by a variety of factors, the typical effect of improved profits and balance sheet ratios can be estimated. Using the already described example of \$10 million manufacturer and typical benefits, and assuming 100,000 shares outstanding and an existing stock price of \$30.00 per share, the stock price exhibits the effects of an effective ERP, as figure 3.3 shows. With a price/earnings multiplier of six, the stock price for the example company could be increased from \$30 to \$58.80 per

Calculating the potential stock appreciation

	Before ERP	After ERP
Before tax profit	\$500,000.00	\$980,000.00
Earnings per share	\$ 5.00	\$9.80
Current stock price	\$30.00	6 * 9.80 = \$58.80
Multiplier	6	6

These calculations suggest that ERP systems can lead to significant impacts on financial results, including the balance sheet, income statement, key ratios, and stock price.

This concludes Part One of a four-part article reprinted from Maximizing Your ERP System by Dr. Scott Hamilton. Bridging the theory and realities of current ERP systems, Maximizing Your ERP System provides practical guidance for managing manufacturing in various

environments. Drawing on case studies from Dr. Hamilton's first-hand experience in consulting with more than a thousand firms, it covers common problems and working solutions for how to effectively implement and use ERP systems. This excerpt on "Justification of ERP Investments" is presented in following parts.

- The Intangible Effects of ERP
- Effects on Accounting
- Effects on Product and Process Design
- Effects on Production and Materials Management
- Effects on Sales
- Effects on the MIS Function

The Intangible Effects of ERP

The intangible or non-financial benefits of an integrated enterprise resource planning (ERP) system can be viewed from several perspectives. For illustrative purposes, the discussion will focus on the benefits for accounting, product and process design, production, sales, and management information system (MIS) functions. From the overall company standpoint, ERP provides a framework for working effectively together and providing a consistent plan for action.

Each of the intangible effects could be quantified in terms of cost savings. Duplicate data maintenance; for example, requires personnel time in entering data (and possibly managerial time in determining which set of data should be used for decision making). Expediting efforts have a visible effect of consuming personnel time. These quantified cost savings can also be used to show impacts on financial results.

Effect on Accounting

With a common database from ERP, accounting no longer requires duplicate files and redundant data entry. Product costing, for example, can be performed using accurate and up to date product structures. Product costing simulations can be used to analyze the impact of changing material costs, labor rates, and overhead allocations as well as planned changes to bills and routings. Differences between actual and standard costs are highlighted as variances. Order related variances help pinpoint problem areas.

Customer invoices can be based on actual shipments (without duplicate data entry), which helps speed invoice processing. Payables can use purchase order and receipt data for three way matching with supplier invoices.

As manufacturing transactions are recorded, the financial equivalents are automatically generated for updating the general ledger. This provides a complete audit trail from account totals to source documents, ensures accurate and up to date financial information, and permits tracking of actual versus budgeted expenses. Detailed transaction activity can also be easily accessed on line for answering account inquiries.

Since manufacturing transactions automatically update the general ledger, time consuming manual journal entries can be eliminated. Period end closing procedures can be performed in hours or days, rather than weeks. This improves reduces clerical accounting work, and improves the timeliness of financial reports.

Financial reports can be easily customized to meet the needs of various decision makers. Financial projections can be based on detailed ERP calculations for future requirements. Cash planning, for example, can account for current and projected sales orders and planned

purchases, as well as current receivables and payables. Decision support tools (such as spreadsheets, graphics packages and data managers) can use the financial data maintained in the ERP database.

Effects on Product and Process Design

The product structure database offers engineering much greater control over product and process design, especially in terms of engineering change control. Planned changes can be phased in and emergency changes can be communicated immediately.

ERP systems offer numerous analytical tools for the engineering function. When diagnosing the impact of changes to materials and resources, for example, engineers can check where used information to identify the affected products. Lead time reduction efforts can use critical path analysis of item lead times in multi-level bills to focus attention on those key components affecting cumulative manufacturing lead time. Costed multi-level bills can be used to focus cost reduction efforts on high value items. Bill comparisons can be used to highlight differences between products or between revisions of the same product such as to identify upgrade kit requirements.

ERP systems support custom product configurations. Rules-based configurations reduce the need for expert assistance from engineers, and ensure sales personnel (or even customers) can develop timely accurate configurations. Cost estimates and pricing for custom product configurations can also be quickly calculated.

Effects on Production and Materials Management

ERP systems help establish realistic schedules for production and communicate consistent priorities so that everyone knows the most important job to work on at all times. Visibility of future requirements helps production prepare for capacity problems, and also helps suppliers anticipate and meet your needs. As changes to demands or supplies do occur, ERP helps identify the impact on production and purchasing.

Finite scheduling capabilities in ERP ensure production activities get scheduled based on capacity, tool and material constraints. Scheduling rules help minimize setup times and optimize sequencing. Changes in factory demands, as well as changes in available machine time, labor headcount and skill levels, tools, and material, can be immediately simulated to assess the impact on production and purchasing. ERP helps eliminate many crisis situations, so people have more time for planning and quality. Buyers can spend more time in vendor negotiation and quality improvement. When the shortage list is no longer used to manage the shop, the quality of working life can improve.

Effects on Sales

Customer service can be improved by making valid delivery promises and then meeting those promises. Custom product quotations can be developed faster and more accurately, which improves job estimating. Delivery lead times can be shortened and customer inquiries on order status can be answered immediately.

E-commerce capabilities enable customers to place orders and check status over the internet at any time. In addition to customer convenience, this reduces the time requirement for sales and customer service personnel.

Effects on the MIS Function

An ERP system implemented as an integrated software package offers several advantages to the MIS function. The software package can offer a growth path from simple to comprehensive applications built on top of a database management system. It provides an upgrade path to technology and functional enhancements supported by the software vendor. It can reduce the development time and cost for software, documentation, and training classes. These costs would be incurred before the firm can start obtaining the benefits of an ERP system. It permits the MIS staff to focus their attention on organizational change and servicing user needs for customization and professional assistance.

1. Costs of Implementing an ERP System
2. One-Time Costs
3. Ongoing Annual Costs

Costs of Implementing an ERP System

Enterprise resource planning (ERP) implementation costs can be divided into one-time costs and ongoing annual costs. Both types of costs can be segmented into hardware, software, external assistance, and internal personnel. The cost of an ERP software package varies widely, ranging from \$30,000 (USD) for micro-based packages to several million for some mainframe packages. The number of concurrent users generally drives the software costs, so that smaller systems cost less. For illustrative and general guideline purposes, the software package costs range from \$50,000 to \$200,000 (USD) for smaller manufacturers. In addition to the ERP software package, one-time costs may include systems software, development of customized software, or integration with other applications.

- **Hardware.** Hardware selection is driven by the firm's choice of an ERP software package. The ERP software vendor generally certifies which hardware (and hardware configurations) must be used to run the ERP system. Hardware may need to be replaced or upgraded. As a general rule, small to medium-size manufacturers already have microcomputers and a local area network, so that a micro-based ERP system built on de facto standards requires little additional investment in hardware.

- **External Assistance.** External assistance includes the consulting and training costs to implement the ERP package. The software vendor, reseller or independent consultant groups may provide external assistance. The amount of required external assistance is dependent on several factors, such as the complexity of the ERP package, the experience or knowledge of internal personnel, and the extent to which external personnel are used in place of internal personnel to implement the system.

A general guideline for these costs has been the ratio with the cost of the ERP software package. A comprehensive micro-based ERP package typically has a .5 to 1.0 ratio, the manufacturer requires \$.50 to \$1.00 (USD) of external assistance for each dollar of software package costs. The elapsed time for implementation of the entire ERP application typically requires four to six months. Many of the mainframe ERP packages have a three to five ratio for the costs of external assistance. The software package typically costs more, and the elapsed time for implementation requires nine to twenty-four months.

- **Internal Personnel.** Internal personnel time reflects the time commitments for the implementation project team, the executive steering committee, the users in various functional areas, and management information system (MIS) personnel. The time commitments include training classes, development of internal procedures for using the system, developing customized reports and applications, preparation of the data, meetings with external consultants, and team meetings. A general guideline for internal personnel costs can also be expressed as a ratio with the ERP software costs, where a typical ratio is .5 to 1.0.

One-Time Costs

The one-time costs for implementing an ERP system can be simplistically estimated using typical ratios with ERP software costs. In many cases, the use of de facto standard hardware means that a firm already has the hardware for an ERP system.

On Going Annual Costs

- **Software.** Ongoing software costs should include the annual customer support agreement with the ERP software and vendor. This customer support typically provides telephone assistance and software upgrades and is typically priced around 15 percent to 20 percent of the software price. Upgrades to system software releases will also be required.

The upgrade path for new releases of the ERP software package is critical. New releases contain enhancements for functionality and bug fixes, and ensure the software runs on the latest technology platform. From the user's point of view, the upgrade path enables the manufacturer to take advantage of hundred of man-years of development efforts undertaken by the ERP software vendor (and other technology vendors) with minimal investment. From the vendor point of view, it is much easier to support users on the latest releases. However, user changes to source code and other user customizations can make it very expensive or even impossible to upgrade. Additional costs must then be incurred to ensure the customizations work with the latest upgrade. A phased implementation approach may mean that additional software must be purchased. A data collection system, for example, may be implemented as part of a second phase.

- **Hardware.** Ongoing hardware costs will reflect new requirements specified by the ERP vendor to run the software.

- **External Assistance.** External assistance should be used as part of a continuous improvement program to effectively use an ERP system application for running the company. Training and consulting can focus on improved business processes, new or poorly used software functionality, and training of new personnel. A phased implementation approach requires additional assistance at each phase. Additional customizations may be required, especially with evolving user sophistication. As shown in the example estimates in figure 3.4, a ratio of .1 to .2 could be used for total annual costs related to external assistance.

- **Internal Personnel.** The implementation project team does not necessarily end its responsibilities at time of system cutover. A phased implementation approach and continuous improvement efforts will require ongoing time commitments. Employee turnover and job rotation will also require ongoing training efforts. The nature of the ERP software package (and associated system software and hardware) typically mandates the number and expertise of MIS personnel needed for ongoing support. It may range from a part-time clerical person (for administering a micro-based ERP package) to a large group of MIS experts (for some mainframe ERP packages). As shown in the example estimates in figure 3.4, a ratio of .1 to

Replacing or re-implementing an ERP system

1. Replacing or Re-implementing an ERP System
2. Classifications of ERP Success

Replacing or Re-implementing an ERP System

An investment analysis focusing on enterprise resource planning (ERP) benefits frequently applies to those firms initially justifying an ERP implementation. It can also be used to justify a "re-implementation" when the initial efforts have failed to produce desired results. The box describing "Classifications of ERP success" identifies situations where the ERP implementation falls short of producing desired benefits.

Several measures have been used to gauge the successful implementation of an ERP system. The impacts on business performance and bottom-line results provide the best measure of success. Another measure of success is the degree to which the formal ERP system is used to run the business. Four classifications —termed Class A through Class D—have often been used to characterize success.

Class A User. The formal ERP system is effectively used to run the entire company. The manufacturing database defines the way products are really built, and efforts have been undertaken to simplify factory layouts and business processes. The ERP system defines realistic agreed-upon S&OP (sales and operations planning) game plans that cover all demands, sales orders have realistic delivery promises, and the schedules are actually used to coordinate supply chain activities. Coordination efforts reflect action messages, with a manageable number of exceptions. The ERP system correctly updates accounting and provides useful management information. The ERP system typically reflects the latest releases from the software vendor.

Class B User: The formal ERP system is partially effective in being used to run the entire company. It defines S&OP game plans, but they typically lack company-wide agreement and completeness. Supply chain activities are frequently initiated that do not reflect schedules from the ERP system, and the volume of action messages frequently makes them difficult to use. Unrealistic delivery promises on many sales orders contribute to the problem, and also create a larger-than-necessary volume of exception conditions requiring expediting. Some informal and parallel systems are employed to manage expediting outside the formal system. While the manufacturing database provides a reasonably complete and accurate model of how products are really built, there are just enough exceptions to make some people question the formal system. The accounting applications are closely coupled to operational reporting, but sufficient exceptions exist to make the financial impacts suspect.

Class C User. The formal ERP system is only used in part of the company, typically in recording information about sales orders, shipments, purchase order receipts and accounting applications. The manufacturing database provides an incomplete or inaccurate model of how products are really built. S&OP game plans are typically non-existent, and unrealistic delivery promises are made on many sales orders. Several informal or parallel systems are required to coordinate procurement and production activities, typically with excessive expediting efforts and duplicate data maintenance. The accounting applications are not closely coupled to the activities reported in production. The ERP system reflects an old version of the software package.

Class D User. The formal ERP system is not used to run any part of the company, and might be “running” only in the management information system (MIS) function. Informal and parallel systems are being used to manage the business.

Over the last twenty-five years, field surveys about ERP success indicate approximately 10percent of firms achieve Class A status, 40percent are Class B, 40percent are Class C and the remainder (10percent) are failures.

Many manufacturers think they need a “new system” when they really need to upgrade and re-implement their current ERP software package. They can be characterized as a “Class B” or “Class C” user, and are not achieving the possible benefits—both quantifiable and intangible. In many cases, they are using an older version of the software package and have made significant customizations.

The costs to re-implement an ERP system should be significantly lower than implementing a new system. The users have familiarity with system usage, and should know the system strengths and weaknesses. Many firms can live with the shortcomings of their existing system. External assistance from the software vendor and consultants can help develop solutions to shortcomings, and should in any case be part of continuous improvement efforts. With a firm understanding of the re-implementation costs and shortcomings, the investment decision should be justified on the basis of benefits.

Many manufacturers are faced with decisions about replacing their current ERP software package or homegrown system. The replacement decision can stem from any number of situations. The current ERP software package is no longer supported, is too expensive to maintain, is heavily customized and cannot be upgraded, runs on old technology, is too complex and expensive to implement, and so forth. A homegrown ERP system provides partial solutions or non-integrated solutions, it's not on the right technology platform, nobody knows the system and can support it, nobody can upgrade the system, and so forth. The investment decision in these cases tends to use cost comparisons between alternatives.

The starting point for cost comparisons should be the previously discussed classification of costs, both one-time and ongoing annual costs. The following case study illustrates the use of cost displacement as the basis for ERP investments.

Case Study: Cost Displacement as the Basis for ERP System Replacement

Several autonomous plants of a multi-site manufacturing firm implemented a stand-alone micro-based ERP package at each site because it was a cheaper alternative than the corporate standard. The corporate ERP system was a complex mainframe system that required very high levels of external assistance, large expenses for customizations, and high charge-out rates from the corporate MIS function. The one-time and ongoing costs for the corporate system were two to three times higher. The plant management even argued (successfully) that they could implement the new system in three months, obtain the benefits over a six month payback period, and ultimately throw it away in two years when the corporate MIS function was finally ready to implement the mainframe system at their plants. Three years after these plants successfully implemented the single-site ERP system (with three month implementation periods), the plants are still using the system while other sites within the company have struggled to even partially implement the mainframe system. The cost displacements (and benefits) have been estimated to be more than one million dollars.

1.4 Evaluation of ERP

ERP, an abbreviated form of Enterprise Resource Planning is essentially an integrated, multi-module application software package that is capable of performing multiple business functions. Such a system encloses purchasing, warehousing, transportation, software for manufacturing, general ledger, order entry, accounts receivable and payable, as well as human resource. The modules of an ERP system are capable of interfacing with a company's own software, with required efforts, and depending on the software. ERP is essentially packaged software meant for manufacturing industry. The aims of an ERP system involve maximize efficiencies, streamlining operations and manage enterprise resources.

ERP evaluation

There are several companies, which offer ERP solutions. An in-depth view would reveal that there are greater differences between every product. Though these products may seem similar functionally, however they have some key differences in the design and internal workings.

Most of the companies make a wrong choice by selecting vendors who are popular in the market. They may choose software based on cost, as this is the decisive factor for most industries. Such factors are not feasible for ERP assessment.

In general, there are many key identifying factors that assist in ERP assessment. This assessment is a major step taken for choosing ERP solution that might be perfect for a business or organization. For an instance, business functionality is considered an important indicator of effective and dependable ERP software solution. It determines both the versatility and effectiveness of the ERP software to cope up with a particular line of business. Implementation of an ERP system is quite difficult. The human cost for installation and customization of the software is far greater than software itself. The ERP vendor's as well as the so-called top consulting companies offer consulting services based on implementing ERP packages. The vendor should accept the implementation risk and reducing the chances of cost overruns. This is why proper assessment of ERP is vital act for any company.

An ERP system is designed to automate the well-engineered business practices. However, most of them lack the best business practices. They are often tempted to modify their software to manage their poor business practices. It is a way of guaranteeing a failed implementation. A better option would be to streamline the business before ERP software implementation. It helps to customize the software less. This would increase the chances of successful implementation.

Every business has something unique about it, this lends it a competitive advantage. Other things should not be automated. The ERP solution must not address these functions. These other things, which should not be automated and your ERP solution should not address these functions. ERP package should only automate those functions, which are common across all industries. These are the mundane function. They add value to the business. However, it must be handled efficiently so that the business survives. The views of a company may not tally with the views of an ERP vendor. The ERP solutions are found in modules. Each module addresses different function, and the modules are normally sold exclusively. A company should select only those modules that are essential for its functioning and purchase it. This would help to avoid both cost as well as the risk of implementation.

1.5 VARIOUS MODULES OF ERP

ERP software is made up of many software modules. Each ERP software module mimics a major functional area of an organization. Common ERP modules include modules for product planning, parts and material purchasing, inventory control, product distribution, order tracking, finance, accounting, marketing, and HR. Organizations often selectively implement the ERP modules that are both economically and technically feasible.

ERP Production Planning Module

In the process of evolution of manufacturing requirements planning (MRP) II into ERP, while vendors have developed more robust software for production planning, consulting firms have accumulated vast knowledge of implementing production planning module. Production planning optimizes the utilization of manufacturing capacity, parts, components and material resources using historical production data and sales forecasting.

ERP Purchasing Module

Purchase module streamlines procurement of required raw materials. It automates the processes of identifying potential suppliers, negotiating price, awarding purchase order to the supplier, and billing processes. Purchase module is tightly integrated with the inventory control and production planning modules. Purchasing module is often integrated with supply chain management software.

ERP Inventory Control Module

Inventory module facilitates processes of maintaining the appropriate level of stock in a warehouse. The activities of inventory control involves in identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances, and reporting inventory status. Integration of inventory control module with sales, purchase, finance modules allows ERP systems to generate vigilant executive level reports.

ERP Sales Module

Revenues from sales are live blood for commercial organizations. Sales module implements functions of order placement, order scheduling, shipping and invoicing. Sales module is closely integrated with organizations' ecommerce websites. Many ERP vendors offer online storefront as part of the sales module.

ERP Market in Module

ERP marketing module supports lead generation, direct mailing campaign and more.

ERP Financial Module

Both for-profit organizations and non-profit organizations benefit from the implementation of ERP financial module. The financial module is the core of many ERP software systems. It can gather financial data from various functional departments, and generates valuable financial reports such balance sheet, general ledger, trail balance, and quarterly financial statements.

ERP HR Module

HR (Human Resources) is another widely implemented ERP module. HR module streamlines the management of human resources and human capitals. HR modules routinely maintain a complete employee database including contact information, salary details, attendance, performance evaluation and promotion of all employees. Advanced HR module is integrated with knowledge management systems to optimally utilize the expertise of all employees

1.6 ADVANTAGE OF ERP

There are a number of powerful advantages to Enterprise Resource Planning. It has been used to solve a number of problems that have plagued large organizations in the past. At the same time, it is not without a number of disadvantages. Being able to weigh the two will allow a company to decide if this solution will properly meet their needs.

It should first be noted that companies that fail to utilize systems such as ERP may find themselves using various software packages that may not function well with each other. In the long run, this could make the company less efficient than it should be.

There are a number of processes that a company may need to integrate together. One of these processes is called design engineering. When a company is in the process of designing a product, the process of actually creating it is just as important as the end result. ERP can be useful in helping a company find the best design process. Another area where ERP can be useful is order tracking. When a company receives orders for a product, being able to properly track the orders can allow the company to get detailed information on their customers and marketing strategies. If different software packages are being used, this data may not be consistent.

Perhaps one of the most important advantages of ERP is its accounting applications. It can integrate the cost, profit, and revenue information of sales that are made, and it can be presented in a granular way. Enterprise Resource Planning can also be responsible for altering how a product is manufactured. A dating structure can be set up which can allow the company to be informed of when their product should be updated. This is important, because it will allow the company to keep better track of their products, and it can allow the products themselves to be produced with a higher level of quality. Another area where ERP can be an indispensable tool is the area of security. It can protect a company against crimes such as embezzlement or industrial-espionage.

However, with all the advantages that ERP offers, there are a number of disadvantages as well. Perhaps one of the biggest disadvantages to this technology is the cost. At this time, only large corporations can truly take advantage of the benefits that are offered by this technology. This leaves most small and medium sized businesses in the dark. A number of studies have shown that the biggest challenges companies will face when trying to implement ERP deals with investment. The employees must be continually trained on how to use it, and it is also important for companies to make sure the integrity of the data is protected.

According to Anthony, R. A, organizational processes fall into three levels - strategic planning, management control and operational control. Even though much of ERP success has been in facilitating operational coordination across functional departments, successful implementation of ERP systems benefit strategic planning and management control one way or other.

Help reduce operating costs

ERP software attempts to integrate business processes across departments onto a single enterprise-wide information system. The major benefits of ERP are improved coordination across functional departments and increased efficiencies of doing business. The immediate benefit from implementing ERP systems we can expect is reduced operating costs, such as lower inventory control cost, lower production costs, lower marketing costs and lower help desk support costs.

Facilitate Day-to-Day Management

The other benefits from implementing ERP systems are facilitation of day-to-day management. The implementations of ERP systems nurture the establishment of backbone data warehouses. ERP systems offer better accessibility to data so that management can have up-to-the-minute access to information for decision making and managerial control. ERP software helps track actual costs of activities and perform activity based costing.

Support Strategic Planning

Strategic Planning is "a deliberate set of steps that assess needs and resources, define a target audience and a set of goals and objectives, plan and design coordinated strategies with evidence of success, logically connect these strategies to needs, assets, and desired outcomes, and measure and evaluate the process and outcomes." Part of ERP software systems is designed to support resource planning portion of strategic planning. In reality, resource planning has been the weakest link in ERP practice due to the complexity of strategic planning and lack of adequate integration with Decision Support Systems (DSS).

Industry wise advantages

Manufacturing Sector.....Speeding up the whole process.

Distribution and retail Stores----- Accessing the status of the goods

Transport Sector-----Transmit commodities through online transactions.

Project Service industry----- Fastens the compilation of reports.

The advantage and disadvantage of ERP is best understood by studying them under different categories. Hence the next paragraph presents information on corporate as a whole because the advantage of ERP systems in a company is different when compared industry wise.

Advantages in a corporate entity

The accounts department personnel can act independently. They don't have to be behind the technical persons every time to record the financial transactions. Ensures quicker processing of information and reduces the burden of paperwork. Serve the customers efficiently by way of prompt response and follow up. Disposing queries immediately and facilitating the payments from customers with ease and well ahead of the stipulated deadline. It helps in having a say over your competitor and adapting to the whims and fancies of the market and business fluctuations. The swift movement of goods to rural areas and in lesser known places has now become a reality with the use of ERP. The database not only becomes user friendly but also helps to do away with unwanted ambiguity. P is suitable for global operations as it encompasses all the domestic jargons, currency conversions, diverse accounting standards, and multilingual facilities .In short it is the perfect commercial and scientific epitome of the verse "Think Local. Act Global". ERP helps to control and data and facilitates the necessary contacts to acquire the same.

AN OVERVIEW OF ENTERPRISE

Structure

- 2.0 An overview of Enterprise
- 2.1 Integrated Management Information
- 2.2 ERP for Small Business
- 2.3 ERP for make to order companies
- 2.4 Business Process Mapping for ERP Module Design
- 2.3 Hardware Environment and its Selection for ERP Implementation

2.0 AN OVERVIEW OF ENTERPRISE

In the computer industry, an enterprise is an organization that uses computers. A word was needed that would encompass corporations, small businesses, non-profit institutions, government bodies, and possibly other kinds of organizations. The term enterprise seemed to do the job. In practice, the term is applied much more often to larger organizations than smaller ones.

Enterprise resource planning (ERP) is a company-wide computer software system used to manage and coordinate all the resources, information, and functions of a business from shared data stores.

An ERP system has a service-oriented architecture with modular hardware and software units or "services" that communicate on a local area network. The modular design allows a business to add or reconfigure modules (perhaps from different vendors) while preserving data integrity in one shared database that may be centralized or distributed.

While 'enterprise' might suggest the development of the next generation of Richard Bransons and Alan Sugars, the definition – much debated over the last few years – is much broader.

Enterprise focuses on developing skills, attitudes and knowledge in three areas:

- Enterprise capability – innovation, creativity, risk management, risk taking, a 'can-do' attitude and a drive to make things happen
- Financial literacy – the ability to manage one's own finances and to become questioning and informed consumers of financial services
- Business and economic understanding – the ability to understand the business context

The word ENTERPRISE is a noun which has multiple meanings the first of which is a difficult or arduous undertaking, secondly, it can be defined as initiative, or purposeful broad plans requiring many coordinates, or in business or financial applications as the overall operating entity.

The role or objective of an enterprise would be dependent on which definition of the word one is using. In the first definition, there need not be a product, per se, or an economic or business purpose.

The question you posed indicates an enterprise of a commercial, financial, or business nature or purpose. In that instance, the ways, models, growth areas and the productivity of the particular enterprise would be dependent on the product, or service that it will be offering. A financial institution such as a bank, operates differently than a manufacturing entity, such as a car company. Even in the broad areas of similarity, such as a bank, and an investment company, which are both financial enterprises, the ways, models, growth areas and the productivity of each of these enterprises is different.

2.1 INTEGRATED MANAGEMENT INFORMATION

One of the biggest challenges facing any organization today is how to manage and integrate an ever-increasing amount of information, especially when this information is in a variety of data types and formats. Departments and divisions within an organization usually have their own information systems, many of which were not designed to be able to communicate and exchange information. In addition, Legacy information systems contain years, if not decades, of historical organizational information that is typically stored in complex, cumbersome and outdated information systems. Individuals generate still more data via e-mail, text documents, spreadsheets, presentations, and a wide variety of other applications.

Research being conducted in Integrated Information Management Systems develops innovative techniques and applications for integrating disparate information systems, whether their data is structured, semi-structured or unstructured.

In ongoing collaborative efforts with NASA and various industry and educational partners, integrated information management systems technology is going from the research lab into widespread service across the agency and to industry, academia and other government agencies as well. Data translation and transformation algorithms are being used to integrate legacy information systems, relational database systems built on a variety of platforms, and unstructured data such as text documents, spreadsheets, PDF documents and presentations. Combined with advanced search algorithms that can perform searches based on both context and the content of data, these systems are offering an unprecedented look at information within NASA. The result is that data analysis, retrieval and reuse have been improved exponentially, while operational and support costs for system maintenance have been substantially decreased.

While this ground-breaking work is providing dramatic benefits for NASA, it can also provide dramatic benefits for any organization that needs to integrate and analyze information from disparate data sources.

Integrated Management is the understanding and effective direction of every aspect of an organization so that the needs and expectations of all stakeholders are equitably satisfied by the best use of all resources.

2.2 ERP FOR SMALL BUSINESS

Do Small Businesses Need ERP?

Ever since the early 1990s, Fortune 500 companies across the world have been on the ERP bandwagon. With millions of dollars required to implement and well-publicized coverage of ERP failures, many wonder if ERP is worth the cost and risk to small businesses. The topic of small businesses and ERP has been of interest to me, especially lately. Approximately 75% of our new clients and prospects interested in having us conduct an ERP assessment and vendor selection are companies with annual revenues under \$100 million. In fact, one of our recent contract signings for this type of work is for a company with annual revenue of \$15 million. Ten years ago, this type of small business interest in ERP was very uncommon.

The key things driving small businesses to ERP seems to be 1) growth of the small business sector, and 2) more focus on the small business market from ERP software vendors. Most of our small business clients are considering or implementing ERP because of their rapid growth and the corresponding strain it puts on their legacy systems. In addition, large ERP vendors that typically focused solely on the Fortune 500 market are now developing lower-cost solutions with more appropriate functionality for smaller businesses.

A third and final possible reason is because many niche ERP players have entered the marketplace to provide functional solutions for specific industries. Open technologies such as .net have reduced barriers to entry into the ERP market, so many smaller, industry-specific niche players are able to fill the voids left by the big ERP companies at a lower cost.

Although this increasing focus on small business is good for companies with limited capital budgets, it also poses additional risks. Now, there are more choices than ever, and some vendors' products are much more proven than others. So small businesses should be especially thorough when evaluating and selecting an ERP package. They should engage in a vendor selection process that ensures they choose a solid software package that provides a strong ROI to the company

ERP for small business calls for voluminous investments. The amount was fairly affordable to small business entities. There is no doubt or two say about its benefits.

But the question that kept ringing in the market was can everyone afford it. The answer was a stubborn no initially but not anymore. ERP outsourcing, Open Source ERP's and ERP applications designed for S.M.E.'s (Small and medium Enterprises) have successfully overcome the above said limitations.

Some relevant issues concerning ERP for S.M.E.'s are the following:

Evolution of ERP in S.M.E.'S

Enterprise Resource planning was a term restricted purely to elite class. This scene was witnessed in the IT market for some long time ever since ERP was introduced. The large organizations went ahead with ERP process unmindful of negative consequences, not to forget mentioning the fact that they took every proactive measure to curb the same. Needles to say firms were interested in serving such large players. So the fate of Small and Medium enterprises remained unanswered. ERP for S.M.E's remained a mere dream.

ERP Vendors and Corporate giants

It so happened that the number of larger companies without ERP turned out to be nil. Thanks to the awareness created by vendors and IT researchers. No doubt companies were initially hesitant lot and apprehensive on just hearing the word ERP. However the industry proved them otherwise. Then came a stage where a company could not exist but without ERP. Even if their performance was satisfactory they were not able to gain any competitive advantages.

This explanation of how goliaths adapted to ERP has lot of significance in studying their intervention with S.M.E. These bigger companies were not providing the required business to ERP vendors. Even though there are many big companies the number of vendors was always greater in multiples. This means only the best could strike deals and there was no possibility for mediocre or average vendors (in terms of performance). The best players also found that they had none to serve after a point of time because almost every company in the market successfully established ERP (whether on the first or further attempts).

Stabilization of ERP in S.M.E s

SO they had to naturally look for greener and fresher pastures. S.M.E.'S was the only answer. The next question was how to provide best services at an affordable cost and still make profit. In this case the vendors had to be worried only about the number of sales they could make and not the quantum of profits because the number of vendors was few and far between when compared with the number of S.M.E.'S choosing to go for ERP. As the saying goes "necessity is the mother of Invention" vendors had to devise cost effective applications to meet the demands of the Small and Medium enterprises. This was the origin of ERP for S.M.E.'S. This benefited them in terms of business .On the other hand the firms enjoyed greater benefits by making use of this application. Hence ERP and S.M.E. was weighed on the same scale.

S.M.E.'s are becoming the popular choice of ERP vendors. There is an increasing awareness of ERP in S.M.E. market. It has practically helped to unravel the myth that ERP is exclusively meant to business empires. ERP and S.M.E have become important part of enterprise studies.

2.3 ERP FOR MAKE TO ORDER COMPANIES

MTO stands for Make to Order. In this mode of manufacturing no finished product is kept in inventory. When a customer places an order the company produces the item specifically for that customer. All job shops operate as MTO manufacturers. Other modes of manufacturing include engineer-to-order, assemble-to-order, and make-to-stock, repetitive and mixed-mode. For different product lines a single company may operate in several of the modes simultaneously.

As companies implement lean manufacturing many companies are making the transition from make to stock (MTS) towards make to order (MTO).

Many vendors of Enterprise Resource Planning (ERP) systems claim that their products are widely applicable - configurable to meet the needs of any business, whatever the product or service offering. However, producers of high-variety and bespoke products, such as Make-To-Order (MTO) companies, present particular challenges to implementation, it remains unclear whether ERP systems can cater for their needs.. This paper provides a state-of-the-art

review of ERP systems and an assessment of the applicability of ERP to the MTO sector. While several comprehensive reviews of the ERP literature have previously been presented, these either do not focus on the MTO sector, or seek to assess the applicability of ERP systems, or give sufficient attention to recent developments in the fast moving ERP industry. In assessing applicability, this paper considers factors such as the planning and control stages of relevance to MTO companies, the typical size and supply chain positioning of MTO companies, and market-related features. The assessment concludes that there is a significant gap between the requirements of MTO companies and the functionality of ERP systems. One such gap is between the customer enquiry management and design & engineering processes of MTO companies and those supported by ERP systems. Eight key areas in need of further research are described. These include: providing effective decision support tools for customer enquiry management activities in the MTO sector, linking ERP systems with production planning and control concepts of relevance to MTO companies, and conducting an in-depth empirical study into existing applications of ERP systems in MTO companies and their impact on performance

2.4 BUSINESS PROCESS MAPPING FOR ERP MODULE DESIGN

Business Process Mapping refers to activities involved in defining exactly what a business entity does, who is responsible, to what standard a process should be completed and how the success of a business process can be determined. Once this is done, there can be no uncertainty as to the requirements of every internal business process. A business process illustration is produced. The first step in gaining control over an organization is to know and understand the basic processes (Deming, 1982, Juran, 1988, Taylor, 1911).

ISO 9001 requires a business entity to follow a process approach when managing its business, and to this end creating business process maps will assist. The entity can then work towards ensuring its processes are effective (the right process is followed the first time), and efficient (continually improved to ensure processes use the least amount of resources).

The first structured method for documenting process flow, the flow process chart, was introduced by Frank Gilbreth to members of ASME in 1921 as the presentation “Process Charts—First Steps in Finding the One Best Way”. Gilbreth's tools quickly found their way into industrial engineering curricula. In the early 1930s, an industrial engineer, Allan H. Mogensen began training business people in the use of some of the tools of industrial engineering at his Work Simplification Conferences in Lake Placid, New York. A 1944 graduate of Mogensen's class, Art Spinanger, took the tools back to Procter and Gamble where he developed their Deliberate Methods Change Program. Another 1944 graduate, Ben S. Graham, Director of Formcraft Engineering at Standard Register Corporation, adapted the flow process chart to information processing with his development of the multi-flow process chart to display multiple documents and their relationships. In 1947, ASME adopted a symbol set derived from Gilbreth's original work as the ASME Standard for Process Charts.

Recent Developments

Process mapping has in recent years developed due to software tools that can attach metadata to activities, drivers and triggers to provide a more complete understanding of processes. For example, data elements, KPIs, Times, Volumes, documents, files, databases, and compliance applying to an activity can be attached to improve understanding and achieve several business goals simultaneously. Valuable analysis might include identification of duplicated use of data elements, proof or lack of proof of compliance.

The developments mean that process mapping is no longer two-dimensional but multi-dimensional, capable of achieving several important business goals:

- Business process re-engineering
- Regulatory compliance
- Activity analysis
- Service level agreement (SLA) role clarity (RACI)
- Simulation

Making process maps available using a web-browser only means that communication to, and access by stakeholders, is achievable - thus improving compliance, training and end-to end process understanding.

Legislation such as "The Sarbanes-Oxley Act" (also known as SOX) has increased the requirements for improved process understanding and visibility of compliance issues.

Quality improvement practitioners have noted that various graphical descriptions of processes can be useful. These include: detailed flow-charts, work flow diagrams and value stream maps. Each map is helpful depending on the process questions and theories being considered. In these situations process map implies the use of process flow and the current understanding of the causal structure. The purpose of these process maps is to document and stimulate the understanding of $y=f(x)$, where the "y" represents the outputs of a process and x represents the various inputs. These inputs would include sources of noise otherwise described as nuisance variables.

ERP AND RELATED TECHNOLOGIES

Structure

- 3.0 ERP and Related Technologies
- 3.1 Business Process Reengineering (BPR)
- 3.2 Management Information System (MIS)
- 3.3 Executive Information System (EIS)
- 3.4 Decision support System (DSS)
- 3.5 Supply Chain Management (SCM)

3.0 ERP AND RELATED TECHNOLOGIES

Related technologies are like CRM, SCM, and BI et al. First go for ERP implementation. Go for big bang approach or parallel execution depending on your confidence level. Better eat the elephant by bytes.

During implementation of ERP package (which may take 3-12 months depending on organization size and also number of modules) , go for change management, continuous training and also consolidation of changes. These are very important for the success of your implementation. If not done properly there are many examples of costly failures and re-implementations.

After implementing the core ERP solution go for a Application depending on your industry. For example if you are in banking industry which is customer facing then go for CRM package first. If you are in manufacturing go for SCM. After that go for Data mining and warehousing and Business Intelligence.

3.1 BUSINESS PROCESS REENGINEERING (BPR)

Business process reengineering (often referred to by the acronym BPR) is the main way in which organizations become more efficient and modernize. Business process reengineering transforms an organization in ways that directly affect performance.

The impact of BPR on organizational performance

The two cornerstones of any organization are the people and the processes. If individuals are motivated and working hard, yet the business processes are cumbersome and non-essential activities remain, organizational performance will be poor. Business Process Reengineering is the key to transforming how people work. What appear to be minor changes in processes can have dramatic effects on cash flow, service delivery and customer satisfaction. Even the act of documenting business processes alone will typically improve organizational efficiency by 10%.

Business process reengineering (BPR) is, in computer science and management, an approach aiming at improvements by means of elevating efficiency and effectiveness of the business

process that exist within and across organizations. The key to BPR is for organizations to look at their business processes from a "clean slate" perspective and determine how they can best construct these processes to improve how they conduct business.

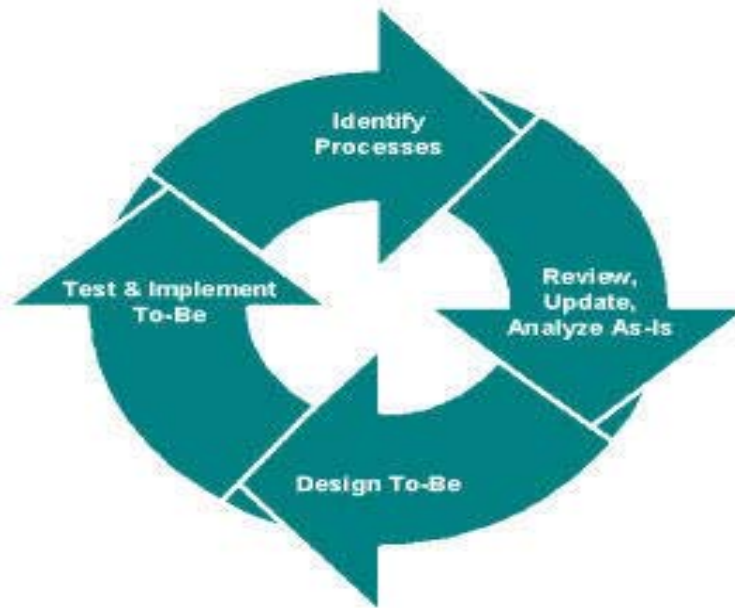


Figure 3.1: Business Process Reengineering Cycle

Business process reengineering is also known as BPR, Business Process Redesign, Business Transformation, or Business Process Change Management.

Overview

Business process reengineering (BPR) began as a private sector technique to help organizations fundamentally rethink how they do their work in order to dramatically improve customer service, cut operational costs, and become world-class competitors. A key stimulus for reengineering has been the continuing development and deployment of sophisticated information systems and networks. Leading organizations are becoming bolder in using this technology to support innovative business processes, rather than refining current ways of doing work.



Reengineering guidance and relationship of Mission and Work Processes to Information Technology

Business process reengineering is one approach for redesigning the way work is done to better support the organization's mission and reduce costs. Reengineering starts with a high-level assessment of the organization's mission, strategic goals, and customer needs. Basic questions are asked, such as "Does our mission need to be redefined? Are our strategic goals aligned with our mission? Who are our customers?" An organization may find that it is operating on questionable assumptions, particularly in terms of the wants and needs of its customers. Only after the organization rethinks what it should be doing, does it go on to decide how best to do it.

Within the framework of this basic assessment of mission and goals, reengineering focuses on the organization's business processes--the steps and procedures that govern how resources are used to create products and services that meet the needs of particular customers or markets. As a structured ordering of work steps across time and place, a business process can be decomposed into specific activities, measured, modeled, and improved. It can also be completely redesigned or eliminated altogether. Reengineering identifies, analyzes, and redesigns an organization's core business processes with the aim of achieving dramatic improvements in critical performance measures, such as cost, quality, service, and speed.

Reengineering recognizes that an organization's business processes are usually fragmented into sub processes and tasks that are carried out by several specialized functional areas within the organization. Often, no one is responsible for the overall performance of the entire process. Reengineering maintains that optimizing the performance of sub processes can result in some benefits, but cannot yield dramatic improvements if the process itself is fundamentally inefficient and outmoded. For that reason, reengineering focuses on redesigning the process as a whole in order to achieve the greatest possible benefits to the organization and their customers. This drive for realizing dramatic improvements by fundamentally rethinking how the organization's work should be done distinguishes reengineering from process improvement efforts that focus on functional or incremental improvement.

History

In 1990, Michael Hammer, a former professor of computer science at the Massachusetts Institute of Technology (MIT), published an article in the Harvard Business Review, in which he claimed that the major challenge for managers is to obliterate non-value adding work, rather than using technology for automating it. This statement implicitly accused managers of having focused on the wrong issues, namely that technology in general, and more specifically information technology, has been used primarily for automating existing processes rather than using it as an enabler for making non-value adding work obsolete.

Hammer's claim was simple: Most of the work being done does not add any value for customers, and this work should be removed, not accelerated through automation. Instead, companies should reconsider their processes in order to maximize customer value, while minimizing the consumption of resources required for delivering their product or service. A similar idea was advocated by Thomas H. Davenport and J. Short in 1990, at that time a member of the Ernst & Young research center, in a paper published in the Sloan Management Review the same year as Hammer published his paper.

This idea, to unbiased review a company's business processes, was rapidly adopted by a huge number of firms, which were striving for renewed competitiveness, which they had lost due to the market entrance of foreign competitors, their inability to satisfy customer needs, and their insufficient cost structure. Even well established management thinkers, such as Peter Drucker and Tom Peters, were accepting and advocating BPR as a new tool for (re-)achieving success in a dynamic world. During the following years, a fast growing number of publications, books as well as journal articles, was dedicated to BPR, and many consulting

firms embarked on this trend and developed BPR methods. However, the critics were fast to claim that BPR was a way to dehumanize the work place, increase managerial control, and to justify downsizing, i.e. major reductions of the work force, and a rebirth of Taylorism under a different label.

Despite this critique, reengineering was adopted at an accelerating pace and by 1993, as many as 65% of the Fortune 500 companies claimed to either have initiated reengineering efforts, or to have plans to do so. This trend was fueled by the fast adoption of BPR by the consulting industry, but also by the study *Made in America*, conducted by MIT, that showed how companies in many US industries had lagged behind their foreign counterparts in terms of competitiveness, time-to-market and productivity.

With the publication of critiques in 1995 and 1996 by some of the early BPR proponents, coupled with abuses and misuses of the concept by others, the reengineering fervor in the U.S. began to wane. Since then, considering business processes as a starting point for business analysis and redesign has become a widely accepted approach and is a standard part of the change methodology portfolio, but is typically performed in a less radical way as originally proposed.

More recently, the concept of Business Process Management (BPM) has gained major attention in the corporate world and can be considered as a successor to the BPR wave of the 1990s, as it is evenly driven by a striving for process efficiency supported by information technology. Equivalently to the critique brought forward against BPR, BPM is now accused of focusing on technology and disregarding the people aspects of change.

Business process reengineering topics

Definition

Different definitions can be found. This section contains the definition provided in notable publications in the field:

"The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed."

"Encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of the change in all its complex technological, human, and organizational dimensions."

Additionally, Davenport (ibid.) points out the major difference between BPR and other approaches to organization development (OD), especially the continuous improvement or TQM movement, when he states: "Today firms must seek not fractional, but multiplicative levels of improvement – 10x rather than 10%." Finally, Johansson provide a description of BPR relative to other process-oriented views, such as Total Quality Management (TQM) and Just-in-time (JIT), and state:

"Business Process Reengineering, although a close relative, seeks radical rather than merely continuous improvement. It escalates the efforts of JIT and TQM to make process orientation a strategic tool and a core competence of the organization. BPR concentrates on core business processes, and uses the specific techniques within the JIT and TQM "toolboxes" as enablers, while broadening the process vision."

