

Enterprise Resource Planning

Introduction

In today's fiercely competitive business environment, there has to be much greater interaction between the customers and manufacturers. This means, 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.

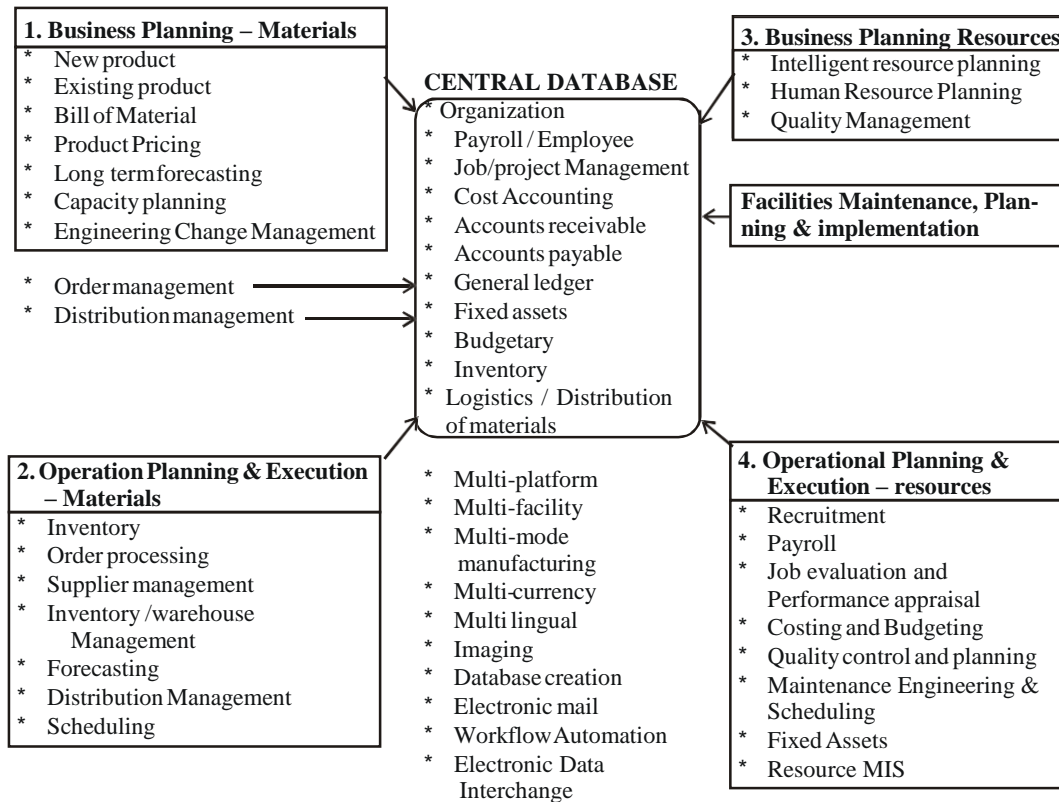
Also, it requires a strong integration across the value chain. Hence, there is a need for a standard software package, which equips the enterprise with the necessary capabilities to integrate and synchronize the isolated functions into streamlined business processes in order to gain a competitive edge in the volatile business environment. Most organizations across the world have realized that in a rapidly changing environment, it is impossible to create and maintain a custom-designed software package, which will cater to all their requirements, and be up-to-date. Realizing the requirement of user organizations, some of the leading software companies have designed Enterprise Resource Planning software, which offers an integrated software solution to all the functions of an organization.

Enterprise Resource Planning (ERP) is the latest high-end solution, information technology has lent to business applications. The ERP solutions seek to streamline and integrate operation processes and information flows in the company to synergies the resources of an organization namely men, material, money and machine through information. Initially implementation of an ERP package was possible only for large multi nationals and infrastructure companies due to high cost. Today, many companies in India have gone in for implementation of ERP. It is expected that in the near future, 60 per cent of the companies will be implementing one or the other ERP packages since this will become a must for gaining competitive advantage.