In order to achieve the major improvements BPR is seeking for, the change of structural organizational variables, and other ways of managing and performing work is often considered as being insufficient. For being able to reap the achievable benefits fully, the use of information technology (IT) is conceived as a major contributing factor. While IT traditionally has been used for supporting the existing business functions, i.e. it was used for

increasing organizational efficiency, it now plays a role as enabler of new organizational forms, and patterns of collaboration within and between organizations.

BPR derives its existence from different disciplines, and four major areas can be identified as being subjected to change in BPR - organization, technology, strategy, and people - where a process view is used as common framework for considering these dimensions. The approach can be graphically depicted by a modification of "Leavitt's diamond".

Business strategy is the primary driver of BPR initiatives and the other dimensions are governed by strategy's encompassing role. The organization dimension reflects the structural elements of the company, such as hierarchical levels, the composition of organizational units, and the distribution of work between them. Technology is concerned with the use of computer systems and other forms of communication technology in the business. In BPR, information technology is generally considered as playing a role as enabler of new forms of organizing and collaborating, rather than supporting existing business functions. The people / human resources dimension deals with aspects such as education, training, motivation and reward systems. The concept of business processes - interrelated activities aiming at creating a value added output to a customer - is the basic underlying idea of BPR. These processes are characterized by a number of attributes: Process ownership, customer focus, value adding, and cross-functionality.

The role of information technology

Information technology (IT) has historically played an important role in the reengineering concept. It is considered by some as a major enabler for new forms of working and collaborating within an organization and across organizational borders.

Early BPR literature identified several so called disruptive technologies that were supposed to challenge traditional wisdom about how work should be performed.

- Shared databases: making information available at many places
- Expert systems: allowing generalists to perform specialist tasks
- Telecommunication networks: allowing organizations to be centralized and decentralized at the same time
- Decision-support tools: allowing decision-making to be a part of everybody's job
- Wireless data communication and portable computers: allowing field personnel to work office independent
- Interactive videodisk: to get in immediate contact with potential buyers
- Automatic identification and tracking: allowing things to tell where they are: instead of requiring to be found
- High performance computing, allowing on-the-fly planning and revisioning

In the mid 1990s, especially workflow management systems were considered as a significant contributor to improved process efficiency. Also ERP (Enterprise Resource Planning) vendors, such as SAP, JD Edwards, Oracle, PeopleSoft, positioned their solutions as vehicles for business process redesign and improvement

Methodology

Although the labels and steps differ slightly, the early methodologies that were rooted in IT-centric BPR solutions share many of the same basic principles and elements. The following outline is one such model, based on the PRLC (Process Reengineering Life Cycle) approach developed by Guha.

Simplified schematic outline of using a business process approach, exemplified for pharmaceutical R&D:

- Structural organization with functional units
- Introduction of New Product Development as cross-functional process
- Re-structuring and streamlining activities, removal of non-value adding tasks
- Envision new processes
- Secure management support
- Identify reengineering opportunities
- Identify enabling technologies
- Align with corporate strategy
- Initiating change
- Set up reengineering team
- Outline performance goals
- Process diagnosis
- Describe existing processes
- Uncover pathologies in existing processes
- Process redesign
- Develop alternative process scenarios
- Develop new process design
- Design HR architecture
- Select IT platform
- Develop overall blueprint and gather feedback
- Reconstruction
- Develop/install IT solution
- Establish process changes
- Process monitoring
- Performance measurement, including time, quality, cost, IT performance
- Link to continuous improvement
- Loop-back to diagnosis

Benefiting from lessons learned from the early adopters, some BPR practitioners advocated a change in emphasis to a customer-centric, as opposed to an IT-centric, methodology. One such methodology, that also incorporated a Risk and Impact Assessment to account for the impact that BPR can have on jobs and operations, was described by Lon Roberts (1994). Roberts also stressed the use of change management tools to proactively address resistance to change—a factor linked to the demise of many reengineering initiatives that looked good on the drawing board.

Some items to use on a process analysis checklist are: Reduce handoffs, Centralize data, and Reduce delays. Free resources faster, Combine similar activities. Also within the management consulting industry, a significant number of methodological approaches have been developed.

BPR, if implemented properly, can give huge returns. BPR has helped giants like Procter and Gamble Corporation and General Motors Corporation succeed after financial drawbacks due to competition. It helped American Airlines somewhat get back on track from the bad debt

that is currently haunting their business practice. BPR is about the proper method of implementation.

General Motors Corporation

General Motors Corporation implemented a 3-year plan to consolidate their multiple desktop systems into one. It is known internally as "Consistent Office Environment" (Booker, 1994). This reengineering process involved replacing the numerous brands of desktop systems, network operating systems and application development tools into a more manageable number of vendors and technology platforms. According to Donald G. Hedeem, director of desktops and deployment at GM and manager of the upgrade program, he says that the process "lays the foundation for the implementation of a common business communication strategy across General Motors." Lotus Development Corporation and Hewlett-Packard Development Company, formerly Compaq Computer Corporation, received the single largest non-government sales ever from General Motors Corporation. GM also planned to use Novell NetWare as a security client, Microsoft Office and Hewlett-Packard printers. According to Donald G. Hedeem, this saved GM 10% to 25% on support costs, 3% to 5% on hardware, 40% to 60% on software licensing fees, and increased efficiency by overcoming incompatibility issues by using just one platform across the entire company.

DELL Incorporated

Michael Dell is the founder and CEO of DELL Incorporated, which has been in business since 1983 and has been the world's fastest growing major PC Company. Michael Dell's idea of a successful business is to keep the smallest inventory possible by having a direct link with the manufacturer. When a customer places an order, the custom parts requested by the customer are automatically sent to the manufacturer for shipment. This reduces the cost for inventory tracking and massive warehouse maintenance. Dell's website is noted for bringing in nearly "\$10 million each day in sales." (Smith, 1999). Michael Dell mentions:

"If you have a good strategy with sound economics, the real challenge is to get people excited about what you're doing. A lot of businesses get off track because they don't communicate an excitement about being part of a winning team that can achieve big goals. If a company can't motivate its people and it doesn't have a clear compass, it will drift."

Dell's stocks have been ranked as the top stock for the decade of the 1990s, when it had a return of 57,282% (Knestout and Ramage, 1999). Michael Dell is now concentrating more on customer service than selling computers since the PC market price has pretty much equalized. Michael Dell notes:

"The new frontier in our industry is service, which is a much greater differentiator when price has been equalized. In our industry, there's been a pretty huge gap between what customers want in service and what they can get, so they've come to expect mediocre service. We may be the best in this area, but we can still improve quite a bit—in the quality of the product, the availability of parts, service and delivery time."

Michael Dell understands the concept of BPR and really recognizes where and when to reengineer his business.

Ford Motor Company

Ford reengineered their business and manufacturing process from just manufacturing cars to manufacturing quality cars, where the number one goal is quality. This helped Ford save millions on recalls and warranty repairs. Ford has accomplished this goal by incorporating barcodes on all their parts and scanners to scan for any missing parts in a completed car

coming off of the assembly line. This helped them guarantee a safe and quality car. They have also implemented Voice-over-IP (VoIP) to reduce the cost of having meetings between the branches.

Procter and Gamble Corporation

A multi-billion dollar corporation like Procter and Gamble Corporation, which carries 300 brands and growing really has a strong grasp in re-engineering. Procter and Gamble Corporation's chief technology officer, G. Gil Cloyd, explains how a company which carries multiple brands has to contend with the "classic innovator's dilemma — most innovations fail, but companies that don't innovate die. His solution, innovating innovation..." (Teresko, 2004). Cloyd has helped a company like Procter and Gamble grow to \$5.1 billion by the fiscal year of 2004. According to Cloyd's scorecard, he was able to raise the volume by 17%, the organic volume by 10%, sales are at \$51.4 billion up by 19%, with organic sales up 8%, earnings are at \$6.5 billion up 25% and share earnings up 25%. Procter and Gamble also has a free cash flow of \$7.3 billion or 113% of earnings, dividends up 13% annually with a total shareholder return of 24%. Cloyd states: "The challenge we face is the competitive need for a very rapid pace of innovation. In the consumer products world, we estimate that the required pace of innovation has double in the last three years. Digital technology is very important in helping us to learn faster." G. Gil Cloyd also predicts, in the near future, "as much as 90% of P&G's R&D will be done in a virtual world with the remainder being physical validation of results and options."

Critique

The most frequent and harsh critique against BPR concerns the strict focus on efficiency and technology and the disregard of people in the organization that is subjected to a reengineering initiative. Very often, the label BPR was used for major workforce reductions. Thomas Davenport, an early BPR proponent, stated that:

"When I wrote about "business process redesign" in 1990, I explicitly said that using it for cost reduction alone was not a sensible goal. And consultants Michael Hammer and James Champy, the two names most closely associated with reengineering, have insisted all along that layoffs shouldn't be the point. But the fact is, once out of the bottle, the reengineering genie quickly turned ugly."

Michael Hammer similarly admitted that:

"I wasn't smart enough about that. I was reflecting my engineering background and was insufficient appreciative of the human dimension. I've learned that's critical."

Other criticisms brought forward against the BPR concept include:

- Lack of management support for the initiative and thus poor acceptance in the organization.
- Exaggerated expectations regarding the potential benefits from a BPR initiative and consequently failure to achieve the expected results.

Underestimation of the resistance to change within the organization.

Implementation of generic so-called best-practice processes that do not fit specific company needs.

- Over trust in technology solutions.
- Performing BPR as a one-off project with limited strategy alignment and long-term perspective.
- Poor project management.

3.2 MANAGEMENT INFORMATION SYSTEM (MIS)

A management information system (MIS) is a subset of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solving business problems such as costing a product, service or a business-wide strategy. Management information systems are distinct from regular information systems in that they are used to analyze other information systems applied in operational activities in the organization. Academically, the term is commonly used to refer to the group of information management methods tied to the automation or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive information systems.

At the start, in businesses and other organizations, internal reporting was made manually and only periodically, as a by-product of the accounting system and with some additional statistics, and gave limited and delayed information on management performance.

In their infancy, business computers were used for the practical business of computing the payroll and keeping track of accounts payable and accounts receivable. As applications were developed that provided managers with information about sales, inventories, and other data that would help in managing the enterprise, the term "MIS" arose to describe these kinds of applications. Today, the term is used broadly in a number of contexts and includes (but is not limited to): decision support systems, resource and people management applications, project management and database retrieval application.

Definition

An 'MIS' is a planned system of the collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of management. According to Philip Kotler "A marketing information system consists of people, equipment, and procedures to gather, sort, analyze, evaluate, and distribute needed, timely, and accurate information to marketing decision makers."

The terms MIS and information system are often confused. Information systems include systems that are not intended for decision making. The area of study called MIS is sometimes referred to, in a restrictive sense, as information technology management. That area of study should not be confused with computer science. IT service management is a practitioner-focused discipline. MIS has also some differences with Enterprise Resource Planning (ERP) as ERP incorporates elements that are not necessarily focused on decision support.

Before one can explain management information systems, the terms systems, information, and management must briefly be defined. A system is a combination or arrangement of parts to form an integrated whole. A system includes an orderly arrangement according to some common principles or rules. A system is a plan or method of doing something.

The study of systems is not new. The Egyptian architects who built the pyramids relied on a system of measurements for construction of the pyramids. Phoenician astronomers studied the system of the stars and predicted future star positions. The development of a set of standards and procedures, or even a theory of the universe, is as old as history itself. People have always sought to find relationships for what is seen or heard or thought about.

A system is a scientific method of inquiry, that is, observation, the formulation of an idea, the testing of that idea, and the application of the results. The scientific method of problem solving is systems analysis in its broadest sense. Data are facts and figures. However, data have no value until they are compiled into a system and can provide information for decision making.

Information is what is used in the act of informing or the state of being informed. Information includes knowledge acquired by some means. In the 1960s and 70s, it became necessary to formalize an educational approach to systems for business so that individuals and work groups and businesses who crossed boundaries in the various operations of business could have appropriate information. Technical developments in computers and data processing and new theories of systems analysis made it possible to computerize systems. Much of this computerization of systems was an out growth of basic research by the federal government.

Management is usually defined as planning, organizing, directing, and controlling the business operation. This definition, which evolved from the work of Henri Fayol in the early 1900s, defines what a manager does, but it is probably more appropriate to define what management is rather than what management does. Management is the process of allocating an organization's inputs, including human and economic resources, by planning, organizing, directing, and controlling for the purpose of producing goods or services desired by customers so that organizational objectives are accomplished. If management has knowledge of the planning, organizing, directing, and controlling of the business, its decisions can be made on the basis of facts, and decisions are more accurate and timely as a result.

Management information systems are those systems that allow managers to make decisions for the successful operation of businesses. Management information systems consist of computer resources, people, and procedures used in the modern business enterprise. The term MIS stands for management information systems. MIS also refers to the organization that develops and maintains most or all of the computer systems in the enterprise so that managers can make decisions. The goal of the MIS organization is to deliver information systems to the various levels of corporate managers. MIS professionals create and support the computer system throughout the company. Trained and educated to work with corporate computer systems, these professionals are responsible in some way for nearly all of the computers, from the largest mainframe to the desktop and portable PCs.

Background

Management information systems do not have to be computerized, but with today's large, multinational corporations, computerization is a must for a business to be successful. However, management information systems began with simple manual systems such as customer databases on index cards. As early as 1642, the French mathematician and philosopher Blaise Pascal invented the first mechanical adding machine so that figures could be added to provide information. Almost two hundred years later, Charles Babbage, a professor of mathematics at Cambridge University in England, wanted to make a machine that would compute mathematical tables. He attempted to build a computing machine during the 1880s. He failed because his ideas were beyond his technical capabilities, not because the idea was flawed. Babbage is often called the father of the computer. With the advent of the computer, management information systems became automated.

In the late 1890s, because of the efforts of Herman Hollerith, who created a punch-card system to tabulate the data for the 1890 census, it was possible to begin to provide data-processing equipment. The punch card developed by Hollerith was later used to form a company to provide data-processing equipment. This company evolved into International Business Machines (IBM). Mainframe computers were used for management information systems from the 1940s, 50s, 60s, and up until the 1970s. In the 1970s, personal computers were first built by hobbyists. Then Apple computer developed one of the first practical personal computers. In the early 1980s, IBM developed its PC, and since then, the personal computer industry has mushroomed. Almost every management information system revolves around some kind of computer hardware and software.

Management information systems are becoming more important, and MIS personnel are more visible than in the 1960s and 1970s, when they were hidden away from the rest of the

company and performed tasks behind closed doors. So remote were some MIS personnel from the operations of the business that they did not even know what products their companies made. This has changed because the need for an effective management information system is of primary concern to the business organization. Managers use MIS operations for all phases of management, including planning, organizing, directing, and controlling.

The MIS Job Today

MIS personnel must be technically qualified to work with computer hardware, software, and computer information systems. Currently, colleges and universities cannot produce enough MIS personnel for business needs, and job opportunities are great. MIS managers, once they have risen through their technical ranks of their organization to become managers, must remember that they are no longer doing the technical work. They must cross over from being technicians to become managers. Their job changes from being technicians to being systems managers who manage other people's technical work. They must see themselves as needing to solve the business problems of the user, and not just of the data-processing department. MIS managers are in charge of the systems development operations for their firm. Systems development requires four stages when developing a system for any phase of the organization:

- Phase I is systems planning. The systems team must investigate the initial problem by determining what the problem is and developing a feasibility study for management to review.
- Phase II identifies the requirements for the systems. It includes the systems analysis, the user requirements, necessary hardware and software, and a conceptional design for the system. Top management then reviews the systems analysis and design.
- Phase III involves the development of the systems. This involves developing technical support and technical specifications, reviewing users' procedures control, designing the system, testing the system, and providing user training for the system. At this time, management again reviews and decides on whether to implement the system.
- Phase IV is the implementation of the system. The new system is converted from the old system, and the new system is implemented and then refined. There must then be ongoing maintenance and reevaluation of the system to see if it continues to meet the needs of the business.

Types of Systems

Management information systems can be used as a support to managers to provide a competitive advantage. The system must support the goals of the organization. Most organizations are structured along functional lines, and the typical systems are identified as follows:

- Accounting management information systems: All accounting reports are shared by all levels of accounting managers.
- Financial management information systems: The financial management information system provides financial information to all financial managers within an organization including the chief financial officer. The chief financial officer analyzes historical and current financial activity, projects future financial needs, and monitors and controls the use of funds over time using the information developed by the MIS department.
- Manufacturing management information systems: More than any functional area, operations have been impacted by great advances in technology. As a result, manufacturing operations have changed. For instance, inventories are provided just in time so that great amounts of money are not spent for warehousing huge inventories.

In some instances, raw materials are even processed on railroad cars waiting to be sent directly to the factory. Thus there is no need for warehousing.

- Marketing management information systems: A marketing management information system supports managerial activity in the area of product development, distribution, pricing decisions, promotional effectiveness, and sales forecasting. More than any other functional area, marketing systems relies on external sources of data. These sources include competition and customers, for example.

Human resources management information systems: Human resources management information systems are concerned with activities related to workers, managers, and other individuals employed by the organization. Because the personnel function relates to all other areas in business, the human resources management information system plays a valuable role in ensuring organizational success. Activities performed by the human resources management information systems include, work-force analysis and planning, hiring, training, and job assignments.

The above are examples of the major management information systems. There may be other management information systems if the company is identified by different functional areas

The Management Information Systems (MIS) program is designed to provide students with a strong educational foundation preparing them as information system (IS) professionals. MIS consists of a specially designed curriculum which emphasizes conceptual, analytical, technical and interpersonal skills.

The MIS program provides comprehensive training in the application, use, and management of information systems preparing students to provide effective information services and support.

Management Information System (MIS.) is basically concerned with processing data into information. This is then communicated to the various departments in an organization for appropriate decision-making. Data Information Communication Decisions Data collection involves the use of Information Technology (IT) comprising: computers and telecommunications networks (E-Mail, Voice Mail, Internet, telephone, etc.) Computers are important for more quantitative, than qualitative, data collection, storage and retrieval, Special features are speed and accuracy, and storage of large amount of data.

Accessing Information Using Computer Systems

Introduction

With the introduction of the Internet and the World Wide Web, students are able to access information faster and more efficiently using modern Computer Systems. In the past, one had to visit national and school libraries and spend large amounts of time accessing information. Presently any individual can quickly access, save and print information from any location. One can access the internet from Cyber Cafes, schools, mobile phones, at home and even at modern libraries through internet service providers and telecommunication links. Apart from the internet, information e.g. encyclopedias, tutorials and documentaries can be accessed from Compact Discs which are read from computer systems. Components of Computer System Modern computer systems consist of a central processing unit, primary storage, secondary storage, input, and output and communication devices.

- The central processing unit (CPU) manipulates data and controls the other parts of the computer system
- Primary storage (RAM) temporarily stores data and program instructions during processing.

- Secondary storage (hard disk drives) stores data and instructions when they are not used in processing.

3.3 EXECUTIVE INFORMATION SYSTEM (EIS)

An Executive Information System (EIS) is a type of management information system intended to facilitate and support the information and decision-making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization. It is commonly considered as a specialized form of a Decision Support System (DSS)

The emphasis of EIS is on graphical displays and easy-to-use user interfaces. They offer strong reporting and drill-down capabilities. In general, EIS are enterprise-wide DSS that help top-level executives analyze, compare, and highlight trends in important variables so that they can monitor performance and identify opportunities and problems. EIS and data warehousing technologies are converging in the marketplace.

In recent years, the term EIS has lost popularity in favor of Business Intelligence (with the sub areas of reporting, analytics, and digital dashboards).

History

Traditionally, executive information systems were developed as mainframe computer-based programs. The purpose was to package a company's data and to provide sales performance or market research statistics for decision makers, as such financial officers, marketing directors, and chief executive officers, who were not necessarily well acquainted with computers. The objective was to develop computer applications that would highlight information to satisfy senior executives' needs. Typically, an EIS provides data that would only need to support executive level decisions instead of the data for all the company.

Today, the application of EIS is not only in typical corporate hierarchies, but also at personal computers on a local area network. EIS now cross computer hardware platforms and integrate information stored on mainframes, personal computer systems, and minicomputers. As some client service companies adopt the latest enterprise information systems, employees can use their personal computers to get access to the company's data and decide which data are relevant for their decision makings. This arrangement makes all users able to customize their access to the proper company's data and provide relevant information to both upper and lower levels in companies.

Components

The components of an EIS can typically be classified as:

Hardware:

When talking about hardware for an EIS environment, we should focus on the hardware that meet the executive's needs. The executive must be put first and the executive's needs must be defined before the hardware can be selected. The basic computer hardware needed for a typical EIS includes four components:

- Input data-entry devices. These devices allow the executive to enter, verify, and update data immediately,
- The central processing unit (CPU), which is the kernel because it controls the other computer system components,
- Data storage files. The executive can use this part to save useful business information, and this part also help the executive to search historical business information easily,

- Output devices, which provide a visual or permanent record for the executive to save or read. This device refers to the visual output device or printer.

In addition, with the advent of local area networks (LAN), several EIS products for networked workstations became available. These systems require less support and less expensive computer hardware. They also increase access of the EIS information to many more users within a company.

Software

Choosing the appropriate software is vital to design an effective EIS. Therefore, the software components and how they integrate the data into one system are very important. The basic software needed for a typical EIS includes four components:

- Text base software. The most common form of text is probably documents,
- Database. Heterogeneous databases residing on a range of vendor-specific and open computer platforms help executives access both internal and external data,
- Graphic base. Graphics can turn volumes of text and statistics into visual information for executives. Typical graphic types are: time series charts, scatter diagrams, maps, motion graphics, sequence charts, and comparison-oriented graphs (i.e., bar charts),
- Model base. The EIS models contain routine and special statistical, financial, and other quantitative analysis.

Perhaps a more difficult problem for executives is choosing from a range of highly technical software packages. Ease of use, responsiveness to executives' requests, and price are all reasonable considerations. Further, it should be considered whether the package can run on existing hardware

User Interface

An EIS needs to be efficient to retrieve relevant data for decision makers, so the user interface is very important. Several types of interfaces can be available to the EIS structure, such as scheduled reports, questions/answers, menu driven, command language, natural language, and input/output. It is crucial that the interface must fit the decision maker's decision-making style. If the executive is not comfortable with the information questions/answers style, the EIS will not be fully utilized. The ideal interface for an EIS would be simple to use and highly flexible, providing consistent performance, reflecting the executive's world, and containing help information.

Telecommunication

As decentralizing is becoming the current trend in companies, telecommunications will play a pivotal role in networked information systems. Transmitting data from one place to another has become crucial for establishing a reliable network. In addition, telecommunications within an EIS can accelerate the need for access to distributed data.

Applications

EIS enables executives to find those data according to user-defined criteria and promote information-based insight and understanding. Unlike a traditional management information system presentation, EIS can distinguish between vital and seldom-used data, and track different key critical activities for executives, both which are helpful in evaluating if the company is meeting its corporate objectives. After realizing its advantages, people have applied EIS in many areas, especially, in manufacturing, marketing, and finance areas.

Manufacturing

Basically, manufacturing is the transformation of raw materials into finished goods for sale, or intermediate processes involving the production or finishing of semi-manufactures. It is a large branch of industry and of secondary production. Manufacturing operational control focuses on day-to-day operations, and the central idea of this process is effectiveness and efficiency. To produce meaningful managerial and operational information for controlling manufacturing operations, the executive has to make changes in the decision processes. EIS provides the evaluation of vendors and buyers, the evaluation of purchased materials and parts, and analysis of critical purchasing areas. Therefore, the executive can oversee and review purchasing operations effectively with EIS. In addition, because production planning and control depends heavily on the plant's data base and its communications with all manufacturing work centers, EIS also provides an approach to improve production planning and control

Marketing

In an organization, marketing executives' role is to create the future. Their main duty is managing available marketing resources to create a more effective future. For this, they need make judgments about risk and uncertainty of a project and its impact on the company in short term and long term. To assist marketing executives in making effective marketing decisions, an EIS can be applied. EIS provides an approach to sales forecasting, which can allow the market executive to compare sales forecast with past sales. EIS also offers an approach to product price, which is found in venture analysis. The market executive can evaluate pricing as related to competition along with the relationship of product quality with price charged. In summary, EIS software package enables marketing executives to manipulate the data by looking for trends, performing audits of the sales data, and calculating totals, averages, changes, variances, or ratios. All of these sales analysis functions help marketing executives to make final decisions.

Financial

A financial analysis is one of the most important steps to companies today. The executive needs to use financial ratios and cash flow analysis to estimate the trends and make capital investment decisions. An EIS is a responsibility-oriented approach that integrates planning or budgeting with control of performance reporting, and it can be extremely helpful to finance executives. Basically, EIS focuses on accountability of financial performance and it recognizes the importance of cost standards and flexible budgeting in developing the quality of information provided for all executive levels. EIS enables executives to focus more on the long-term basis of current year and beyond, which means that the executive not only can manage a sufficient flow to maintain current operations but also can figure out how to expand operations that are contemplated over the coming years. Also, the combination of EIS and EDI environment can help cash managers to review the company's financial structure so that the best method of financing for an accepted capital project can be concluded. In addition, the EIS is a good tool to help the executive to review financial ratios, highlight financial trends and analyze a company's performance and its competitors.

Advantages and Disadvantages

Advantages

- Easy for upper-level executives to use, extensive computer experience is not required in operations
- Provides timely delivery of company summary information
- Information that is provided is better understood
- Filters data for management
- Improves tracking information
- Offers efficiency to decision makers

Disadvantages

- Functions are limited, cannot perform complex calculations
- Hard to quantify benefits and to justify implementation of an EIS
- Executives may encounter information overload
- System may become slow, large, and hard to manage
- Difficult to keep current data
- May lead to less reliable and insecure data
- Small companies may encounter excessive costs for implementation
- Too detailed Oriented

Future Trends

The future of executive info systems will not be bound by mainframe computer systems. This trend allows executives escaping from learning different computer operating systems and substantially decreases the implementation costs for companies. Because utilizing existing software applications lies in this trend, executives will also eliminate the need to learn a new or special language for the EIS package. Future executive information systems will not only provide a system that supports senior executives, but also contain the information needs for middle managers. The future executive information systems will become diverse because of integrating potential new applications and technology into the systems, such as incorporating artificial intelligence (AI) and integrating multimedia characteristics and ISDN technology into an EIS

3.4 DECISION SUPPORT SYSTEM (DSS)

Decision support systems constitute a class of computer-based information systems including knowledge-based systems that support decision-making activities.

Definition

Decision Support Systems (DSS) are a specific class of computerized information systems that supports business and organizational decision-making activities. A properly-designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions.

Typical information that a decision support application might gather and present would be:

- An inventory of all of your current information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- Comparative sales figures between one week and the next,
- Projected revenue figures based on new product sales assumptions,

- The consequences of different decision alternatives, given past experience in a context that is described.

History

In the absence of an all-inclusive definition, we focus on the history of DSS. According to Keen, the concept of decision support has evolved from two main areas of research: the theoretical studies of organizational decision making done at the Carnegie Institute of Technology during the late 1950s and early 1960s, and the technical work on interactive computer systems, mainly carried out at the Massachusetts Institute of Technology in the 1960s. It is considered that the concept of DSS became an area of research of its own in the middle of the 1970s, before gaining in intensity during the 1980s. In the middle and late 1980s, executive information systems (EIS), group decision support systems (GDSS), and organizational decision support systems (ODSS) evolved from the single user and model-oriented DSS.

In 1987 Texas Instruments completed development of the Gate Assignment Display System (GADS) for United Airlines. This decision support system is credited with significantly reducing travel delays by aiding the management of ground operations at various airports, beginning with O'Hare International Airport in Chicago and Stapleton Airport in Denver Colorado.

Beginning in about 1990, data warehousing and on-line analytical processing (OLAP) began broadening the realm of DSS. As the turn of the millennium approached, new Web-based analytical applications were introduced.

It is clear that DSS belong to an environment with multidisciplinary foundations, including (but not exclusively) database research, artificial intelligence, human-computer interaction, simulation methods, software engineering, and telecommunications.

The advent of better and better reporting technologies has seen DSS start to emerge as a critical component of management design. Examples of this can be seen in the intense amount of discussion of DSS in the education environment.

DSS also have a weak connection to the user interface paradigm of hypertext. Both the University of Vermont PROMIS system (for medical decision making) and the Carnegie Mellon ZOG/KMS system (for military and business decision making) were decision support systems which also were major breakthroughs in user interface research. Furthermore, although hypertext researchers have generally been concerned with information overload, certain researchers, notably Douglas Engelbart, have been focused on decision makers in particular. There is no way to confirm/deny this.

Taxonomies

As with the definition, there is no universally-accepted taxonomy of DSS either. Different authors propose different classifications. Using the relationship with the user as the criterion, Haettenschwiler differentiates passive, active, and cooperative DSS. A passive DSS is a system that aids the process of decision making, but that cannot bring out explicit decision suggestions or solutions. An active DSS can bring out such decision suggestions or solutions. A cooperative DSS allows the decision maker (or its advisor) to modify, complete, or refine the decision suggestions provided by the system, before sending them back to the system for validation. The system again improves, completes, and refines the suggestions of the decision maker and sends them back to her for validation. The whole process then starts again, until a consolidated solution is generated.

Taxonomy for DSS has been created by Daniel Power. Using the mode of assistance as the criterion, Power differentiates communication-driven DSS, data-driven DSS, document-driven DSS, knowledge-driven DSS, and model-driven DSS.

A model-driven DSS emphasizes access to and manipulation of a statistical, financial, optimization, or simulation model. Model-driven DSS use data and parameters provided by users to assist decision makers in analyzing a situation, they are not necessarily data-intensive. Dicodess is an example of an open source model-driven DSS generator.

A communication-driven DSS supports more than one person working on a shared task, examples include integrated tools like Microsoft's NetMeeting or Groove. A data-driven DSS or data-oriented DSS emphasizes access to and manipulation of a time series of internal company data and, sometimes, external data.

A document-driven DSS manages, retrieves, and manipulates unstructured information in a variety of electronic formats.

A knowledge-driven DSS provides specialized problem-solving expertise stored as facts, rules, procedures, or in similar structures.

Using scope as the criterion, Power differentiates enterprise-wide DSS and desktop DSS. An enterprise-wide DSS is linked to large data warehouses and serves many managers in the company. A desktop, single-user DSS is a small system that runs on an individual manager's PC.

Architectures

Once again, different authors identify different components in a DSS. For example, Sprague and Carlson¹⁰ identify three fundamental components of DSS: (a) the database management system (DBMS), (b) the model-base management system (MBMS), and (c) the dialog generation and management system (DGMS).

Haag et al. describe these three components in more detail:

The Data Management Component stores information (which can be further subdivided into that derived from an organization's traditional data repositories, from external sources such as the Internet, or from the personal insights and experiences of individual users), the Model Management Component handles representations of events, facts, or situations (using various kinds of models, two examples being optimization models and goal-seeking models), and the User Interface Management Component is, of course, the component that allows a user to interact with the system.

According to Power academics and practitioners have discussed building DSS in terms of four major components: (a) the user interface, (b) the database, (c) the model and analytical tools, and (d) the DSS architecture and network.

Hättenschwiler identifies five components of DSS:

- a) Users with different roles or functions in the decision making process (decision maker, advisors, domain experts, system experts, data collectors),
- b) A specific and definable decision context,
- c) A target system describing the majority of the preferences,
- d) A knowledge base made of external data sources, knowledge databases, working databases, data warehouses and meta-databases, mathematical models and methods, procedures, inference and search engines, administrative programs, and reporting systems, and
- e) A working environment for the preparation, analysis, and documentation of decision alternatives.

Arakas proposes a generalized architecture made of five distinct parts:

- a) The data management system,
- b) The model management system,
- c) The knowledge engine,
- d) The user interface, and
- e) The user(s).

Development Frameworks

DSS systems are not entirely different from other systems and require a structured approach. A framework was provided by Sprague and Watson (1993). The framework has three main levels.

1. Technology levels;
2. People involved;
3. The developmental approach

1. Technology Levels

Sprague has suggested that there are three levels of hardware and software that has been proposed for DSS.

- **Level 1 – Specific DSS**

This is the actual application that will be used to by the user. This is the part of the application that allows the decision maker to make decisions in a particular problem area. The user can act upon that particular problem.

- **Level 2 – DSS Generator**

This level contains Hardware/software environment that allows people to easily develop specific DSS applications. This level makes use of case tools or systems such as Crystal, AIMMS, iThink and Clementine.

- **Level 3 – DSS Tools**

Contains lower level hardware/software. DSS generators including special languages, function libraries and linking modules

2. People Involved

Sprague suggests there are 5 roles involved in a typical DSS development cycle.

- a) The end user.
- b) An intermediary.
- c) DSS developer
- d) Technical supporter
- e) Systems Expert

3. Developmental

The developmental approach for a DSS system should be strongly iterative. This will allow for the application to be changed and redesigned at various intervals. The initial problem is used to design the system on and then tested and revised to ensure the desired outcome is achieved.

Classifying DSS

There are several ways to classify DSS applications. Not every DSS fits neatly into one category, but a mix of two or more architecture in one.

Holsapple and Whinston classify DSS into the following six frameworks: Text-oriented DSS, Database-oriented DSS, Spreadsheet-oriented DSS, Solver-oriented DSS, Rule-oriented DSS, and Compound DSS.

A compound DSS is the most popular classification for a DSS. It is a hybrid system that includes two or more of the five basic structures described by Holsapple and Whinston¹³.

The support given by DSS can be separated into three distinct, interrelated categories¹⁴: Personal Support, Group Support, and Organizational Support.

Additionally, the build up of a DSS is also classified into a few characteristics.

- 1) Inputs: this is used so the DSS can have factors, numbers, and characteristics to analyze;
- 2) User knowledge and expertise: This allows the system to decide how much it is relied on, and exactly what inputs must be analyzed with or without the user;
- 3) Outputs: This is used so the user of the system can analyze the decisions that may be made and then potentially
- 4) Make a decision: This decision making is made by the DSS, however, it is ultimately made by the user in order to decide on which criteria it should use.

DSSs which perform selected cognitive decision-making functions and are based on artificial intelligence or intelligent agents technologies are called Intelligent Decision Support Systems (IDSS).

The nascent field of Decision engineering treats the decision itself as an engineered object, and applies engineering principles such as Design and Quality assurance to an explicit representation of the elements that make up a decision.

Applications

As mentioned above, there are theoretical possibilities of building such systems in any knowledge domain.

One example is the Clinical decision support system for medical diagnosis. Other examples include a bank loan officer verifying the cr of a loan applicant or an engineering firm that has bids on several projects and wants to know if they can be competitive with their costs.

DSS is extensively used in business and management. Executive dashboard and other business performance software allow faster decision making, identification of negative trends, and better allocation of business resources.

A growing area of DSS application, concepts, principles, and techniques is in agricultural production, marketing for sustainable development. For example, the DSSAT4 package developed through financial support of USAID during the 80's and 90's has allowed rapid assessment of several agricultural production systems around the world to facilitate decision-making at the farm and policy levels. There are, however, many constraints to the successful adoption on DSS in agriculture.

A specific example concerns the Canadian National Railway system, which tests its equipment on a regular basis using a decision support system. A problem faced by any railroad is worn-out or defective rails, which can result in hundreds of derailments per year. Under a DSS, CN managed to decrease the incidence of derailments at the same time other companies were experiencing an increase.

DSS has many applications that have already been spoken about. However, it can be used in any field where organization is necessary. Additionally, a DSS can be designed to help make decisions on the stock market, or deciding which area or segment to market a product toward.

Benefits of DSS

- Improves personal efficiency;
- Express problem solving;
- Facilitates interpersonal communication;

- Promotes learning or training;
- Increases organizational control;
- Generates new evidence in support of a decision;
- Creates a competitive advantage over competition;
- Encourages exploration and discovery on the part of the decision maker;
- Reveals new approaches to thinking about the problem space.

3.5 SUPPLY CHAIN MANAGEMENT (SCM)

Supply chain management (SCM) is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers (Harland, 1996). Supply Chain Management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption (supply chain).

Idea

The definition an American professional association put forward is that Supply Chain Management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies. More recently, the loosely coupled, self-organizing network of businesses that cooperates to provide product and service offerings has been called the Extended Enterprise.¹

Supply Chain Management can also refer to Supply chain management software which are tools or modules used in executing supply chain transactions, managing supplier relationships and controlling associated business processes.

Supply chain event management (abbreviated as SCEM) is a consideration of all possible occurring events and factors that can cause a disruption in a supply chain. With SCEM possible scenarios can be created and solutions can be planned.

Supply Chain Management Problems

Supply chain management must address the following problems:

Distribution Network Configuration: Number, location and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks and customers.

Distribution Strategy: Including questions of operating control (centralized, decentralized or shared), delivery scheme (e.g., direct shipment, pool point shipping, Cross docking, DSD (direct store delivery), closed loop shipping), mode of transportation (e.g., motor carrier, including truckload, LTL, parcel, railroad, inter-modal, including TOFC and COFC, ocean freight, airfreight), replenishment strategy (e.g., pull, push or hybrid), and transportation control (e.g., owner-operated, private carrier, common carrier, contract carrier, or 3PL).

Trade-Offs in Logistical Activities

The above activities must be coordinated well together in order to achieve the least total logistics cost. Trade-offs exist that increase the total cost if only one of the activities is optimized. For example, full truckload (FTL) rates are more economical on a cost per pallet basis than less than truckload (LTL) shipments. If, however, a full truckload of a product is

ordered to reduce transportation costs there will be an increase in inventory holding costs which may increase total logistics costs. It is therefore imperative to take a systems approach when planning logistical activities. These trade-offs are key to developing the most efficient and effective Logistics and SCM strategy.

Information: Integration of and other processes through the supply chain to share valuable information, including demand signals, forecasts, inventory, transportation, and potential collaboration etc.

Inventory Management: Quantity and location of inventory including raw materials, work-in-progress (WIP) and finished goods.

Cash-Flow: Arranging the payment terms and the methodologies for exchanging funds across entities within the supply chain.

Supply chain execution is managing and coordinating the movement of materials, information and funds across the supply chain. The flow is bi-directional.

Activities/functions

Supply chain management is a cross-function approach to manage the movement of raw materials into an organization, certain aspects of the internal processing of materials into finished goods, and then the movement of finished goods out of the organization toward the end-consumer. As organizations strive to focus on core competencies and becoming more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other entities that can perform the activities better or more cost effectively. The effect is to increase the number of organizations involved in satisfying customer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain management concepts. The purpose of supply chain management is to improve trust and collaboration among supply chain partners, thus improving inventory visibility and improving inventory velocity.

Several models have been proposed for understanding the activities required to manage material movements across organizational and functional boundaries. SCOR is a supply chain management model promoted by the Supply Chain Council. Another model is the SCM Model proposed by the Global Supply Chain Forum (GSCF). Supply chain activities can be grouped into strategic, tactical, and operational levels of activities.

Strategic

- Strategic network optimization, including the number, location, and size of warehouses, distribution centers, and facilities
- Strategic partnership with suppliers, distributors, and customers, creating communication channels for critical information and operational improvements such as cross docking, direct shipping, and third-party logistics
- Product life cycle management, so that new and existing products can be optimally integrated into the supply chain and capacity management
- Information Technology infrastructure, to support supply chain operations
- Where-to-make and what-to-make-or-buy decisions
- Aligning overall organizational strategy with supply strategy

Tactical

- Sourcing contracts and other purchasing decisions.
- Production decisions, including contracting, scheduling, and planning process definition.
- Inventory decisions, including quantity, location, and quality of inventory.
- Transportation strategy, including frequency, routes, and contracting.
- Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise.
- Milestone payments
- Focus on customer demand.

Operational

- Daily production and distribution planning, including all nodes in the supply chain.
- Production scheduling for each manufacturing facility in the supply chain (minute by minute).
- Demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers.
- Sourcing planning, including current inventory and forecast demand, in collaboration with all suppliers.
- Inbound operations, including transportation from suppliers and receiving inventory.
- Production operations, including the consumption of materials and flow of finished goods.
- Outbound operations, including all fulfillment activities, warehousing and transportation to customers.
- Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers.

Supply chain management

Organizations increasingly find that they must rely on effective supply chains, or networks, to successfully compete in the global market and networked economy.² In Peter Drucker's (1998) new management paradigms, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

During the past decades, globalization, outsourcing and information technology have enabled many organizations, such as Dell and Hewlett Packard, to successfully operate solid collaborative supply networks in which each specialized business partner focuses on only a few key strategic activities (Scott, 1993). This inter-organizational supply network can be acknowledged as a new form of organization. However, with the complicated interactions among the players, the network structure fits neither "market" nor "hierarchy" categories (Powell, 1990). It is not clear what kind of performance impacts different supply network structures could have on firms, and little is known about the coordination conditions and trade-offs that may exist among the players. From a systems perspective, a complex network structure can be decomposed into individual component firms (Zhang and Dilts, 2004). Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal management working of other individual players. Therefore, the choice of an internal management control structure is known to impact local firm performance (Mintzberg, 1979).

In the 21st century, changes in the business environment have contributed to the development of supply chain networks. First, as an outcome of globalization and the proliferation of

multinational companies, joint ventures, strategic alliances and business partnerships, there were found to be significant success factors, following the earlier "Just-In-Time", "Lean Manufacturing" and "Agile Manufacturing" practices.³ Second, technological changes, particularly the dramatic fall in information communication costs, which are a significant component of transaction costs, have led to changes in coordination among the members of the supply chain network (Coase, 1998).

Many researchers have recognized these kinds of supply network structures as a new organization form, using terms such as "Keiretsu", "Extended Enterprise", "Virtual Corporation", "Global Production Network", and "Next Generation Manufacturing System". In general, such a structure can be defined as "a group of semi-independent organizations, each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration" (Akkermans, 2001).

The security management system for supply chain is described in ISO/IEC 28000 and ISO/IEC 28001 and related standards published jointly by ISO and IEC.

Developments in Supply Chain Management

Six major movements can be observed in the evolution of supply chain management studies: Creation, Integration, and Globalization (Lavassani et al., 2008^a), Specialization Phases One and Two, and SCM 2.0.

1. Creation Era

The term supply chain management was first coined by an American industry consultant in the early 1980s. However the concept of supply chain in management, was of great importance long before in the early 20th century, especially by the creation of the assembly line. The characteristics of this era of supply chain management include the need for large scale changes, re-engineering, downsizing driven by cost reduction programs, and widespread attention to the Japanese practice of management.

2. Integration Era

This era of supply chain management studies was highlighted with the development of Electronic Data Interchange (EDI) systems in the 1960s and developed through the 1990s by the introduction of Enterprise Resource Planning (ERP) systems. This era has continued to develop into the 21st century with the expansion of internet-based collaborative systems. This era of SC evolution is characterized by both increasing value-added and cost reduction through integration.

3. Globalization Era

The third movement of supply chain management development, globalization era, can be characterized by the attention towards global systems of supplier relations and the expansion of supply chain over national boundaries and into other continents. Although the use of global sources in the supply chain of organizations can be traced back to several decades ago (e.g. the oil industry), it was not until the late 1980s that a considerable number of organizations started to integrate global sources into their core business. This era is characterized by the globalization of supply chain management in organizations with the goal of increasing competitive advantage, creating more value-added, and reducing costs through global sourcing.

4. Specialization Era -- Phase One -- Outsourced Manufacturing and Distribution

In the 1990s industries began to focus on "core competencies" and adopted a specialization model. Companies abandoned vertical integration, sold off non-core operations, and outsourced those functions to other companies. This changed management requirements by extending the supply chain well beyond the four walls and distributing management across specialized supply chain partnerships.

This transition also re-focused the fundamental perspectives of each respective organization. OEMs became brand owners that needed deep visibility into their supply base. They had to control the entire supply chain from above instead of from within. Contract manufacturers had to manage bills of material with different part numbering schemes from multiple OEMs and support customer requests for work -in-process visibility and vendor-managed inventory (VMI).

The specialization model creates manufacturing and distribution networks composed of multiple, individual supply chains specific to products, suppliers, and customers who work together to design, manufacture, distribute, market, sell, and service a product. The set of partners may change according to a given market, region, or channel, resulting in a proliferation of trading partner environments, each with its own unique characteristics and demands.

5. Specialization Era -- Phase Two -- Supply Chain Management as a Service

Specialization within the supply chain began in the 1980s with the inception of transportation brokerages, warehouse management, and non asset based carriers and has matured beyond transportation and logistics into aspects of supply planning, collaboration, execution and performance management.

At any given moment, market forces could demand changes within suppliers, logistics providers, locations, customers and any number of these specialized participants within supply chain networks. This variability has significant effect on the supply chain infrastructure, from the foundation layers of establishing and managing the electronic communication between the trading partners to the more-complex requirements, including the configuration of the processes and work flows that are essential to the management of the network itself.

Supply chain specialization enables companies to improve their overall competencies in the same way that outsourced manufacturing and distribution has done, it allows them to focus on their core competencies and assemble networks of best in class domain specific partners to contribute to the overall value chain itself – thus increasing overall performance and efficiency. The ability to quickly obtain and deploy this domain specific supply chain expertise without developing and maintaining an entirely unique and complex competency in house is the leading reason why supply chain specialization is gaining popularity.

Outsourced technology hosting for supply chain solutions debuted in the late 1990s and has taken root in transportation and collaboration categories most dominantly. This has progressed from the Application Service Provider (ASP) model from approximately 1998 through 2003 to the On-Demand model from approximately 2003-2006 to the Software as a Service (SaaS) model we are currently focused on today.

6. Supply Chain Management 2.0 (SCM 2.0)

Building off of globalization and specialization, SCM 2.0 has been coined to describe both the changes within the supply chain itself as well as the evolution of the processes, methods and tools that manage it in this new "era".

Web 2.0 is defined as a trend in the use of the World Wide Web that is meant to increase creativity, information sharing, and collaboration among users. At its core, the common attribute that Web 2.0 brings is it helps us navigate the vast amount of information available on the web to find what we are looking for. It is the notion of a usable pathway. SCM 2.0 follows this notion into supply chain operations. It is the pathway to SCM results – the combination of the processes, methodologies, tools and delivery options to guide companies to their results quickly as the complexity and speed of the supply chain increase due to the effects of global competition, rapid price fluctuations, surging oil prices, short product life cycles, expanded specialization, near/far and off shoring, and talent scarcity.

SCM 2.0 leverages proven solutions designed to rapidly deliver results with the agility to quickly manage future change for continuous flexibility, value and success. This is delivered through competency networks composed of best of breed supply chain domain expertise to understand which elements, both operationally and organizationally, are the critical few that deliver the results as well as the intimate understanding of how to manage these elements to achieve desired results, finally the solutions are delivered in a variety of options as no-touch via business process outsourcing, mid-touch via managed services and software as a service (SaaS), or high touch in the traditional software deployment model.

Supply chain business process integration

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes. An example scenario: the purchasing department places orders as requirements become appropriate. Marketing, responding to customer demand, communicates with several distributors and retailers as it attempts to satisfy this demand. Shared information between supply chain partners can only be fully leveraged through process integration.

Supply chain business process integration involves collaborative work between buyers and suppliers, joint product development, common systems and shared information. According to Lambert and Cooper (2000) operating an integrated supply chain requires continuous information flow. However, in many companies, management has reached the conclusion that optimizing the product flows cannot be accomplished without implementing a process approach to the business. The key supply chain processes stated by Lambert (2004) are:

- Customer relationship management
- Customer service management
- Demand management
- Order fulfillment
- Manufacturing flow management
- Supplier relationship management
- Product development and commercialization
- Returns management

Much has been written about demand management. Best in Class companies have similar characteristics. They include the following:

- a) Internal and external collaboration
- b) Lead time reduction initiatives
- c) Tighter feedback from customer and market demand
- d) Customer level forecasting

One could suggest other key critical supply business processes combining these processes stated by Lambert such as:

- a) Customer service management
- b) Procurement
- c) Product development and commercialization
- d) Manufacturing flow management/support
- e) Physical distribution
- f) Outsourcing/partnerships
- g) Performance measurement

a) Customer service management process

Customer Relationship Management concerns the relationship between the organization and its customers. Customer service provides the source of customer information. It also provides the customer with real-time information on promising dates and product availability through interfaces with the company's production and distribution operations. Successful organizations use following steps to build customer relationships:

- determine mutually satisfying goals between organization and customers
- establish and maintain customer rapport
- produce positive feelings in the organization and the customers

b) Procurement process

Strategic plans are developed with suppliers to support the manufacturing flow management process and development of new products. In firms where operations extend globally, sourcing should be managed on a global basis. The desired outcome is a win-win relationship, where both parties benefit, and reduction times in the design cycle and product development are achieved. Also, the purchasing function develops rapid communication systems, such as electronic data interchange (EDI) and Internet linkages to transfer possible requirements more rapidly. Activities related to obtaining products and materials from outside suppliers requires performing resource planning, supply sourcing, negotiation, order placement, inbound transportation, storage, handling and quality assurance, many of which include the responsibility to coordinate with suppliers in scheduling, supply continuity, hedging, and research into new sources or programs.

c) Product development and commercialization

Here, customers and suppliers must be united into the product development process, thus to reduce time to market. As product life cycles shorten, the appropriate products must be developed and successfully launched in ever shorter time-schedules to remain competitive. According to Lambert and Cooper (2000), managers of the product development and commercialization process must:

- coordinate with customer relationship management to identify customer-articulated needs,
- select materials and suppliers in conjunction with procurement, and
- develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

d) Manufacturing flow management process

The manufacturing process is produced and supplies products to the distribution channels based on past forecasts. Manufacturing processes must be flexible to respond to market changes, and must accommodate mass customization. Orders are processes operating on a just-in-time (JIT) basis in minimum lot sizes. Also, changes in the manufacturing flow process lead to shorter cycle times, meaning improved responsiveness and efficiency of demand to customers. Activities related to planning, scheduling and supporting manufacturing operations, such as work-in-process storage, handling, transportation, and time phasing of components, inventory at manufacturing sites and maximum flexibility in the coordination of geographic and final assemblies postponement of physical distribution operations.

e) Physical distribution

This concerns movement of a finished product/service to customers. In physical distribution, the customer is the final destination of a marketing channel, and the availability of the

product/service is a vital part of each channel participant's marketing effort. It is also through the physical distribution process that the time and space of customer service become an integral part of marketing, thus it links a marketing channel with its customers (e.g. links manufacturers, wholesalers, retailers).

f) Outsourcing/partnerships

This is not just outsourcing the procurement of materials and components, but also outsourcing of services that traditionally have been provided in-house. The logic of this trend is that the company will increasingly focus on those activities in the value chain where it has a distinctive advantage and everything else it will outsource. This movement has been particularly evident in logistics where the provision of transport, warehousing and inventory control is increasingly subcontracted to specialists or logistics partners. Also, to manage and control this network of partners and suppliers requires a blend of both central and local involvement. Hence, strategic decisions need to be taken centrally with the monitoring and control of supplier performance and day-to-day liaison with logistics partners being best managed at a local level.

g) Performance measurement

Experts found a strong relationship from the largest arcs of supplier and customer integration to market share and profitability. By taking advantage of supplier capabilities and emphasizing a long-term supply chain perspective in customer relationships can be both correlated with firm performance. As logistics competency becomes a more critical factor in creating and maintaining competitive advantage, logistics measurement becomes increasingly important because the difference between profitable and unprofitable operations becomes narrower. A.T. Kearney Consultants (1985) noted that firms engaging in comprehensive performance measurement realized improvements in overall productivity. According to experts internal measures are generally collected and analyzed by the firm including

- Cost
- Customer Service
- Productivity measures
- Asset measurement, and
- Quality.

External performance measurement is examined through customer perception measures and "best practice" benchmarking, and includes:

- 1) Customer perception measurement, and
- 2) Best practice benchmarking.

Components of Supply Chain Management are:

1. Standardization
2. Postponement
3. Customization

Theories of Supply Chain Management

Currently there exists a gap in the literature available in the area of supply chain management studies, on providing theoretical support for explaining the existence and the boundaries of supply chain management. Few authors such as Halldorsson, et al. (2003), Ketchen and Hult (2006) and Lavassani, et al. (2008) had tried to provide theoretical foundations for different areas related to supply chain with employing organizational theories. These theories include:

- Resource-based view (RBV)
- Transaction Cost Analysis (TCA)

- Knowledge-based view (KBV)
- Strategic Choice Theory (SCT)
- Agency theory (AT)
- Institutional theory (InT)
- Systems Theory (ST)
- Network Perspective (NP)

Supply chain sustainability

Supply chain sustainability is a business issue affecting an organization's supply chain or logistics network and is frequently quantified by comparison with SECH ratings. SECH ratings are defined as social, ethical, cultural and health footprints. Consumers have become more aware of the environmental impact of their purchases and companies' SECH ratings and, along with non-governmental organizations (NGOs), are setting the agenda for transitions to organically-grown foods, anti-sweatshop labor codes and locally-produced goods that support independent and small businesses. Because supply chains frequently account for over 75% of a company's carbon footprint many organizations are exploring how they can reduce this and thus improve their SECH rating.

Components of Supply Chain Management Integration

The management components of SCM:

The SCM components are the third element of the four-square circulation framework. The level of integration and management of a business process link is a function of the number and level, ranging from low to high, of components added to the link (Ellram and Cooper, 1990, Houlihan, 1985). Consequently, adding more management components or increasing the level of each component can increase the level of integration of the business process link. The literature on business process re-engineering, buyer-supplier relationships and SCM suggests various possible components that must receive managerial attention when managing supply relationships. Lambert and Cooper (2000) identified the following components which are:

- Planning and control
- Work structure
- Organization structure
- Product flow facility structure
- Information flow facility structure
- Management methods
- Power and leadership structure
- Risk and reward structure
- Culture and attitude

However, a more careful examination of the existing literature will lead us to a more comprehensive structure of what should be the key critical supply chain components, the "branches" of the previous identified supply chain business processes, that is, what kind of relationship the components may have that are related with suppliers and customers accordingly. Bowersox and Closs states that the emphasis on cooperation represents the synergism leading to the highest level of joint achievement (Bowersox and Closs, 1996). A primary level channel participant is a business that is willing to participate in the inventory ownership responsibility or assume other aspects of financial risk, thus including primary level components (Bowersox and Closs, 1996). A secondary level participant (specialized), is a business that participates in channel relationships by performing essential services for

primary participants, thus including secondary level components, which are in support of primary participants. Third level channel participants and components that will support the primary level channel participants, and which are the fundamental branches of the secondary level components, may also be included.

Consequently, Lambert and Cooper's framework of supply chain components does not lead us to the conclusion about what are the primary or secondary (specialized) level supply chain components (see Bowersox and Closs, 1996, page. 93). That is, what supply chain components should be viewed as primary or secondary, how these components should be structured in order to have a more comprehensive supply chain structure, and to examine the supply chain as an integrative one (See above sections 2.1 and 3.1).

Reverse Supply Chain Reverse logistics is the process of planning, implementing and controlling the efficient, effective inbound flow and storage of secondary goods and related information opposite to the traditional supply chain direction for the purpose of recovering value or proper disposal. Reverse logistics is also referred to as "Aftermarket Customer Services". In other words, anytime money is taken from a company's Warranty Reserve or Service Logistics budget that is a Reverse Logistics operation

ERP SYSTEM

Structure

- 4.0 ERP system
- 4.1 Finance
- 4.2 Plant Maintenance
- 4.3 Quality Management
- 4.4 Materials Management.

4.0 ERP SYSTEM

ERP Systems - ERP Software, Business Processes, Users and Hardware: From a systems perspective, the components of an ERP system are the common components of Management Information Systems (MIS) - software, business processes, users and hardware. AN ERP system is more than sum of its parts or components. Those components interact together to achieve a common goal - streamline and improve organizations' business processes.

ERP Software

ERP software applications are module-based. Each software module automates business processes within a functional department. ERP applications can be implemented and deployed module-by-module. Major ERP software modules cover the major functional areas of organizations. Common ERP modules include product planning module, parts and material purchasing module, inventory control module, product distribution module, order tracking module, finance module, accounting module, marketing module, and HR module. Organizations often selectively implement the ERP modules that match their business needs.

Reengineering of Business Processes

Anthony, R. A classifies organizational processes into three levels - strategic planning, management control and operational control. The driving force behind the acceptance of ERP was to streamline and automate enterprise-wide resource planning at strategic planning level. In reality, much of ERP success has been in facilitating operational coordination across departments. The success of ERP at strategic planning, management control calls for the integration of ERP with other enterprise applications and demand long term management commitment.

ERP Users

Following Anthony, R. A's classification of organizational processes, workers can be classified into 1) those who execute strategic planning, 2) those who perform managerial control, and 3) those who do operational control. Even though ERP applications have been mostly beneficial to the operational control, the users of an ERP system include workers from all levels of an organization.

Operating Systems for ERP

ERP software runs on various operating systems and hardware, from UNIX, Linux, and Windows to mainframe. Since one organization may acquire ERP and other enterprise software from many different vendors, the requirements for running ERP applications are common - security, stability, scalability and open standards.

One of the booming areas of Information Technology is unquestionably the ERP system. Enterprise Resource Planning systems (or ERPs in short) attempt to integrate all data and processes of an organization under one umbrella. A typical ERP system deploys a whole host of hardware and software components. Every component is synchronized to work in tandem. One of the most powerful components of an ERP system is the existence of a common database. This database is responsible for storing data of various components of the system. From a techno-commercial standpoint, ERP refers to an integrated suite of application software packages that are implemented to take care of multiple business functions. Manufacturing, order entry, finance & accounts, transportation and warehousing, human resource management – in short, every business activity comes under the ambit of ERP. The main contribution of ERP towards an organization is that it allows companies to understand their business better and concentrate on their core area of competency. Existing business processes get streamlined in due course and organizations evolve towards best practices. All these are aimed at maximizing profitability, generating a satisfied pool of customers and realizing early Return on Investments (ROI).

The Modus Operandi of Implementation of an ERP System within an Organization:

You can build your own ERP solution or else settle for packaged software. In case of the former, you stand to benefit from customization, as the proposed solution would be tailored to suit your needs. However, you have to incur huge development and maintenance costs. Often the solution might face implementation problems and perform less than expected. Packaged solutions, the second option, are backed up by vendor support. In spite of that it might not exactly match your company's requirements. At times, you might even have to deviate significantly from the business process you follow at present. This might not be acceptable to you always. Settling for an ERP solution had always been a tough call. Always weigh your priorities with the advantageous features of each type.

Implementing an ERP system is not a child's play. The personnel in charge of implementing an ERP system must have high-level business analysis skills and significant domain expertise is highly desired. They should be able to grasp your organization's business practices quickly and also have a strong command over the technical nitty-gritty. Study of the existing legacy applications is an important step. The challenge lies in addressing diverse, even conflicting business requirements and churning out a solution that is best acceptable to the users, the management and that ultimately benefits the consumers. Minimizing cost and maintaining deadline are added headaches. The ERP implementation team's composition is highly crucial. The team should be well managed and every team member's activity should be synchronized. Thorough understanding of the package architecture gives the team an advantageous edge.

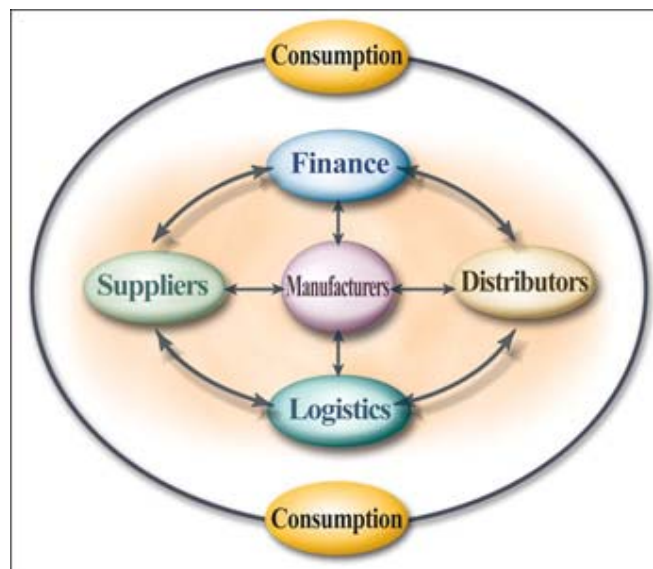
Integrated financials, Business Intelligence, Manufacturing, Logistics & Distribution, Customer Relationship Management, Communication services etc. are some of the areas best benefited by ERP. Experts coin ERP system as the "brain" of an enterprise and that is truly justified.



4.1 ERP-FINANCE

ERP Financial Module

Both for-profit organizations and non-profit organizations benefit from the implementation of ERP financial module. The financial module is the core of many ERP software systems. It can gather financial data from various functional departments, and generates valuable financial reports such balance sheet, general ledger, trail balance, and quarterly financial statements.



All kind of organizations small scale, large scale organizations benefit from the implementation of ERP finance module. The financial module is the core of many ERP software systems. It can gather financial data from various functional departments, and

generates valuable financial reports such general ledger, trail balance, as balance sheet and quarterly financial statements.

This module of the ERP software will take care of all accounts related entries and their impact on the whole system. How the finance comes and how it is been utilized. Total flow of money (Cash/Bank) and total expenditures will be reflected here. As an after effect of this, the management will be able to take their important financial decision, Budgeting etc. They can come to know about company's financial position at any point of time. All sorts of important financial reports i.e. Trial Balance, Trading A/c, Profit & Loss A/c, Balance Sheet, Debtor's Balance, Creditors Balance, Cash/Bank Fund position and many more are covered in this module. General Ledger

The General Ledger module is the foundation of your accounting system, with flexibility that meets the current and future financial management requirements of organizations of all types and sizes. It provides a robust feature set designed to handle your most demanding budgeting and processing needs. General Ledger fully integrates with all modules and is the key to maximizing the efficiency and accuracy of your financial data. Security The G/L Security module enables organizations to control which users can view or use certain general ledger accounts based on segment validation in G/L Security settings G/L Consolidations G/L Consolidations lets you transfer and merge General Ledger account and transaction information between separate company and branch office locations. It is also designed to enable subsidiaries and holding companies to run without being on the same network or accounting database. G/L Consolidations provides a feature set that allows your company to define the level of detail to consolidate and provides a comprehensive audit trail.

Inter-company Transactions

The Inter-company Transactions module lets you enter General Ledger and Accounts Payable transactions that affect more than one company by automatically distributing transactions across two or more companies. In addition, its built-in flexibility automatically generates inter-company loan account entries according to user-defined relationship tables called routes. Inter-company Transactions simplifies and significantly reduces the amount of work required for inter-company accounting.

The Accounting Module is completely transaction based unlike journal based. This implies most of the accounting functions are handled through relevant transactions in other Modules there by saving lot of time. The Module contains complete functionality required for any Accounting Department right from vouchers to the Balance Sheet and Profit and Loss Account.

Budgeting and Variance Analysis between Budgeted and Actual figures helps in controlling the Enterprise Expenses and Income efficiently. The Module also includes Cost Centers, which is completely flexible in terms of defining Cost Centers and their components. Cost Allocations for General Overheads can also be done on a pre-defined basis and required outputs could be generated for analysis purposes. Outstanding of Payables and Receivables with Ageing Analysis of both debtors and creditors are some the features of this module. Overall the module takes care of complete functions of any Accounting department.

The function of this module starts with accounts creation. External departments like marketing or purchase will create some of those accounts. Apart from regular voucher entries this module will help the authority as well as other departments by providing financial figures. Final accounts will be generated from this module. Documents like Receivable and

Payable statements are generated from this module. This module bridges between Sales & Procurement processes. All figures will be protected under password. Only authorized person will be eligible to access information from this module.

Funds manipulations for a concern are important factor and some times it is treated as blood for an organization. So in this regard, sources of funds and application of funds are to be taken care of, by defining Balance sheets, Schedules, General and Sub-Ledger, party and customer masters etc. Also the various input transaction such as Voucher Entry, Credit/Debit entry, Cash/Bank receipts, Cash/Bank Payment, Bank Reconciliation statements, Bill verification etc. Then finally different types of financial reports, which can be of various types according to specified company standard.

4.2 ERP-PLANT MAINTENANCE

Business do not exist to provide information, But without information business does not exists.

PP Processes (1)

Production by lot size: Product several customer requirements in one lot (responsive to customer, reduce stock and production runs)

Work orders Process –

- Production by lot-size steps;
- Sales and Operation planning.
Demand management –
- Integrates customer demands; and
- Long-term planning production plan master production schedule MPS

MPS Balanced against the rough-cut capacity Develop detailed Material plan via MRP Set of planned orders for purchased material, material transferred from other plants, manufactured items Transfer to procurement / stock transfer

Release Work orders to production.

- Materials
- Operations
- Close (settle) work orders
- Costing / quality process

PP processes (2)

- Repetitive manufacturing
- High volume production
- Use production schedules instead of work orders
- Make to order
- Plan and track the actual cost of production on an order-by-order basis each sales object generates an internal cost object Engineer-to-order
- Complex one-of-a-kind products (airplanes, ships)
- Integrates no production time (engineering, design)

PP processes (3)

- Process manufacturing
- Integrates production and business processes

- Production is integrated in supply chains
- Capacity-based planning versus material based planning
- Spans the entire logistic chains from multiple plant business planning to plant-based process
- Quality Management production for goods receipt from production
- Material that flows out of production is recorded as goods receipt
- With inspection criteria (in inspection lots –Sequence of operations) the system generates QM orders
- QM Activities are charged to cost management system
- Scheduling problems

Master data:

- **Description of business process:** materials, human labor
- **Derive factual master data:** Find the reality (theory, shop floor practice)
- **Very big effort:** implications
- **Demand management**
- **Involves determining quantities and dates for finished products / assemblies**

Three possibilities

- Create planned independent requirements
- Requirements are planned for future (not actual) sales
- Create customer independent requirements without sales and distribution with customer requirements with sales and distribution

Uses:

- SOP plan
- Production plan
- Manual data
- Forecast data
- Scheduling
- Obtain an achievable plan that directs the actual manufacturing of firm's products

Material Resource Planning (MRP):

- The core of scheduling Production master data (time, equipment, Labor)
- Begins with higher level items of BOM (bill of materials)
- Schedules production and procurement MPS (master production scheduling) + MRP (Material requirements planning)
- Master production scheduling Applied initially to the highest level of BOM
- Easier to formulate rough schedules for high- value materials

MPS total planning run:

- Encompasses all materials within the plant
- Large load on the system

MPS Run -

- Outputs
- Create new / modify existing plans
- Create purchase requests
- Delivery schedules for externally procured items

- Supply chain
- Material Requirements Planning MRP determines: which material is required, in which quantity?
- It creates work order proposals
- MPS usually runs for the first layer of products
- MRP runs for every level in the BOM (depth can be specified)
- Runs frequently on individual materials (less often global – system workload)
- Create new / modify existing plans
- Create purchase requests Delivery schedules for externally procured items

Plant Maintenance

- Change from Reactive repair service to regular, preventive maintenance actions
- Diminish costs: excess capacity, inventory, and delays Improve quality of production
- Insure installation warranties Respect government, safety regulations
- Maintenance plans Counter based Time based Production planning ERP - Assessment
- Production moved from firefighting to planning CSR call less Production, Customer service, Purchasing view Stock requirements
- Maintenance activities visible on line Purchasing integrated with plant scheduling
- Real-time system replaces word-of-mouth

Plant Maintenance module supports the definition of all planned maintenance tasks to be carried out against the plant. Tasks can be defined as supervisory which do not impact availability or can be defined to affect the availability of the machine or the group in which it resides.

The frequency of maintenance tasks can be defined on a calendar, cyclic or shutdown basis to reflect the way in which maintenance should be carried out. Maintenance processes can be defined which detail the skills, resources, materials and times required for maintenance activities.

The maintenance scheduling process automatically raises works orders for maintenance tasks which are visible to the production and planning departments.

In addition to planned maintenance orders, additional orders can be raised for corrective and emergency work. The costs of maintenance spares and labour can be booked to each order and the maintenance costs are tracked against budgets defined by cost centre and maintenance category.

Reason codes can be defined against the maintenance orders and these can be used to analyze the reasons for maintenance work. Maintenance costs and down time can be analyzed by cost centre, resource, location, reason cost and user-defined date range.

A full maintenance log is kept for each resource.

4.3 ERP-QUALITY MANAGEMENT

IQMS Quality Management System

The Quality Management System (QMS) within Enterprise IQ provides a systematic approach to meeting the quality needs of manufacturers. Enterprise IQ Quality Management System provides a comprehensive set of tools and capabilities necessary to ensure customer satisfaction and compliance with the most stringent quality standards including automotive, medical and ISO standards.

- Direct access to all ERP related information eliminates redundant data entry thereby reducing costly errors, saving time and improving communications.

- Increase visibility and improve reaction time by pushing data to those who need it using secure electronic signatures and approvals.
- Enterprise IQ workflow automatically evaluates status and sends e-mail notifications to both internal and external team members.
- The Enterprise IQ Quality Management System is a complete and comprehensive suite of module that includes key features and functionality's such as:
 - Advanced Product Quality Planning (APQP/PQ)
 - Facilitate compliance to ISO and FDA requirements with complete tracking of all the information required for process documentation and definition.

4.4 MATERIALS MANAGEMENT.

Materials Management

The Materials Management functionality of Cubic ERP is delivered through three tightly integrated modules - Material Requirements Planning, Procurement Management and Inventory Management.

Material Requirements Planning

Cubic Material Requirements Planning (MRP) is a full-featured material planning solution that supports production planning, material planning and purchasing. The application architecture of Cubic, particularly the normalized database and native SQL application layer, gives Cubic MRP exceptional speed and database integrity allowing it to run frequently and virtually real-time. Planners and buyers do not have to wait for an overnight batch MRP run to simulate schedule changes and evaluate the impact of recent scheduling actions. Just-in-Time suppliers and shop floor operations can see the effect of new firmed demand on a daily, hourly or even minute-by-minute basis.

Cubic MRP reduces planner workloads and increases speed and efficiency of material planning through a combination of features, including:

To-Order MRP - special features support material planning for specific projects, contracts and orders, including order-specific multi-level pegging and centralized procurement of common items

Online Planner Workbench - a robust online planner workbench makes it easy to browse research and act upon MRP recommendations

Automated Message Processing - user-defined parameters trigger and control automated action on MRP recommendations

Many-to-Many Linkage and Allocation - a unique online supply/demand allocation feature enables planners to easily "peg" or link orders and on-hand inventory as well as create multi-level "families" of fully-pegged production and procurement orders

Procurement Management

Cubic Procurement Management is a feature-rich purchasing and procurement solution designed to meet the needs of a broad range of manufacturing environments. Through flexible, embedded workflow and tight integration with other Cubic modules, Cubic Procurement Management ensures timely availability of critical materials and reduces material acquisition and carrying costs.

Manufacturers need to procure a wide variety of materials and services including: stock components for use in production, MRO materials for maintenance operations, outside laboratory and manufacturing services, and pure expense items such as administrative supplies or leased storage space. The embedded workflow rules of Cubic Procurement

Management guide inventory accounting, payables and "put-away" activities allowing purchasing and receiving personnel to do their jobs using a single, consistent user interface for manual data entry. Finally, in cases where a single job or project requires a combination of materials and services, Cubic Procurement Management can easily consolidate all types of procurement requirements on a single purchase order, even if materials and services are to be provided to various company locations.

Cubic Procurement Management delivers many additional features and functions, such as:

- **Requisition and Approval Workflow** - flexible and customizable requisition, commitment and approval workflow process
- **Many-to-Many Order Linkage** - online order linkage and allocations to support project and order-specific procurement without having to split purchase orders
- **Buyer Workbench** - A powerful, one-stop workbench allowing buyer to browse firm purchase orders and easily consolidate and release orders on a supplier-by-supplier basis
- **Vendor Performance Measurement** - automatic capture and reporting of vendor performance metrics such as performance-to-schedule, administrative accuracy and conformance to quality specifications
- **External Object Management** - allowing engineering drawings, customer contracts, special mark and pack instructions, or any other documentation to be linked to purchase orders for use by buyers and suppliers
- **Subcontracted Operations** - specialized orders to facilitate procurement of subcontracted services and manufacturing operations

Inventory Management

Cubic Inventory Management delivers comprehensive functionality and flexibility to fit the needs of any manufacturing enterprise. From highly controlled, high value or hazardous materials to floor stock and miscellaneous expense items, Cubic Inventory Management offers user-selectable options to implement the right level of material control. A comprehensive set of predefined inventory transactions simplifies workflow administration and creates a user-friendly interface requiring minimal manual input. In addition, real-time integration with the rest of Cubic ERP means real-time visibility of financial data, on-hand stock balances and detailed transaction history.

Cubic Inventory Management delivers a rich set of special features including:

- **Online Visibility** - a robust set of online search and inquiry functions support: part search using engineering attributes, graphical visibility of supply and demand information, lot and serial tracking and detailed audit trails of inventory transaction history
- **Material Control for Expensed Items** - the ability to easily track and control expensed items in inventory using normal inventory control processes
- **Installed Equipment Base** - automatic population of the installed equipment database upon shipment of serialized products
- **Requisition Workflow for Material Issues** - the option to initiate workflow-based requisition control over material issues from stores
- **Crating and Containerization** - multi-level container packing and shipment with the ability to carry containers on the books as assets for location control and tracking
- **Serial and Lot Number Control** - serial and/or lot number control rules are automatically enforced throughout all inventory control processes

- **Flexible Stores Security** - security over a specific material location can be set at location level (i.e., an authorized employee can perform all transactions affecting inventory at that location) or at transaction level (i.e., certain employees are authorized for specific transactions)
- **Consignment Stock** - consignment items can be received into inventory using normal purchase order receipt processing while the system automatically applies zero inventory cost upon receipt and generates payable liability upon issuance from stores

ERP MARKET

Structure

- 5.0 ERP Market
- 5.1 SAP AG
- 5.2 Baan Company
- 5.3 Oracle Corporation
- 5.4 People Soft
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- 5.7 System Software Associates, Inc. (SSA)
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- 5.9 A Comparative Assessment and Selection of ERP Packages and Modules

5.0 ERP MARKET

Analyzing ERP market share is quite different when compared with reviewing the market segments for any other product or service. The segmentations in that case will be numerous and in the form of many criteria like physical, geographical, functional, distribution level and many more factors. ERP the segmentation falls in three main categories namely type of the industry, size of the industry and geographical areas in terms of the nations where the product is demanded. This helps in arriving at ERP market and ERP software market share. (Instead use ERP Market can be segmented into three major segments/Categories)

While discussing size of industry it refers to the volume of business transacted and the capacity of the firm in terms of large sized or mid sized or low rung. When it comes to the question of type it refers to the mode of business viz. hospitality or insurance or manufacturing or health etc...The market for them purely depends on the services offered by the vendor. The question of geographical segmentation involves a detailed study when it comes to ERP markets.

Some of the nations and continents requiring attention are as follows:

Malaysia

The markets remain untapped at large. However it is quite promising with the encouragement of ERP intervention in Small and Medium industries. The manufacturing sector occupies the chunk (benefactor and beneficiary) however the fact remains that others are not lagging behind. ERP has significantly contributed in terms of jobs and income. ERP market and ERP Software market share is quite encouraging.

Singapore

This market is promising but for the cost consciousness among ERP companies and small and medium enterprises. They are a potential target for the ERP vendor. However it is extremely difficult to sell one's commodity as the demands are ever multiplying in terms with the competition. This is still a good place for vendors who can offer additional facilities like ASP. They determine ERP market share.

South Korea

This market here is highly fragmented. It calls for specialized knowledge to provide for services in the relevant areas. MERP software occupies prominence like in Singapore and in Malaysia. This nation is known for high rejection rate of ERP products due to the greater emphasis on functions and cost.

Australia

This place deserves all appreciation and applause for exposing ERP to many sectors. Even the conventional ones have started to demand the. This is a niche market for ERP vendors wherein they can target everyone right from big players to S.M.E.'s. ERP Market and ERP market share can even become dominating factors of the country's economy. The only sector that requires more coverage covered is production management.

Europe

The continent has numerous potential for ERP market. The success rate of ERP vendors is not encouraging. Since the requirements are too diverse it becomes difficult for vendors to meet the demands and very few players have been able to do that. Integrated application suites are in high demands in this continent where employees are demanding software programs with multiple options.

Japan

The market here is quiet disappointing both for the vendors and companies. Lot of abnormalities in functional designs still happens. The market will not flourish until this is solved and ERP interventions will not take place in a full fledged manner. The mistakes in functional design are mostly due to implementing ERP for particular functions also (partial implementation). A country like Japan needs full fledged ERP implementation. Even though little success has been claimed by some customer satisfaction is not enough for the industry to sail smoothly.

5.1 SAP AG

SAP AG is the largest European software enterprise and the fourth largest in the world, with headquarters in Walldorf, Germany. It is best known for its SAP ERP Enterprise Resource Planning (ERP) software.

History

SAP was founded in 1972 as Systemanalyse und Programmentwicklung ("System Analysis and Program Development" by five former IBM engineers in Mannheim, Baden-Württemberg (Dietmar Hopp, Hans-Werner Hector, Hasso Plattner, Klaus E. Tschira, and Claus Wellenreuther)

As part of the Xerox exit strategy from the computer industry, Xerox retained IBM to migrate their business systems to IBM technology. As part of IBM's compensation for the migration, IBM acquired the SDS/SAPE software, reportedly for a contract credit of \$80,000. The SAPE software was given by IBM to the founding ex-IBM employees in exchange for founding stock provided to IBM, reportedly 8%. Imperial Chemical Industries (ICI) was SAP's first ever customer in 1972.

The acronym was later changed to stand for Systeme, Anwendungen und Produkte in der Datenverarbeitung ("Systems, Applications and Products in Data Processing"). In 1976, "SAP GmbH" was founded and the following year, it moved its headquarters to Walldorf. SAP AG became the company's official name after the 2005 annual general meeting (AG is short for **Aktiengesellschaft**).

In August 1988, SAP GmbH transferred into SAP AG (a corporation by German law), and public trading started November 4. Shares are listed on the Frankfurt and Stuttgart stock exchanges.

Four of the founding members -- Hopp, Plattner, Tschira and Hector -- form the executive board. In 1995, SAP was included in the German stock index DAX. On 22 September 2003, SAP was included in the Dow Jones STOXX 50. In 1991, Prof. Dr. Henning Kagermann joined the board, Dr. Peter Zencke became a board member in 1993. Claus Heinrich and Gerhard Oswald have been members of the SAP Executive Board since 1996. Two years later, in 1998, the first change at the helm took place. Dietmar Hopp and Klaus Tschira moved to the supervisory board and Dietmar Hopp was appointed Chairman of the supervisory board. Henning Kagermann was appointed as Co-Chairman and CEO of SAP next to Hasso Plattner. Werner Brandt joined SAP in 2001 as a member of the SAP Executive Board and Chief Financial Officer. Leo Apotheker has been a member of the SAP Executive Board and president of Global Customer Solutions & Operations since 2002, was appointed Deputy CEO in 2007, and then became co-CEO alongside Kagermann in 2008.

Henning Kagermann became the sole CEO of SAP in 2003. In February 2007 his contract was extended until 2009. After continuous disputes over the responsibility of the development organization, Shai Agassi, a member of the executive board who had been named as a potential successor to Kagermann, left the organization. In April 2008, along with the announcement of Leo Apotheker as co-CEO, the SAP supervisory board also appointed to the SAP Executive Board, three new members, effective 1 July 2008: Corporate Officers Erwin Gunst, Bill McDermott and Jim Hagemann Snaube.

Milestones technical solutions

In 1973 the SAP R/1 solution was launched. Six years later, in 1979, SAP launched SAP R/2.^[14] In 1981, SAP brought a completely re-designed solution to market. With the change from R/2 to R/3 in 1992, SAP followed the trend from mainframe computing to client-server architectures. The development of SAP's internet strategy with mySAP.com redesigned the concept of business processes (integration via Internet). SAP was awarded Industry Week's Best Managed Companies in 1999.

Business and markets

SAP is the world's second largest business software company and the third-largest independent software provider in terms of revenues. It operates in three geographic regions – EMEA, which represents Europe, Middle East and Africa, the Americas (SAP America, headquartered in Newtown Square, Pennsylvania), which represents both North America and Latin America, and Asia Pacific Japan (APJ), which represents Japan, Australia, India and parts of Asia. In addition, SAP operates a network of 115 subsidiaries, and has R&D facilities around the globe in Germany, North America, Canada, China, Hungary, India, Israel and Bulgaria, Turkey.

SAP focuses on six industry sectors: process industries, discrete industries, consumer industries, service industries, financial services, and public services. It offers more than 25 industry solution portfolios for large enterprises and more than 550 micro-vertical solutions for midsize companies and small businesses.

SAP and Enterprise Service-Oriented Architecture

Service-oriented architecture moves the ERP landscape toward software-based and web services-based business activities. This move increases adaptability, flexibility, openness and efficiency. The move towards E-SOA helps companies reuse software components and not have to rely as much on in-house enterprise resource planning hardware technologies which helps make ERP adoption more attractive for small- or mid-sized companies.

According to a press fact sheet from SAP, "SAP is the only enterprise applications software vendor that is both building service-orientation directly into its solutions and providing a technology platform (SAP NetWeaver) and guidance to support companies in the development of their own service-oriented architectures spanning both SAP and non-SAP solutions."

SAP E-SOA Authentication

SAP E-SOA, client certificate-based authentication is the only authentication method (besides username/password) and the only Single Sign-On method to be supported across all SAP technologies. Kerberos and logon tickets, for example, are not compatible with SAP service-oriented architecture.

Products

SAP's products focus on Enterprise Resource Planning (ERP). The company's main product is SAP ERP. The current version is SAP ERP 6.0 and is part of the SAP Business Suite. Its previous name was called R/3. The "R" of SAP R/3 stood for real-time - even though it is not a real-time solution. The number 3 related to the 3-tier architecture: database, application server and client (SAPgui). R/2, which ran on a Mainframe architecture, was the predecessor of R/3. Before R/2 came System RF, later dubbed as R/1.

SAP ERP is one of five enterprise applications in SAP's Business Suite. The other four applications are:

- customer relationship management (CRM) - helps companies acquire and retain customers, gain marketing and customer insight
- product lifecycle management (PLM) - helps manufacturers with product-related information
- supply chain management (SCM) - helps companies with the process of resourcing its manufacturing and service processes
- supplier relationship management (SRM) - enables companies to procure from suppliers

Other major product offerings include: the Net Weaver platform, Governance, Risk and Compliance (GRC) solutions, Duet (joint offering with Microsoft), Performance Management solutions and RFID. SAP offers SOA capabilities (calling it Enterprise SOA) in the form of web services that are wrapped around its applications.

While its original products were typically used by Fortune 500 companies SAP is now also actively targeting small and medium sized enterprises (SME) with its SAP Business One and SAP Business All-in-One.

On 19 September 2007 SAP announced a new product named SAP Business ByDesign. SAP Business ByDesign is a Software as a Service (SaaS) offering, and provides a fully integrated Enterprise Resource Planning (ERP) solution, On Demand. SAP Business ByDesign was previously known under the code name "A1S".

SAP officials say there are over 100,600 SAP installations serving more than 41,200 companies in more than 25 industries in more than 120 countries.

But SAP has also in general been criticized for their One-size-fits-all product strategies implying that it now covers such a large scope that it has become a hindrance for company mergers and acquisitions.

Partnerships

Partnerships are core to SAP's strategy and in its 35 years of history the network of software solution providers, value-added resellers, distributors, technology and services partners has developed into a broad ecosystem that is among the industry's largest. Opened in June 2007, the SAP Co-Innovation Lab in Palo Alto, Calif. provides an efficient work environment for joint projects with independent software vendors (ISVs), such as Novell, Questra and Wonderware, system integrators (SIs) and technology partners to work together with SAP around current and future technologies. Co-founded by Cisco, Hewlett-Packard, Intel and NetApp, the lab offers a hands-on environment and real-world performance for Web-enabled and Internet/intranet-accessible business applications based on Enterprise SOA.

SAP partners include Global Services Partners with cross-industry multinational consulting capabilities, Global Software Partners providing integrated products that complement SAP Business Suite solutions, and Global Technology Partners providing user companies with a wide range of products to support SAP technology, including vendors of hardware, database, storage systems, networks, and mobile computing technology.

SAP partners with CSC, Capgemini, Deloitte, IBM, PricewaterhouseCoopers, Hewlett-Packard, Siemens IT Solutions and Services and Accenture in offering services, including assessment, government and architecture for R3.

SAP PartnerEdge

SAP solutions for small businesses and midsize companies are delivered through its global partner network. In 2008, SAP signed SAP Global Service partnership with HCL Technologies, a \$4.9 b technology service provider, headquartered in India. The SAP PartnerEdge program, SAP's partner program, offers a set of business enablement resources and program benefits to help partners including value added resellers (VARs) and independent software vendors (ISVs) be profitable and successful in implementing, selling, marketing, developing and delivering SAP solutions to a broad range of customers.

Gartner states that SAP PartnerEdge has "set a new standard for innovation in channel development for the small and midsize business application market."

Communities

SAP Developer Network (SDN) is a community of developers, consultants, integrators, and business analysts gaining and sharing knowledge about ABAP, Java, .NET, SOA, and other technologies via expert blogs, discussion forums, exclusive downloads and code samples, training materials, and a technical library. The Business Process Expert (BPX) Community is a collaborative environment for business process experts to share information, experiences and best practices to leverage enterprise SOA in order to increase business agility and IT value. The SAP Enterprise Services Community serves as a platform for members from customers, industry experts and partners working collaboratively to define enterprise services. Industry Value Networks (IVN) brings together customers, partners and SAP to co-innovate and develop solutions to solve industry-specific customer challenges. There are currently eleven active IVNs (e.g. Banking, Chemicals, Consumer Products, High Tech, Public Sector, Retail)

SAP EcoHub was launched in the fall of 2008 as an online marketplace where SAP customers can find certified SAP solutions from SAP partners and SAP.

Organization

Functional units of SAP are split across different organizational units for R&D needs, field activities and customer support. SAP Labs are mainly responsible for product development where as the field organizations spread across each country are responsible for field activities

such Sales, Marketing, Consulting etc. Head office located in SAP AG is responsible for overall management as well as core engineering activities related to Product Development. SAP customer support, also called Active Global Support (AGS) is a global organization to provide support to SAP customers worldwide.

SAP Labs

SAP Labs is the research and development organization of the parent company. SAP has its development organization spread across the globe. Many, but not all, labs locations are hosting SAP Research groups.

Prominent labs are located in Palo Alto, USA, Bangalore, Hyderabad and Gurgaon India, Ra'anana and Karmiel, Israel, Montreal, Canada and Shanghai, China. SAP Labs located in Bangalore is the largest development unit in terms of number of employees outside the SAP headquarters located in Walldorf, Germany. Other SAP Labs locations include France, Bulgaria and Hungary.

Each SAP Lab has prominent area of expertise and focus. SAP Labs in Sofia, Bulgaria for example specializes in development of Java based SAP software products. Whereas, SAP Labs in U.S. is famous for its focus on innovation and research.

User groups

User Groups are independent, not-for-profit organizations of SAP customer companies and partners within the SAP Ecosystem that provide education to their members, influence SAP product releases and direction, exchange best practices, and provide insight into the market needs. Examples of User Groups are the Americas' SAP Users' Group (ASUG), the German speaking SAP User Group (DSAG), the SAP Australian User Group (SAUG) and the SAP UK & Ireland User Group. Further SAP User Groups can be found at the List of SAP Users' Groups.

In 2007, the SAP User Group Executive Network (SUGEN) has been established to foster the information exchange and best practice sharing among SAP User Groups and to coordinate the collaboration with SAP for strategic topics.

Competitive landscape

SAP competitors are primarily in the Enterprise Resource Planning Software industry. SAP also competes in the Customer Relationship Management, Marketing & Sales Software, Manufacturing, Warehousing & Industrial Software, and Supply Chain Management & Logistics Software sectors.

Oracle Corporation, SAP's major competitor, filed a case against SAP for malpractice and unfair competition in the California courts on 22 March 2007. The complaint alleged that a Texas subsidiary, SAP TN (formerly Tomorrow Now before being purchased by SAP), which provides discount support for legacy Oracle product lines, used the accounts of former Oracle customers to systematically download patches and support documents from Oracle's website and appropriate them for SAP's use. Later SAP admitted wrong-doing on smaller scale than Oracle claimed in the lawsuit.

SAP has admitted to inappropriate downloads, however the company denies the theft of any intellectual property.

SAP is known to grow organically in contrast to its main rival, Oracle, which has been spending US\$20 billion since 2004 acquiring 30 smaller competitors. SAP was able to increase its annual profits by 370% since 2002.

In something of a departure from its usual organic growth, on 7 October 2007, SAP announced that it would acquire Business Objects, the market leader in business intelligence software, for \$6.8B.

SAP provoked controversy and frustration among its users in 2008 by raising the cost of its maintenance contracts. The issue is the subject of intense discussion among user groups.

Legacy Platforms

- SAP R/2
- SAP R/3

The implementation of SAP software, such as SAP R/3 is almost always a massive operation that brings a lot of changes in the organization. The whole process can take up to several years. Virtually every person in the organization is involved, whether they are part of the SAP technical support organization (TSO) or the actual end-users of the SAP software. The resulting changes that the implementation of SAP generates are intended to reach high level goals, such as improved communication and increased return on information (as people will work with the same information). It is therefore very important that the implementation process is planned and executed with the usage of a solid method. There are various SAP implementation methods. An example of how one company, Robert Bosch GmbH, implemented SAP R/3 over 10 years is available This study shows that designing IT architecture is very critical in SAP implementation practices.

5.2 BAAN COMPANY

Baan was a vendor of enterprise resource planning (ERP) software that is now owned by Infor Global Solutions. Baan or Baan ERP was also the name of the ERP product created by this company.

History

The Baan Corporation was created by Jan Baan in 1978 in Barneveld, Netherlands, to provide financial and administrative consulting services. With the development of his first software package, Jan Baan and his brother Paul Baan entered what was to become the ERP industry. The Baan company focused on the creation of enterprise resource planning (ERP) software.

Baan gained its popularity in the early nineties. Baan software is famous for its technical architecture and its 4GL language, which nowadays is still considered to be one of the most efficient and productive among database application development platforms. Baan became a real threat to market leader SAP after beating SAP in the Boeing deal. However the fall of the Baan company began when it went public and became listed in the stock market. The management exaggerated company revenue by booking "sales" of software licenses that were actually transferred to a related distributor. The discovery of this "creative" revenue manipulation led to a sharp decline of Baan's stock price at the end of 1998.

In June 2000, facing worsening financial difficulties, law suits and reporting seven consecutive quarterly losses and bleak prospects, Baan was sold at a price of US\$700 million to Invensys, a UK automation, controls, and process solutions group to become a unit of its Software and Services Division. Laurens van der Tang was the president of this unit. With the acquisition of Baan, Invensys's CEO Allen Yurko began to offer "Sensor to Boardroom" solutions to customers.

In June 2003, after Allen Yurko stepped down, Invensys sold its Baan unit to SSA Global Technologies for US\$ 135 million. The main attempt was to reduce the high amount of debt of Invensys, and also because Invensys had no cash to inject into Baan's turn-around.

Upon acquiring the Baan software, SSA renamed Baan as SSA ERP Ln. In August 2005, SSA Global released a new version of Baan, named SSA ERP LN 6.1. In May 2006, SSA was acquired by Infor Global Solutions of Atlanta, which was a major ERP consolidator in the market.

Today Baan ERP software is still used by thousands of mid-range companies in the world, the majority on version BaanIVc4 and most of the rest on Baan5c. Sales of ERP LN have since been slow until a pickup Q4 2008 that has so far continued.

5.3 ORACLE CORPORATION

Oracle Corporation (NASDAQ: ORCL) specializes in developing and marketing enterprise software products — particularly database management systems. Through organic growth and a number of high-profile acquisitions, Oracle enlarged its share of the software market. By 2007 Oracle ranked third on the list of largest software companies in the world, after Microsoft and IBM. Subsequently it became larger than IBM after its acquisition of Hyperion and BEA.

The corporation has arguably become best-known due to association with its flagship Oracle database. The company also builds tools for database development, middle-tier software, enterprise resource planning software (ERP), customer relationship management software (CRM) and supply chain management (SCM) software.

The founder and CEO of Oracle Corporation, Larry Ellison, has served as Oracle's CEO throughout the company's history. Ellison also served as the Chairman of the Board until his replacement by Jeffrey O. Henley in 2004. Ellison retains his role as CEO.

Ellison took inspiration from the 1970 paper written by Edgar F. Codd on relational database systems named "A Relational Model of Data for Large Shared Data Banks". He had heard about the IBM System R database from an article in the IBM Research Journal provided by Ed Oates (a future co-founder of Oracle Corporation). System R also derived from Codd's theories, and Ellison wanted to make his Oracle product compatible with System R, but IBM stopped this by keeping the error codes for their DBMS secret. Ellison co-founded Oracle Corporation in 1977 under the name Software Development Laboratories (SDL). In 1979 SDL changed its name to Relational Software, Inc. (RSI). In 1982, RSI renamed itself as Oracle Systems to align itself more closely with its flagship product Oracle Database. At this stage Robert Miner served as the company's senior programmer.

On April 20, 2009 Oracle announced it was acquiring Sun Microsystems for \$7.4B (\$9.50 per share).

Functionality

Oracle Enterprise Manager performs much of its activity through intelligent agents which Oracle Corporation refers to as Oracle Management Agents. These run as autonomous proxy processes on a managed node, and perform execution and monitoring tasks for Oracle Enterprise Manager, communicating using the Hypertext Transfer Protocol (HTTP or HTTPS). Oracle Release 10g has 14 additional packs (plug-ins) which require separate licensing. By default, upon installation, the OMA enables several packs (Change Management, Performance & Tuning, Diagnostics and Configuration Management) without any regard to what a customer has licensed. Users need to de-select unlicensed packs after installing the agent on a target database.

5.4 PEOPLESOFT

PeopleSoft, Inc. was a company that provided human resource management systems (HRMS), customer relationship management (CRM), manufacturing, financials, enterprise performance management, and student administration software solutions to large

corporations, governments, and organizations. PeopleSoft was also the name of the company's product suite

History

Founded in 1987 by David Duffield and Ken Morris, PeopleSoft was originally headquartered in Walnut Creek, California before moving to Pleasanton, California. PeopleSoft was formed when Duffield envisioned a client-server version of Integral Systems' popular mainframe HRMS package. Once Integral declined development, Duffield was released to pursue this endeavor on his own, and PeopleSoft was born. PeopleSoft version 1, released in the late 1980s, was the first fully-integrated, robust client-server HRMS application suite. PeopleSoft expanded its product range to include a Financials Module in 1992-3, Distribution in 1994-5, and Manufacturing in 1996 (via the Red Pepper Acquisition). In 2003, when the company acquired J.D. Edwards, it decided to differentiate its former product line with those of Edwards by renaming both products. In January 2005, PeopleSoft was acquired by Oracle Corporation. PeopleSoft products continue to be used.

Applications

PeopleSoft's product suite (also called PeopleSoft) was initially based on a client-server architecture. The entire software suite moved to a web-centric design called Pure Internet Architecture (PIA) with the release of PeopleSoft Version 8. The new format allowed all of a company's business functions to be accessed and run on a web browser. Originally, a small number of security and system setup functions still needed to be performed on a fat client machine; however, this is no longer the case. One important feature of PeopleSoft's PIA is that no code is required on the client - there is no need for additional downloads of plugins, or JVMs such as the Jinitiator required for older Oracle Applications.

Development platform

The architecture is built around PeopleSoft's proprietary PeopleTools technology (development platform similar to a 4GL). PeopleTools includes many different components a developer needs to create Web-based application using a SQL database, including a scripting language called PeopleCode, design tools to define various types of metadata, standard security structure, and batch processing tools. The metadata describes data for user interfaces, tables, messages, security, navigation, portals, and so forth. The benefit of creating their own development platform allowed PeopleSoft applications to run on top of many different operating systems and database platforms. Currently, it is not tied to any specific database platform. PeopleSoft implementations exist or have existed on Oracle, Microsoft SQL Server, Informix, Sybase, IBM DB2 (including its z/OS, Unix and OS/400 variant s), Oracle Rdb and HP AllBase/SQL.

All of PeopleSoft's modules (Human Resources, Supply Chain, Financials, CRM, etc.) are built with the PeopleTools technology. A benefit of the technology is that all the code which makes up a module can be customized to suit a company's business needs.

J.D. Edwards

In 2003, PeopleSoft performed a friendly merger with smaller rival J.D. Edwards. The former rival's similar product line was differentiated by its target audience: mid-sized companies who could not afford the original PeopleSoft applications. J.D. Edwards product lines, formerly J.D. Edwards World on the AS/400 and One World, were and continue to be differentiated by the Configurable Network Architecture or CNC Architecture. This architecture is designed to shield applications from both the operating system and the database backend as long as some flavor of the SQL language is used. Thus, IBM's

DB2/UDB, Microsoft's SQL 2005 and Oracle databases are supported. J.D. Edwards also continued to support thousands of customers on AS/400s running its original J.D. Edwards World or World Software" product.

Likewise, servers can run on a host of operating systems including Linux, Microsoft Windows and IBM's AS/400 operating system. In addition, PeopleSoft remains committed to supporting J.D. Edwards's original AS/400-based World software, also called World Software, the old-style "green screen" application — the same application which drove Duffield to branch out and create PeopleSoft in the first place.

Oracle Corporation

Beginning in 2003, PeopleSoft battled with Oracle over control of the PeopleSoft company. In June 2003, Oracle made a \$7 billion bid (\$19.50/share) in a hostile corporate takeover attempt. In February 2004, Oracle increased their bid to approximately \$9.4 billion (\$26/share), a 33% increase, this offer was also rejected forthwith by PeopleSoft's board of directors. Later that month, the U.S. Department of Justice filed suit to block Oracle, on the grounds that the acquisition would break anti-trust laws, however, in September 2004, the suit was rejected by a U.S. Federal judge, who found that the Justice Department had not proven its anti-trust case, in October, the same decision was handed down by the European Commission. Though Oracle had reduced its offer to \$7.7 billion (\$21/share) in May, it again raised its bid in November to \$9.4 billion (\$24/share), marking a 14% increase.

In December 2004, Oracle announced that it had signed a definitive merger agreement to acquire PeopleSoft for approximately \$10.3 billion (\$26.50/share). In January 2005, Oracle made drastic cuts in the PeopleSoft ranks. These cuts affected approximately 9% of the 55,000 staff of the combined companies, but Oracle maintained at least 90% of PeopleSoft's product development and support staff.

Oracle moved to capitalize on the perceived strong brand loyalty within the JD Edwards user community by re-branding former JD Edwards products. Thus PeopleSoft Enterprise One became JD Edwards Enterprise One and PeopleSoft World became JD Edwards World.

Oracle has announced that a new product Fusion is to be released in the near future. Oracle says Fusion will take the best aspects of the PeopleSoft, JD Edwards and Oracle Applications and merge them into a new product suite.

Oracle continues to support the existing Oracle and PeopleSoft product lines for current users. By retaining current applications and supporting the move to Fusion when appropriate, Oracle may be attempting prevent customer defections to rival Enterprise Resource Planning (ERP) vendors.

PeopleSoft in use

PeopleSoft projects have been somewhat successfully implemented by many users, and there has been at least one instance of litigation relating to a Student Admin implementation. As with any ERP software, the implementation process (including analysis, planning and development), performance (load) testing and various other types of software testing are critical to the success of the project.

In 1997, Cleveland State University licensed PeopleSoft's software for tracking student records. After seven years of difficulties, CSU sued PeopleSoft for \$510 million, claiming breach of contract, fraud, negligent misrepresentation and four other counts. The case was settled for \$4.25 million in 2005.. The University also sued Kaludis Inc, the implementation partner responsible for PeopleSoft - that part of the action was settled by a payment of \$50,000 by Kaludis to the University, also in 2005

PeopleSoft CEO David Duffield pledged a \$20 million donation to Cornell's nanotechnology research building in 1997 which became named Duffield Hall. In a process beginning in

1995, the university implemented PeopleSoft. There are reports of problems with the implementation as of 2008 (Note that the article linked to also contains a report of a student who encountered no problems using the system).

The deployment of PeopleSoft payroll and Oracle accounting King County, Washington systems more than doubled in its projected cost.

California State University was investigated by the state legislature after a \$500 million investment in the PeopleSoft solution, finding multiple examples of possible misconduct and unnecessary expense.

Planned implementations

The largest PeopleSoft system currently planned is for the United States Department of Defense, which has over 10 million people on payroll.

The largest implementation in the UK is at Wm Morrison Supermarkets who are implementing PeopleSoft V9 HR, Global Payroll, Absence Management and Time & Labor. Morrisons has over 130,000 employees.

PeopleSoft timeline

- 1987: PeopleSoft, Inc. founded by David Duffield and Ken Morris in Walnut Creek, CA, USA.
- 1988: PeopleSoft HRMS released.
- 1991: Begins opening international offices.
- 1994: Public distribution of Distribution and Financials modules.
- 1995: Launch of Student Administration System.
- 1996: Releases manufacturing and PeopleSoft 6, their first ERP package.
- 1997: PeopleSoft 7 is released within upgraded ERP modules.
- 1998: PeopleSoft 7.5 is released with improved client/server technology. Acquired Intrepid Systems.
- 1999: Craig Conway named new CEO, release products to enable Internet transactions.
- 2000: Acquired Vantive Corporation.
- 2000: Deliver PeopleSoft 8 with an in-house application service provider.
- 2003: Acquired J.D. Edwards
- 2005: Acquired by Oracle Corporation.
- 2006: PeopleSoft FMS 9.0 is released.
- 2006: PeopleSoft HCM 9.0 is released.(December 2006)

5.5 JD EDWARDS WORLD SOLUTIONS COMPANY

J.D. Edwards, also called JDE, is a software company founded in March 1977 in Denver, Colorado by Jack Thompson, C.T.P."Chuck" Hintze, Dan Gregory and Ed McVaney. The company made its name building accounting software for IBM minicomputers, beginning with the System/34 and /36, focusing from the mid 1980s on System/38 minicomputers, switching to the AS/400 when it became available. Their main AS/400 offering was called JDEdwards WorldSoftware and is popularly called World. In 1996, J.D. Edwards also launched a client-server version of their software called OneWorld. The company's official name was J.D. Edwards World Solution Company and it is located at One Technology Way, in Denver, CO 80237. JDE was bought out by PeopleSoft in 2003. PeopleSoft, in turn, was purchased by Oracle Corporation in 2005.

J.D. Edwards and the Ed McVaney story

Ed McVaney was originally trained as an engineer at the University of Nebraska. Upon finishing his MBA from Rutgers and taking a job with Western Electric in mid-1964, and working applied mathematics schemes theory McVaney first came into contact with both computers used for operations research using mathematical modeling programs. Self-taught in machine language, but discouraged by computer and software limitations, McVaney took a position with Peat Marwick in New York City in 1964. From NYC he was transferred to Denver, Colorado in 1968. He continued with Marwick until 1970 when he took a position with Alexander Grant, which subsequently became Grant Thornton. While at Grant Thornton, McVaney met Jack Thompson who was working an IBM 1130 in Billings, Montana, and he was making \$630 a month. Thompson was lured to Grant Thornton for \$750 a month which brought him from Billings to Denver. McVaney had worked closely with Thompson going back to the time they had spent as consultants at the Great Western Life Insurance Company. At that time McVaney also met Dan Gregory, a college MBA student from University of Denver. McVaney hired him out of the MBA program at Denver University. McVaney describes that time as a period in which he was developing his personal concept of integrity from a "high school level" to a much more mature business-related notion of absolute reliability. At the same time he was coming to the realization that, in his words, "The culture of a public accounting firm is the antithesis of developing software. The idea of spending time on something that you're not getting paid for -- software development -- they just could not stomach that." This indicated to McVaney that accounting clients at that time did not understand what was required for software development at that time. After what McVaney described as a consulting "failure" at a client, Haviland Whitcon Company, in San Jose, California, McVaney came to the conclusion that he had to start his own firm to implement his own approach to accounting business software development. McVaney had been discussing starting his own firm with his wife as well as Thompson and Gregory. Now it was time to make the move, telling her, "I think it's time for me to start my own company. Look, I don't really fit in here. The culture isn't right. I want to get done some things that can't be done as context. I'd like to start my own company." Soon he would have his chance.

J.D. Edwards is born

In 1977, unsatisfied with conventional approaches to business and accounting software development and accounting software services, McVaney started J.D. Edwards by selling co-workers, Dan Gregory and Jack Thompson on his concept of a radically different approach to accounting software development that represented for all of them a significant cultural shift from typical sales promises to total commitment to customer goals based on an integrity-based approach to customer requirements. After discarding the name, Jack Daniels & Co., the group decided that J.D. Edwards sounded better. In order to get an \$8,000 loan, McVaney took a salary cut from \$44,000 to \$36,000 and in order to live on that salary, all optional family expenses such as piano lessons, skiing and swimming lessons were spared.

Initial clients

Start-up clients included McCoy Sales in Denver, Colorado, a then \$4-million wholesale distribution company and Cincinnati Milacron Company, a makers of machine tools. McVaney and his team received a \$75,000 contract to write software to develop a wholesale distribution system. The new company also got a \$50,000 contract with the Colorado Highway Department to develop a governmental accounting, construction cost accounting system. McVaney's first international client was Shell Oil Company in Cameroon, Africa. Co-founder Dan Gregory flew to Shell Oil, himself to install the company's first international,

multi-national, multi-transcurrency client software system. JD Edwards's software was originally coded for the IBM System 36/38 and later upgraded to support the AS/400 and called JDEdwards World Software.

Enterprise Resource Planning or ERP software concept developed

With the vast majority of JDEdwards's customers in the medium sized area, clients did not have the luxury of gigantic accounting software implementations. There was a basic business need for all accounting to be tightly integrated. As McVaney would explain in 2002, integrated systems were created precisely because "you can't go into a moderate-sized company and just put in a payroll. You have to put in a payroll and job cost, general ledger, inventory, fixed assets and the whole thing. SAP had the same advantage that J.D. Edwards had because we worked on smaller companies; we were forced to see the whole broad picture." It was this requirement for both JDE clients in the USA and Europe as well as competitor SAP, whose typical clients were much smaller than the American fortune 500 firms. McVaney and his company, along with their European competitors developed what would be called ERP software in response to that business requirement.

Three roles in JDE ERP

As an ERP system JDE comprises 3 basic areas of expertise:

- Functional-business;
- Programmer-developer; and
- Technical-CNC-system administration.

Functional business analyst

A JDE functional person is an expert on one or more of the JDE modules, financials, manufacturing, operations, transportation, sales and other areas. This person is the business subject matter expert. Often they started as a JDE user, the super user or power user and gradually developed the skill set of being able to support the business aspects of JDE. Other times, they might have a business degree and come into JDE on the job as a business analyst. This person seldom has any programming or development experience.

Developer/programmer

This person is trained in the software development and programming tools that translate the business requirements as identified by the functional people above into code and programming. Sometimes these individuals simply modify existing JDE objects and in other cases, develop entire suites of applications using the OneWorld/EnterpriseOne development tools including the Report Design Aide (RDA), Table Design Aide (TDA), business function C-code design tools and others using JDE's change management system, Object Management Workbench.

CNC - ERP System architect, engineer and administrator

This is a catch-all function comprising all that the two positions above do not cover including, installation, upgrades, updates, change management, system administration, security, performance tuning, package build and deployment and over-all architecture. The CNC title is taken from the term Configurable Network Computing which describes the overall JDE architecture.

OneWorld Client-Server ERP System launched in 1996

Late in 1996, the software was ported to client-server systems and branded JD Edwards OneWorld. By first quarter 1998, JD Edwards had 26 OneWorld customers and was finally implementing its strategic vision of "life after AS/400" and moving its mid-sized companies customers to the new client-server flavor of ERP. By second quarter, JDE had 48 customers. By 2001, JD Edwards could state that it had more than 600 customers around the world are using its OneWorld ERP software which represented a fourfold increase over 2000. . After the 2004 PeopleSoft Buyout, OneWorld would be re-branded as EnterpriseOne which would continue to be its name even after the Oracle buy-out of PeopleSoft in 2006.

Quality control issues with OneWorld begin to surface

Within a year of the release of OneWorld, customers and industry analysts were discussing serious reliability, unpredictability and other bug-related issues. In user group meetings, these issues were raised with JDE management. So serious were these major quality issues with OneWorld that by 2000, one of JDE's founders, Ed McVaney came out of retirement specifically to get OneWorld back on track. At an internal 2000 meeting in Atlanta, Georgia with some of his Company's CNC consultants, McVaney told them he had decided that he would "wait however long it took to have OneWorld 100% reliable and had thus delayed the release of version B7333 one full year because he "wasn't going to let it go out on the street until it was "ready for prime time."

Re-branding OneWorld as XE after QA issues addressed with Release B7333

The release of B7333, branded OneWorld Xe saw a marked improvement in quality. The patching process and change management process had been markedly improved and the product was received with a collective sigh of relief by both customers and a doubtful press. Since the release of Xe, the product has gone through a brand change from OneWorld to EnterpriseOne as a result of the PeopleSoft purchase of JD Edwards in early 2004. The underlying code had not changed dramatically with the exception of a Web-based client, introduced in 2001 and finally robust for customer use with the release of E810 in 2005. Initial issues with release E811 in 200, lead to a quick service pack to E811-SP1 which salvaged the reputation of that product. By 2006, E812 was announced and by 2008, the much-anticipated B9 was being tested internally and the 8.97 system/foundation code called a Tools Release was announced.

The update to Tools Release 8.96 on top of the applications upgrade to E812 saw the replacement of often unstable proprietary object specifications (also called 'specs') with an XML-based system which promised to be much more reliable. A linkage to the traditional Oracle Applications layer called "Oracle Fusion" was also in the offing.

5.6 WORLD SOLUTIONS COMPANY

J.D. Edwards is a leading provider of agile, collaborative solutions for the Internet economy. The Company's open solutions give organizations the freedom to choose how they assemble their internal applications and how they collaborate with partners and customers across the supply chain to increase competitive advantage.

Oracle Corporation, the world's largest enterprise software company, specializes in developing and marketing enterprise software products — particularly database management systems. Through organic growth and through a number of high-profile acquisitions (PeopleSoft, Siebel, Agile, Hyperion, Demantra, Retek and others) Oracle enlarged its share of the software market. By 2007 Oracle ranked third on the list of largest software companies

in the world, after Microsoft and IBM. Oracle subsequently surpassed IBM after its acquisition of Hyperion and of BEA.

The corporation has arguably become best-known due to association with its flagship Oracle database. Oracle also develops, manufactures, markets, distributes, and services database and middleware software as well as applications software designed to help customers manage business data, support business operations, and facilitate collaboration and application development and grow their business operations.

CEO and founder of Oracle Corporation, Larry Ellison, has served as Oracle's CEO throughout the company's history. Ellison also served as the Chairman of the Board until his replacement by Jeffrey O. Henley in 2004. Ellison still retains his role as CEO.

5.7 SYSTEM SOFTWARE ASSOCIATES, INC. (SSA)

System Software Associates, Inc. (SSA) is one of the world's leading providers of software for industrial businesses. It is the single largest supplier of software for the AS/400 line of minicomputers manufactured by IBM. The flexibility of SSA's software products allows them to be reconfigured to meet specific customer and business demands in any industry. The company maintains its global presence through offices and business affiliates in 67 countries, while support for clients is provided by a network of over 5,000 professionals.

SSA's core product line is the Business Planning and Control System (BPCS), a group of integrated software products for industry that includes applications for manufacturing, distribution, and financial operations. The company is also a leader in computer-aided systems engineering (CASE) technology. Its AS/SET line uses CASE technology to allow clients to build their own applications. Electronic Data Interchange (EDI), which enables businesses to communicate electronically with trading partners, is another area in which SSA has developed advanced products. The company's Main/Tracker line automates maintenance, safety inspection, and warranty tracking, and is the leading maintenance management system in the world.

SSA sprouted from a humble home business into a major international player in less than a decade. The company was founded in 1981 by Roger E. Covey. At age 26, Covey was already experienced in selling software manufacturing systems, having previously worked for Chicago, Illinois-based Professional Computer Resources, Inc. For mid-sized manufacturing concerns, he noted a need for an integrated software product that could handle every stage of operations, from raw materials to the distribution of finished goods. Convinced that he could develop such a product, Covey launched his own firm, initially running it from his mother's dining room table. With his first three employees, Covey developed SSA's Business Planning and Control System (BPCS), which ran on the IBM System/34 computer. BPCS was essentially an umbrella product for about 20 applications modules, each compatible with the others, which enabled customers to easily adapt the system for their own requirements. The company's first customer was Best Chairs, a chair manufacturer based in southern Indiana.

The key to the company's early growth was its unique distribution system. Covey had determined that selling through retail channels made it difficult to find customers, while selling through a direct sales force and providing extensive servicing made it difficult to turn a profit. Therefore, SSA instead developed a network of local affiliates, trained by SSA, that would sell, install, and service the products for a commission. This enabled the company to expand at an impressive rate while keeping its overhead costs low. Within a year, SSA was big enough to move to a new location in Chicago's loop.

Early on, Covey and his employees decided to concentrate on improving the company's specialty, integrated software packages for industry, rather than search for ways to diversify its product line. By 1984, SSA had sales of \$3.9 million. And SSA continued to grow rapidly

through the mid 1980s by continuing to cater to medium-sized companies, which often needed to expand their computer system capacities and software capabilities without adding programming personnel to their payrolls.

In 1986, SSA began to expand by acquiring smaller companies, first acquiring Syncrocom, Inc. for about \$540,000. SSA went public in February 1987. Its stock, which was initially offered at \$13 a share, was hovering around \$20 within a few months. The proceeds from the offering were used to finance the acquisitions of three of its affiliated companies by the end of 1987: Outlook, Inc., ASE Services, Inc., and portions of the Australian-based EDP Pty. Limited.

SSA's scope was international by 1987. The company had 40 affiliates in 25 countries, and half of its sales were generated outside the United States. Its customer list had reached 1,500 and was dominated by companies with annual sales between \$5 million and \$300 million. Of SSA's \$31 million in sales for 1987, about 22 percent were on software for financial operations. Manufacturing and distribution applications each accounted for about half of the remaining share. For the year, sales increased 92 percent, and the company's net income jumped 88 percent to \$3.3 million.

In 1988, IBM introduced a new mid-sized computer, the AS/400 (also known as Silverlake). Companies that had been taxing their System/36 and System/38 computers eagerly awaited the appearance of the new minicomputer, and SSA was among the handful of companies ready and waiting with software for the new system. Despite fierce competition from a group of companies that included IBM, Chicago's Pansophic Systems, and Arthur Andersen, SSA was able to carve out a sizable chunk of the new software market for itself. On the strength of its new BPCS/400 system (essentially the old BPCS revamped for the AS/400), SSA was able to nearly double its net income to \$5.9 million on sales of \$61.5 million in 1988. That year, it was ranked number 23 on Inc. magazine's list of the 100 fastest-growing small public companies. SSA was also ranked number 25 on the list of 100 Best Small Companies published by Business Week.

By 1989, SSA had nearly 400 employees and over 4,000 customers in 30 countries. The company was producing software in eight languages, including Chinese, Japanese, French, German, and Italian. Twenty-six integrated software products were being offered by this time, ranging in price from \$50,000 to \$500,000, depending on the size of the computer on which the applications were to run. SSA's network of affiliates had grown to 52 by the middle of 1989, penetrating nearly every major market in the world. Although competition remained tough, particularly IBM's improved integrated software package, the market for integrated software for medium-sized companies remained somewhat under-penetrated, and SSA was able to sustain its rapid growth rate through the year. For 1989, the company's sales made another jump, to \$95 million, with net income reaching \$11.1 million.

SSA was able to continue its remarkable growth into the beginning of the 1990s. In 1990, the company recorded net income of \$16.4 million on sales of \$124.2 million. That year, SSA launched SSA Mid Atlantic, Inc., a 50-50 joint venture with its New Jersey-based affiliate Software Plus, Inc. The company entered another joint venture the following year with the stockholders of Solid Beheer B.V., a Dutch company. Later in 1991, SSA founder Covey resigned as company president and CEO to pursue an academic career. He remained on the board of directors as vice chairman, and kept his 30 percent stake in the company. The void left by Covey's resignation was filled by Larry J. Ford, an IBM vice-president in charge of marketing the AS/400. Ford, who had been with IBM for 28 years, assumed the posts of president, chairman, and chief executive of SSA.

Under Ford, SSA continued to prosper. Increasing emphasis was placed on the company's CASE products, which assist clients in adapting software for their own purposes as business conditions change. By 1991, SSA had over 4,000 customers, more than half of them

overseas. The company's net income finally began to level off during that year, although sales continued to climb, reaching \$146 million.

SSA's growth jumped back into high gear in 1992. By the middle of the year, the company's CASE tool, AS/Set, was bringing in about 10 percent of its revenue. SSA continued to benefit from the trend in business away from the use of large mainframes toward the use of minicomputers such as the AS/400. The acquisition of two overseas companies helped spur growth in 1992. Comat Services Pvt. Ltd. was purchased through the company's SSA Asia Pty. Ltd. subsidiary, and SSA acquired an Italian affiliate, CSA Sistemi Software, renaming it SSA Italia. For 1992, SSA's revenue shot up to nearly \$229 million, with profits of \$26.6 million.

By 1993, SSA software was being translated into 20 languages. The company continued to expand its global network, strengthening its operations in Asia, Africa, Scandinavia, Eastern Europe, the Middle East, and Latin America. In February 1993, the company launched a new joint venture with DAT GmbH, a German affiliate. SSA acquired Elke Corporation, a maker of maintenance tracking software, in August.

Although the company's network of affiliates continued to work well in keeping marketing and servicing costs down, it became apparent that this system was not particularly well-suited for its large, multinational clients, which were left in the position of working with different affiliates at different locations. SSA began to enhance its own support staff to improve its service to those clients. SSA's net income slipped to \$23.4 million for 1993, on sales of \$263.4 million.

Through the end of 1993 and into 1994, SSA focused its attention on a new strategy for supporting open-system client server computing environments. Using its CASE technology, SSA began offering more flexible software than was previously available. The company's new version of its flagship BPCS series was called BPCS/AS (for "advanced solution"). BPCS/AS consists of over 40 integrated applications, which can be easily manipulated to keep up with rapid changes taking place in both the hardware on which they are run and the business climates in which they are used. The company announced that its new client/server application products could be run on Unix-based systems as well as on the AS/400.

In a relatively short period of time, SSA has maneuvered itself into a dominant position in its niche market. Whether the company can sustain its tremendous growth record remains to be seen. If its management continues to make the kinds of decisions it has made in the past, such as its early commitment to CASE technology and its early jump onto the AS/400 bandwagon, SSA's chances for continued growth will certainly be enhanced.

Principal Subsidiaries: SSA Services Pty. Ltd. (Australia), System Software Associates Ltd. (England), System Software Associates Co., Ltd. (Japan), System Software Associates Asia Pte. Ltd. (Singapore), System Software Associates Caribbean, Inc. (Puerto Rico), System Software Associates Nederland B.V. (Netherlands), System Software Associates, New Zealand Ltd., General Business Solutions S.A. (Spain), Comat Services Pte. Ltd., System Software Associates Italia (Italy)

System Support Alternatives, Inc. (SSA) is a premier Operations Management company providing expertise and qualified resources in support of its client's critical operations. For more than a quarter of a century, SSA has been successfully providing Operations Management services to federal, state, local, and commercial organizations.

SSA provides its clients the expertise and ability to effectively and efficiently organize, manage, and perform mission-critical operational tasks and objectives. We focus our unique skills, disciplines, experience, and knowledge in three primary operations realms – Logistics/Base Operations, IT Operations, and Administrative Operations. SSA's success is rooted in our ability to provide our clients highly qualified, professional work teams - along

with the management expertise and best practice approach to most appropriately address their issues. In short, SSA provides quality Operations Management services to our clients.

5.8 QAD

QAD NASDAQ: QADI produces Enterprise Resource Planning software. The software is targeted to 6 main industries: Automotive, Consumer Products, Electronics, Food and Beverage, Industrial Products, and Life Sciences. As of January 31, 2008, QAD software was licensed at approximately 6,100 sites in more than 90 countries. The company was founded in 1979.

History

In 1979, Karl Lopker needed a way to automate his shoe factory, but he didn't have to go to Silicon Valley for help. He found an answer closer to home. His wife, Pam, a graduate of the University of California at Santa Barbara (UCSB) in mathematics, created the software he needed. Her software worked so well, she started a company, QAD Inc., to sell it.

QAD Products

- QAD Enterprise Application provides single-site companies and multinational organizations with a fully integrated, core enterprise solution.
- QAD Manufacturing enables companies to reduce costs and increase throughput using the latest manufacturing scheduling techniques, including the capability to fully support lean adoption.
- QAD Financials provide the ability to manage and control businesses at a local, regional and global level with solutions for accounting, regulatory compliance, financial reporting and other critical business requirements.
- QAD Supply Chain includes modules that help the management of supply and suppliers through real-time collaboration.
- QAD Customer Management provides improved responsiveness through collaboration and management of customers and demand.
- QAD Analytics helps companies analyze data to measure business performance in key areas.
- QAD Open Technology allows database portability and operating system flexibility, and works with QAD QX tend integration layer to enable access to all elements of QAD application

5.9 A COMPARATIVE ASSESSMENT AND SELECTION OF ERP PACKAGES AND MODULES

CIOs have expressed growing concerns over the Total Cost of Ownership (TCO) of enterprise software and have highlighted costs as a contributing factor in the decline of IT investments. As a result, software vendors are trying to develop more structured "Ownership Experience" strategies and, in some cases, have focused R&D efforts and resources on improving the ownership experience for customers. In response to these executive concerns, PeopleSoft launched its Total Ownership Experience (TOE) initiative 16 months ago, followed by other major application vendors with varying kinds of programs for, and degrees of success in, controlling costs and improving the overall ownership experience. A team of consultants each with over 15 years of expertise in enterprise application software

and every phase of the ownership lifecycle, has reviewed and evaluated key software features that directly impact the ownership experience of enterprise applications. Some of these feature sets included: advanced data loading and moving during the implementation phase, task-oriented navigation for the usability phase, and user-centric performance testing for the maintenance phase. This research offered an objective assessment of these detailed features, validated through in-depth interviews with the panel of consulting experts distinguished by multi-vendor and multi-lifecycle experience.

The resulting study provides a comparative, multi-vendor assessment across the three major phases of the application lifecycle: implementation, application usage, and ongoing support and maintenance. The players and software versions evaluated in the study included:

- Microsoft Great Plains Version 7.5 and Previews of Microsoft Great Plains Version 8.0
- Oracle E-Business Suite 11.5.9
- PeopleSoft Enterprise 8.8 and 8.9 and EnterpriseOne 8.11
- SAP mySAP Business Suite R/3 4.6 and SAP R/3 Enterprise 4.7
- Siebel 7.5 and Siebel 7.7.

From a summary perspective across the ownership lifecycle, PeopleSoft demonstrates consistent advantages for the key features evaluated in this study. The research validates PeopleSoft's leadership for key ownership features in three categories:

Implementation:

PeopleSoft features for implementation rated higher than Microsoft's, SAP's, and Siebel's in enabling implementation teams to install, implement, and deploy enterprise applications through comprehensive configuration wizards and pre-packaged integration packs for all major enterprise application vendors. Oracle also rates consistently high in the areas of configuration, data loading, pre-packaged integrations, and web services. PeopleSoft has made more progress than other vendors in enabling and streamlining its configuration and integration tools.

Usability:

Across the features evaluated, PeopleSoft and Siebel rated highest in terms of the usability features evaluated. The task-oriented organization of application screens and the consistency of screen layouts across all modules in PeopleSoft applications improve end user productivity and enables end users to complete tasks faster and with fewer errors. Microsoft Business Solutions usability is limited due to a continued reliance on "thick client" architecture for most of the applications, and SAP was found lacking in task-oriented dashboards.

Maintenance, Support, and Upgrades:

PeopleSoft rated consistently high across the maintenance feature set primarily due to the ability to proactively and rapidly isolate and resolve application issues through embedded diagnostics scripts, thorough test scenarios and scripts, and streamlined upgrade process. Specifically in relation to Microsoft Business Solutions, PeopleSoft's complete web enablement streamlines the upgrade process compared to an offering like Microsoft Great Plains, which operates in a client-server environment and requires the client to be upgraded as well. The results of this evaluation by this consulting team can provide guidance to decision makers on how to evaluate the major enterprise application vendors relative to the

ownership experience, which impacts both the cost of ownership and the value derived from the applications.

Key Research Findings

Each phase of the enterprise application lifecycle has potential pitfalls that can affect the ultimate success or failure of the ownership experience. For example, if an enterprise software application is not installed completely or correctly, then the rest of the implementation will have problems. Maintenance costs often reflect repetitive tasks, such as upgrades performed many times over the lifecycle of an enterprise application, while poor diagnostics tools lead to unpredictable downtimes and business disruption. Finally, usability features affect end user adoption, and poor usability can lead to increased costs due to lost productivity. The experts looked at these potential outcomes and identified the key feature sets that enabled implementers, IT, or end users to successfully implement, maintain, or use the applications of the five vendors.

Then, based on its primary and secondary research, the team rated each vendor as to whether it offered the feature and then rated how successfully each implementation, usability, and maintenance feature set contributed to the ownership experience. Vendors received either a full circle for a full offering, a half circle for less than a full offering, and an empty circle for no offering. The following analysis represents a compilation of a detailed vendor-to-vendor comparison by application.

Implementation

The implementation phase includes the initial installation of the software, its configuration, the initial load of data into the new application, and any work that might be required for the application to interface properly with the IT environment of the customer, such as integration with other applications, and whether the integration is batch or real time. The implementation phase is typically broken into three major steps:

1. Software installation
2. Configuration
3. Integration

The installation step is important since an incomplete or incorrect initial installation of the software can lead to significant lost time in further steps of the implementation. Streamlined configuration tools are critical in keeping an application implementation project on time, since, during configuration; all the specifics of customer business requirements are captured and shared across implementation staff.

Finally, the integration step is typically one of the most challenging - with many hidden and unanticipated costs. Three factors - the complexity of the applications to interface with, the complexity of the business processes between applications, and the complexity of the integration tools that may require multiple experts and multiple types of expertise - make it difficult to establish detailed project plans and thus to accurately estimate project costs. For the analysis and comparison of vendor approaches to implementation, the experts utilized seven criteria:

1. Application installation wizard
2. Advanced configuration
3. Process modeler
4. Advanced data loading and moving

5. Process-oriented integration
6. Pre-packaged integration between vendor applications
7. Built-in web services integrations

PeopleSoft and Oracle emerge with the most comprehensive feature set for the implementation phase. PeopleSoft excels in the areas of application installation wizard, advanced configuration, advanced data loading and moving, pre-packaged integration between vendor applications, and built-in web services integration. Oracle shows strength in advanced configuration, the process modeler, advanced data loading and moving, and built-in web services integration, but not in pre-packaged integration between vendor applications. SAP and Siebel slightly address all seven criteria, while Microsoft is clearly lacking in four areas - advanced configuration, process modeler, advanced data loading and moving, and process-oriented integration repository.

Let's examine each of the seven feature sets in the installation category.

1. Application installation wizard

Both Microsoft and Siebel offer a streamlined installation wizard that is comprehensive and well packaged. PeopleSoft offers an application installation wizard that removes manual steps and automates key installation processes, including the configuration of the underlying database. By contrast, while SAP also uses wizards, its installation procedure and wizards are proprietary and more complex and very often require the implementers to step out of the automated process to handle tasks that were omitted during the planning phase. Oracle has improved its installation wizard tremendously over previous releases, but still the wizard is inconsistent across modules and requires additional manual steps to be accomplished outside the wizard.

2. Advanced configuration

PeopleSoft has gone further than any vendor in enabling the application to be configured by product or by business processes. For example, the PeopleSoft Setup Manager Configuration tool enables implementation staff to connect to documentation online and navigate through the documentation by selecting product and features directly from the configuration screen. Both Siebel and Oracle provide advanced tools to support the definition of business processes and data flows. SAP provides tools that are more complex and require more technical expertise. Microsoft limits end user ability to fully configure applications.

3. Process modeler

PeopleSoft provides 1,200 pre-defined models that cover PeopleSoft best practices business process flows. Oracle Workflow allows for business processes to be modeled using a drag-and-drop designer and produces a visual diagram of the business process. With Siebel, customers can add pre-defined or custom business processes, branching, and sub-processes to create a workflow process tailored to their unique business requirements. SAP offers functionality in process modeling only within the context of its own applications. The ability to manipulate existing business processes within Microsoft Great Plains is limited and requires customization work. Process modeling is independent from integration but is a critical step for developing process oriented integration (see below).

4. Advanced data loading and moving

Microsoft simply does not allow advanced data loading and moving. Oracle iSetup automates and simplifies the initial setup of data. Oracle iSetup is a question-driven wizard that automatically generates application related parameters and flows such as chart of accounts,

expense policies, and rules. PeopleSoft provides advanced data-loading and moving capabilities, including the ability to load data online from Excel spreadsheets into PeopleSoft applications through component interfaces. SAP provides a free set of tools and procedures that make it possible to transfer data from a variety of sources without any programming. Siebel has a set of proprietary tools for the data load, the tools can be used as batch loading for information that must be reloaded on a regular basis, once the mapping of data is done.

5. Pre-packaged integration between vendor applications

PeopleSoft Process Integration Packs deliver all levels of required integration: data transformation, routing, cross-reference maps, and standard-based connectors/adapters for a complete end-to-end integration. PeopleSoft currently provides five pre-packaged integrations for key SAP and Oracle business processes out of the box. These pre-packaged integrations replace the need for custom integrations, thereby saving customers up to 60% off the cost of custom integration. While not offering pre-packaged integration packs, Oracle maintains adapters to most commonly used applications. Its adapters do help reduce the effort for custom integration. SAP encapsulates integration tasks within its NetWeaver platform, but still requires deep technology expertise to complete the integration. Siebel Universal Application Network provides a common interface layer for Siebel Application to interface with non-Siebel applications but requires third-party components. Microsoft introduced a toolbox for integration to replace Great Plains integration tools (Integration Manager). It is reported to be a great improvement over the previous proprietary tools but has not yet reached a level of usability and completeness comparable to other vendors.

6. Process-oriented integration

Within Oracle E-Business Suite, Oracle Workflow supports basic process-oriented integration and the modeling of it. Siebel's approach to process-oriented integration is to publish all its process-oriented business services as web services. PeopleSoft's new interactive integration repository enables customers to display integration points from a business process point of view and generate integration process plans. SAP's integration approach has been very focused on business processes, but it relies heavily on proprietary technologies. Microsoft Integration Manager includes a set of templates that allow the control of the underlying business logic.

7. Built-in web services integrations

PeopleSoft provides built-in web services and fully supports industry standards for web services. In addition, Oracle supports web services integration at every layer of its application framework (database, middle-tier, and application layer) using open connector standards such as SOAP, WSDL and UDDI. Siebel's strategy is to expose all its business processes as web services to deliver business services-driven integration. SAP provides integration based on web services through its SAP NetWeaver platform.

Usability

The usability phase includes all key functionality that is related to the application ease of use. Usability covers topics such as ability to perform tasks with the minimum amount of errors, intuitive use of the application, end user productivity, ability to learn how to use the application effectively with the minimum amount of training, number of screens or clicks required to perform a specific task, support for novice as well as advanced users, alignment with industry standard interfaces, response times, and ease of adapting application terminology to customer business cases. With this kind of scope to the issue of usability, it does provide value to evaluate and build an objective comparison on the usability of various applications.

Usability, in fact, can impact positively or negatively the total ownership experience. First and foremost, usability has a direct impact on end user adoption, which can make or break a deployment. Poor usability can lead to on going hidden costs through lower end user productivity, error-prone applications, or applications that are misaligned with a company's business processes.

Five criteria were involved in the analysis assessment of usability:

1. Task-oriented navigation
2. Navigation configurability
3. Task-oriented dashboards
4. Web client
5. Integrated office productivity.

Both PeopleSoft and Siebel have obviously made usability a key deliverable to customers and, among the five vendors, provide the fullest feature set for usability, including task oriented navigation, the ability to configure navigation, task-oriented dashboards, and web clients. Only SAP provides no task-oriented dashboards, and Microsoft provides no web clients.

Let's examine each of the five feature sets in the usability category.

1. Task-oriented navigation

A task-oriented navigation is designed to allow users to use business process based navigation to complete tasks. PeopleSoft delivers an easy-to read graphical layout that displays task-based terminology and icons representing the portal registry content. Navigation pages not only have a consistent layout throughout the application, but users can more easily and quickly locate navigation items by scanning the new 2-level navigation shortcut collection. This process based flow for the application is consistent from the top level portal page down to the specific application pages, where application pages have process driven recommended actions and selectively show only the fields that are relevant to the current stage of a specific business process. To ensure optimal design of this task based navigation metaphor, PeopleSoft performs usability tests with at least 100 customers per application per release. This continuous investment in customer driven solution design enables PeopleSoft to continually improve usability and explains the high degree of usability compared to other vendors. Oracle's screens can be rearranged slightly to align better with the customer's business processes and tasks, but this ability is not systematic across all modules and requires a high level of expertise in Oracle. Within SAP, navigation can be customized but requires custom development on top of the SAP Portal, which is part of SAP NetWeaver and is not currently used by most customers. Both Microsoft and Siebel have focused much development effort on usability and both deliver a simplified user interface, leading to applications that are relatively easy to navigate.

2. Navigation configurability

Most vendors provide tools to the technical staff and the implementation team to customize the application interface in order to better fit the business needs and business processes of the customer. Microsoft provides only limited tools to customize the application interface. All modifications made to Microsoft Great Plains' interface and navigation are done through custom coding rather than configuration and wizard-driven, point-and-click tools. With PeopleSoft, Oracle, and Siebel, it is easy to create customized and personalized navigation pages and choose to use these pages in addition to, or instead of, the default navigation pages that are provided out of the box. SAP requires advanced programming to achieve a level of configuration and customization of the interface that might be fit for the average user.

3. Task-oriented dashboards

Microsoft and Oracle offer only limited functionality with task-oriented dashboards. Through task-oriented, pre-built dashboards that organize key tasks, such as applicant job tracking and reporting, PeopleSoft delivers greater productivity to end users. PeopleSoft is so focused on usability and end user productivity that new releases can ship only when a majority of new users tested can complete key tasks without any assistance in a timed usability exercise. Siebel also supports task oriented dashboards that are end user-oriented. By comparison, vendors such as SAP have not fully migrated their interface toward a more task-oriented navigation and still require users to click back and forth between multiple screens to complete the various steps necessary for a specific business task.

4. Web client

All PeopleSoft modules and applications, including PeopleSoft Enterprise One, are fully web-enabled and do not require the download of any application code on the end user workstation. This feature facilitates upgrades that are very transparent to the end users and that do not require the attention of either the end user or the technical staff regarding client side issues. Siebel has added 100% web deployment in the most recent version of its software. Previously with Siebel, some code had to be downloaded to the client. While Oracle claims to be 100% web enabled, some code components are still downloaded to the client. And unfortunately, Oracle's web architecture is not consistent across all Oracle modules. SAP is not yet fully web-enabled. By contrast, Microsoft's applications are still mostly client-server, and release upgrades can trigger significant disruption to business operations through additional downtime and unnecessary incremental costs to upgrade each end user workstation.

5. Integrated office productivity

Microsoft has developed the most integration points between its business applications and its desktop applications, such as Microsoft Office and Outlook. Siebel provides basic integration between its sales force automation modules and email. Meanwhile, PeopleSoft CRM provides integration to standard desktop software tools like Microsoft Office Suite and Lotus Notes as well as mobile devices including laptops, Pocket PC and Blackberry devices to ensure user adoption and enable new levels of user effectiveness. Integration with personal productivity tools is an area that remains underdeveloped for Oracle and SAP, but each vendor does offer some capabilities in this area.

Maintenance, Support, and Upgrades

The maintenance includes all post-implementation activities that are required to keep the application operational under normal and stressed conditions. It includes on going support, upgrades (patches and minor and major upgrades), all diagnostics and tuning activities managed by administrators to maintain the application running in optimal conditions, and the archiving of historical data. Maintenance costs have an important impact on the overall ownership experience, due to the traditionally labor-intensive and repetitive nature of these activities. Diagnostics and tuning facilitate the upgrade process by staying current on releases, while poor diagnostics tools lead to unpredictable downtimes and business disruption. Seven criteria were involved in the expertise assessment of the maintenance phase:

1. Diagnostic and technical support
2. Remote and online support

3. Performance diagnostics and tuning
4. Patch management
5. Automated upgrade process and toolsets
6. User-centric performance testing
7. Data archiving.

In this phase, PeopleSoft offers the fullest feature sets covering diagnostic and technical support, performance diagnostics, patch management, user centric performance testing, and data archiving. PeopleSoft, Oracle, and SAP all offer full performance diagnostics and tuning. And PeopleSoft, Microsoft, and Siebel fully address patch management, while only PeopleSoft and Siebel fully address the issue of user-centric performance testing. All vendors have basic automated upgrade tools, and all have shown progress in addressing maintenance improvements to the ownership experience.

Let's examine each of the seven feature sets in the maintenance, support and upgrade category.

1. Diagnostic and technical support

Microsoft, SAP, Oracle, and Siebel support is delivered the "traditional" way: a knowledge base on the web and phone calls with technical support. PeopleSoft is the only vendor to provide a built-in diagnostic framework through embedded diagnostics scripts that let customers send secure, real-time production system snapshots to PeopleSoft's support center. This unique capability ensures faster issue diagnosis and resolution. With SAP, Oracle, and Siebel, diagnostics and resolution information is exchanged between the customer and the vendor through tailored emails that depend on the availability, the responsiveness, and the knowledge of the vendor's support staff. In some cases, support requires extensive communication and exchange of files such as log files that contain the exact configuration of the customer implementation.

2. Remote and online support

All vendors provide some form of a remote support and online capabilities to help customers self-diagnose issues. Both PeopleSoft's and Oracle's online support databases are rich in content but can be time consuming to navigate. Siebel provides some support content over the web but, once a problem has been logged online, always promotes interaction with the customers over web self service support. SAP has recently introduced multiple web sites to provide better post implementation information to its customers, but the efforts remain fragmented across various interaction points with customers.

3. Performance diagnostics and tuning

Oracle, PeopleSoft, and SAP provide a built-in, instrumented performance monitoring tool that tracks the application performance in real time as well as by component. The tool provides comparisons to average performance levels to proactively identify and troubleshoot non-performing components. Siebel supports industry-standard application response-time management that implies performance tuning across all tiers of the Siebel Smart Web Architecture and supports proactive performance monitoring by a third-party ARM-compliant monitoring application. Because it requires third-party software, Siebel is not rated as highly. With Microsoft, performance monitoring is done at the platform level (Windows/NT), no specific application performing tools are available.

4. Patch management

Applying patches to enterprise applications can be a very time consuming and disruptive activity. SAP, Oracle, and Siebel make their list of patches fully available on the web but provide limited guidance and automated tools to select which patches are relevant to a specific configuration. PeopleSoft has streamlined this task by offering a Change Assistant toolset that supports the automatic checking of pre and post- requisites and by automatically selecting which patch should be applied for the customer to be current. Microsoft releases new versions of patches for its applications very infrequently (less than once a year), so the features with respect to patch management are well suited.

5. Automated upgrade process and toolsets

SAP offers tools to identify pre-requisites and guide technical staff through the various steps of an upgrade. The SAP upgrade process is only partially automated, with many complex tasks to be performed manually. PeopleSoft provides Upgrade Assistant, an automated upgrade tool with well tested and complete upgrade scripts. Starting with Enterprise Human Capital Management 8.9 customers, PeopleSoft has re-engineered the upgrade process from eight steps to five with Accelerated Upgrades. Now customers can use a visual compare tool to identify customizations and an ETL-based data migration tool to ensure downtime is less than a day. Oracle offers upgrade scripts and tools but with a lesser degree of automation. Microsoft provides basic upgrade automation tools that are adequate for Microsoft's low frequency of releases.

6. User-centric performance testing

PeopleSoft allows customers to submit test cases, which are used as part of the application testing and release process. PeopleSoft is the only vendor to test functionality and performance using real customer data on volume database systems. Oracle relies mostly on its database performance test to validate the performance of its application. SAP offers test services reported to be so expensive that very few customers opt to use them. Siebel has been focused on usability since it released its first CRM application, and user-centric testing is an integral part of its product development cycle. Microsoft delivers good usability but the functionality delivered is less sophisticated.

7. Data archiving

Oracle only provides purge capabilities and does not allow customers to archive or restore/reinstate archived data into production. Both SAP and PeopleSoft provide archive, purge, and restore capabilities natively. In addition, PeopleSoft provides rules-based archiving templates enabling administrators to set up different archiving rules for different regions for better global compliance support. Siebel and Microsoft do not directly offer archive, purge or restore capabilities.

Vendor Approaches to Ownership Experience

Microsoft

Microsoft has no formal ownership experience program defined. Microsoft has developed its cost management strategy based on a very low software price point and close to 100% out-of-the-box deployments with little ability to customize the software. As a result, Microsoft offers basic functionality that does not require extensive training, but it also does not necessarily deliver the full value expected by the customer in view of the ownership experience.

Oracle

Addressing cost of ownership is at the heart of Oracle's philosophy for Enterprise Applications. Based on the Oracle e-Business Suite, an integrated suite of applications, Oracle claims that it can lower implementation costs by avoiding unnecessary costs, such as those associated with costly custom integration between applications. Although Oracle's approach has some merit - some measurable benefits have been highlighted through ROI case studies, serious concerns are still being raised regarding what Oracle has delivered to date.

PeopleSoft

Structured in a formal program, PeopleSoft dedicated over 1,000 developers and \$800 million to improve the Total Ownership Experience for customers. Rather than focusing simply on best practices that improve the ownership experience, PeopleSoft has rethought its entire set of applications to ensure that they are built from the ground up to minimize deployment and maintenance costs.

SAP

Many users of SAP applications have, over the years, noted the complexity of SAP applications, the resulting high implementation costs, and consequent budget over-runs. In response to these issues, SAP today highlights SAP NetWeaver as the centerpiece to SAP's product strategy for decreasing the complexity and cost of ownership for SAP applications. Currently, the impact of SAP NetWeaver on the overall SAP cost of ownership remains to be proven. SAP has not yet provided proof points validating that its customers benefit from improved ownership experience through the implementation of SAP's latest technology.

Siebel

Siebel's customer experience initiative was first focused on customer satisfaction and high-level ROI measurements. It is only recently (12+months) that Siebel has focused more specifically on cost-of-ownership issues (mainly in response to customers' complaints). Siebel's improvements to its software development process are guided by the experience and insight gained from close examination of 200 Siebel 7.x deployments.

Research Methodology

For this study, the research was organized along key ownership experience criteria that allowed the research to capture quantitative and qualitative information across the major components of enterprise applications. The list of criteria was thoroughly defined to take into account the experience of not only the technical staff, but also end users who must accomplish specific business tasks with the application. The software versions that were compared included:

- Microsoft Great Plains version 7.5 and previews of Microsoft Great Plains version 8.0
- Oracle E-Business Suite 11.5.9
- PeopleSoft Enterprise 8.8 and 8.9 and Enterprise One 8.11
- SAP: my SAP Business Suite R/3 4.6 and SAP R/3 Enterprise 4.7
- Siebel 7.5 and Siebel 7.7

The research also included functional areas such as Financial and Human Capital Management Systems (FMS & HCM), Supply Chain Management (SCM), Customer Relationship Management (CRM), and application lifecycle phases such as installation, implementation, configuration, usage, maintenance, support, and upgrades. The team broke the entire process down into five steps:

1. Reviewed vendors' web sites and their positioning documents, as well as their online and hard copy documentation.
2. Utilized analyst reports, press articles, and technical reviews that is available to the general public.
3. Validated, using the defined criteria, the information collected in steps 1 and 2 through in-depth interviews with the consulting panel of experts. For the interview process, preference was given to respondents with multi-year experience and experience with the latest version of the application to ensure that the entire application lifecycle was properly covered.
4. Compared and analyzed findings from this primary and secondary research to generate a rating for each vendor on specific criteria. In this comparison and analysis, the respondent's experience with multiple vendors was leveraged as well.
5. Aggregated comparisons and ratings along three major phases of the enterprise application ownership lifecycle.

ERP IMPLEMENTATION LIFECYCLE

Structure

- 6.0 ERP Implementation Lifecycle
- 6.1 Issues in Implementing ERP Packages
- 6.2 Pre-evaluation Screening
- 6.3 Package Evaluation
- 6.4 Project Planning Phase
- 6.5 Gap Analysis
- 6.6 Reengineering
- 6.7 Configuration
- 6.8 Implementation
- 6.9 Team training
- 6.10 Testing
- 6.11 Going Live
- 6.12 End-user Training
- 6.13 Post Implementation (Maintenance Mode)

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.0 ERP IMPLEMENTATION LIFECYCLE

ERP Implementation Life Cycle

The process of ERP implementation is referred as d as "ERP Implementation Life Cycle". The following are the steps involved in completing the lifecycle:

Shortlist on the basis of observation

Selecting an ERP package for the company can nevertheless be compared with the process of "Selecting the right Person for the Right Job". This exercise will involve choosing few applications suitable for the company from the whole many.

Assessing the chosen packages

A team of Experts with specialized knowledge in their respective field will be asked to make the study on the basis of various parameters. Each expert will not only test and certify if the package is apt for the range of application in their field but also confirm the level of

coordination that the software will help to achieve in working with other departments. In simple terms they will verify if the synergy of the various departments due to the advent of ERP will lead to an increased output. A choice is to be made from ERP implementation models.

Preparing for the venture

This stage is aimed at defining the implementation of ERP in all measures. It will lay down the stipulations and criteria to be met. A team of officers will take care of this, who will report to the person of the highest hierarchy in the organization.

Gap Analysis

This stage helps the company to identify the gaps that has to be bridged, so that the company's practice becomes akin to ERP environment. This has been reported as an expensive procedure but it is inevitable. The conglomerate will decide to restructure the business or make any other alterations as suggested by GAP analysis in order to make ERP user friendly. [Click here for a detailed study on GAP analysis.](#) A choice is to be made from ERP implementation models.

Business process reengineering

Changes in employee rolls, business process and technical details find place in this phase of restructuring most popularly referred as business process engineering. For more details on BPR [click here](#).

Designing the System

This step requires lot of meticulous planning and deliberate action. This step helps to decide and conclude the areas where restructuring have to be carried on. A choice is to be made from ERP implementation models.

In-house Guidance

This is regarded as a very important step in ERP implementation. The employees in the company are trained to face crisis and make minor corrections as well because the company can neither be at liberty nor afford the bounty to avail the services of an ERP vendor at all times.

Checking

This stage observes and tests the authenticity of the use. The system is subjected to the wildest tests possible so that it ensures proper usage and justifies the costs incurred. This is seen as a test for ERP implementation.

The real test

At this stage the replacement takes place viz. the new mechanism of operation and administration takes over the older one.

Preparing the employees to use ERP

The employees in the organization will be taught to make use of the system in the day to day and regular basis so as to make sure that it becomes a part of the system in the organization.

Post Implementation

The process of implementation will find meaning only when there is regular follow up and proper instruction flow thereafter and through the lifetime of ERP. This will include all

efforts and steps taken to update and attain better benefits once the system is implemented. Hence an organization has to perform ERP implementation safely and correctly.

6.1 ISSUES IN IMPLEMENTING ERP PACKAGES

- ERP Projects are large and important projects
- Critical in terms of their potential and actual impact
- The track record is far from excellent
- Benefit realisation is questionable
- Preparedness is critical but badly understood
- This leads to problems during the implementation phase that are not solved properly => dysfunctional ERP
- Very low levels of end-user satisfaction are reported
- Essentially different from traditional IS projects => need for a different approach in terms of project management

Implementation is not satisfactory because of the following reasons:

- Poor preparation for project
- Lack of managerial awareness of risks / opportunities
- Lack of understanding of how to select software
- Lack of vision of the business impact
- Poor rationale for ERP
- Poor understanding of how to scope project
- Poor perception of system a priori in user community
- Project management nightmare
- No guide book to find out where to start
- Project leader may not be an experienced project manager (ownership)

6.2 PRE-EVALUATION SCREENING

Like any other project, the ERP implementation project also has to go through different phases. There are no clear separating lines between these phases and in many cases, one phase will start before the previous one is completed. But the logical order is followed. Also, all the phases that we are discussing in this session may not be applicable in all cases. For example, in some cases, the organization might have already identified a particular package, then the pre- selection screening and package evaluation phases are not done.

The different phases of the ERP implementation are given below:

- Pre-evaluation Screening;
- Package Evaluation;
- Project Planning Phase;
- Gap Analysis;
- Reengineering;
- Configuration;
- Implementation Team Training;
- Testing;
- Going Live;
- End-user Training;
- Post-implementation.

Although these phases may seem very linear and distinct from each other, in reality, throughout an actual implementation, the phases are in fact quite fluid. In many cases, companies go through many implementations in different business units, different modules, or manufacturing locations. So at any given time, more than one of the phases may be operational. Some companies opt for the one and only 'Big Bang', while other companies favor sequential rollouts - each company has different needs. But whether it is the 'Big Bang' method or sequential rollout, the lifecycle phases are the same. Once the company has decided to go in for the ERP system, the search for the perfect package starts. But there are hundreds of ERP vendors - of all sizes and shapes - all claiming to have the solution that is ideal for you. Analyzing all the packages before reaching a decision is not a viable solution. It is also a very time consuming process. So it is better to limit the number of packages that are evaluated to less than five. It is always better to do a thorough and detailed evaluation of a small number of packages, than going a superficial analysis of dozens of packages. Hence, the company should do a pre-evaluation screening to limit the number of packages that are to be evaluated by the committee. Not all packages are equal - each has its own strengths and weakness. The pre evaluation process should eliminate those packages that are not useable for the company's business processes. One can zero in on the few best packages by looking at the product literature of the vendors, getting help from external consultants and most importantly, by finding out what package is used by companies which are similar. It is always better to find out how the different packages are performing in environments similar to yours.

If one studies the history of ERP packages and finds out how each package evolved, it soon becomes evident that every ERP package grew out of the experience or opportunity of a group of people, working in a specific business, who created systems that could deal with certain business segments. It is generally accepted that most ERP packages are stronger in certain areas than in others, and each one is madly trying to add functionality in areas where they have been lacking. For example, PeopleSoft is strong in HR and less so in manufacturing, Baan, on the other hand, is historically stronger in manufacturing than in finance and so on.

As the companies grew over time the ERP packages evolved. The experience gained from implementation, the feedback by the users, the need to enter into new markets and the pressure from the competitors forced most ERP vendors to redefine and expand the scope of the activities and functionality of their products. The concepts were expanded upon, new functions were introduced, and good ideas were copied from others, and so on. But still, each package has a history (or origin) that determine in which type of business it is best suited for. While making the analysis it would be a good idea to investigate the origins of the different packages. Now, most packages cater to almost all business and service sectors. It would be wrong to say that a system that was developed initially for manufacturing is now not capable of catering to the needs of another business

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.3 PACKAGE EVALUATION

ERP packages, if chosen correctly, implemented judiciously and used efficiently have the ability to raise productivity and profits dramatically. The book, ERP Demystified (Second Edition) by Alexis Leon helps decision-makers in choosing the ERP package that is best suited for their organization. The market for ERP systems is very competitive. Industry analysts are forecasting steady growth rates for the ERP market. Why are companies replacing their manual or semi-automated systems with ERP systems? Some of the reasons

for the increasing popularity of ERP systems are information integration, improved productivity, improved business agility, reduction in errors, automation, etc. As more and more companies join the ERP bandwagon, the competition is getting keener and ERP vendors are gearing up to meet this challenge by offering more features and better capabilities for their products. So, the future will see a fierce battle for market share and mergers and acquisitions aimed at gaining strategic and competitive advantage. The ultimate winner in this race will be the customer, who will get better products and better services at affordable prices. ERP package evaluation and selection ERP systems are now available in all sizes and shapes for all platforms and development environments. Evaluating the ERP systems available in the marketplace and then selecting one for your organization is a very critical task. This decision can make or break an organization. If the choice is not right, then the organization will pay dearly for it.

So, you think that all ERP packages are the same? Think again, because they are not. Of the more than 50 ERP packages available, the features they offer vary, as do the technologies they support, the technologies they use, the architecture on which they are built and the available platforms. Each package has its own strengths and weaknesses.

But the marketing literature from ERP vendors will give the impression that their product is just as good as any other. Such literature is valuable for giving the reader an overview of functionality and a glimpse at the differentiator for that vendor's offering.

But, if you compare the literature or listen to a vendor's presentation, it would be very difficult to evaluate which package is the best or which would be most suitable for your organization. Deciding which package is suited to your organization is a difficult task. If you go by what is written in the product brochure or what the salespeople say, you will find it very difficult to make a decision and might end up with the wrong choice. So package selection is something that should be done in a systematic and scientific manner.

The most important factor to keep in mind when analyzing the different packages is that none of them are perfect. The idea that there is no perfect package needs to be understood by everyone in the decision-making team. The objective of the selection process is to find a package that is flexible enough to meet the company's needs. Or in other words, to find a package that can be customized to obtain a "good fit." If one studies the history of ERP packages and finds out how each package evolved, then it soon becomes evident that every ERP package grew out of the experience of a group of people working in a specific business, who created systems that could deal with certain business segments. The ERP packages evolved over time as the companies grew. The experience gained from implementation, the feedback by the users, the need to enter into new markets and the pressure from competitors, forced most ERP vendors to redefine and expand the scope of the activities and functionality of their products. The concepts were expanded upon, new functions were introduced, and good ideas were copied from others, and so on. But still each package has an origin that determines the type of business it is best suited for. So while making the analysis, it is a good idea to investigate the origins of the different packages. So, after the decision to go in for an ERP package is taken, the company needs to develop the selection criteria that will permit evaluation of all the available packages on the same scale.

To choose the best system, the company should identify the system that meets the business needs, matches the business profile, and identifies with the business practices of the company. It is impossible to get a system that will perform, exactly as the company does

business, but the aim should be to get the system that has the least number of differences. The selection process once you have decided to implement the ERP system, you have to find a package that is best suited for you. The selection process is one of the most important phases of the ERP implementation because the package that you select will decide the success or failure of the project. Since ERP systems involve huge investment, once a package is purchased, it is not an easy task to switch to another one. So it is a 'do it right the first time' proposition. The consequences of choosing a wrong package are catastrophic, often forcing the company to close shop. There are many ERP packages available in the market. Analyzing all the packages before reaching a decision is not a viable solution. So, it is better to limit the number of packages that are evaluated to less than five. It is always better to do a thorough and detailed evaluation of a small number of packages, than to do a superficial analysis of dozens of packages.

The company should do a pre evaluation screening to limit the number of packages that are to be evaluated by the committee. Since all packages are not equal, the pre-evaluation process should eliminate those packages that are not at all suitable for the company's business processes. One can select the few best packages by looking at the product literature of the vendors, getting help from the external consultants and, most importantly, finding out what package is used by similar companies. It is always better to look around to find out how the different packages are performing in environments similar to yours. Once you select a few packages after the screening, you can call the respective vendors for presentations/ demos.

The selection committee: It is always better to form a selection or evaluation committee that will do the evaluation process. This committee should comprise of people from the various departments (the functional experts), top management (preferably the CIO or COO), consultants (package experts) and end-users. This team can provide the different perspectives and can ensure that the needs of all stakeholders are addressed.

The selection committee should be entrusted with the task of choosing a package for the company. Since all business functions are represented and the management is involved, the package that is selected will have company-wide acceptance. The package experts or the consultants can act as mediators or play the role of explaining the pros and cons of each package.

Handling the vendors once you make a decision to go in for an ERP package, the marketing executives of the different vendors will swamp you. Each will have colorful and excellently produced brochures and presentations claiming that their product is the best one for you. They will use all the tricks to get you hooked. So it is better that you have a strategy for dealing with these vendors. Since you have done a detailed evaluation of the few packages that meet your pre-selection criteria, you can be prepared for the vendor presentations. This point is being stressed again and again because most vendors can make presentations that leave potential users dazzled. The selection may thus end up being based on a set of factors that are insufficient for arriving at a well-informed and judicious decision. So, instead of just listening to presentations, you should be prepared with your questions. The questions should be prepared beforehand and should address all your concerns. The responses that you get for your questions will help you in either eliminating a vendor or strengthening its case. The questions, if properly prepared and asked will expose the weak/problem areas that exist in the vendors' products. Also, when you are asking questions, it means that you are not taking anything for granted. It is a good idea to prepare the minutes of the meeting and make the vendors sign it. This will prevent them from making false claims and you can make them

accountable if they fail to deliver what they have promised. The vendors should be asked to show testimonials and practical demonstrations of the system. The vendor should provide references of organizations where the system has been implemented successfully. But all vendors will have customers for whom their products have failed. In my opinion, getting those names and the reasons for the failure is more important than the success stories. Also, in my experience, while vendor representatives are well prepared for the success stories, the questions about failed implementations usually reveal points and issues that the vendor is trying to downplay. So it is important to ask about failed implementations.

The vendor will usually send two representatives to visit you—a marketing agent and a technical expert. Most of your questions should be directed to the technical expert. The marketing expert should be asked about warranties, licenses, cost, support, training, etc, whereas, the technical expert should be asked about the functionality and capabilities of the system they are offering. The role of technology The existing technology will play a very important role in the ERP selection process. Each organization will have its own technological environment. The management must decide whether the ERP systems will be selected keeping in mind the existing infrastructure or not. It is always a better idea to find a package that is compatible with the hardware, software and technology that the company already has in place. If the organization has the necessary infrastructure then it can think of buying the required components from the vendors and integrating them with the existing system. For example, if an organization is using an HR management system and is quite satisfied with it, then it can go in for the other modules and not for the complete offering from the vendor. It is not imperative that all the components offered by the vendor be bought. The evaluation committee in association with the vendor can select the required components and then integrate them with the existing infrastructure. But here, do not forget to get the vendor's assurance (in writing) that the existing system will integrate smoothly and seamlessly with the purchased components.

The selection criteria

ERP packages come in all sizes and shapes, with all the frills, bells and whistles, gizmos and gadgets that you can imagine. Hence, it is a good practice to specify selection criteria for evaluating the packages that survive the pre-evaluation screening. The criteria can be in the form of a questionnaire and a point system can be implemented. This will help in making the selection process more objective. The questions should address the company's business needs and concerns and each issue or question should be given a weight according to how critical that function is for the company. For example, if the company has offices in different countries, then the capability of handling multiple languages and currencies becomes an important criterion. Likewise the selection criteria should be divided into categories—vital, essential and desirable—and points should be given to each criterion. The point rating system will simplify the evaluation process. But the importance of human intuition, gut feeling, and judgment should never be underestimated. The best method for preparing the selection criteria is to conduct a requirements analysis—find out what the company needs. The requirements must reflect those factors that the company considers indispensable for the successful running of the business according to the company's work culture and practices. Given below are some examples of the selection criteria:

- The package should have Multilanguage and multi-currency support.
- The package should be international and should have installations in specified countries (basically in countries where the company have offices). The vendor should also have a local presence in those countries.
- The package should have at least 'x' number of installations out of which at least 'y' should be in your business sector.

- The cost of the package with all the necessary modules should be less than 'x' Rupees.
- The package should have the facility to do an incremental module addition. For example, the company should have the facility to buy the core modules initially and then go in for the additional modules as and when desired.
- The vendor should provide implementation and post implementation support.
- The vendor should give a commitment on training the company employees on the package.
- The package should have the capability of interfacing with other systems that the company is dealing with—banks, suppliers, customers, etc.
- The package must be customizable and the customization process should be easy (something that could be done in-house)
- The vendor's policy and practices regarding updates, versions, etc, should be acceptable.

In this way, the issues, concerns and expectations that the company has, regarding the package, can be consolidated and made into a list. Then the items in the list should be placed into the 'vital-essential-desirable' categories.

Then, using this list each package should be evaluated. Many items in the list will have descriptive answers. The committee should sit together and analyze these issues and assign points to these items. One important thing that should be kept in mind is that whenever a decision is made, the committee should discuss it and a consensus must be reached to ensure commitment and avoid conflicts. The functional experts (who know the business process well) and vendor representatives (who know the ERP package well) can tell areas and issues that should be given more importance, the aspects that should be scrutinized more thoroughly and how the company's current business practices could be replaced with new ones or modified to suit the package. Another source from which the evaluation committee can get information about the tools is independent research agencies and companies. These sources supply information, comprehensive analyses and comparison reports about the leading tools. But these reports, although excellent sources of information and a single-point reference about the leading ERP systems, are not totally unbiased, completely accurate and totally objective and therefore, should not be taken as gospel truth. But these reports can provide valuable information about the tools. So, at least a few reports by these research groups should be studied along with the vendor's literature so that you get a complete picture of the ERP system marketplace. These reports analyze and compare the tools and their features, predict market trends, forecast the position of the different players in the coming years, and so on. A number of companies and consultants do this kind of analysis.

Sometimes trade magazines like CIO, HBR, Forbes, Fortune, etc, publish articles about ERP and its current state. This information is also worth looking into because it is independent and not biased. Once the committee has evaluated all the packages that have cleared the pre-evaluation criteria, listened to the vendor presentations and demos, and have cleared pending issues, a decision is reached on which package to buy.

Once the committee has reached a decision on a package, it is a good idea to visit a few companies that have installed the particular package and see it in action. But many people will not admit that they have made a mistake, so whatever the existing owners say about a package should be taken with a pinch of salt. But visiting 4 or 5 installations should give a good idea about the package. If the committee members feel that their decision is right and what they have thought is what they have seen, then the company can proceed with the purchasing and implementation. If anybody is uneasy about some aspect or feels that the product is not up to the expected standard, then the committee members should sit and

discuss this again and perhaps do the analysis once again. The package that has got the maximum score in the point rating system need not necessarily be the one that is best suited for the company. The extra time spent on analysis and evaluation is not a waste, it might save the company from a potential disaster.

Finally:

One final word, the most critical factor that determines the success of any ERP implementation is the support of the people who use the system. Even the best ERP systems will fail if there is no user support. So the decision of the committee should be a consensus decision. If there are some people whose views are overridden by majority vote, then the management should take every effort to make them understand the reasons for the decisions and should spare no effort to win them over. Disagreements are common in any group discussion, but the success of the group lies in the fact that all the people in the group own the decisions that are made. Thus, since the group as a whole makes the choice, everybody emerges as a winner. This feeling is very important, as the company will need everyone's goodwill and support to achieve success during and after implementation.

6.4 PROJECT PLANNING PHASE

As in any project plan, a detailed and methodical process must commence to guarantee success. A plan for software selection and purchase of new ERP software is no different than any major project being undertaken by a corporation. It requires a significant investment of time and resources, requires the involvement of the entire organization, as well as a considerable amount of research, planning, and reevaluation along the way. This document is designed to offer an example of the typical ERP software selection process. Although this document and described process flow refers to ERP specific products, the core of the selection methodology may be utilized to search for and purchase other products such as supply chain management software, manufacturing software, or other related business software. The best projects are well thought out and fully researched. Reviewing this document, as well as the other documents available in TGI's Software Selection Tool Kit, is one of the first steps to a successful software selection and implementation project. Software selection requires five individual elements, or phases, within the overall process. The entire process itself can span months or even up to a year depending on the number of internal resources available for the project. Within each phase are a number of secondary steps or tasks that must be completed by members of the team once the team is selected. Although the steps themselves may not exactly fit each organization type, they provide a solid basis for the overall structure and allow the team to use them as the core template for its individual project. This document is composed of three sections, each containing a different level of detail regarding the software selection process. The first section simply identifies the five phases of software selection coupled with a brief narrative on each phase. Section two identifies the specific steps involved in executing each of the five phases. Finally, in section three, we provide some more specific content regarding each of the various steps. How far you dive into the document is up to you. We have specifically constructed the document as we have so you can examine the detail associated with any phase or step at your discretion. We hope you find this material helpful as well as instructive.

Software Selection Process

The Five Phases Defined

In this section, we provide a high level definition of the five phases involved in the traditional software selection process. The five phases of the software selection process are:

1. **Project Preparation and Planning:** This is the portion of the project in which you get things organized by identifying the key business sponsors and drivers for the project. Your project will not succeed without having specific business needs that are driving the need for new software, as well as specific executive sponsors who have identified the importance of those needs.
2. **Request for Information (RFI) and Initial Demonstrations:** Once you have identified why you need new software, the next big task is to identify some of the specifics associated with those needs (an RFI), and which software suppliers are available whose software is likely to be able to satisfy those needs. This phase of the process is when you tackle these issues and begin to get to know the software suppliers themselves and how they operate. Your initial list of potential suppliers may contain as many as 25 software providers.
3. **Prepared Requirements and Request for Proposal (RFP):** This is the first part of the process of narrowing down the list of suppliers. Once you have seen initial demonstrations of available packages, you will develop a much longer and more detailed list of requirements for your business software. This will result in the elimination of a number of potential suppliers and, at the same time, provide you with a formal document (the RFP) defining your requirements for use in gaining more detailed information from your remaining potential suppliers. This, in turn, will allow you to narrow the list down even further.
4. **Scripted Demonstrations:** This is typically the most poorly executed step in a software selection process. Unfortunately, it is also the singularly most important step. This is your opportunity to define the specifics of what you want to see the software suppliers' products do for your business. It is your opportunity to be quantitative rather than qualitative in the process. It also provides you with the ability to identify what your remaining suppliers' products can do 'right out of the box.' Software Selection Process.
5. **Reference Calls, Site Visits, and Supplier Selection:** Ultimately, it comes down to making a choice. If you have engaged in a process along the lines of what we suggest, you are now armed with a significant volume of both quantitative as well as qualitative information about your suppliers and their products. What is left is to perform due diligence activities such as reference calls. If you believe reference calls are going to act as a true differentiator, you are going to be sadly surprised. Vendors are highly unlikely to provide you with poor references. Reference calls are necessary; however, because they help you prove to yourself that the products are in fact being used in a production environment by real businesses processing real business transactions.

Specific Steps Involved in the Software Selection Process: Within each phase of the software selection process are a number of secondary steps that must be completed by members of the team once the team is selected. Although the steps themselves may not exactly fit each organization type, they provide a solid basis for the overall structure and allow the team to use them as the core template for its individual project

1. Project Preparation and Planning

- Obtain Initial Executive Support
- Form a Steering Committee

- Review Key Business Initiatives and Long Term Goals (Top Down Approach)
 - a) Interview Corporate Executives and Senior Management
 - b) Interview Information Technology (IT) and Operations Managers
- Identify Internal and External Stakeholders
- Clarify Objectives and Constraints
- Perform a High Level Needs or Requirements Analysis (Bottom Up Approach)
 - a) Evaluate Existing System Performance
 - b) Interview Functional Departments Managers and Key Users
- Develop a Strategic Systems Plan
- Develop a Detailed Project Plan
 - a) Define Project Structure
 - b) Define Project Scope
 - c) Identify Project Phases and Tasks
- Prepare a Business Case
 - a) Prepare a Project Budget
 - b) Calculate Potential ROI
- Obtain Executive Level Support
 - a) Obtain Approval of Project Plan & Resources
 - b) Obtain Budget Approval
 - c) Assign an Executive Champion

2. Request for Information (RFI) and Initial Demonstrations

- Inform the Organization of the Project
 - a) Inform Department Managers
 - b) Inform Employees
- Form a Project Team
- Educate Team on Project Plan
- Establish Project Controls
- Requirements Definition
 - a) Prepare for the Definition of Requirements
 - b) Interview Functional Areas
 - c) Prioritize Requirements
 - d) Review Completed Requirements with Team
- Research and Identify Long List of Potential Suppliers (15 – 25)
- Create a Formal Request for Information (RFI) and send to Suppliers
 - a) Define Required Response Questions and Initial Selection Criteria
 - b) Issue Formal Request for Information
- Conduct Supplier Interviews with Long List of Suppliers
 - a) Perform Verbal Interviews
- Reduce Initial Long List of Suppliers (10 – 15)
- Conduct Remote Demonstrations for Long List of Suppliers
 - a) Produce High Level Demonstration Script
 - b) Identify Key Features and Provide Sample Data
- Reduce Suppliers to Short List of Candidates (7 - 10)

3. Prepared Requirements and Request for Proposal (RFP)

- Finalize RFP and Submit to Supplier Short List
- Evaluate Supplier Responses
- Reduce Suppliers to Final Short List of Candidates (3-5)

4. Scripted Demonstrations

- Perform On-Site Demonstrations with Supplier Short List
 - a) Develop Detailed Demonstration Script
 - b) Assemble Sample Data
 - c) Send Script and Data to Supplier Short List
 - d) Perform Individual Supplier Demonstrations Based on Detailed Demonstration Script
 - e) Interactively Score each Supplier During Demonstration
 - f) Document the Team's Initial Reaction Immediately Following Each Demonstration

5. Reference Calls, Site Visits and Supplier Selection

- Evaluate RFP Responses
- Evaluate On-Site Demonstrations
- Reduce Short List to Two Top Suppliers
- Conduct Reference Check on Top Two Suppliers
- Select Supplier of Choice
- Conduct Site Visit with Supplier of Choice
- Notify Suppliers of Decision
- Negotiate Contract

Narrative on Each Software Selection Step

1. Project Preparation and Planning

This phase begins with a review of key indicators or project drivers leading to the initiation of this project. It then compares those project drivers to the overall business objectives held by the corporation to ensure they are aligned. Next; it moves to the development of a project plan and business case; which allows for executive support and approval for the selection process. All are necessary to guarantee the project is on the right path from the project's beginning. Obtain Initial Executive Support

Executive support is imperative for project success. The executive staff will not only provide valuable insight on the corporation's direction and future; it will force organizational support and provide approval for the project budget. Form a Steering Committee

A steering committee is the group of key system users who are empowered to act as representatives for their respective functional areas. This group will help guide the project team along the selection process.

Review Key Business Initiatives and Long Term Goals

This is also referred to as the top down approach because it starts with the executives of the organization and then flows down to the functional levels. The new ERP system must be able to support not only existing user requirements; but also allow the growth and future direction of the organization. Since this direction is established at the executive level; the executive staff must be the starting place for building the system's requirements. Note that it is best to begin at the highest organizational level; which is the President. Once the President is engaged; lower level middle managers will be quick to follow.

Executive Level Questions

1. What is the vision of the company in regards to growth and expansion?
2. Do you have an ideal operating environment for the team to base technology requirements against?
3. Looking at the current operating environment and software; if you could change something or start over again; what would you do differently?
4. Do you feel the current software supports the company's mission statement? If not; where could you make improvements?

5. Do you know of any existing policies or procedures that you would like eliminated with the new software?

Ascertain the interests; background; and responsibilities of the person you are interviewing before the interview takes place. Gather facts concerning the matters to be discussed beforehand. Prepare a list of the questions to ask during the interview. Obtain approval for the interview from the immediate supervisor or manager. Make an appointment that is convenient to the interviewee. Provide the interviewee some information prior to the interview and allow the interviewee to gather his or her thoughts if desired. Open the interview by explaining the individual's role in the process and the importance of his or her information. Listen carefully to the interviewee's answers and let him or her speak without interruption. Do not use industry or technical buzzwords; talk at the interviewee's comfort level. End the interview with a summary of the discussion and thank the individual for his or her time and assistance in the process. Provide written feedback shortly after the interview. Allow the interviewee to review your notes and correct any errors if needed. Provide a forum for the interviewee to express continued comments if he or she feels necessary.

1. Are there new or unreleased policies or procedures that the team should consider when developing the requirements listing?
2. Are there any customer satisfaction problems that need to be resolved with the new system?
3. Are there any functional areas you would like the team to focus on when developing the requirements listing?
4. Are there any areas of waste or possible cost reductions that stand out as possible achievements in the new system?
5. Are there any current issues with either personnel or facility related resources that the new system needs to address?
6. Do you feel you receive adequate reporting from the existing system? What additional areas of reporting or type of information would you like to see with the new system?
7. How do you feel you compare with our competition? Do you feel they have a competitive edge that the new system needs to address?

After interviewing the executive staff; the process needs to move to senior management; including the IT and operations managers or directors. These individuals will provide a high level approach to the organization's needs and provide a platform from which to build the individual departmental requirements.

IT and Operation Manager Questions

1. Does the current system manage existing user volume in regards to active users and transaction volumes? Software Selection Process
2. If the company were to see growth; could the existing system manage this growth?
3. If you could increase system capacity; how far would you need to increase it to feel secure enough to handle existing and additional volume due to growth?
4. What do you feel are the largest inadequacies in the current system? How do you currently deal with these issues?
5. How would you rate the existing supplier regarding technology; service; and support? What learning lessons can be taken from this supplier and system?
6. Would you recommend using the existing software supplier as a potential supplier for the new system? Why or why not?

7. Do you have enough resources to manage the existing system? Do you have concerns about needing added headcount to support a new system?
8. Do you feel you can adequately support the user base in regards to training; documentation; report requests; etc.?
9. Would your department be capable of leading the implementation and training phase of the new system; or would you require substantial outside assistance?
10. List your top five requirements of the new system.
11. Does the existing system have a recovery plan? Would the new system require the new supplier to provide a disaster recovery plan; or is your department capable of handling this in house?
12. Do you have a preference for ASP or leasing?
13. Is there anything the team should know that has not already been covered? Identify Internal and External Stakeholders exist both inside and outside of the corporation. They include the various functional departments; as well as outside parties such as customers or suppliers. Functional areas should include accounting; customer service and sales; support; manufacturing and planning; purchasing; inventory control and warehouse operations; transportation; etc.

The customer is the future of the organization and therefore plays an important role in developing the needs of a new system. The organization must ask if it is currently meeting and exceeding the customer's expectations. If the answer is anything other than; "absolutely we exceed the customer's expectations;" the customer must be a top priority in creating the requirements listing. Clarify Objectives and Constraints

By this point the steering committee should have a clear understanding of overall company issues that the new system needs to address. These issues begin to lay out the objectives of the system at a summary level. Once these high level objectives are documented; the lower level user requirements can be matched up to provide the entire requirements listing for the system. This detailed requirements listing will be completed

An extensive interview process with users and will occur later in the identification phase of software selection. At this stage it is important to understand the basic organizational needs and system requirements to allow for the development of the system or business plan. Keep in mind that these objectives need to encompass both the objective of the firm and the objectives of the functional areas.

Generic Business Objectives

- Efficient and Economical Operations
- Adequate Capacity for Expected Growth
- Timeliness in Responding to Inquiries and Reports
- Reliability of System Hardware and Software
- Accurate; Up-to-Date; and Relevant Information
- Security of Data and Facilities
- Flexibility and Adaptability to Changes and New Demands
- Simple and User-Friendly Operating Environment
- Ability to Meet Customer and Industry Compliance Requirements

Perform a High Level Needs or Requirements Analysis

Evaluate Existing System Performance: This requirement is completed by the IT department and is based on historical system performance. The information should be specific in nature and provide detailed information on existing performance versus desired performance and

industry benchmarking. These areas can include both statistical and financial data. Interview Functional Departments Managers and Key Users At this stage; the functional interviews will remain more high level and will focus on the overall system; not the specific requirements for the new system. Answers will be used to develop the business case to obtain initial project approval and funding. Questions should be given to individual functional area managers and their savviest user. The interview will not only provide the interviewer with information; it will provide an initial entree into this functional area and facilitate discussion within the department for usage in developing the detailed requirements document. In other words; while the team is busy developing the business case and obtaining executive approval and funding; the functional area can begin reviewing its departmental needs and its view of the current system more in depth.

Functional Questions

1. Do you feel the current system adequately supports your needs?
2. Do you feel the current system is capable of supporting the needs of the customer?
3. Can you currently access information as needed and in a timely manner?
4. Do you currently perform any manual processes or 'work around' due to existing system constraints?
5. Do you feel knowledgeable with the current system's processes and capabilities?
6. Do you feel you need additional training on the existing system?
7. Is there sufficient documentation in the existing system to help you in your daily job or assist in training new employees?
8. Are there any existing company or system policies and procedures that prevent you from doing your job and meeting the customer's requirements successfully?

Develop a Strategic Systems Plan

A strategic plan is in effect a blueprint for system development in the coming years. Many times this is referred to as a technology road map. It provides a means to coordinate system planning and other strategies; as well as a basis to build a business case. Develop a Detailed Project Plan the project plan includes a definition of the project structure; project scope; and individual project phases and tasks. At this time; a project manager should also be fully established and leading the team's efforts. It is important to maintain a single point of contact to form continuity in the project.

The project structure refers to the style used to manage the project; the responsibilities of those parties involved; and the method by which to communicate this to the organization. Do not underestimate the value of effective communication to the organization. Good communication of the project's overall goals and possible rewards will foster a more positive organizational response and engagement in the process. The scope refers to the functional areas covered by the new software; as well as the Strategic Systems Plan

- Summary of the Plan
- Objectives of the New System

Tougher competition in the marketplace is generating the need to better optimize resources; improve profitability and keep customers satisfied. Companies are increasingly implementing Enterprise Resource Planning (ERP) software solutions to improve operations and provide faster customer response. Choosing an ERP solution that meets your specific business requirements will enable you to have a smoother implementation. If the software package is written for your industry; you won't have to custom design a solution. Customized solutions are time consuming to implement and add unnecessary cost. One of the top reasons ERP implementations fail is because the software doesn't meet basic industry specific business

requirements. However; purchasing an ERP application is only half the battle. A well designed implementation plan is the key to success.

5 Steps to Successful ERP Implementation

1. Strategic Planning

- Assign a project team.
- Examine current business processes and information flow.
- Set objectives.
- Develop a project plan.

Project team: Assign a project team with employees from sales; customer service; accounting; purchasing; operations and senior management. Each team member should be committed to the success of the project and accountable for specific tasks; i.e. developing a timeline; finalizing objectives; formulating training plan. Make sure you include first line workers as well as management on your team. Base the selection on the knowledge of the team not status of the employee. Examine current business processes: Have the team perform an analysis on which business processes should be improved. Gather copies of key documents such as invoices; batch tickets and bill of lading for the analysis. To start the team discussion; consider questions such as: Are your procedures up to date? Are there processes that could be automated? Are personnel spending overtime processing orders? Does your sales force and customer service personnel have real-time access to customer information? The team members should also conduct interviews with key personnel to uncover additional areas of improvement needed. Set objectives: The objectives should be clearly defined prior to implementing the ERP solution. ERP systems are massive and you won't be able to implement every function. You need to define the scope of implementation. Ideally; the scope should be all inclusive. But practically; it is very difficult to implement. Examples of objectives would include: Does the solution reduce backlogs? Can the solution improve on-time deliveries? Will you be able to increase production yields?

Develop a project plan: The team should develop a project plan which includes previously defined goals and objectives; timelines; training procedures; as well as individual team responsibilities. The end result of the project plan should be a "to do" list for each project team member.

2. Procedure Review

- Review software capabilities.
- Identify manual processes.
- Develop standard operating procedures.

Review software capabilities: Dedicate 3-5 days of intensive review of the software capabilities for the project team. Train on every aspect of the ERP software to fully educate the team on capabilities and identify gaps. Determine whether modifications are needed prior to employee training.

Identify manual processes: Evaluate which processes that are manual and should be automated with the ERP system.

Develop standard operating procedures (SOPs): for every aspect of your business. These procedures should be documented. Make sure that you modify the document as your SOPs change. This is a huge task; but it is critical to the success of your implementation.

Examples of SOPs:

- How do you handle global price changes?
- What are the processes for inputting new customer records?
- How do you currently handle the paperwork on drop shipments?
- How do we add a new product or formula?

3. Data Collection & Clean-up

- Convert data.
- Collect new data.
- Review all data input.
- Clean-up data.

Convert data: You can't assume 100% of the data can be converted as there may be outdated information in the system. Determine which information should be converted through an analysis of current data.

Collect new data: Define the new data that needs to be collected. Identify the source documents of the data. Create spreadsheets to collect and segment the data into logical tables (Most ERP systems will have a utility to upload data from a spreadsheet to their database).

Review all data input: After the converted and manually collected data is entered into the ERP database; then it must be reviewed for accuracy and completeness. Data drives the business; so it is very important that the data is accurate.

Data clean-up: Review and weed out unneeded information such as customers who haven't purchased in a while or are no longer in business. Now is the time for improving data accuracy and re-establishing contact with inactive customers.

4. Training and Testing

- Pre-test the database.
- Verify testing.
- Train the Trainer.
- Perform final testing.

Pre-test the database: The project team should practice in the test database to confirm that all information is accurate and working correctly. Use a full week of real transaction data to push through the system to validate output. Run real life scenarios to test for data accuracy. Occurring simultaneously with testing; make sure all necessary interfaces are designed and integration issues are resolved to ensure the software works in concert with other systems.

Verify testing: Make sure the actual test mirrors the Standard Operating Procedures outlined in step 2; and determine whether modifications need to make.

Train the Trainer: It is less costly and very effective if you train the trainer. Assign project team members to run the in-house training. Set up user workstations for at least 2 days of training by functional area. Provide additional tools; such as cheat sheets and training documentation. Refresher training should also be provided as needed on an ongoing basis.

Final Testing: The project team needs to perform a final test on the data and processes once training is complete and make any needed adjustments. You won't need to run parallel systems; if you have completed a thorough testing.

5. Go Live and Evaluation

- Develop a final Go-Live Checklist.
- Evaluate the solution.

Sample Final Go Live Countdown Checklist Sample

- Physical inventory process is complete.
- Beginning balance entry procedures are developed for all modules.
- Any transition issues are addressed.
- Documents & modifications are tested thoroughly.
- Executives and department's heads are fully trained.
- Vendor is available for go-live day.
- Users will have assistance during their first live transactions.

Evaluation: Develop a structured evaluation plan which ties back to the goals and objectives that were set in the planning stage. In addition; a post-implementation audit should be performed after the system has been up and running for the first week for reconciliation purposes and three to six months following to test whether or not the anticipated ROI and business benefits are being realized. Comparing actual numbers with previously established benchmarks will reveal if the software tool does what it is intended to do - add value to the business. It is important to periodically review the system's performance to maximize ROI.

Summary

- Set reasonable goals and objectives.
- Make project team members accountable for implementation.
- Test software across departments.
- Constantly evaluate to maximize the return on your investment.

You will hit bumps in the road and you need to be patient. Upper management and project team members should be committed for the company to realize the benefits of successful ERP.

6.5 GAP ANALYSIS

Why Gap Analysis?

Gap analysis is an important step in ERP implementation. ERP is meant to integrate the data of all the departments in a company under one common platform. This call for a radical change in the system of the company's is functioning. The organization can either drop the idea of implementing ERP or choose to go by it. Such a decision can be arrived only by comparing with parameters like the reaction of their customers. The organization can go ahead with ERP by modifying the software to suit their needs but as earlier discussed it leads to other complications and dilutes the working of ERP. If the company wants to go for ERP it will stick on to ways and means for implementing ERP. In order to help the company arrive at a proper decision in such unwary circumstances GAP analysis is advocated and followed. Gap analysis basically identifies analyses and as well suggests a sequence of steps to be followed after taking into account "What ought to be "and "what actually exists". It provides to overcome /bridge the gap. Above all it is aimed at improving the commercial viability. The process is aimed at facilitating ERP function so that the benefit of ERP is received in full.

Steps in a Gap Analysis

The primary step will be to make a note of the existing business system and list out the flaws and positive aspects. This is an attempt to have an idea of what is currently happening given the scenario in question so as to help in ERP implementation.

Evaluate and decide the additions that need to be made to the business in view of ERP implementation. The aim is to make sure that there is not even a thin line of difference

between ERP and the organizations commercial activities. It will be oriented to ERP function.

Rating the existing level of performance to set a benchmark or standards for the business as on date. This will help in finding out the benefit of ERP.

Having an in-depth study of the regulations and statements in the organizations and suggesting modifications. This also will decide ERP implementation.

Clearly defining the roles of individuals in the organization so that the priorities are met and the structure remains undisturbed. This is to make things clear for ERP function.

Checking if the objective in discharging duties are met because it is the ultimate solution to any issue. If they are not met the gaps should be made known and corrected. Only then the organization can achieve the benefit of ERP.

Ensuring that functions are executed properly and if need be personnel can be rewarded to boost up and encourage performance.

Similarly comparisons are to be made for every other factor that draws relation in one way or other. These results are to be complied for ERP gap analysis.

The gap analysis takes into account all the factors of study and gives the results. It either recommends the implementation of an ERP system or rejects the idea in totality.

This whole process takes about 90-120 days depending on the complexities and technicalities involved. Gap analysis requires the proper understanding of the firm and the ERP product in question. The analysis should fully focus on how the business process and software can be mutually beneficial to one another. GAP analysis becomes instrumental in deciding ERP implementation; so as Business Process Reengineering.

6.6 REENGINEERING

In today's fiercely competitive business environment; there has to be much greater interaction between the customers and manufacturers. This means that; in order to produce goods tailored to customer requirements and provide faster deliveries; the enterprise must be closely linked to both suppliers and customers. In order to achieve this improved delivery performance; decreased lead times within the enterprise and improved efficiency and effectiveness; manufacturers need to have efficient planning and control systems that enable very good synchronization and planning in all the processes of the organization. Today; however; the challenge is intense and requires a strong integration across the value chain. Enterprise Resource Planning is such a strategic tool; which equips the enterprise with the necessary capabilities to integrate and synchronize the isolated functions into streamlined business processes in order to gain a competitive edge in the turbulent business environment.

It is said that; what the stethoscope is to medical treatment; ERP; is to reengineering. Reengineering can be called as an essential precursor to ERP implementation. Since; ERP gets the best out of the available resources; it is very important to reengineer the business processes before going for an ERP implementation. If the business processes are not streamlined; the resource allocation will always be sub-optimal. Reengineering also makes it smooth to drive the ERP implementation programme; because the former builds the spirit of competitiveness and adaptation of best practices. In late 1994; for instance the ¥450 billion Yamaha Motors started a global reengineering project to consolidate its operations in 65 countries. Every process in the company was to be right-sized as part of the project. The first to be tackled was financial accounting. From a situation where Yamaha did not even attempt the consolidation of global accounts; it took only six months to implement an ERP based

system in which such a consolidation was routine. While production planning was implemented next; the entire project is expected to be completed by mid 1998.

Applications

The earlier MRP systems were meant for the manufacturing organizations. However; ERP system has gone beyond this barrier. Today; ERP is being implemented in almost all types of organizations irrespective of its mode and spread of operation. A typical list of segments where ERP systems have been implemented are Aerospace & Defense; Automotive industry; Banking & insurance; Chemical & pharmaceutical industries; Consumer goods; Healthcare; High-tech & electronics; Mechanical engineering & heavy construction; Oil & gas; Project oriented manufacturing; Public administration & education; Retail; Telecommunications; Utilities; etc.

ERP implementation in India is picking up very fast. Last few years have seen lot of products coming into the market and the leading companies taking initiatives to implement ERP. But most of these implementations have not yet witnessed the expected results. However; the experts are hopeful about the success an ERP system can bring to the industry. Again; it is not a magic tool; which will transform everything overnight; rather successful implementation is a long journey towards enterprise excellence.

The reengineering of software was described by Chikofsky and Cross in their 1990 paper; as "The examination and alteration of a system to reconstitute it in a new form". Less formally; reengineering is the modification of a software system that takes place after it has been reverse engineered; generally to add new functionality; or to correct errors. This entire process is often erroneously referred to as reverse engineering; however; it is more accurate to say that reverse engineering is the initial examination of the system; and reengineering is the subsequent modification.

Business process reengineering (BPR) is; in computer science and management; an approach aiming at improvements by means of elevating efficiency and effectiveness of the business process that exist within and across organizations. The key to BPR is for organizations to look at their business processes from a "clean slate" perspective and determine how they can best construct these processes to improve how they conduct business. Business process reengineering is also known as BPR; Business Process Redesign; Business Transformation; or Business Process Change Management. It is the radical redesign of an organization's processes; especially its business processes. Rather than organizing a firm into functional specialties (like production; accounting; marketing; etc.) and considering the tasks that each function performs; complete processes from materials acquisition; to production; to marketing and distribution should be considered. The firm should be re-engineered into a series of processes.

The main proponents of re-engineering were Michael Hammer and James A. Champy. In a series of books including Reengineering the Corporation; Reengineering Management; and The Agenda; they argue that far too much time is wasted passing-on tasks from one department to another. They claim that it is far more efficient to appoint a team who are responsible for all the tasks in the process. In The Agenda they extend the argument to include suppliers; distributors; and other business partners. 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 functions. Enterprise resource

planning; supply chain management; knowledge management systems; groupware and collaborative systems; Human Resource Management Systems and customer relationship management systems all owe a debt to re-engineering theory.

6.7 CONFIGURATION

The choices made in setting up a computer system or an application program so that it meets the user's needs. Properly configuring your system is one of the more onerous tasks of personal computing and is mostly performed via manual alteration of system files in the /etc directory or 'dotfiles' in a user's home directory. Wizards such as the linuxconf and webmin can make such a task much easier

In communications or computer systems; a configuration is an arrangement of functional units according to their nature; number; and chief characteristics. Often; configuration pertains to the choice of hardware; software; firmware; and documentation. The configuration affects system function and performance. Auto-configuration is the automatic configuration of devices without manual intervention; without any need for software configuration programs or jumpers. Ideally; auto-configuring devices should just "Plug and Play". Auto configuration has been made common because of the low cost of microprocessors and other embedded controller devices.

Configurations may be stored in NVRAM; loaded by a host processor; or negotiated at system initialization time. In some cases; hot pluggable devices may be able to renegotiate their configuration. Example of auto-configuring devices:

- USB

Example of auto-configuring devices and protocols:

- DHCP
- Zeroconf

Configuration management (CM) is a field of management that focuses on establishing and maintaining consistency of a system's or product's performance and its functional and physical attributes with its requirements; design; and operational information throughout its life. For information assurance; CM can be defined as the management of security features and assurances through control of changes made to hardware; software; firmware; documentation; test; test fixtures; and test documentation throughout the life cycle of an information system.

6.8 IMPLEMENTATION

Significance of ERP Implementation

Companies have to clearly know what enterprise resource is planning before thinking of implementing them. The catch word of ERP implementation is speed.

The faster it is implemented the quicker and better are the advantages and delivery in terms of results. This early process has another hold. The returns are sought at a shorter period. This deviation from the conventional practice has become the order of the day as far as many companies are concerned. Formerly Business process reengineering played a vital role with respect to implementation. It is important to know the components of Enterprise resource

planning .Merely defining enterprise resource planning will not help in this.This naturally paved way to development of gaps between the actual results and the one derived during the process of foreseeing. Tuning ERP as per the whims and fancies of the practices followed in the company became a routine affair. This led to slogging and dragging beyond the time limits permitted. It was monetarily pinching and played havoc in the customer's trust. It is also necessary to understand that mere ERP planning does not guarantee the benefit of ERP. It has to be implemented as planned after understanding the components of enterprise resource planning.

In spite of having improved the implementation issues what remains static and unfettered is the manner in which companies go ahead with ERP implementation. They do it for the heck of it and without following systematic procedures. In fact they don't even check the desirability of going into ERP. Some issues that an organization has to address after defining enterprise resource planning are:

- Popular information systems
- Likelihood of fluctuations in the choice of technology
- The ability of market players to stay in tune with it
- The ways and means to implement a business applications like ERP
- To benefit from the same so as to gain a competitive edge
- Their usage and services
- The necessity for innovating software applications

If an organization is able to answer these questions without any ambiguity and substantiate the results then it can be said that it has a path or up focus in taking ERP. The questions mentioned above are crucial and will even decide the business model of the company. ERP implementation is a vital in the whole process of ERP. They can take place only if one understands "What is enterprise resource Planning" and defining enterprise resource planning in their organization.

Current Approach

It is essential to have an overview of the current approach. The current approach is claimed to be relatively successful.

The current approach more popularly referred to as "baan" has two underlying principles

The idea which concentrates on molding the business:

This category is prominent when the organizational unit calls for a radical restructuring process by all means. This process will be carried in all aspects of the business .Some of them include strategic manouvere; operation of trade and the circumstances that call for change and adaptability. Defining enterprise resource planning in context to the concerned organization will help to decide on this issue.

The plan which lays more emphasis on technical parameters:

Here business takes the back seat. The thrust lies on technical dimensions. This does not ignore the commercial viability as such but they occupy seat only in the due course of time more so when operations are triggered in full stream and not at the initial stage itself. The advantage with this type is that it does not call for an immediate modification of the business structure. However it is essential to know the components of enterprise resource planning.

It's not pretty out there. Companies have spent fortunes on ERP software and implementation only to find that business performance has not improved at all. These large investments and

negative ROIs have created a whirlpool of controversy; rampant company politics and even a number of lawsuits. The trade press has reported any negative ERP stories; and even annual reports have pointed the finger at ERP for lower-than-expected learning. For some; this has created a higher level of fear about making a big ERP mistake. Much of the time; ERP software vendors are the targets for blame when anticipated results do not materialize. Are the ERP vendors that sold the software the real culprits for the lack of business performance improvement? The answer is; not very often. Certainly; it can often be argued that ERP system logic is sometimes illogical; functionality is missing; and functions perform poorly and so on. But accountability for ERP software selection and implementation usually lies to varying degrees with internal personnel and often with external consultants. Selecting and implementing a new ERP system; and the process changes that go with it; is unquestionably a complex undertaking. Regardless of your size and perceived resources; an ERP implementation is not something that should be approached without a great deal of careful planning. Among companies that have been through a less-than-fully successful ERP implementation; five reasons for poor results show up consistently:

- Operating strategy did not drive business process design and deployment.
- The implementation took much longer than expected.
- Pre-implementation preparation activities were done poorly; if at all.
- People were not well-prepared to accept and operate with the new system.
- The cost to implement was much greater than anticipated.

How can we avoid some of these costly mistakes? Here are some guidelines to help you with ERP success.

(Rather than repeat a discussion here of pre-implementation preparation activities; please refer back to my column in the September 1998 issue of Midrange ERP. It's the process Management is getting its hoped-for results from ERP less often than not; and this begs an explanation for ERP's often-poor performance. What many manufacturers fail to realize is that extensive supply chain improvement requires that management begin to redefine its business in terms of strategic opportunities. The purpose of ERP technology is to support the business processes that support the company's strategic opportunities.

There are some basic tenets of ERP that should guide management's actions and decisions.

1. There is no magic in ERP software. ERP's benefits are a direct result of effective preparation and implementation; and appropriate use. This seems obvious; but nine out of 10 companies don't get it right the first time around. Expecting a quick fix; silver-bullet solution is a dangerous mindset.
2. No amount of advanced information technology can offset the problem of a flawed business strategy and poorly performing business processes. This area; in particular; is something that ERP software implementers may not fully address because it can slow system deployment.
3. Define a business strategy that will give you a competitive advantage or; at the very least; make you competitively equal. Then; analyze your current business processes and develop your objectives. Once this step is done; the following steps for preparation; ERP software selection and implementation can support your strategic and process objectives better.
4. Acquire flexible ERP information technology that can accommodate rapidly changing business conditions. The high-velocity flow of information needed to support action up and down the supply chain is a major step forward for most manufacturers. It will be mandatory in the future just to compete; much less stay ahead of; the competition.

5. Have the implementation led by a senior executive who has the authority to make changes happen and happen quickly. Make sure there is a sense of urgency and true accountability for completing preparation and implementation activities on time. Moving away from functional silos and creating effective cross-functional processes that are truly integrated via an ERP system is not an easy task. When ERP is not fully integrated into day-to-day business operations; however, it is not likely to be very beneficial.

If enterprise integration or more advanced supply chain management strategies are to have any chance of complete success it will be due; to a large extent; to the removal of traditional cross-functional barriers. These silos comprise the organizational boundaries where information flows; and often cooperation; stops. You must ask; “How will we use the ERP system?” Some not-so-obvious issues will surface as you try to answer that question. For example; will you combine demand-based flow and lean manufacturing techniques; which will negate the need for some traditional ERP functionality? Focus on your business strategy and not just software selection and implementation. Many problems are reinforced by contradictory objectives and performance measures that actually create inconsistent value and belief systems; to the company’s detriment. No amount of information technology will correct these problems. Management must aggressively remove them once and for all through business process redesign.

Plan to succeed successfully implementing ERP the first time requires a structured methodology that is strategy-; people and process-focused. This is the only way to manage the risk effectively. A good methodology covers all the bases; but when the unexpected pops up; as it usually does; you will be prepared to handle these exceptions without severe negative consequences. One very common mistake is not having your employees prepared to use the new processes and support system.

The consequence here can range all the way to total failure; but they are avoidable. Evaluate your business strategy and ERP plan before you commit to software acquisition and installation. Doing it right the first time is the only cost-effective way to go. Many people out there wish they had paused to evaluate their direction. The following questions do not cover every possible contingency; but should be helpful to stimulate thought and discussion.

- How do we want to run our business?
- What business problems need to be solved?
- Do we know and understand our priorities?
- Do we fully understand our as-is condition versus our could-be/should be processes?
- Have we carefully defined an action plan for pre-implementation preparation activities?
- What tasks will be accomplished and when?
- What are the missing links in our current system and our software of choice?
- What are the real costs; benefits and timetable going to be?
- Do we have an executive-level ERP champion to provide the necessary link to top management?
- Who will implement ERP and make it work?

ERP and supply chain management systems implementations are; in fact; projects without an end. After all; the supply chain is; to a large extent; the very life blood of a manufacturing company. For the well-prepared; new supply chain management systems based on ERP have become significant competitive differentiators.

Implementing ERP can become a mind-altering experience for those involved. Following a sound methodology will greatly increase your likelihood of success the first time. Yet; it will not guarantee your success. Only you can do that. U; Strengthening Manufacturing's Weak Links; and other educational materials through

6.9 TEAM TRAINING

Staffing the ERP Training Team: Staffing an ERP Training Team can be intimidating. This may well be the biggest; most complex; training project you ever attempt. However; the standards and thoroughness you normally use when staffing projects still apply. You pore over the project plan to get an idea of timing. You look at scoping documents to learn about content complexity. You ask questions to understand your audience and figure out which training delivery systems you might be able to use. Then; you identify skills needed and roles to be staffed.

Roles needed throughout the ERP Project Lifecycle On this chart you'll see some familiar training team roles; set within the context of a typical ERP project lifecycle. Below; we'll step through each role and discuss activities performed and skill sets needed.

- Project
- Preparation
- Business
- Design
- Development Implementation
- Training Team
- Lead
- Training
- Team Lead
- Instructional Designer
- Online Learning
- Developer
- Technical Writer
- Training
- Coordinator
- Training Team Lead

The team lead is the first of the training team members to arrive and usually the last to leave the project. During the first two project phases; the team lead performs information-gathering and planning tasks such as:

- Conducting an audience assessment
- Developing a training strategy and plan
- Contributing project plan line items
- Selecting and securing other training team members
- Developing a project orientation in preparation for other training team members joining the project
- Contributing to the Change Management strategy and plan a good candidate will have a broad knowledge of the business and great analysis and negotiation skills.
- During Development; the team lead becomes a conduit between projects management and the training group. Some of the crucial activities performed during this phase are:

- Keeping the team moving towards milestones
- Training the team on development tools or systems used for training
- Communicating and resolving issues within the team and on the project
- Communicating status
- Preparing and delivering end user training presentations to the business.

The lead must be highly organized and possess superior communication and people skills. Ideally; the person will also have led multi-functional teams and had some ERP experience. If experience cannot be found in-house; a consultant is often paired with the team lead; to provide mentoring and support. Instructional Designer Instructional designers build the curriculum and design the courseware. They join the project during the Development phase; and their participation continues until the training materials are complete. Their contributions include:

- Curriculum development
- Course design
- Course development for the classroom or the web
- Train the Trainer Workshop design and development

In this role; the ability to understand and analyze complex business processes is important. You'll need to look for individuals who are team players and have experience in instructional design; adult learning theory; interviewing; and communications.

The number of instructional designers needed is based on three factors:

- Timeline—The shorter the timeline; the more you'll need.
- Number of business processes and their complexity—How many processes can one instructional designer reasonably handle?
- Number of subject matter experts—How many people will one designer need to work with to obtain information?

Online Learning Developer If you plan on delivering training over the web; you'll need an online learning developer. The individual initially consults with your instructional designers to develop courseware standards and give advice about how learning content translates to an online environment. The person then builds on-line modules from course storyboards.

The online learning developers should be skilled in:

- Training development tools for the web
- Producing online learning for business process and software tools
- Instructional design concepts
- Visual communication of ideas

The number of online learning developers needed depends on many factors unique to your project. Technical Writer Technical writers can make fast work of many tasks; if the tasks are clearly delineated. Add this talent during the last 2-3 months before end user training begins.

Skills to look for are:

- Experience writing online help and tutorials
- Knowledge of your online development tools
- Broad and numerous writing experiences within a corporate environment

Assign one technical writer to do all the online work. Assign others to produce reference manuals and associated job aids.

There are two ways of finding trainers for classroom delivery. The first way is to grow your own. Find individuals in each business area with good communication and people skills. Over the life of the project; show them how the ERP system will work for them. As end user training nears; teach these subject matter experts how to use the course materials you've developed to train the end-users. The second way is to hire professional trainers who already know the system and processes to be taught. Professional trainers can be added to the project about 1-2 months prior to the start of end user training. With either approach the duties of the trainer are the same:

- Become familiar with course material
- Assist instructional designers in the development of the participant exercises by advising on likely business scenarios.
- Load practice data in a training system.
- Deliver end user training
- Participate in the assessment of the end user training

Required skills include excellent communication and facilitation skills; ERP subject matter expertise; and limitless patience and enthusiasm in the classroom. The number of trainers needed depends upon the number of business processes and end users to be trained. Training Coordinator The training coordinator takes on the enormous task of scheduling learners into appropriate courses; tracking completion; scheduling make-up courses; and adjusting training schedules. Add this full time person to the project about 2 months prior to the start of end user training. Essential skills include attention to detail; organization; working knowledge of database software; and above average written and verbal communication. Now that you have a clearer understanding of the skills required for each training team role; staffing your ERP training team will be easy.

6.10 TESTING

ERP Testing is a procedure that usually occurs before a company fully implements an ERP software package and the software goes live. It is done in order to identify certain situations may arise after the implementation has been completed; such as determining operational responsibility; training needs; and problem management procedures.

Testing (or Unit Testing) as we refer to it; is a very important part of development and delivering a solution to a client. First off; you need to develop a test script so that a full end to end test can be performed and ensure that the results you get are the results you expect.

In order to do this you need to have specific business specialist that can give you the business scenario. Then the business scenario can be converted to business steps. I suggest that you firstly create a process flow to diagram what you believe the process is. Remember; that this process is subject to change during the development of the test script and unit testing.

Once you have the process flow documented; you can then do a system walk through to see if the existing software will do what the process calls for. If not; then development will be needed to meets the business needs.

Once development is completed; the true unit testing occurs. You must do integrated testing on all possible scenarios that may come out of the business process (different variations of the same process)

Once unit testing is approved; then the solution can be delivered to the client. After this is done; the client should be given the details of the test plan so that they can also do scenario testing to get an agreement on the solution.

Enterprise Resource Planning is the means to integrate your business processes. It is the solution to managing labour intensive; tailor made systems. To optimize your business processes you don't have to 'reinvent the wheel': you can achieve it by activating the right functionality within the ERP system. Standardization; integration and the non redundant storage of data within your company are the key benefits of ERP systems. Advantages could turn into disadvantages. Standardization; integration; non-redundant storage and a comprehensive installation are advantageous. However; they can also become disadvantages. Besides being dependent on one single supplier; the total integration and non redundant storage of data could cause one error to crash the entire system. Also; standard ERP solutions usually do not perfectly fit the way your company runs its business: customization with plain Re programming will have to be made to parts of the ERP system. The quality and success of your business operations has a direct relation to the quality of the ERP system. No company can afford to implement an ERP system or to implement an update without considering the risks involved. How can you implement effective risk management? The answer is Structured Testing.

Test Frame for SAP realizes the benefits Fitting; structuring and tooling are the key principles within Test Frame; Logic a CMG's method for structured testing. Since implementing SAP differs from standard system development; the key principles of Test Frame have been customized.

Fitting

Fitting means determining and defining the right test approach by looking at the organization and the chosen development approach. Business Scenarios are developed for the business processes that SAP supports. This reduces the risk element and assures the proper running of the ERP system. Structuring within Test Frame Action Words helps to determine the Business Scenarios. These Action Words describe the processes to cover in a structured way and at a high level. On a lower level; the transactions and the data required to carry out a business process are identified. This structured approach enables you to identify; after the execution of the tests; both parts that fail and pass the tests. Thus the quality of the SAP implementation can be comprehensively measured.

Tooling

The structured description of the business processes can be used for manual testing but; with limited effort; can also be used as input for the automated testing of the SAP system; even in combination with other systems. In practice; executing a manual test three times or more will exceed the costs of automated testing. Tooling for SAP exists of the CATT module within SAP and a CAST-tool (Computer Aided Software Testing). This combination ensures the fast and effective processing within SAP and also enables you to execute automated tests on other integrated systems. When you also consider the short lead time of executing the tests and the possibilities of repeated testing; Test Frame provides a unique and complete solution.

6.11 GOING LIVE

Maintenance Programs Generally these are data entry programs in which you enter information into the database so it can be used by the computer system; as in Work Center Maintenance.

Example:

Numbered 100 – 199 CAP100 – Work Center Maintenance Transaction Programs May be either on-line or batch processed. These programs manipulate data entered to them. For example; CAP500 is an on-line ERP LX program for generating rough cut capacity requirements.

Numbered 500 – 699 CAP500 – Generate Rough Cut Capacity Requirements

CAP600 – Generate Detail Capacity Requirements

Inquiry Programs

These are always on-line programs that access information files. Use these programs instead of reports when you need to access limited records in the file.

Numbered 300 – 399

CAP300 – Work Center Load

Inquiry Report Programs

Reports are on-line or batch programs that print the data from the files in report form. Information may be sorted for logical sequence or limited report parameters.

Numbered 200 – 299 CAP250 – Input / Output Report

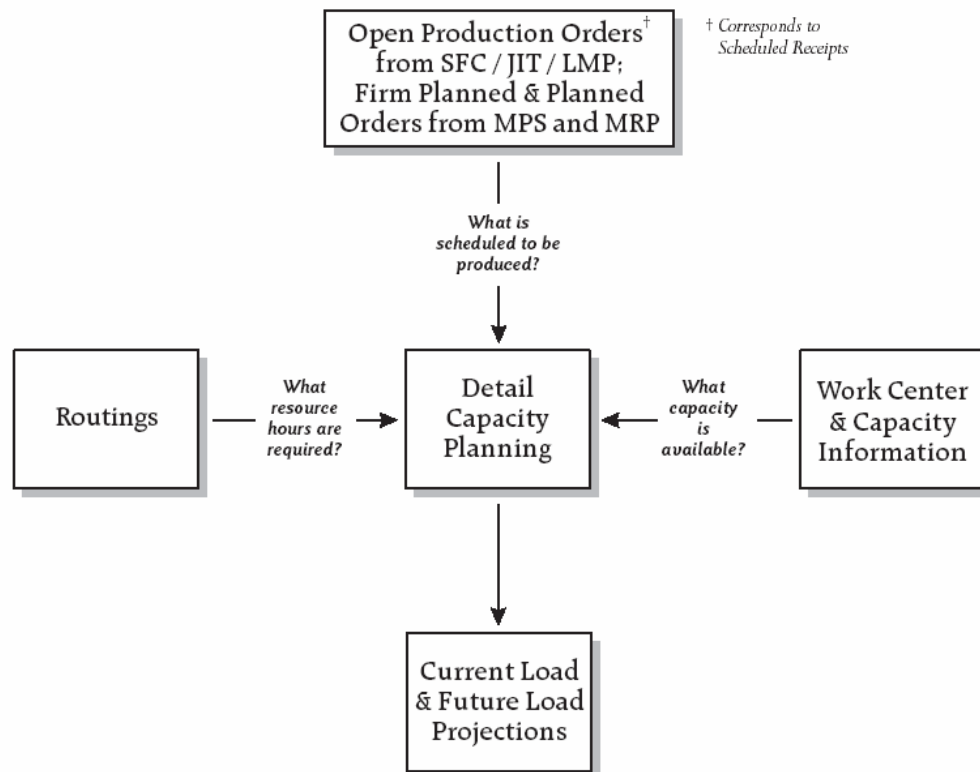
Period Close Programs

These programs are batch-type programs that process data at the end of the month or year.

Numbered 900 – 999

CAP900 – Capacity Week End Close

Detail Capacity Planning



Detail capacity planning reviews current and planned load for all work center

- Uses item routings (primary and alternative)
- All manufactured items

- All work centers
- Material requirements planning tool
- Smooth the flow of planned production
- Performed after MPS and MRP generations

Planning Level	Planning Function	Length of Planning Horizon
Top Management Planning	Production Plan	Long Range 1–5 years
Operations Management Planning	MPS MRP CRP	Medium Range 1–6 months
Operations Management Execution	Shop Floor Control Lean Manufacturing Process JIT/Repetitive Process	Short Range weeks / days / hours

6.12 END-USER TRAINING

The key to a successful implementation of any enterprise application software is proper end-user training. Users must be properly trained to fully utilize the functionality of the system so that it can deliver on the software's capability to reduce costs; improve processes and save time spent on each transaction. CIBER can help you maximize return on your ERP investment through our End-User Training program; which includes custom courseware; hands-on training and a variety of instructional tools that help your users become system experts; so that your ERP system delivers the expected ROI.

End User Training

Companies that invest in effective End-User Training programs obtain immediate and long-term advantages. CIBER's customized End-User Training programs can mean the difference between simply using an enterprise application; and taking full advantage of its extensive capabilities. Research by the Gartner Group indicates that untrained users can take three to six times longer than trained users to complete the same amount of work. Advances in technology and resulting business changes require an adaptable; skilled and educated workforce. Our End-User Training program offers custom; on-site training to meet needs of a diverse and rapidly changing e-business world; and help companies large and small increase the effectiveness of their change efforts.

The Way IT Training Should Be

If you need to train your end-users to properly use and obtain maximum value from your ERP system; CIBER can help. With 28 years of IT industry experience; and more than 10 years as a leading partner of software vendors such as Oracle; PeopleSoft and SAP; CIBER provides effective End-User Training for a variety of ERP systems and applications. Our application training includes Financials; HRMS; Payroll; Manufacturing and Customer Relationship Management training for users of all the leading packaged software vendors. Our templates

give us a jump-start towards development of a client-specific; customized end-user training curriculum based on a comprehensive evaluation of your business objectives.

Our training delivery options include:

- Custom courseware
- New business processes and procedures
- Job aids
- Quick reference guides
- Instructor guides
- Hands-on labs and exercises
- Pre- and post-tests
- Instructor- Led Training
- Distance Learning

CIBER has delivered effective training solutions to customers in a broad range of industries from telecommunications; manufacturing; retail; financial services; higher education; health care and the public sector. We recognize that no two companies' training needs are the same. Our expertise is in matching the best delivery methods and formats with customized learning content to ensure that your users gain the necessary skills to maximize return on your enterprise software investment post implementation (Maintenance mode)

Enterprise resource planning (ERP) systems have become a fact of life in higher education. A 2002 EDUCAUSE Center for Applied Research (ECAR) study estimated that higher education had spent close to \$5 billion on ERP systems.¹ According to the study; 54 percent of survey respondents had implemented an ERP as of the summer of 2002; and an additional 35 percent expected to implement an ERP module or to add a module to an existing system within the next three years. By the time this article appears in print—assuming these plans were realized—a large majority of institutions of higher education will be running ERP systems.

An ERP system's success rests on the integration of data across the institution. An ERP eliminates the need for individual data stores; duplicate records; and coordination of disparate data systems with unique record formats. At one institution; circumstances that argued for moving to an ERP system included redundant; disorganized database structure; inaccurate data; difficulty in reporting and sharing information; dependence on manual processes and human interventions; problems in providing seamless customer service between offices; difficulty complying with reporting requirements; heavy reliance on the computing center staff; and lack of capacity for process improvements

Many participants at an EDUCAUSE 2001 Roundtable cited an increased ability to provide student services as an additional reason for moving to an integrated ERP.³ ERP systems promise to increase operational efficiency; improve customer service; and help enforce an institution's business rules.

An ERP system represents a significant investment; both for acquisition and for ongoing support. At small and mid-size institutions; the cost of acquiring an ERP system can seem daunting. For many such institutions; the ongoing support costs; both direct and indirect; represent the single largest technology expenditure each year. An ERP system is more than just an information system; however—it embodies the institution's business rules. It must be closely tied to the institution's business needs for the institution to realize the system's full benefit.

Therefore; not only is it critical that institutions choose an ERP system with utmost care; they should periodically review that system. Such a review should highlight; to the extent possible; the total cost of ownership (TCO) and how well the system aligns with the institution's business needs. What follows is a description of just such a review conducted at Gonzaga University.

A Brief History of Gonzaga's ERP System

In 1995; Gonzaga University embarked on a project to implement a university-wide information system. The search for an "out-of-the-box" solution began following an attempt to build an integrated data management system in-house. In the early 1990s; the university had slowly begun to digitize its student records as well as its financial and student accounts data. The university realized the advantage of tying these different data systems into an integrated system and the efficiency to be gained by managing one set of computer records. After more than two years of trying to get different departments to specify their data needs and to integrate those needs with those of other departments; however; database managers had made little progress.

In 1994; Gonzaga decided to look at commercial solutions to its database management problems. With the blessing of the university's administration; the CIO pulled together a steering committee that oversaw the development of a request for proposal (RFP); the solicitation of bids; and the awarding of a contract. The ERP system selected was a database-centric suite of software applications that supported admissions; registration; financial aid; finance; human resources; and university advancement. The implementation of Gonzaga's ERP solution took two years and was completed in 1997. Since that time the application has matured; with the school's business processes being melded into and molded by its use.

Six years have passed since the migration to the new ERP system from in-house developed and third-party software solutions. University management asked the CIO to review the investment Gonzaga had made in the software and its relationship with the software vendor. Management also wanted to determine if the current strategy for use of enterprise software was still sound or if a different way of supporting the business functions of Gonzaga would be advantageous and a strategy of change prudent.

Analysis Methodology

Based on the answers to the above questions; recommendations were to be made regarding Gonzaga's ERP use and suitability.

Total Cost of Acquisition and Total Cost of Ownership

Both the total cost to acquire Gonzaga's ERP system and the total cost for ongoing support were determined by combining the direct and indirect costs for each. Direct costs include hardware; software; licensing; support contracts; and consultation. Indirect costs consist primarily of the salaries of staff necessary to support the system. This includes employees tasked with supporting the ERP both within and outside Gonzaga's central technology department. In the latter case; the work performed was often classified as technology-type work but included making policy and process decisions necessary for implementation of the ERP and its operation. Where necessary; an employee's salary was prorated by the time the employee spent supporting the system.

Return on Investment

ROI is; conceptually; the savings returned to the institution by the adaptation of a new business system or process. Ideally; an institution would be able to show either that a new business system was less expensive than the existing system or that a new system accomplished the same work more efficiently than the existing system. ROI ends up as one of the more elusive measurements in higher education. First; while the costs of the new system are easy to identify; the savings often are not. The "return" part of ROI often comes from indirect savings; which typically do not appear on the bottom line. Instead they are the savings that come from operating more efficiently; or even from expenses avoided. Second; it can be difficult to clearly attribute some savings to the new system and not—in whole or in part—to other organizational changes. Institutions of higher education are dynamic; with myriad changes taking place at any time. It can be difficult; if not impossible; to confidently assign a savings or a return to a particular change; especially in a post hoc analysis.

Business Needs Assessment

The RFP by which the university chose its ERP served as the vehicle to judge the extent to which the ERP was meeting business needs. The heads of various critical departments were surveyed to determine the extent to which the ERP did or did not meet those original business needs.

Comparison with Peer Institutions

The CIOs of nine other universities were interviewed to determine what software they used to support their business functions; their experience with their software vendor(s); and their propensity to change applications. This select group of institutions was reasonably comparable to Gonzaga—all were private schools with enrollments of less than 10;000 students. The results of this survey were combined with one conducted by the Association of Jesuit Colleges and Universities (AJCU). The AJCU consists of 28 Catholic colleges and universities of various sizes in the United States.

Gonzaga's CIO kept extensive notes and files on the process of selecting and implementing an ERP. These materials proved invaluable in looking back to 1995 and 1996. The original RFP was used as the baseline for project goals. The CIO's notes gave a full picture of the implementation team and its meeting schedule; the notes were used to provide an estimate of the personnel costs for implementation. Many key department heads also kept notes of the implementation process within their departments; and these notes were used to estimate how the implementation affected those departments. Thus; the study was able to determine; with a comfortable degree of accuracy; the initial cost of implementation. Costs for ongoing support relied on current expenditures and estimates of personnel time.

Results

To evaluate the Gonzaga ERP implementation; the study sought data in each of the categories considered relevant: total costs of acquisition and ownership; ROI; business needs; and comparison with peer institutions. The findings follow.

Total Cost of Acquisition

To determine the total cost of acquisition of the ERP system; the study combined direct and indirect costs.

Direct Costs. Gonzaga's original budget for this project was just under \$1 million; including software; consulting; and the cost to upgrade to an HP 9000 mid-range server. The

consulting budget was to cover implementation; education; and training; as well as some customization of the ERP. There were significant overruns in direct costs; which added approximately one-third to the original budget. These overruns were attributed to a mid-stream change in the software from a character-mode screen format to a graphical user interface (GUI) screen format; a lack of understanding of the amount of Gonzaga resources needed to assist in the project; which drove a significant increase in scope and cost from the application vendor; a need to engage the application vendor to perform programming tasks that were assumed Gonzaga staff would perform; and a significant increase in the need for vendor education of Gonzaga staff.

Indirect Costs

Indirect costs more than doubled the cost of acquisition. They were estimated at about \$2.2 million; making the estimated total cost of acquisition close to \$3.5 million. The majority of those costs were human resources devoted to implementing and migrating to the ERP. The cost of human resources was estimated from the project plan developed by the CIO. The CIO closely detailed the makeup of both managerial and departmental resource teams; their project meeting plans and frequency; and the duration of the project. Discounting current employee costs developed a historical cost of resource. Time logs kept by some department heads during the project were used to estimate departmental resource investments in the ERP project.

Gonzaga anticipated it would take a significant investment of time and other resources to acquire and implement its ERP. However; the magnitude of the costs was surprising. If Gonzaga's experience is typical; the indirect cost to an organization of implementing a business-wide software application far exceeds the direct costs. Regardless of the actual numbers; it is likely that most institutions fail to understand exactly how much staff time is required; nor do they account for the value of that time. A significant additional burden is also placed on the staff; particularly in terms of data and process migration.

Total Cost of Ownership

Again; TCO was estimated by combining direct and indirect costs of ownership.

Direct Costs: The direct costs for ongoing support of Gonzaga's ERP were calculated as the total of annual licensing for the ERP as well as supporting software; the costs of supporting hardware; and an amortization of the mainframe system that supports the ERP. The hardware for the ERP is amortized over a five-year period—a bit on the long side for equipment of this type; but it balances hardware aging versus the demands of a tight budget. Ongoing costs for software represent about 20 percent of the initial software expenditure; which is typical for enterprise applications. Direct costs of ownership are about 42 percent of the total ongoing costs to support the ERP.

Indirect Costs: The total indirect costs are less well articulated. Included here are the costs of staff tasked with supporting and developing the ERP; whether or not they are in the central technology department. Also included are the ongoing costs for internally driven training. Together; these indirect support costs are 58 percent of the total ongoing cost to support the ERP. As would be expected; however; the ongoing indirect costs are a mere fraction of the cost to acquire and implement the system (18 percent).

Costs of Ownership

Direct Costs	Percent
Software and licensing	29
Hardware	4
Amortization	9
Indirect Costs	
Training	6
Gonzaga staff	52
Total	100

Summary of the total costs of ownership

As should be clear; supporting an ERP demands a significant investment of funds. Gonzaga annually expends close to three quarters of what it cost to acquire the system to support it. Moreover; a little over half of the costs are indirect in the form of staff dedicated to system and end-user support.

Return on Investment

Disappointingly; it proved impossible to estimate the ROI for the present project because no financial justification was developed when Gonzaga decided to move from a homegrown system to an ERP system. As strange as this seems; it makes perfect sense. University management knew that an integrated software system was the only way that business processes could be standardized and the foundation built that would allow Gonzaga to grow and prosper. Increased efficiencies and productivity were the common theme for ROI from the ERP system.

ROI discussions with staff quickly turned to discussions of what it would cost if Gonzaga did not use an integrated software system. Several people in the development area stated that departmental headcount would have to be increased by six positions. The admissions department reduced headcount by four after the ERP implementation; while enrollment increased by a factor of two. General consensus was that because of the ERP capabilities; Gonzaga was able to maintain level or reduced staffing while the university grew substantially.

Business Needs Assessment

We surveyed key department heads to determine the role the ERP system plays in the university's business processes. The survey included a look back at the university's expectations for the ERP implementation and asked whether respondents believed the ERP solution has met RFP requirements. Department heads were also asked if they were aware of other ERP systems or best-of-breed systems that would better meet their departments' needs or the needs of their constituents. These needs were the same used to develop the initial RFP.

ERP System Expectations Based on RFP

General Objectives

To provide a single integrated university information system that Reduces redundancy and streamlines data entry using a variety of methods such as keyboard entry; scanning; bar-coding; and others. Allows current and historical data to be efficiently stored; secured; and

accessed to provide accurate information to the university community. Provides a sophisticated tracking system for use by all areas of the university. Provides an easy-to-use; user friendly; ad hoc report writer that can easily access any field (with appropriate security) to extract data for producing management; information; or special reports on screen; printed; or downloaded to the workstation. Provides a flexible system that can adapt to changes and will continue to meet our needs in the future through new functionality; enhancements; and improvements offered by future software releases. Utilizes a system based on UNIX and Open Systems standards; which better poises the university for future technological decisions. Integrates with various PC applications. Allows for the opportunity to consolidate computing services for cost; operating; and technology efficiency. Allows for integration of image processing; campus-wide ID cards; a kiosk system; and telephone processing of information. Provides the university with the opportunity to seriously examine the current processes and determine how to improve and realign our business policies and practices in order to better serve the university community. Provides opportunities for better personnel utilization. Is completely operational; in its baseline state; by the April/May 1997 timeframe.

Alumni/Development

Provide effective management of alumni information and events including maintenance of historical information. Provide effective and accurate tracking of cash gifts; pledges and outstanding pledges; estates; matching gifts; and other development records; allowing for management of historical data on donors and prospects to include tracking progress of prospects through cultivation; solicitation; and stewardship. Provide an effective means of managing the gift accounting and acknowledgement process. Allow for coding of donors/prospects according to region and/or interest.

Financial

Maintain all required accounting records in accordance with GAAP; NACUBO; the federal government; and other agencies and standards. Maintain all accounting records and files to ensure accurate and efficient budget management; from both a current and historical perspective. Ensure that all requirements for financial statements; audit reports; grant reports; IRS compliance audits; etc.; can be met accurately and efficiently. Ensure that all internal requests for any type of financial information (individual payroll; departmental revenue or expenditure; etc.) can be met promptly. Provide authorized end-user access to appropriate financial information on line.

Financial Aid

Provide annual updates of recent regulatory changes affecting the administration of the federal student aid programs. Provide for enhanced budgetary controls in order to monitor offers; acceptances; and declinations of all types of financial aid. Reduce redundancy between the Student Employment; Financial Aid; and Payroll databases for student worker data. Allow for certain holds to be created that are document- or fund-specific in order to allow or prohibit certain types of financial aid from being awarded or disbursed. Provide for automation of the receipt and accounting of electronic fund transfers for student loan proceeds. Eliminate the majority of manual efforts involved in monitoring of satisfactory academic progress. Allow for incorporation of a financial aid voice response system. Provide for automated packaging of financial aid based on packaging philosophies and criteria determined by our financial aid management. Provide for efficient passing of applicable taxable aid (i.e.; waivers) information to Payroll.

Human Resources

Provide an integrated database for Human Resources and Payroll to streamline and enhance management of employee records. Provide a source of data on applicants and employees that HR can use to monitor; manage; and plan various aspects such as Employment Administration; Job Classification; System Design; Total Compensation System Design; Benefits Administration; Equal Employment and Affirmative Action Compliance; Position Management; Position Control; and Employee Relations Administration. Provide a source of data for federal and state compliance reporting. Provide the ability to maintain and report historical salary and benefits data by program; department; and/or employee group.

Student Information

Provide for automated billing and letter generation functions throughout the Student system. Provide for the advancement of institutional research; through the availability of centralized data; for retention and marketing efforts. Allow restricted access to students in order to eliminate unnecessary processing steps. Provide for an accurate; streamlined process for academic records from Recruitment through Degree Audit. Provide services to achieve enrollment goals. Provide faculty access to advising information. Provide for a centralized location management facility.

No one interviewed said that needs were not being met. When presented with the list of system expectations drawn from the RFP; all agreed that the system met their basic needs. There was one unanimous exception—the need for an easy to use; ad hoc report writer. The consensus was that the ERP system's report writer is difficult to use; especially if only used occasionally. Once an employee was experienced in extracting and reporting data; the tool became second nature. A recurring theme hammered home by everyone interviewed was the value of an integrated system and a single historical database for all business and student information. Several employees stated that the ERP far exceeded their expectations and that it fully supported the mission of both the university and their specific departments. The core reason for this view is the availability of clean; reliable data supporting a system that enforces set business processes. Some of the supporting comments follow:

- "Gonzaga could not have progressed to the point it is today without an integrated application like [our ERP]."
- "We could not be raising the kind of funds we are today without [our ERP]."
- "[Our ERP] revolutionized the use of data in the university environment."
- "It was critical for Gonzaga to reconcile and standardize its business processes. [Our ERP] did that for us."
- "Implementation of [our ERP] was the single greatest achievement of the last decade at Gonzaga."

Comparison with Peer Institutions

What do other colleges and universities use for their core business application(s); how do they like their vendor relationship; and how well are they being supported? Of the nine institutions surveyed; 67 percent used the same ERP system as Gonzaga for their core application. All of them used enterprise applications; no university used a best-of-breed approach. Of the 28 institutions in the AJCU; 86 percent of them use an ERP solution; 11 percent use best-of-breed; one uses a homegrown application; and one uses nothing. Interestingly; no institution was interested in changing. Each was pleased with its vendor's support; frequency of feature/function upgrades; response to technical issues; and so on. Some complained of being oversold or of being sold "vaporware;" but that is a prevalent

phenomenon in the enterprise software world. Most of the institutions surveyed have looked at other enterprise applications from time to time but found no compelling reason to change.

The benefits of changing did not outweigh the costs. Of the nine CIOs interviewed; none would ever again use anything other than an enterprise-level application. Implementing a best-of-breed solution was deemed too costly and; as one CIO stated; "A step back into the dark ages." Some CIOs were concerned about individual small software companies going out of business; and two had experienced just that problem. Most mentioned either the difficulty or the impossibility of integration as a reason not to consider best-of-breed systems. Two also stated that best-of-breed solutions do not allow for setting and enforcing business processes; which is critical to all but the smallest universities. The study also explored outsourcing and collaboration as ways for Gonzaga to obtain the business application support needed other than by managing its own ERP.

Outsourcing: With an outsourcing solution; an outside vendor owns the equipment and software and provides connectivity to the application; support for the application; and other services for a fee. The systems are usually housed in a hardened data center. The institution's connection to both the database and the application is by a high-speed dedicated network or through the Internet.

Although we did not price outsourcing as part of our research; this solution usually costs more. Moreover; institutions usually have some cultural comfort issues with outsourcing. First is the concern that "Someone else has my data!" Outsourcing vendors are aware of this concern and take steps to build systems and processes to assuage the nervousness of their prospects. Second is a concern about the responsiveness of the vendor to problems or change requests. There is a general belief that the closer you are to the resource; the better the support you will receive; and the farther away; the worse. However; responsiveness usually isn't an issue after the system is turned over to the outsource provider and things are stabilized.

Collaboration: With a collaborative or consortium solution; two or more universities negotiate collectively to purchase hardware and software on the theory that cost per user will be driven down by economies of scale; particularly from the standpoint of the server and storage farm. One university hosts the equipment and the other consortium members connect as they would if the service were outsourced. For those consortium members not hosting the service; not only are there the same set of concerns as in the outsourcing solution; but additional questions about data integrity and security and about the hosting institution's commitment to equal service. Can non-host institutions be ensured parity of support; or will the host institution take care of itself first? Many software application vendors are not supportive of these arrangements. Consortium solutions often translate into lower licensing fees and larger support headaches.

Conclusions

Each university needs a system that supports all its business functions; which need to be integrated. Business processes and practices must be well defined; supported; and enforced; and the university's ERP system is central to this enforcement. Universities; in their role as businesses; need accurate; clean; stable; current; and historical data. For universities to make informed decisions; to operate efficiently; and to offer their students the best educational experience possible; they need the best data possible. An ERP that integrates the business data on which an institution relies best meets this need. Moreover; data must be available in

real time to users across multiple departments and business functions. University faculty; staff; and students should find the system easy to use.

The cost of supporting technology is high for any business. Moreover; as the present study demonstrated; much of the cost of implementing and maintaining technology can be hidden from view. Approximately two-thirds of Gonzaga's total cost for implementing its ERP system was indirect. Still; the system goes a long way to pay for itself in terms of savings from unfilled staff positions alone. Even more difficult to price are the increased efficiency and improved customer service the system provides.

Gonzaga still has much more to gain from its ERP implementation. The university needs to extend its investment in the ERP system to support its new technological vision and fulfill the expectations of its stakeholders. The university should determine the functionality available within the application that is not being used; develop a program to begin using this unfulfilled potential; and educate staff on the features and use of the added functions. Finally; Gonzaga should develop an ongoing educational program for mid to senior management to train them in new features and refresh their knowledge of the system's capabilities. These steps will help Gonzaga University take full advantage of its ERP implementation.

SELECTION OF ERP VENDORS

Structure

- 7.1 Consultants and Users
- 7.2 In-House Implementation - Pros and Cons
- 7.3 Selection of ERP Vendor

7.1 VENDORS

ERP Vendors by Revenue

The largest vendors worldwide in 2005 according to Gartner Dataquest:

Market share 2005 according to Gartner Dataquest			
#	Vendor	Revenue (million \$)	Market share (%)
1	SAP	4726	28.7
2	Oracle Applications	1674	10.2
3	The Sage Group	1221	7.4
4	Microsoft Dynamics	616	3.7
5	SSA Global Technologies	464	2.8

Vendors of popular ERP software include (sorted roughly according to worldwide ERP related revenue):

Vendor	Revenue (Native currency)	Revenue (million \$)	Year
SAP	9.4 billion EUR	12401.4	2006
Oracle Applications	14.38 billion USD	14380.0	2006
Info Global Solutions	2.1 billion USD	2100.0	2006
The Sage Group	935.6 million GBP	1832.0	2006

Microsoft Dynamics (Formerly Microsoft Business Solutions)	44.2 billion USD	44200.0	2006
Unit 4 Agresso	352.6 million EUR	465.2	2005
Lawson Software	390.776 million USD	390.8	2006
Epicor	384.1 million USD	384.1	2006
Visma	1;907 million NOK	305.5	2005
Industrial and Financial Systems (IFS)	288 million USD	288.0	2005
QAD	225 million USD	225.0	2006
Consona Corporation	130 million USD	130	2007
COA Solutions Ltd	50.5 million GBP	98.47	2007
Net Suite	67.2 million USD	67.2	2006
ABAS Software	45 million EUR	62.6	2006
Ramco Systems	2;648 million INR	60.1	2006
SIV.AG	14.2 million EUR	18.7	unknown
CDC Software	unknown	unknown	unknown

7.1 CONSULTANTS AND USERS

ERP Consultant

Our ERP Package Implementation Consultants are known in the industry for their professional; comprehensive results. They are responsible for:

- ERP strategy
- Package selection
- Implementation Planning
- Business process and fit
- Gap analysis
- Configuration
- Conversion
- Training

Step 1

An Enterprise Resource Planning (ERP) consultant is responsible for facilitating the day-to-day management of the supply-demand chain for larger businesses. In the world of big business; larger corporations typically employ a staff of ERP consultants; and you can become one by understanding business needs; ERP computer applications and gaining professional certification. Graduate from a 4-year college. It is a very good idea to major in engineering or computer science; ideally combined with a business background; to differentiate yourself from the tough field of competition you'll be facing. ERP consultants are constantly using the latest in business software and building a flexible skills database.

Step 2

Learn what ERP software platforms businesses are using most. Oracle ERP platforms have traditionally enjoyed a large market share.

Step 3

Educate yourself by completing learning modules to master the use of the software that's being used by ERP professionals providing business solutions. It's a good idea to familiarize yourself with the basics of several different applications from several different software manufacturers before moving on to formal training.

Step 4

Connect to educators offering formal training in the use of ERP software. Many online schools even offer free tutorials that can go a long way for self-starters looking to become an ERP consultant.

Step 5

Complete formal training in as wide a variety of ERP platforms as you can find. Having a diverse skill set can only help your job prospects in this highly competitive field. It is wiser to learn more than just the most common ERP software products.

Step 6

Accept that it is often necessary to work for companies for free when starting up to build a portfolio of satisfied clients. Advertise your services to local mid-sized merchants; using your software extension building skills to personalize their enterprise resource planning.

Step 7

Build a solid base of satisfied clients before you start to look for paid gigs. The education where you completed your formal training can often help link you to prospective employers. You'll need some experience to draw on before approaching job offerers.

Step 8

Establish a reputation by succeeding in providing ERP solutions to clients once you start landing paid jobs. ERP consulting has the potential to be very lucrative to the individual. However; it requires a great deal of hard work to become one.

7.2 IN-HOUSE IMPLEMENTATION - PROS AND CONS

The Pros and Cons of Integrated and Autonomous ERP Systems: It can be difficult to determine whether your company needs a single integrated enterprise solution or whether autonomous systems would be the better option in your particular case. Both approaches have their pros and cons.

Integrated vs. Autonomous

IT systems in the food and beverage industry are usually designed in autonomous parts; where each functional area (such as sales; procurement; finance; and maintenance systems) is bought as a separate best-of-breed solution. Interfaces developed in-house then need to handle any information exchange between systems.

There have been two main reasons for this approach. First; the industry has separated the business functions from each other and from manufacturing. Second; the suppliers of integrated ERP systems have not developed the functionality the industry requires.

Keeping Pace with Industry Changes

ERP suppliers have mainly focused on the assembly industry; so food and beverage companies have turned to separate; incomplete solutions. But some ERP suppliers have started to develop the functionality the industry needs; and it won't be long before they can provide functional support that can compete with best-of-breed solutions. One reason for this is that the size and resources that these suppliers can put into development. Smaller best-of-breed suppliers often just can't keep up with industry advancements. For some companies; the best overall solution is a combination of ERP and best-of-breed systems. But this can be tricky. Every company has to determine what's right for them. Here are some pros and cons of each.

Autonomous Best-of-Breed Systems

Pros

- Easy to replace in a system-by-system approach; which decreases risk.
- Less sensitive.
- One system can freeze; but the others can continue.
- Also; maintenance on one system can be done without affecting the others.
- The best solution can be selected for the actual demand.

Cons

Need many custom interfaces.

- Data warehouse needed to access all data at the same time.
- Require knowledge of many systems and possibly platforms.
- Contact with many suppliers.
- Do not support a business process method.
- Complex maintenance; as when changes in one system mean changes in interfaces and other systems.
- Local; small suppliers with limited international support.
- Different user interfaces for every system.
- Upgrades for parts of the system may require new interfaces; and may not be able to be upgraded simultaneously.

Integrated ERP Systems

Pros

- All data available in one system.
- Contact with one supplier.
- Support a business process methodology. Online data from all functional areas is always accessible for people with the right security level.
- Continuous development with new releases.
- Requires knowledge of only one system or platform.
- One user interface and dialog.
- Large suppliers with significant resources and international support.

Cons

- Perhaps not the best possible functionality in all areas.
- A release update affects the entire system; which can make it more complex to implement.
- Requires a relatively large project demanding significant internal resources from the entire organization for implementation.

The key factors in the decision are the critical functionality required; whether an in-house IT staff can handle multiple systems and platforms; and the difficulty of dealing with multiple system suppliers as opposed to a single primary supplier. Using an ERP system backbone with integrated best-of-breed applications for the few critical areas may offer the best of both worlds

7.3 SELECTION OF ERP VENDOR

If your company has decided to implement an ERP system in your office then your ERP vendor selection is going to be important. You are going to want to compare the many different vendor selections available; like Compiere; Peoplesoft; NetERP; and Microsoft. Each company has its own strategy when it comes to planning software and hardware implementation and all of the ERP software companies on the market will work closely with your company to find the right combination of products for your needs. Your ERP vendor selection should be the developers of a software solution which includes integrated modules for manufacturing; accounting; and inventory tracking among others. You are going to want to do a little comparison shopping and review numerous packages before making a final decision. The vendor selection should be the one that is the most willing to work with your company and your needs. They should be able to adjust and modify their software so that you get the modules that you need. If you are unsure which way to go in finding an appropriate ERP vendor selection; you may wish to look into the many different consultants that specialize in this type of work. A consultant will help you sit down and lay out exactly what you need; the best way to implement your needs; and what programs are available out there and the vendors who carry them who can meet the needs of your company. The consultant will work with the vendor – who could actually be the consulting firm as well – to develop a comprehensive game plan for implementing the change over from your old system to the new ERP one. An ERP vendor selection should be done after you have researched each vendor and their product as thoroughly as possible. You will also want to investigate open source ERP vendors as open source programs may provide you with the flexibility you are looking for. Most ERP systems are Internet based which makes them perfect for any sized business and ones that span across the globe. The streamline all of the data into one

accessible database and allows for all departments to access all but the most confidential information stored at your location. It will integrate with most other accounting software; and the ease of setup requires little to no IT maintenance.

The major ERP vendor selection has all established application hosting programs. Some have multiple programs in place simultaneously. Thus; public-sector organizations typically have a number of choices of not only which software best meets their needs but which application hosting program they prefer. There are three aspects to costing application hosting: software costs; processing costs; and implementation costs. Software prices can be priced per user/per month. Processing services can also be priced this way or based on actual transactions processed. Implementation services are most often paid up front but can be amortized over a number of years. The concept of "rent your software; don't buy it" has real appeal to elected officials who wish to avoid high initial cash outlays. However; because SAP Oracle ERP Systems implementation costs are typically at least two times (and as much as five times) greater than the basic software costs; this benefit is somewhat illusory. If you want to change software vendors; you must re-implement.

Although at least one ERP vendor does provide both software and implementation services; in most instances; the software; processing; and implementation require three separate and distinct firms to provide the software and services. Typically; an ERP vendor has established a fixed software rental fee and partners with other firms that provide processing and implementation service. The ERP vendors also offer a choice of implementation and customer services options. This means that a single public agency can acquire the same ERP software from a variety of providers with multiple pricing formats. Implementation of SAP Oracle ERP Systems is often approached in a Big Bang; let's-do-it-all-at-once style of approach. Another approach to SAP Oracle ERP system implementation hosting has agencies replacing existing modules one at a time until the full ERP system is in place. The underlying theme is to plan long term and select an ERP vendor for a number of years. At the same time; act short term by implementing financials; or HR/payroll; or maintenance management; or utility billing one module at a time; as the older systems become obsolete. Implementations are now being completed in nine months and often can take less time. Four-month implementations are even possible in smaller agencies.

Implementing ERP vendor selection one module at a time has the disadvantage of having to build interfaces to the remaining legacy systems that will eventually be discarded. On the other hand; the potential of having to maintain a single technology and work with a single vendor to obtain a truly integrated system is considered worth the cost in the long run. The major advantage to SAP Oracle ERP Systems application hosting is that medium and smaller public entities can obtain the functionality and power of comprehensive administrative and financial systems at a fraction of the costs of installing and maintaining these systems on their own. The most important of these advantages are the following: the opportunity costs associated with software ownership; its zero residual value; and reduced useful life expectancy. In addition; with the difficulty that local governments have in attracting and retaining IT staff; application hosting becomes an even more attractive alternative and one that local government financial managers should seriously consider.

FUTURE DIRECTIONS IN ERP

Structure

- 8.1 New Markets
- 8.2 New Channels
- 8.3 Faster Implementation Methodologies
- 8.4 Business Modules and BAPIs
- 8.5 Convergences on Windows NT
- 8.6 Application Platform
- 8.7 New Business Segments
- 8.8 More features
- 8.9 Web Enabling
- 8.10 Market Snapshot

8.1 NEW MARKETS

Before speaking about the future of ERP it is important to remember the history of ERP in order to keep a track on the developments that happened gradually. ERP evolved from manufacturing resource planning (which originated from material resource planning). The functioning of ERP has gained much prominence and utility with the intervention of web enabled and open source technologies. ERP II the latest advancement in ERP software deserves special mention. In this context it becomes important to analyze the direction in which ERP is geared to progress or will ERP diminish in the future etc...

Some of the points requiring attention are as follows:

Current level

ERP has undoubtedly become an important business application to all industries. It has almost become a must for all organizations irrespective of the type of business manufacturing or service. If companies feel that coordination and enterprise communication are their only problems they don't have any other alternative but to go for ERP; provided they want to make profits and remove the existing setbacks. Needless to say ERP has helped companies in monetary and non monetary aspects if they are keen in utilizing it to the core and take the necessary steps to overcome the setbacks. However ERP needs lot of improvement (this statement included the latest versions also). ERP is an effective application. It will be great if one can bring an ERP system that is devoid of the drawbacks from the existing ones. The

latest intrusions namely open source and web enabled technologies has increased the effectiveness of the application. However they are not enough (technically speaking). ERP applications should be designed to make the maximum use of internet so that the user can access data from any part of the world just by a click of the mouse. This has further deepened the future of ERP. ERP's future is yet to reach saturation.

Market forecasting

Formerly ERP was purely restricted to fortune 500 companies; in the sense only they could afford to invest on them. This put the small and Medium Industries at a large disadvantage. They were not able to make use of the application to gain the necessary benefits. ERP's future seemed to be dooming on them. However this drawback has been removed after the intervention of open source facilities. The concept of outsourcing has helped in removing the difficulties faced by small and medium enterprises. Hence a large potential for ERP still exists in the S.M.E. market. The ERP vendors can target this market effectively. However both the vendor and the companies in this segment have to remember that there are lot of competition in this sector and one is not likely to succeed unless he serves the best product.

The international Scenario; employment and Education

ERP has thrown open opportunities for many companies to trade with foreign counter parts in the name of outsourcing; implementation and deployment of the existing ones. It has contributed lot to the economy .Academics also boast its own share of ERP relations. It has promoted lot of employment and educational opportunities. India happens to be a key beneficiary in this aspect. The dream of enterprise resource planning systems is that a single application can track and monitor all of a business's functions. In a perfect world; a manager opens a single ERP app to find data about any aspect of the business; from financials to HR to distribution schedules. Alas; we're not there yet – or at least most companies aren't. Looking at the ERP landscape; “there still tends to be a lot of disparate components; that are either homegrown or older packages;” says Forrester analyst Paul Hamerman. Moreover; there are still a lot of gaps in ERP systems; particularly in industries where ERP functionality has grown up from its historic origins in manufacturing. There are even gaps in core ERP areas; Hamerman tells Datamation; “where they just haven't done a particularly good job; in areas like budgeting; and recruitment...where the vast majority of customer uses something other than their ERP vendor.”

The global market for enterprise resource planning (ERP) is undergoing rapid change. Driven by fears of saturation in the top tier of the market; leading vendors are developing software which is rapidly breaking free from its monolithic structures to appeal to new markets. Datamonitor's new report 'New Markets for ERP Software' is a timely consideration of the current and future ERP market opportunity. Key issues covered include: The economic and business process drivers underpinning market growth; Developments that influence new market opportunities (e.g. mid-market; hosting strategies; e-business extension; change distribution channels); the changing role of ERP in the enterprise. Crucially; the report provides in-depth data on how the ERP market will develop by: Geography (Europe; US; rest of the world); Size-band (+\$1bn+; \$250-;\$1bn; \$50-250m; less than \$50m); Sizeband within each geography; All market segmentations are forecast to 2003.

Scope

Contains an executive summary and data on value; volume and segmentation Provides textual analysis of the industry's prospects; competitive landscape and leading companies Includes a five-year forecast of the industry

8.2 NEW CHANNELS

The prevalent misconception among channels is that ERP is only for bigger companies as its resource intensive. However; many small partners have implemented ERP and are reaping rich dividends. In 2005; Ludhiana-based solution provider; Secant Technologies; a Rs 4 crore company then; went for ERP deployment roping in a local vendor; Disha Informatics. The deployment took about eight months and it cost Secant Rs 8.5 lakh. In retrospect; Secant CEO Paramjit Singh Juneja is happy that he took that investment decision. "Over the last three years; we have grown at 50 percent year on year; and such growth rates would have been hard to imagine without ERP. We have increased efficiency in almost all business processes ranging from administration; sales; solutions deployment; to support;" says Juneja. Luck now-based solution provider; Acme Digitek has a similar experience to share. It deployed a locally developed ERP in the year 2003 that cost the company Rs 1.5 lakh. "Since ERP brought everything on a single platform; the delays on account of coordination goof-ups reduced considerably. The MIS gave us a clear picture of where the business was moving;" says CEO Ajit Mital.

Many channel companies have invested in ERP because of the sheer benefits it brings to business. "Last year we did Rs 12 crore in sales and expect to double it this year; courtesy ERP. Our response time to sales calls has become 40 percent faster and there has been 30 percent improvement in servicing support calls;" says Rishi Pande; CEO of Ranchi-based Sigma Computers. The company implemented Microsoft Navision ERP in 2005.

Veeras Infotek of Chennai has also deployed Navision investing Rs 10 lakh; two years ago. Through ERP; Veeras has been able to measure employee performance with greater transparency. "When you do not have ERP; the inefficiencies of many employees remain hidden. With ERP; they come to the fore. Rewarding good performers and motivating the inefficient people to work smartly becomes lot easier;" says Sudarsan Ranganathan; CEO; Veeras Infotek. Since the deployment in 2004; Veeras has grown by more than double to Rs 40-crore in annual turnover and Sudarsan gives a handsome share of credit for the company's achievements to ERP.

For Delhi-based Rs 5-crore security specialist; MikroZ Solutions; ERP has resulted in optimal utilization of resources. Says CEO; Ashok Shiroor; "The systematic comparison of employee's performance and work loads have helped in staffing optimally and allocating right skill-sets for various projects." The time is now , Looking at the benefits; there is a compelling case for smaller channel partners to consider deployment of ERP. So what is an ideal time to implement the application? "You are the best judge of what is required for your company. Some entrepreneurs may want to deploy it in the start-up phase; while some may do it once they achieve a critical mass. It depends on various factors such as your own financial muscle; risk-taking capability and belief in systems and processes. We took the decision as we felt that we won't be able to grab future growth opportunities if internal systems were not in place;" says Juneja.

According to Shiroor of MikroZ; "Any channel organization that is providing solutions to SMBs invariably requires some kind of business-automation system to efficiently manage organizational resources. From the revenue perspective; organizations with Rs 5 crore or more in revenue; may find it compelling to deploy ERP."

Who said its costly?

The most prevalent misconception is that ERP implementation is cost and time intensive. Secant for instance invested a total of Rs 8.5 lakh including hardware cost. Acme Digitek bought locally developed software for Rs 1.5 lakh. Mikrooz has deployed a free ERP package called Geebis. "People think implementing ERP is costly and time consuming. In our case; however; we spent Rs 4 lakh on the implementation and it took us only three months to deploy and eight months to recover the cost. However; I admit spending a considerable time finding the right product;" says Sigma's Pande. And this is true even for large implementations. For instance; the Rs 60-crore Mumbai-based system integrator Orient Technologies has spent just Rs 8.5 lakh on deploying an ERP for its 450 person organization. "We are deploying ERP from 3e Business Solutions. The software cost us Rs 5.5 lakh and we spent Rs 3 lakh on hardware. We plan to go live by the end of January 2007;" says Umesh Shah; Director; Orient. "I don't think cost is ever a critical factor for ERP implementation. Even if the system helps me achieve productivity gains equivalent to 4 employees; it will save me Rs 8 lakh in annual salary. In fact; the productivity gains are far more. An MIS report that took us 3 days to prepare before gets done in a single day now;" says Shah.

What to implement?

"The best option is to evaluate various alternatives and choose the one that best fits your requirements and budget. Navision fit our budget and had all the features we needed;" says Sigma Computers' Pande who extensively evaluated SAP Business One; the mid-market module of SAP before finally choosing Navision. Orient Technologies looked at various alternatives like Navision; 3i InfoTech and Godrej's Mcompass. Acme's Mital went for customized application as no branded application was available at affordable price in 2003. Since his business has grown manifold now; he is considering moving to a high-end product. "At that time the product we chose was adequate for our needs. But with branch expansion we will require a more sophisticated product;" says Mital. ERP implementation has helped companies like Secant and Veeras increase their application deployment business. "The fact that we have implemented the same ERP product that we sell gives us a lot more credibility in the market. It also allows us to offer our customers several practical tips that enhance the benefits; which other providers might not have;" says Juneja.

Challenges involved

Just like any system-driven implementation; change management is the biggest challenge. Getting employees buy-in for the new system and training them are two critical issues. "The big issue is about enabling your employees to make the best use of the system. They have to be convinced that the new system augurs well for the company's future and also their own individual self. And secondly they need to be trained;" says Orient's Shah.

Agrees P Ramesh; Director (Finance); Precision Infomatic—and he should know it better as his company has implemented ERP twice—initially Orion and recently Navision. "We did face resistance from employees. ERP is a change management tool; so it needs to be driven by the top management. We convinced employees by telling them that it will help improve performance and that would amount to better incentives and better growth prospects;" he says. The other critical and recurring issue is the attrition of ERP trained employees. "It really hurts when employees trained on ERP leave. As the new ones have to be trained again; the processes suffer in the interim. So now we have worked out a system that warrants every team leader to train his staff on ERP and that is linked to his KRAs;" says Umesh Shah.

8.3 FASTER IMPLEMENTATION METHODOLOGIES

A framework for smooth; fast and accurate implementations. Recent growth or consolidation; increased competition; re-directed priorities. Whatever the reason; change is taking place; and your enterprise business solutions must keep pace. ERP Services One Point Implementation Methodology offers the strategic value and increased business efficiency you expect from implementing new software; adding new functionality; or upgrading to a new version of your existing applications. It offers a proven; disciplined approach to implementing enterprise software backed by people with the applications knowledge and business expertise to make sure your deployment is smooth; fast; and accurate. ERP Services One Point Implementation Methodology helps companies like yours:

- Reduce risk
- Increase operational effectiveness
- Achieve strategic goals
- Optimize your systems at a low total cost of ownership
- Improve competitive advantage

ERP Services One Point Implementation Methodology is driven by the ERP Services Framework for Excellence; a business consulting offering which provides a structured knowledge base that allows companies to achieve specific business goals through the application of people; process; and technology components. This methodology is based on years of ERP Services Global experience in refining and improving the phases and procedures which constitute implementation best practices; as well as Project Management Institute (PMI) and Project Management Body of Knowledge (PMBOK) standards. In addition to pre- and post- implementation phases; it consists of five phases that are repeatable from customer to customer: initiate; design; build; deploy; and closure. ERP Services Global professional consultants guide the entire process — from project kick-off; to creating a design blueprint; to building the actual components; to production cut-over and go-live; and finally to formal handover of the solution — so every implementation is completed on time and on budget.

8.4 BUSINESS MODULES AND BAPIS

Wasting too much time negotiating prices; approving purchases or checking inventories for existing stocks? EC's ERP Business Process Module can automate your company's entire purchase & requisition process; bringing you better control; increased efficiency as well as time & cost savings.

Introduction / Overview

Every bit of time wasted can mean a lost opportunity for your business. By automating your organization's purchase & requisition process; Emirates Computers' ERP Business Process Module helps you profit from saved time and controlled costs. With easy-to-understand interfaces; you can now:

- Automate purchase requisition and approval processes.
- Prevent unwanted purchases.
- Verify prices.
- Check previously negotiated vendor contracts.

- Track; monitor; trigger or approve purchase requests.
- Streamline purchasing procedures to business policies.

Key Features

- Convenient Workflow Interface to enable triggering
- Managing and tracking processes accessible through the company's Share Point Site.
- Attachments to Workflow processes stored in Share Point Portal Server for easy access.
- Comprehensive integration allows you to use Great Plains to access requests and purchase orders created & approved in the Workflow process.
- Carbon copy options for managers to review requisition details.
- Unlimited number of approval levels enabling complete or partial approval.
- Automatic purchase order generation upon approval.
- Comprehensive audit trail of all tasks performed in the Workflow process.
- Workflow forms based on company business template.
- Complete integration with directory services.
- Officiator approval for unavailable users.
- Easy; robust and reliable.
- Allows grouping of all purchases from the same supplier.
- The Budget Tracker add-on functionality helps confirm funds availability prior to approval. Facilitates tracking of invoices and payment commitments to suppliers.
- Collects reorder information from the inventory to enable automatic generation of requisitions in purchase orders.
- Enables similar purchase tracking for recommendations and opinions.
- Auto-generated reminders for requests pending approval.
- Access control for confidential information. Extremely cost-efficient and competitively priced.

Benefits

EC's ERP Business Process Module is a flexible Web-based application that enables your organization to streamline and manage the supply chain by allowing you to:

- Centralize
- Automate
- Speed up and control the entire purchase request;
- Approval; order and receiving processes in compliance with company policies
- Review all the details of a requisition on a single screen for simplified use
- Standardize the look of official purchase documents based on company business templates. Save document formats as templates for easy future reuse
- Control costs by avoiding unwanted purchases and verifying prices with previous contracts from the same vendor
- Cut operational costs and reduce error potential due to duplications by eliminating unwanted paperwork associated with purchasing processes
- Increase employee productivity by reducing time wasted on physical purchase requests and approvals with features such as auto-generation of purchase orders on approval of requisition and email notifications for pending approvals
- Eliminate the need for providing staff access to the company accounting system
- Define various approval levels such as partial approval; complete approval or rejection. Minimize shipping costs and avail of bulk discounts by combining orders

for the same supplier; and encouraging ordering from suppliers offering better prices & terms.

- Budget Tracker allows you to confirm the availability of funds before approving any purchase request; while tracking cash flow requirements to meet commitments made to suppliers reduces the dispute potential
- Enhance team collaboration and get feedback and recommendations by tracking similar purchases made previously by others
- Capture all relevant data into a centralized database for easy access and up-to-date information for audits
- Automatically generate open orders by intelligent retrieval of reorder information from the inventory.
- Allow requisition & approval of items not listed in your Microsoft Dynamics GP inventory list; even adding new items to the list
- Easily add comments; costs; taxes; shipping details and additional information to each requisition. Conveniently view full-order totals or separate totals for each invoice
- Separate terms and discounts for each invoice enable easy understanding and better financial planning
- Keep confidential financial details safe by controlling access to data such as budget information
- Easily distribute purchase orders to vendors electronically
- Improve control and reporting with real-time monitoring of item movement

Technical Requirements

- Captaris Template Workflow
- Microsoft Share Point Portal Server 2003
- SQL server 2000
- Web server - IIS
- Server Class machine (To Host the Application)
- Net Framework on the Application Server

Application Architecture

The ERP Business Process Module consists of a combination of various technologies to enhance the speed of operations and the flexibility of design. What follows; is a brief description of the technologies used.

Definition of BAPI

A Business Application Programming Interface (BAPI) is a precisely defined interface providing access to processes and data in business application systems such as R/3.

BAPIs of SAP Business Object Types

BAPIs are defined as API methods of SAP business object types. These business object types and their BAPIs are described and stored in the Business Object Repository (BOR). A BAPI is implemented as a function module; that is stored and described in the Function Builder.

BAPIs of SAP Interface Types

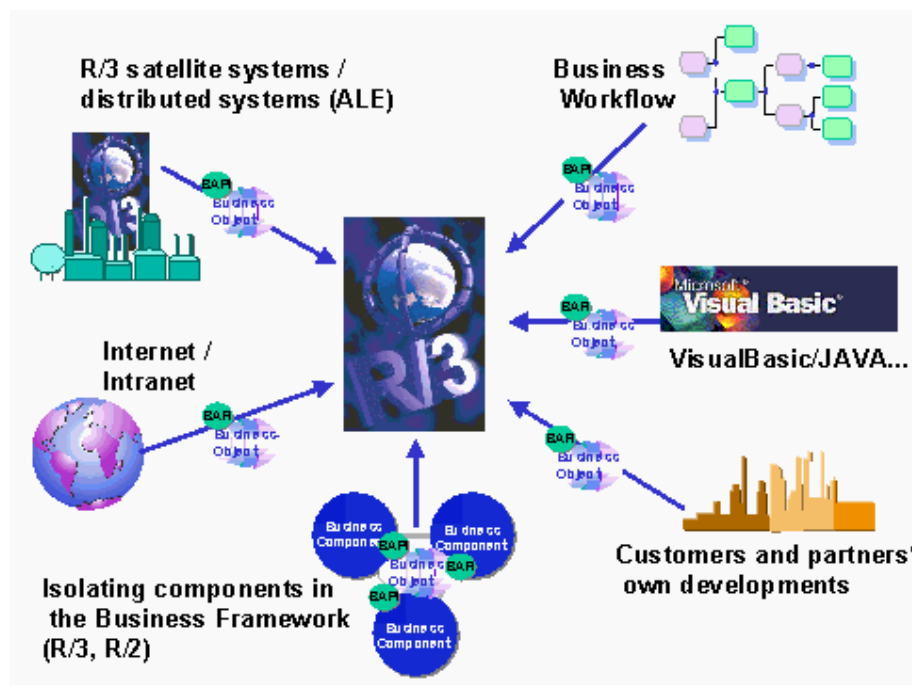
As of Release 4.5A BAPIs can also describe interfaces; implemented outside the R/3 System that can be called in external systems by R/3 Systems. These BAPIs are known as BAPIs used for outbound processing. The target system is determined for the BAPI call in the distribution model of Application Link Enabling (ALE). BAPIs used for outbound processing

are defined in the Business Object Repository (BOR) as API methods of SAP Interface Types. Functions implemented outside the R/3 System can be standardized and made available as BAPIs. For further information see BAPIs Used for Outbound Processing.

Integration

BAPIs can be called within the R/3 System from external application systems and other programs. BAPIs are the communication standard for business applications. BAPI interface technology forms the basis for the following developments:

- Connecting:
- New R/3 components; for example; Advanced Planner and Optimizer (APO) and Business Information Warehouse (BW).
- Non-SAP software
- Legacy systems
- Isolating components within the R/3 System in the context of Business Framework
- Distributed R/3 scenarios with asynchronous connections using Application Link Enabling (ALE)
- Connecting R/3 Systems to the Internet using Internet Application Components (IACs)
- PC programs as front ends to the R/3 System; for example; Visual Basic (Microsoft) or Visual Age for Java (IBM).
- Workflow applications that extend beyond system boundaries
- Customers' and partners' own developments



The graphic shows how BAPI interfaces enable different types of applications to be linked together.

Programming with BAPIs

Use

Assume that the application you developed is to use the data held in business objects in the R/3 System and that this data is to be accessed by calling BAPIs. Your application can be as simple or as complex as you like and can include more than one BAPI call.

Integration

BAPIs are defined in the Business Object Repository (BOR) as methods of SAP business object types or SAP interface types and are implemented as function modules. As the BAPI definition is separation from its actual implementation; you can access a BAPI in two ways: You can call the BAPI in the BOR using object-oriented method calls (see Object-oriented Access to BAPIs). You can make RFC calls to the function module on which the BAPI is based (see Function-oriented Access to BAPIs).

Applications that access BAPIs can be broadly divided into two categories:

Dialog applications

With dialog applications the caller usually waits until the method call has been processed; for example; waits for the results of a Get List BAPI.

Distributed applications

BAPIs can also be used in Application Link Enabling (ALE) to exchange and replicate data between two distributed systems. For more information see Distributed Applications Programming.

Activities

Regardless of the approach you use; you need to complete the following tasks in order to invoke BAPIs from your application program:

Task	For Further Information:
Identify the SAP business object type or the SAP interface type and the required BAPI and determine the parameter information for the BAPI interface.	Determining BAPI Details
Include the BAPI call or function call and the parameter declarations in your application program.	Programming Dialog Applications or Programming Distributed Applications For examples of calling BAPIs from various development platforms see Examples of BAPI Calls.

8.5 CONVERGENCE ON WINDOWS NT

The company's MAN-FACT II ERP system; designed for custom; job-shop; Manufacturers; was one of the first robust software systems to run on NT. Now; the Dataflow system will allow the high-volume; discrete and repetitive manufacturer to also run on Windows NT Servers and Workstations. Stu Clifton; president and chief executive officer of Data Works; commented: "We believe running ERP systems in the NT operating environment is a major step forward in empowering users -- one of Data Works' primary concerns in developing manufacturing software systems. That's why we were one of the first to add NT to the many operating environments customers can use with our MAN-FACT II ERP system. "Now all of the rich functionality of Dataflow UNIX version is also available to NT users; enabling customers to have higher productivity; lower hardware costs and easier training. Dataflow provides a robust; work-flow-oriented manufacturing solution designed to handle the constant and unpredictable changes demanded by the current global manufacturing environment.

Today's manufacturers are concerned about becoming more agile; and the company believes the Dataflow ERP information system meets this need by empowering users with the most advanced capabilities available including: client/server architecture; relational database and tool technologies; 4GL development tools; customizable graphical user interface and application program interfaces (APIs). Data Works is a supplier of software solutions for discrete and repetitive manufacturers. The company's products feature advanced ERP system functionality combined with open system technologies; including client/server architecture; relational database and easy- to-use Windows-based graphical user interfaces. The company has more than 600 customer sites.

8.6 APPLICATION PLATFORM

Companies optimizing ERP investments are looking for deeper industry expertise; larger returns on investment (ROI); and financial viability from their vendors. Technical architecture renewal is gaining increased momentum through aggressive development efforts of several vendors — including Lawson; Microsoft Business Solutions; Oracle; and SAP — but customers remain cautious. Conclusive proof points of adaptable and open ERP systems; however; will not be demonstrated until 2007 or later. After three years of declines; the market regained momentum in 2004; largely due to SAP's strong performance in the wake of Oracle's acquisition of PeopleSoft. Going forward; the market will grow 4% through 2008; as ERP vendors continue to consolidate for stability and deepen industry specialization to compete against larger rivals.

Enterprise Resource Planning (ERP) applications might not have had divine origins; but there is little doubt that somewhere; right now; a business or technology professional like yourself is praying for a successful ERP deployment. As the name implies; ERP software is a set of applications that ultimately are relied upon to automate and integrate many or all functions of an enterprise. Common components include Finance modules; Human Resources software; as well as Manufacturing and Logistics applications. After a successful roll out; ERP applications offer a variety of returns on the initial investment. Benefits might include more efficient business processes; tighter cost controls; and better customer service. However; these gains do not happen overnight. ERP applications are notoriously complex and usually require extensive customization. Recognizing these gains in your enterprise will require

significant investments in time and money. Business processes may need to change; and users will need time to become efficient in using the new system. In the middle of planning for and making these changes; there is one item that often gets overlooked: The network. "Systems" people spend a good deal of time sizing servers and figuring out how many users they can support. "Desktop" folks plan for the software distribution on the client side. Department heads discuss when and how their people will be trained to use the new application. In many cases it is simply assumed that the network will handle this application just like it handles every other application. Is this a fair assumption? Do ERP applications behave like other network applications? The answer to both questions is - No! In a 1999 Computerworld cover story article entitled: ERP Pioneers; Keith Bearden; CIO of A-dec Inc.; described some of the challenges he faced when he was tasked with addressing the performance issues associated with an ERP application which A-dec had recently purchased and deployed. It took about six months to fix the performance issues during which time they changed databases and performed server and network upgrades. Another six months was spent redesigning business processes and training end users – doubling the cost of the project. Mr. Bearden was quoted as saying: "We lost a lot of business; because [workers] didn't understand it; and the performance was so bad." In this White Paper we will discuss the behavior of ERP transactions and the crucial role that the network plays in delivering acceptable levels of performance to the end users. We will detail the potentially dramatic performance impact associated with running these applications across slower; higher-latency links and demonstrate why an up-front analysis of network performance is critical.

ERP Architecture

ERP applications are most commonly deployed in a distributed and often widely dispersed manner. While the servers may be centralized; the clients are usually spread to multiple locations throughout the enterprise. Generally speaking; there are three functional areas of responsibility that is distributed among the servers and the clients. First; there is the database component – the central repository for all of the data that is transferred to and from the clients. Then; of course; the clients – here raw data gets inputted; requests for information are submitted; and the data satisfying these requests is presented. Lastly; we have the application component that acts as the intermediary between the client and the database. Where these components physically reside and how the processes get distributed will vary somewhat from one implementation to the next. The two most commonly implemented architectures are outlined below.

Two-Tier Implementations

In typical two-tier architecture; the server handles both application and database duties. The clients are responsible for presenting the data and passing user input back to the server. While there may be multiple servers and the clients may be distributed across several types of local and wide area links; this distribution of processing responsibilities remains the same.



Illustration of a Two-Tier Implementation.



Three-Tier Client/Server Implementations

In three-tier architectures; the database and application functions are separated. This is very typical of large production ERP deployments. In this scenario; satisfying client requests requires two or more network connections. Initially; the client establishes communications with the application server. The application server then creates a second connection to the database server.

Transaction Flows and Volumes

So far; this all looks pretty unremarkable; right? We have clients talking to servers; servers talking to other servers; no big deal... After all; in the vast majority of cases; there are several other applications already in place that are doing similar things in terms of transactions flows long before the ERP application enters the picture. There is PC; Mac; or UNIX clients talking to web servers; sending and receiving email; transferring and printing files; running legacy host-based applications; etc. etc. Pay attention now; we're getting to the good part! It isn't the pattern of the transaction flows that we are worried about here. It is the sheer volume of constant back-and-forth transactions traveling between the client and the server(s). On a high-speed; low-latency link; this may not present a problem. In fact this is why performance problems may not surface until after the application roll out is well underway. During the initial development and pilot testing of the system; the clients and the servers are often sitting on an isolated network or a single subnet. In this environment; the end-users may experience no performance problems whatsoever. But what happens when the application gets rolled out to other buildings on the campus; branch offices; or remote users?

Looking at the Numbers

So how much client to server interaction is we talking about here? Well; keep in mind that most ERP applications are customized for each individual customer; so the results you see will in all likelihood be unique to your organization. But let's try to put things in perspective. In building Application Scripts that emulate real application transaction flows; Ganymede Software has done extensive analysis of how various applications perform "on the wire." Here are some of the results we have observed. As a baseline; let's start with a typical network transaction such as sending an email message using SMTP (Simple Mail Transfer Protocol). From the network perspective; this type of transaction will result in about a dozen "sends" of data to and from the email client. By "send" we mean a transmission of data that is initiated by either the client or the server. So how does this compare to a typical ERP transaction? Here are some sample transactions from the top five ERP applications

8.7 NEW BUSINESS SEGMENTS

ERP is once again itching to be top-of-mind among geeks and corporate. And new trends in ERP software are throwing up new vistas for the local mid-tier vendors. Chiranjoy Sen Tracks how small has become the middle word of this segment. Small is the new paradigm in enterprise resource planning (ERP) today. Small businesses; small verticals; small-sized deals and small-to-mid sized vendors are what keeps this sector ticking — at least in India.

ERP was the buzzword that yielded space to customer relationship management and supply chain management in the late nineties. These days; even though Service-Oriented Architecture is top-of-mind; ERP is back in a new avatar: it is focused on the small and medium business segment; more customized and targeted at micro-verticals - where it is industry specific and not process driven. The interesting fallout of these changes is that they are throwing up more opportunities for mid-sized local ERP vendors

Inflexibility of earlier ERP systems from SAP; Oracle and PeopleSoft pushed the customization drive. "Customers are moving from a 'best-of-breed' to a 'best-for-business' approach; implying they prefer extensions to their existing ERP for applications like planning and optimization; business intelligence and knowledge management. This has resulted in ERP vendors introducing new technologies;" says RK Kanthi; group head; Enterprise Systems; 3i Infotech.

"The requirements of each company differ in terms of standard industry practices and unique practices. Hence there is greater demand for componentized solutions with standard modules and specific functionality to address the unique processes;" says Vittal Devarajan; head; corporate marketing; Ramco Systems.

8.8 MORE FEATURES

ERP II has become the talk of the day in the enterprise world. ERP II features are said to be advanced when compared with the former. However some shun it as a mere extension of ERP. It becomes very important to analyze ERP II in this contest.

Well known features of ERP II are as follows:

Structuring the enterprise applications to suit to the latest technicalities

The history of enterprise resource planning reveals an interesting fact. ERP was discovered in the early 80's and 90's. The information technology was at the budding phase in this period and though it was nearing the pinnacle in many developed countries. Needless to mention that the ERP software programs developed initially were not computer friendly (if we are to discuss the practical situation). This stage was critical for both Information technology and ERP. ERP was nearing completion while IT was rapidly expanding (and is still so) till date. ERP was developed keeping in mind the latest advancements of IT. However when the ERP systems were developed it showed an imbalance with the latest technological features of computers that were improved during the manufacturing of ERP. There seemed to be no end to this gap even in successive ERP modifications because if ERP was improved twice computers also experienced the more improvements and in multiple propitiations.

This proved to be the main reason for ERP's failure to make maximum advantage of facilities like internet. Even web enabled ERP was not effective to the desired extent. However things proved to be otherwise with the intrusion of ERP II. The main advantage and well known feature of ERP II is that it is designed in such a way that it makes optimal exploitation of the technological advances.

Providing specific applications

The main drawback of enterprise resource planning is that it is a generic application which remains less focused on specific functions. However ERP II believed in restructuring ERP rather than restructuring the business process in the name of business process engineering or others. ERP II comes with comprehensive features that are exclusively suited industry wise. Further the packages also offer innumerable choice for the functional components. This is the crux of ERP II features.

Autonomy for Vendors and users

ERP II has helped the vendors and users to be liberal in choosing each other in addition by giving them the required freedom in designing and demanding applications as well. The vendor is also relieved from catering only to a particular sect of customers. The case is equally true for the customers. ERP II features help the vendor in choosing his target market and serving their needs by designing applications exclusively for them. On the other hand the company is also free to make any sort of demands as applications are going to be solely based on them.

Built on ERP's failure

ERP II evolved from its predecessor. It originated due to ERP's failure. The contribution of ERP in redefining enterprise operations is still significant but not enough. Hence ERP II has been devised to overcome the drawbacks of ERP. They have been devised by working on the weakness and disadvantages of ERP.

What are the added features of ERP II?

There are arguments saying that ERP II is only an extension or an advanced version of ERP. However there is another school of thought that advocate ERP II as an entirely different application. It remains clueless as where one should draw the line. Irrespective of the belief it

needs to be remembered that there are special features of ERP II that needs to be given due credit.

Some of the special features are as follows:

Gifted to Perform non enterprise functions

The expansion of ERP which goes enterprise resource planning denotes that it has been devised to perform only enterprise functions. The back up and supportive functions remained untouched or if not lesser coverage was given. ERP II feature was specially designed to remove this drawback .ERP ii packages offer a one stop solution to all problem irrespective of the fact that they are internal or external or relating to enterprise function or not. At the same time it is not to be inferred that the application lacks focus. The application is also known for the strong focus. In other words the applications are totally flexible with the ability to work in selected environments intensively and as well wide environments extensively.

Encourages the participation of user

In the case of enterprise resources planning the users remain as mute spectators especially if he is apprehensive on ERP or not able to comprehend it technically. They bank on the process of training for improving their idea and inputs on ERP. This might seem to work well but will often retaliate due to two popular reasons. The training methods don't address the problems directly and is largely viewed as a formality. On the other hand when it comes to employees they are not participative during the discussion sessions. His views are not given due coverage by the vendor. The result is that the vendor supplies an application based on his own whims and fancies and without covering major business issues. The end user will be utilizing them without proper knowledge. This is a disadvantage of ERP. This is not the case with ERP II advantage. It is an application which meets the needs of the user and the vendor. The vendor selects his own customers. Simultaneously the customer selects his vendor. The restructuring process is sure to involve their participation proportionately. The mutual sharing will help in discussing the pros and cons of each and activity. Since both of them will be working together the chances of one blaming the other for mistakes is absent in ERP II feature. This is an advantage of ERP II.

Features of ERP

Some of the major features of ERP and what ERP can do for the business system are as below:

- ERP facilitates company-wide Integrated Information System covering all functional areas like Manufacturing; Selling and distribution; Payables; Receivables; Inventory; Accounts; Human resources; Purchases etc.;
- ERP performs core corporate activities and increases customer service and thereby augmenting the Corporate Image.
- ERP bridges the information gap across the organization.
- ERP provides for complete integration of Systems not only across the departments in a company but also across the companies under the same management.
- ERP is the only solution for better Project Management.
- ERP allows automatic introduction of latest technologies like Electronic Fund Transfer (EFT); Electronic Data Interchange (EDI); Internet; Intranet; Video conferencing; E-Commerce etc.

- ERP eliminates the most of the business problems like Material shortages; Productivity enhancements; Customer service; Cash Management; Inventory problems; Quality problems; Prompt delivery etc.;
- ERP not only addresses the current requirements of the company but also provides the opportunity of continually improving and refining business processes.
- ERP provides business intelligence tools like Decision Support Systems (DSS); Executive Information System (EIS); Reporting; Data Mining and Early Warning Systems (Robots) for enabling people to make better decisions and thus improve their business processes

8.9 WEB ENABLING

Web enabled ERP services have helped to remove many drawbacks of the earlier applications. This has gained momentum as it has made ERP function more meaningful and dynamic with the latest inclusions.

Some of the facilities offered by WEB ERP are as follows:

Dependability

Web enabled ERP services help the companies to keep track on what is going on. Since the entire system comes under the purview of internet it is not possible for the employees to engage in any sort of misappropriations funds or otherwise. In addition the errors could be easily deduced and corrected. This system not only helps the personnel in the company but also its stakeholders and well-wishers or anyone who would like to obtain information on the company. They can access the details anytime online.

Convenience in reaching

Formerly when customers had to know the status of their order or any other query he must communicate to the marketing department. They will in turn speak to the concerned department trace the product or get clarifications in the case of technical query or any another information and then get back to them after confirming the required and relevant details. This process could take a few days and few weeks in the case of errors. With the intervention of WEB erp all that the customer has to do is to speak to the person in charge. He then gets back to the customer within few minutes. On the other hand web enabled ERP has reduced that time to a few seconds. In addition the customer can access the details from his personal computer and need not even depend on the company for trivial information. ERP on the web has done away with all these. The C.E.O. can know the status of the company's business and problems by sitting anywhere in the world. Similarly any other person can obtain the desired information at the shortest possible span of time. This has thrown lot of issues on confidentiality especially in sensitive subjects like hospital details and financial information.

Easy to use

Web enabled applications makes the job of the employees easy. They don't have to rely on others before taking a decision for every petty issue. Infact it has helped them to work efficiently and in a relaxed manner. Besides the company the outsiders will be benefited lot as all the clarifications can be made online. Since they tend to be crisp the outsiders will not make mistakes in dealing with the company. The errors if any will be easily filtered in the

online tracking system and hence the rectifications will be very quick. This would not have been possible without ERP on the web.

Integrating technology and manual Data in public domain

Web enabled applications have greatly reduced the limitations of manual data. These manual data became easily accessible after computerization and enterprise resource planning. However the data brought under public domain was still not satisfactory. Web ERP applications have helped to improve this feature by offering everything online.

Future

Web enabled ERP have been cited as one of the important reason for ERP's dominance in the days to come. This system needs more development apart from the present changes

8.10 MARKET SNAPSHOT

The ERP market shows lots of avenues irrespective of the size of the company. As a subject matter of this link it becomes important to analyze the market opportunities of ERP in S.M.E.'s. S.M.E. market and ERP is analyzed from various dimensions.

Some of the issues requiring attention are as follows

Competition among larger and smaller players

The competition for ERP market in S.M.E.'s is quiet fierce. The vendors have increased considerably with the influx of bigger players in the fray. Formerly only the smaller vendors catered to S.M.E.'s. However the situation is totally reversed in the current scenario. The numbers of vendors are increasing not only due to the intervention of bigger players but also due to the intrusion of many smaller ones. This makes it difficult for all of them to compete as the best only get to strike a deal. This market scenario has thrown more demands from the companies because they now have many vendors to choose. On the contrary the emerging increase has also resulted in more complexions in the market because each vendor is different and unique when it comes to the issue of software.

Saturation point for ERP market in S.M.E.'S

It has been largely argued that S.M.E. market has attained saturation point for ERP. This statement might appear logically true. There was not enough number of players for the ERP products in the S.M.E. market formerly. S.M.E. market for enterprise resource planning was not competitive. Hence these existing ones made a killing with the software companies. Some of them handle lot of project simultaneously and successfully. All this makes one to conclude that the Small and Medium Enterprises. market for ERP is quiet saturated. On the contrary it is not so though it might be tempting to think so. The needs of small companies are quiet different when it comes to ERP unlike the larger companies. The larger companies may have some common parameters in common whereas it is not possible to find the same in small and medium enterprises. Their requirements are largely varying. Infact it is not possible for bigger companies to place such demands considering the magnitude of the operations and the volume of investment required.

The minds of the ERP vendor are still tuned to this framework even in the case of small and medium enterprises. This drawback has remained unanswered though there are exceptions. The companies are not yet satisfied even though the market sound saturated. This is an

important issue of S.M.E. market and ERP. The intervention of new vendors from different segments has given a positive response to this problem. Many of them have made commendable alterations and started to suit the needs of Small and medium ERP companies requiring ERP. The market still shows greater opening if companies can come forward to rectify this or deploy the existing ones. This statement is made on the assumption that other drawbacks are nil.

Opportunities for innovation

ERP vendors are frequently coming out with inventions and modular improvements not to forget mentioning the up gradation in the market. Small and medium enterprises can afford to go for such modifications are invested in newer ones if it is demanding and worth (assuming that finance is not a problem). Though larger companies have a greater capacity to do the same it is not practically advisable. Hence S.M.E.'s are still prosperous when it comes to ERP market.

OTHER RELATED TECHNOLOGIES OF SCM

Structure

- 9.1 E-procurement
- 9.2 E-Logistics
- 9.3 Internet Auctions
- 9.4 E-markets
- 9.5 Electronic business process optimization
- 9.6 Business objects in SCM
- 9.7 E commerce.

9.1 E-PROCUREMENT

Enterprise Resource Planning or ERP systems are integrated information systems within an enterprise that serves all the departments. ERP solutions help you automate your business processes and give you an edge over your customers. Damco has developed dedicated practices in SAP suite of ERP solutions for the Enterprise. Damco has the right skills and methodology to deliver the complete range of SAP offerings. Our team of experts has real-world experience of successfully implementing large ERP solutions in various industry verticals. Damco has pool of experts with worthy domain and technology experience to act as client's extended IT team for version upgrades; optimization; troubleshooting and maintenance of ERP applications in a 24 / 7 working environment. Our ERP services have helped many customers reduce their total cost of ownership by maintaining or enhancing the quality of service using our Global Delivery Model. Our services are focused on operational efficiency; performance improvement; cost reduction and integration of business applications ensuring that your ERP applications are always up and running.

Our ERP services include:

- Implementation & Support Services
- Functional Consulting
- Support and Maintenance
- Application Support - Functional and Technical
- Helpdesk Support
- Application / System Monitoring
- System Maintenance
- Database Tuning and Optimization
- Post Implementation Support
- Migration
- Version Upgrades

- System Migration
- Project Management
- Integration with Other Applications
- ERP Consulting on New dimensions
- Business Information Warehouse
- Strategic Enterprise Management
- Enterprise Portal
- APO (Advanced Planner and Optimizer)

SAP Practice Areas

E-procurement (electronic procurement; sometimes also known as supplier exchange) is the business-to-business or business-to-consumer or Business-to-government purchase and sale of supplies; Work and services through the Internet as well as other information and networking systems; such as Electronic Data Interchange and Enterprise Resource Planning. Typically; e-procurement Web sites allow qualified and registered users to look for buyers or sellers of goods and services. Depending on the approach; buyers or sellers may specify costs or invite bids. Transactions can be initiated and completed. Ongoing purchases may qualify customers for volume discounts or special offers. E-procurement software may make it possible to automate some buying and selling. Companies participating expect to be able to control parts inventories more effectively; reduce purchasing agent overhead; and improve manufacturing cycles. E-procurement is expected to be integrated with the trend toward computerized supply chain management. E-procurement is done with a software application that includes features for supplier management and complex auctions. The new generation of E-Procurement is now on-demand or a software-as-a-service.

There are seven main types of e-procurement:

- Web-based ERP (Electronic Resource Planning): Creating and approving purchasing requisitions; placing purchase orders and receiving goods and services by using a software system based on Internet technology.
- E-MRO (Maintenance; Repair and Overhaul): The same as web-based ERP except that the goods and services ordered are non-product related MRO supplies.
- E-sourcing: Identifying new suppliers for a specific category of purchasing requirements using Internet technology.
- E-tendering: Sending requests for information and prices to suppliers and receiving the responses of suppliers using Internet technology.
- E-reverse auctioning: Using Internet technology to buy goods and services from a number of known or unknown suppliers.
- E-informing: Gathering and distributing purchasing information both from and to internal and external parties using Internet technology.
- E-market sites: Expands on Web-based ERP to open up value chains. Buying communities can access preferred suppliers' products and services; add to shopping carts; create requisition; seek approval; receipt purchase orders and process electronic invoices with integration to suppliers' supply chains and buyers' financial systems.

The e-procurement value chain consists of Indent Management; eTendering; eAuctioning; Vendor Management; Catalogue Management; and Contract Management. Indent Management is the workflow involved in the preparation of tenders. This part of the value chain is optional; with individual procuring departments defining their indenting process. In works procurement; administrative approval and technical sanction are obtained in electronic

format. In goods procurement; indent generation activity is done online. The end result of the stage is taken as inputs for issuing the NIT. Elements of e-procurement include Request For Information; Request For Proposal; Request for Quotation; RFx (the previous three together); and eRFx (software for managing RFx projects).

Advantages

In reality e-procurement has the advantage of taking supply chain management to the next level; providing real time information to the vendor as to the status of a customer's needs. For example; a vendor may have an agreement with a customer to automatically ship materials when the customer's stock level reaches a low point; thus bypassing the need for the customer to ask for it.

9.2 E-LOGISTICS

In last couple of years; various on-line shipping tools have been developed for the e-commerce application developers. Take the example of the transportation industry; UPS provides on-line XML Tools and HTML Tools and FedEx provides their own Web tools for their developers to enable the development of on-line shipping tools; respectively. However; we have not seen a common service interface to allow users to easily hook up existing tools. Client application developers have to manually construct different requests for different backend servers that demand much effort and time. Different shipping carriers might require different implementations and could have proprietary platform and their own implementation constraints. In order to expedite the shipping process and minimize costs; the shipping solutions must empower the customers and suppliers with the ability to rate; ship and track shipments. Many solutions in today's competitive market have been able to achieve this but they are:

- Platform dependent and unique to the specific shipping carrier. The solutions are not generic so that they could not be considered as a standard and followed by the rest of players.
- Windows-based applications that are mostly standalone applications and users are forced to purchase them before actually using them.

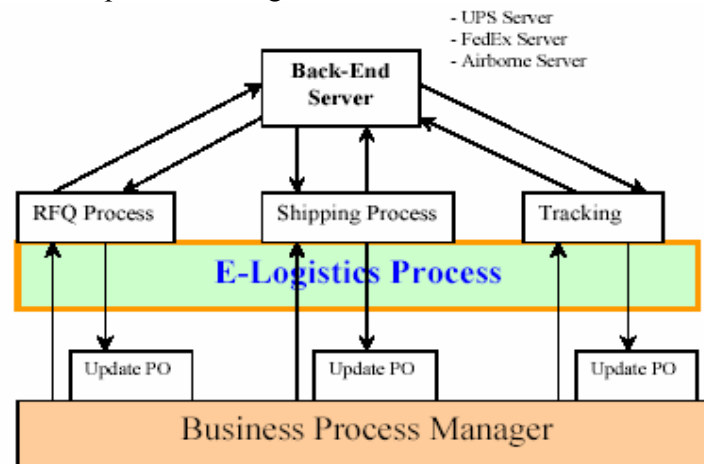
With the development of Web Services; to define a uniform interface for the solution developers becomes technically feasible and itself leads to potential business opportunities. The framework; ELPIF; presented in this paper proposes to have a common generic interface for all the Shipping Service Providers and all providers could build their Web Services on such a standard interface and then deploy those services in the UDDI Registries for other companies to find and use them. Though we are focused on the shipping industry; the principles embodied in ELPIF can be applied to other domains. Blending the Web Services and the common interface approach would result in allowing shipping services to adhere to a model of what could be considered a generic shipping service.

This is critical since this allows a shipping service client to design and deploy code to use the generic shipping model; and then at run time use dynamic data binding mechanism to invoke a specific implementation of a shipping service. Because Web Services can be implemented in any programming language; developers are not obligated to change their development environments in order to generate or use Web Services. Consequently; any client application

can benefit from the characteristic of architectural independence that is embraced in our framework. For most integration architecture; XML plays a role of trivializing the exchange of business data among companies by providing cross-platform approach in the areas of data encoding and data formatting. For example; SOAP; built on XML; defines a simple way to package information for information exchange across system boundaries. UDDI Registries; on the other hand; allow programmable elements to be placed on Web Sites where others can access remotely. By adopting the above technologies; not only do we get interoperability for our customers but we can use our multi-platform approach to provide better offerings and solutions with the help of which any industry can accomplish their transactions efficiently and profitably. ELPIF serves as a Web Services Model such that any user could easily access the services provided by ELPIF through a standard SOAP protocol. ELPIF helps businesses act more quickly and more efficiently; and it also provides a methodology of automating process integration resulting in reducing integration time and cost; increasing the efficiency of service delivery; and gaining competitive advantage in the marketplace. E-logistics processes integration after reviewing e-logistics processes and also presents our proposed integration framework; ELPIF; by introducing common alliance layer; adaptation layer and dynamic data binding mechanism. Section 3 gives an integration example using UPS On-Line XML Tools in a purchase order management process. Section 4 shows a working B2B system using e-logistics Web Services.

E-Logistics Processes Integration

When it comes to logistics; the challenge has always been how to deliver products to customers as quickly as possible. Logistics is concerned with the flow of materials in the supply chain; from source through the industrial process to the customer; and then on to re-use/re-cycle or disposal. By coordinating all resources; logistics have to ensure that service levels agreements with customers are honored. E-logistics is defined to be the mechanism of automating logistics processes and providing an integrated; end-to-end fulfillment and supply chain management services to the players of logistics processes. Those logistics processes that are automated by e-logistics provide supply chain visibility and can be part of existing e-Commerce or Workflow systems in an enterprise. The typical e-logistics processes include Request for Quotes (RFQ); Shipping; and Tracking. As shown in Figure 1; e- Logistics interacts with the business process manager in an e- Commerce server.



High Level View of ELPIF

Business Process manager invokes the RFQ process to get the basic services such as getting the quotes in an e-logistics process. Whenever the response is obtained; the purchase order (PO) is updated. Shipping process is also invoked by the business process manager and upon completion updates the PO. Once goods are shipped; the tracking number is given to the customer and that tracking number is mapped to the PO number in an e-commerce system. Customers can track their shipment with the help of that number. The interaction diagram of e-logistics and business process manager is shown in Figure 1.

ELPIF Components and Services

Common Alliance Layer

Common Alliance Layer is a higher level service interface that shields the clients from multiple transportation carriers and provides an abstraction layer of available services. Such interface contains the method signatures of the functions that need to be implemented by the Web Services that are published by different Shipping Service Providers such as UPS; FedEx; and Airborne that directly talk to their legacy applications. These methods require XML as an input and their result is also a XML String. As a multi-carrier connector; the Common Alliance Layer makes the overall shipping processes simpler than current practices because:

- A set of common interfaces are available to all the shipping carriers; and they would ease the work of a service requestor who is required to issue a single service request using standardized interfaces as opposed to composing and sending several complex requests to multiple targeted service providers.
- It would also ease the job of the client application developers who would have to just code once for all the Shipping Service Providers.
- From a shipping carrier's perspective a set of standard interfaces provided by Common Alliance Layer of ELPIF can be used as a means to increase the customers' awareness of their quality services and products in terms of reliability and efficiency.
- It would reduce development effort by alliance layer reuse and allow easier adaptation to new service requirements or technologies. The common interface is implemented by all the shipping carriers and the resulting Web Services is published in the UDDI Registry so that trading partners and customers can search and retrieve those services.

9.3 INTERNET AUCTIONS

Most business activity on the Internet is limited to publicizing the business opportunity and catalog based sales; but it will rapidly expand to include the negotiations conducted to settle the price of the goods or commodities being traded. These negotiations are currently conducted by human intermediaries through various forms of auctions; bidding systems for awarding contracts; and brokerages. The role of the intermediaries can now be performed by Internet trading applications at a fraction of the cost. Trading on the Internet allows a business to reach a larger number of potential customers and suppliers in a shorter time and a lower cost than possible by other modes of communication; and to settle business transactions with lower cost overhead in a shorter time. Hence the rapid emergence of

Internet based trading applications. Lee discusses the factors behind the success of Internet auction of second hand automobiles in Japan supporting our belief.

Auctioned or brokered sales are the norm in the business world for negotiating trades of large value. But consumer sales and small scale purchases typically stay with fixed prices; perhaps because of the high overhead cost of using the auction or brokerage method. The new economics of the Internet will make auctions popular in consumer and small business transactions also. Lee and Clark present economic forces underlying this transition. Several success stories about Internet auctions are cited by Turban. Many types of auctions are practiced in different real world situations to achieve different business objectives such as best price; guaranteed sale; minimum collusion possibility; etc. Ralph Cassidy presents an extensive survey of auction practices around the world. Game theoretic treatments of the different kinds of auctions can be found in while some experimental results are reported. Some of the important requirements are support for a wide variety of commonly practiced auctions and ease of integrating auctions with business's existing back end applications to create a completely automated trading process. Security mechanisms; based on cryptographic methods and audit trails; are needed to prevent hackers from sabotaging auctions and buyers and sellers from cheating or disrupting the auctions. Efficient notification mechanisms to inform bidders of the latest bids are required to scale the auction application to large number of bidders.

We have implemented an auction system that is operational now. It supports the breadth of auction styles; interaction requirements; and other attributes. We present the design for this auction application which implements these auction types and allows the seller to choose any of them and further fine-tune the rules to maximize his business objective. We describe key features of the underlying object; process; and interaction models. In a companion paper we discuss various types of auctions in detail. There we also discuss how auctions relate to other types of commonly used trading models such as brokerages; two party negotiations; and competitive bid-based procurement.

9.4 E-MARKETS

Organizations that are using electronic markets as a way of coordinating information and the supply chain. New information technologies that enable the creation of new electronic marketplaces; use of electronic brokers. Existing industry boundaries disappear and create new cross-industry markets. Companies operating across multiple value chains. An electronic market (PEM) utilizes the Internet to connect a limited number or pre-qualified buyers or sellers in one market. PEMs are a hybrid between perfectly open markets (e.g. exchanges where there is no pre-existing relationship between buyer and seller - similar to eBay) and closed contract negotiations (such as a sealed bid tender; where there is no visibility between competitors and hence no response to competition). The core idea of PEMs is to create competition among buyers/sellers while allowing buyers/sellers to adjust all those aspects of the deal that are typically only dealt with in a negotiation. This creates a problem of "comparing apples and oranges": bids may be quite different in many dimensions and therefore cannot easily be compared. Apart from the dimension of price these could include pre-negotiated discounts (e.g. for loyalty); specific qualities; combinations of goods and services with conditional pricing; freight differentials; contract fulfillment timing; payment terms; or deliberate constraints such as market share limits.

Practical example

A Government owned agency in Australia (Vic Forests) regularly invites a number of saw mills to bid for native timber supply (forestauctions.com). The Vic Forests Private Electronic Market allows saw mills to specify exactly the volume they require; the quality; species; payment terms etc. Saw mills can also create conditional bids such as "if I win x and y I am willing to pay more". Further; market participants are factored e.g. based on transport costs. In effect; a saw mill that is further away will have to bid more than one that is close by. Similarly; a bid for one particular lot may be the highest but a bundle created by another participant may still win based on higher total revenue. Participants receive real-time feedback on where they stand with their current bids and are able to respond. Compared to the traditional sealed bid tender approach; Vic Forests' PEM resulted in a substantial revenue increase

Relevance

The overall effect of a well designed Private Electronic Market is what is described as allocative efficiency or in simple terms: a win-win for the seller (who maximizes revenue) and buyers (acquiring exactly what is of highest value to them). PEMs are based on game theory and combinatorial auction theory.

9.5 ELECTRONIC BUSINESS PROCESS OPTIMIZATION

Organizations used to blame their ERP systems when implementations didn't produce costs savings or measurable boosts in productivity. Now; most realize that implementing technology alone isn't enough – that improving processes is also critical to success. However; you don't have to endure the old and radical approach of process re-engineering to get there. Instead; you can significantly improve your ROI through business process optimization (BPO) – a more focused; less painful; and much more affordable approach. BPO eliminates bottlenecks and redundancies; enabling you to take full advantage of your ERP technology. Cherry Road has helped organizations streamline specific processes in order to recruit faster and better; reduce expenses; close the books faster; focus collections; streamline payroll; and much more. Consider these impressive results of specific BPO efforts:

Eliminating unnecessary approvals. One organization had multiple approval levels that kept it from streamlining workflow and kept employees from using the software's self-service capabilities. Standardizing the approval levels enabled the organization to use self service; cut transaction cycle time by more than 50 percent; and eliminate outdated policies.

Streamlining customizations and eliminating shadow systems. A large public sector organization had over 150 customizations just in the Financials applications. By analyzing these customizations – and the business needs behind them – our BPO effort found that more than 50 percent could be eliminated through redesigned; streamlined processes and better utilization of existing technology. In addition; we discovered that eliminating multiple shadow systems would drive savings of more than \$225; 000 annually.

Focusing on significant purchases. At a large financial services company; the Accounts Payable and Purchasing department spent the majority of its time focused on low-dollar; low-value activities like entering redundant data and handling minor transactions. By converting targeted transactions to monthly; electronic invoices or the Procurement Card program; they increased electronic invoicing by 255 percent. Improvements such as these typically eliminate 25 percent or more of the manual transactions and allow key resources to pursue more valuable activities like strategic sourcing and reverse auctions.

In the past; ignoring process opportunities and specific measurement programs often initiated a destructive cycle; as organizations disappointed with their project results blamed the technology; and then were reluctant to further invest in the system and related processes. This drove them to inadequately fund and scope upgrades; which crippled their ability to leverage the technology and led to even further disappointment.

9.6 BUSINESS OBJECTS IN SCM

The traditional objective of SCM is to minimize total supply chain cost to meet fixed and given demand; where the total cost is composed of raw material and other acquisition costs; inbound transportation costs; facility investment costs; direct and indirect manufacturing costs; direct and indirect distribution center costs; inventory holding costs; interfacility transportation costs; and outbound transportation costs. Total cost minimization is an inappropriate and timid objective; while firms should seek to maximize net revenue which is gross revenues minus total cost. Our objection to focusing only on cost control when using an optimization model for strategic or tactical planning is that the model provides insights into product costs that should be exploited to increase net revenues by suitable adjustments in sales. Integration of supply chain and demand management : difficult; but interesting to most companies; since supply chain and demand management decisions are closely linked to corporate financial decisions; especially when planning the firm's strategy.

Supply Chain Modeling: Incorporating Concepts from Several Management Disciplines

Good models and modeling systems provide the manager with a framework for representing concepts from various management disciplines; especially those concerned with improving supply chain management using data and analysis.

Disciplines from the perspective of supply chain management and models:

- Strategy formation and the theory of the firm
- Logistics; production; and inventory management
- Management accounting
- Demand forecasting and marketing science
- Operations research

Strategy Formation and the Theory of the Firm

A number of important and useful concepts for analyzing supply chains from a strategic; top-down perspective are available from the field of strategy formation

Value Chain

Every firm = a collection of activities (design; produce; market; deliver; and support its product.) A firm's value chain = a reflection of its history; its strategy; its approach to implementing its strategy; and the underlying economics of the activities themselves. The supply chain is a special case of the value chain. The value chain has been called the value added chain = adding value to its products or services at each stage in the chain. Competitive advantage will accrue to those companies that control value chain costs and/or differentiate their products. Value chain being composed of the following activities:

Support Activities:

- Firm Infrastructure
- Human Resource Management; Procurement
- Technology Development
- IT
- SCM. a larger portion of overall value chain activity

Primary Activities:

- Inbound Logistics
- Operations
- Outbound Logistics
- Marketing& Sales
- Service. a smaller portion.
- Controlling these costs
- adding value to individual activities
- Is crucial to achieving and maintaining competitive advantages measured by the firm's short- term long-term profits.

Linkages can lead to competitive advantage in two ways: optimization and coordination. : A firm must optimize such linkages reflecting its strategy in order to achieve competitive advantage. The ability to coordinate linkages often reduces costs or enhances differentiation. To be competitive; the firm can and must use data; models; and modeling systems to optimize and coordinate its value chain. Modeling systems can help identify cost-effective plans that sustain the company's superior level of customer service; quality; or some other differentiating factor.

The Theory of the Firm.

The supply chain concept is; to a large extent; a managerial interpretation of well-established microeconomic models and theories. Microeconomics is concerned with the construction and interpretation of models that describe in mathematical terms how firms operate; expand; merge; and contract according to economic principles. It is also concerned with models describing why and how consumers demand a firm's products and how firms within an industry compete.

Microeconomic models vs. optimization models:

Common view: Microeconomic models are highly relevant to the optimization models because both types of models address supply chain decisions facing the firm.

Different view: A major difference is their intention rather than their mathematical form.

Optimization models are empirical

Microeconomic models are intended to provide qualitative insights into the economics of the firm and competition among firms in an industry. Subtle issues arise when the reality of a supply chain problem is not perfectly suited to microeconomic theory: ex) a company that establishes a policy restricting the acquisition of a critical raw material to at least two vendors with no vendor providing less than 20% of the total volume. Management has imposed the

policy despite the fact that a particular vendor is offering to sell the raw material in unlimited quantities at significantly lower cost than other vendors.

Externality = a policy that means it is a planning factor that is not immediately justifiable by economic arguments

This is not practical. By contrast; optimization models can readily incorporate policy constraints. Moreover; they can provide information regarding the cost of imposing such constraints. That is; optimization models can perform policy analyses pragmatically and expeditiously. Microeconomic theory is based on felicitous assumptions about the underlying structures of mathematical models that permit well-behaved results to be derived describing the firm's operations. Unfortunately; data from the real world do not always support these assumptions (ex. Situations where fixed costs and economies of scale are considered). Logistics; production; and inventory management. Logistics; production; and inventory management are concerned with managing supply chain operations from the bottom up. In academic journals over the years have approached these problems in a theoretical manner. The situation has changed significantly in recent years as companies have begun to actively seek analytic tools to help them improve operations.

Logistics

Logistics is concerned with managing transportation; warehousing; and inventory stocking activities. : Transportation planning involves complex decisions about transportation nodes; carriers; vehicle scheduling and routing; and many other activities. Optimization models are used to seek faster and more powerful methods. Importance of integrated supply chain management: According to Stock and Lambert The foundation of the integrated logistics management concept is total cost analysis (minimizing the cost of transportation; warehousing; inventory; order processing and information systems; and lot quantity cost; while achieving a desired customer service level). allude to the indirect costs; the need to balance nonmonetary objectives and manufacturing costs The overall supply chain strategy of the consumer products company maybe significantly suboptimal. Although the logistics managers may seek to minimize total logistics costs; larger issues of integrating strategies far logistics; manufacturing; and even marketing are not addressed. E.g In the typical consumer products company; marketing managers plan marketing strategies for sales in the next year. Manufacturing managers plan production strategies based on the marketing strategies. Based on these marketing and production strategies; logistics managers plan transportation; warehousing; and inventory strategies.

Production Management.

Production planning activities:

- Process manufacturing: involves expensive capital equipment that is run continuously with infrequent changeovers. e.g.) oil refineries or breweries
- Discrete parts manufacturing: involves multiple-stage product lines with setups at each stage for intermediate products. Buffer stocks are maintained between stages to promote continuous production. e.g.) automobiles and their components or printed circuit boards.
- Job-shop scheduling: involves facilities with capital equipment that is used sporadically as individual jobs with different profiles of tasks to be completed are

undertaken. e.g.) repair operations on aircraft engines or finishing operations in a paper mill;

At the operational level; optimization models and modeling systems for production scheduling must be customized to the peculiarities of the production environment; (particularly those associated with the timing of setups; changeovers; production run lengths; and so on.) Such models are needed to provide master schedule information to MRP systems

At the tactical and strategic planning levels; the various classes of production planning problems can often be accurately modeled by general-purpose models and modeling systems that address multistage and multiperiod planning decisions. Still; intertemporal coordination of strategic; tactical; and operational production plans is very important. Production planning and scheduling models can play an important; role in implementing new qualitative methods for improving production; such as lean production or agile manufacturing. : Lean production refers to the reduction of waste in the production line; including reduction of inventory; shortening of setup times; and improvement in quality. Agile manufacturing refers to production environments that are more agile than in the past with respect to production customization and reengineering; product changeovers; changes in customer order and so on.

Inventory Management.

Inventory types: raw materials; part work-in-process; or finished products for a variety of reasons. Reason for inventory carrying: to hedge against the uncertainties of supply and demand; to take advantage economies of scale; or to build up reserves for seasonal demands or promotional sales. By reducing uncertainty; reduce inventory. Inventory management problems are characterized by holding costs; shortage costs; and demand distributions for products specified at a detailed stock keeping unit (SKU) level. Models for optimizing inventory policies for individual items use arguments and methods from statistics and applied probability theory.

We study models for inventory management with an emphasis on approaches for integrating inventory decisions with other supply chain decisions. This perspective is crucial because holding costs are only one element of total supply chain cost.

Management Accounting

The process of identifying; measuring; reporting and analyzing information about the economic events of organizations.

Operations research (OR)

OR has been called the science and technology of decision making: The scientific component is concerned with ideas and processes for modeling decision problems by determining the objectives and the constraints under. The technological component is concerned with software and hardware tools for collecting and communicating data; organizing these data; using them to generate and optimize models; and reporting results. OR models and methods have demonstrated their relevance in a wide range of applications. This generality creates opportunities and challenges. A major opportunity is that many supply chain problems can be analyzed using optimization models and algorithms. A major challenge in any specific situation; therefore; is to precisely define an appropriate model. Advent of O.R. Operations research was one of the disciplines that sprang to life at the start of the information revolution in the mid 1940s. Between 1970 and 1985; information technology to support practical implementations of OR models lagged behind the theory. Often the data required for a realistic model were not readily available or could not be acquired in a timely manner.

Without opportunities to work on real world problems; academics and other researchers kept busy by extending the theory despite the shortcomings of the past; the future of operations research is bright. The growing interest by managers in SCM has opened up important opportunities for model building and analysis. OR has become an important element in the methodologies of information technology.

Innovations in Information Technology: Requiring and Supporting Supply Chain Modeling

Recent developments in ERP systems provide the reality of transactional databases that are comprehensive and easily accessed. Such databases are the foundation from which we can construct and apply supply chain modeling systems. To emphasize the need for modeling systems; we highlight two serious problem involving data currently faced by managers:

Data Problem One: There is an overabundance of transactional data for the purposes of managerial decision making. These problems has become more acute in recent years due to the advent of ERP; point-of-sales systems; and other systems focused on streamlining the collection and communication of transactional data.

Data Problem Two: Managers do not know what the data imply about how to integrate their activities with the supply chain activities of other managers in the company and with those of company's vendors and customers. Integrated supply chain planning will not occur magically once systems far managing transactional data are in place.

Solutions to these problems are the major theme.

The solution has two aspects. :

Technological Solution: Develop and deploy modeling systems for analyzing strategic; tactical; and operational decisions affecting the company's supply chain. The technological solution involves the construction and application of modeling systems for all levels of planning - strategic; tactical; and operational. Supply chain decision databases are consistent and coherent. Given the capabilities of today's software and hardware; achieving a technological solution to the analytical problems of interpreting transactional data is not a barrier. Instead; the barrier is in realizing following:

Organizational Solution: Redesign company processes and revise managerial incentive schemes to promote and facilitate competitive strategies for supply chain management based on data; models; and modeling systems. The company must commit to routine application of modeling tools where the cycle time for their use depends on the type of analysis they perform. Strategic planning may be performed once a year; tactical planning once a quarter or once a month; and operational planning once a week or once a day. The company must revise its managerial incentive schemes so that plant managers; distribution managers; and other middle and upper-middle managers are encouraged to make decisions and pursue plans that serve to globally optimize the company's supply chain.

Organizational Adaptation to Integrated Supply Chain Management and Modeling

Improvements in supply chain management can be realized when managers use modeling systems to achieve true integrated planning. Conveying the form and function of such systems is the goal. Once a company's management understands them; it can begin to adapt its business processes to allow insights provided by modeling systems to be exploited. Most companies are undergoing radical change due to a host of interconnected factors. It is difficult to separate cause and effect from among the following: Globalization; E-commerce; Enterprise resource planning systems; Business process reengineering; Organizational

learning and change management; integrated supply chain management. A great deal has already been written about these phenomena; and even more will be written in the future. Our contention is that considerable discipline may be imposed on supply chain management by creating modeling systems; implementing the supporting decision databases; and then adapting the organization to exploit them.

9.7 E commerce

Electronic Commerce; commonly known as (electronic marketing) e-commerce or eCommerce; consists of the buying and selling of products or services over electronic systems such as the Internet and other computer networks. The amount of trade conducted electronically has grown extraordinarily with widespread Internet usage. The use of commerce is conducted in this way; spurring and drawing on innovations in electronic funds transfer; supply chain management; Internet marketing; online transaction processing; electronic data interchange (EDI); inventory management systems; and automated data collection systems. Modern electronic commerce typically uses the World Wide Web at least at some point in the transaction's lifecycle; although it can encompass a wider range of technologies such as e-mail as well. A large percentage of electronic commerce is conducted entirely electronically for virtual items such as access to premium content on a website; but most electronic commerce involves the transportation of physical items in some way. Online retailers are sometimes known as e-tailers and online retail is sometimes known as e-tail. Almost all big retailers have electronic commerce presence on the World Wide Web. Electronic commerce that is conducted between businesses is referred to as business-to-business or B2B. B2B can be open to all interested parties (e.g. commodity exchange) or limited to specific; pre-qualified participants (private electronic market). Electronic commerce that is conducted between businesses and consumers; on the other hand; is referred to as business-to-consumer or B2C. This is the type of electronic commerce conducted by companies such as Amazon.com. Electronic commerce is generally considered to be the sales aspect of e-business. It also consists of the exchange of data to facilitate the financing and payment aspects of the business transactions

History and Early development

The meaning of electronic commerce has changed over the last 30 years. Originally; electronic commerce meant the facilitation of commercial transactions electronically; using technology such as Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT). These were both introduced in the late 1970s; allowing businesses to send commercial documents like purchase orders or invoices electronically. The growth and acceptance of credit cards; automated teller machines (ATM) and telephone banking in the 1980s were also forms of electronic commerce. Another form of e-commerce was the airline reservation system typified by Sabre in the USA and Travicom in the UK. Online shopping was invented in the UK in 1979 by Michael Aldrich¹ and during the 1980s it was used extensively particularly by auto manufacturers such as Ford; Peugeot-Talbot; General Motors and Nissan. From the 1990s onwards; electronic commerce would additionally include enterprise resource planning systems (ERP); data mining and data warehousing.

The earliest example of many-to-many electronic commerce in physical goods was the Boston Computer Exchange; a marketplace for used computers launched in 1982. The first online information marketplace; including online consulting; was likely the American Information Exchange; another pre-Internet online system introduced in 1991. Until 1991; commercial enterprise on the Internet was strictly prohibited Although the Internet became

popular worldwide around 1994; it took about five years to introduce security protocols and DSL allowing continual connection to the Internet. And by the end of 2000; a lot of European and American business companies offered their services through the World Wide Web. Since then people began to associate a word "ecommerce" with the ability of purchasing various goods through the Internet using secure protocols and electronic payment services.

Timeline

- **1990:** Tim Berners-Lee writes the first web browser; WorldWideWeb; using a NeXT computer.
- **1992:** J.H. Snider and Terra Ziporyn publish Future Shop: How New Technologies Will Change the Way We Shop and What We Buy. St. Martin's Press. ISBN 0312063598.
- **1994:** Netscape releases the Navigator browser in October under the code name Mozilla. Pizza Hut offers pizza ordering on its Web page. The first online bank opens. Attempts to offer flower delivery and magazine subscriptions online. Adult materials also becomes commercially available; as do cars and bikes. Netscape 1.0 is introduced in late 1994 SSL encryption that made transactions secure.
- **1995:** Jeff Bezos launches Amazon.com and the first commercial-free 24 hour; internet-only radio stations; Radio HK and Net Radio start broadcasting. Dell and Cisco begin to aggressively use Internet for commercial transactions. eBay is founded by computer programmer Pierre Omidyar as AuctionWeb.
- **1998:** Electronic postal stamps can be purchased and downloaded for printing from the Web.
- **1999:** Business.com sold for US \$7.5 million to eCompanies; which was purchased in 1997 for US \$149; 000. The peer-to-peer filesharing software Napster launches.
- **2000:** The dot-com bust.
- **2002:** eBay acquires PayPal for \$1.5 billion. Niche retail companies CSN Stores and NetShops are founded with the concept of selling products through several targeted domains; rather than a central portal.
- **2003:** Amazon.com posts first yearly profit.
- **2007:** Business.com acquired by R.H. Donnelley for \$345 million
- **2008:** US eCommerce and Online Retail sales projected to reach \$204 billion; an increase of 17 percent over 2007^[4].

Business applications

Some common applications related to electronic commerce are the following:

- Email
- Enterprise content management
- Instant messaging
- Newsgroups
- Online shopping and order tracking
- Online banking
- Online office suites
- Domestic and international payment systems
- Shopping cart software
- Teleconferencing
- Electronic tickets

Government regulations

In the United States; some electronic commerce activities are regulated by the Federal Trade Commission (FTC). These activities include the use of commercial e-mails; online advertising and consumer privacy. The CAN-SPAM Act of 2003 establishes national standards for direct marketing over e-mail. The Federal Trade Commission Act regulates all forms of advertising; including online advertising; and states that advertising must be truthful and non-deceptive. Using its authority under Section 5 of the FTC Act; which prohibits unfair or deceptive practices; the FTC has brought a number of cases to enforce the promises in corporate privacy statements; including promises about the security of consumers' personal information. As result; any corporate privacy policy related to e-commerce activity may be subject to enforcement by the FTC. The Ryan Haight Online Pharmacy Consumer Protection Act of 2008; which came into law in 2008; amends the Controlled Substances Act to address online pharmacies.

Forms

Contemporary electronic commerce involves everything from ordering "digital" content for immediate online consumption; to ordering conventional goods and services; to "meta" services to facilitate other types of electronic commerce. On the consumer level; electronic commerce is mostly conducted on the World Wide Web. An individual can go online to purchase anything from books or groceries; to expensive items like real estate. Another example would be online banking; i.e. online bill payments; buying stocks; transferring funds from one account to another; and initiating wire payment to another country. All of these activities can be done with a few strokes of the keyboard. On the institutional level; big corporations and financial institutions use the internet to exchange financial data to facilitate domestic and international business. Data integrity and security are very hot and pressing issues for electronic commerce today.

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Rai Technology University

ENGINEERING MINDS

Rai Technology University Campus

Dhodballapur Nelmangala Road, SH -74, Off Highway 207, Dhodballapur Taluk, Bangalore - 561204

E-mail: info@raitechuniversity.in | Web: www.raitechuniversity.in