ERP - Definition

An Enterprise resource planning system is a fully integrated business management system covering functional areas of an enterprise like Logistics, Production, Finance, Accounting and Human Resources. It organizes and integrates operation processes and information flows to make optimum use of resources such as men, material, money and machine. ERP is a global, tightly integrated closed loop business solution package and is multifaceted.

In simple words, Enterprise resource planning promises one database, one application, and one user interface for the entire enterprise, where once disparate systems ruled manufacturing, distribution, finance and sales. Taking information from every function it is a tool that assists employees and manager's plan, monitor and control the entire business. A modern ERP system enhances a manufacturer ability to accurately schedule production, fully utilize capacity, reduce inventory, and meet promised shipping dates.



General Model of ERP

Evolution of ERP: In the ever-growing business environment, the following demands are placed on the industry:

- Aggressive cost control initiatives
- Need to analyse costs/revenues on a product or customer basis
- Flexibility to respond to changing business requirements
- More informed management decision making
- Changes in ways of doing business.

The difficulty in getting accurate data, timely information and proper interface of complex business functions have been identified as the hurdles in the growth of any business. Time and again, depending on the velocity of the growing business needs, one or the other applications and planning systems have been introduced into the business world for crossing these hurdles and achieving growth. They are:

- Management Information Systems (MIS)
- Integrated Information Systems (IIS)
- Executive Information Systems (EIS)
- Corporate Information Systems (CIS)
- Enterprise Wide Systems (EWS)
- Material Resource Planning (MRP)
- Manufacturing Resource Planning (MRP II)
- Money Resource Planning (MRP III)

ERP has evolved from the system known as MRPII (Manufacturing Requirement planning) system with the integration of information between Vendor, Customer and Manufacturer using networks such as LAN, WAN and INTERNET etc.

MRPII system again evolved from MRP (Material Requirement Planning) system. MRP is a technique that explodes the end product demands obtained from Master Production Schedule (MPS) for the given product structure which is taken from Bill of Material (BOM) into a schedule of planned orders considering the inventory in hand. MRP system processes this data and provides valuable guidelines to the scheduler in the form of work orders to plan the Production Schedule. The net requirements for each item are computed and replenishment orders are created and planned for release.

MRP system provides reports such as MRP reports, Planned Order releases for Purchase orders, Work Orders, Reschedule open orders report, Firm planned reports, Shortages report etc. MRP is considered as an important planning and manufacturing control activity for materials.

MRPII is a method for planning of all the resources of the manufacturing company. It involves all operational and financial planning and has simulation capabilities to answer 'WHAT IF' questions. It links different functional areas like Business Planning, Production Planning, MPS, MRP, Capacity Requirement Planning and Execution system for capacity and priority. Output from these systems is integrated with Financial Reports such as Business Plan, Purchase, Shipping, Budget, and Inventory for production etc.

MRPII has a number of drawbacks. The main problem is that it has not been able to effectively integrate the different functional areas to share the resources effectively.

ERP as the name indicates is the integration of Enterprise Resources.

The ERP package works on the fundamental premise that the whole being greater than the sum of its parts. It provides an integrated information storehouse where information needs to be stored only once and can be further processed and reported to anyone in the value chain. The traditional application systems, which the organizations generally employ, treat each transaction separately. They are built around the strong boundaries of specific functions that a specific application is meant to cater. For an ERP, it stops treating these transactions separately as stand-alone activities and considers them to be the part of the inter-linked processes that make up the business.

Almost all the typical application systems are nothing but the data manipulation tools. They store data, process them and present them in the appropriate form whenever requested by the user. In this process, the only problem is that there is no link between the application systems being used by different departments. An ERP system also does the same thing, but in a different manner.

There are hundreds of such data tables, which store data generated as a result of diverse transactions, but they are not confined to any departmental or functional boundaries, but rather integrated to be used by multiple users, for multiple purposes and at multiple places.

Enabling Technologies: It is not possible to think of an ERP system without sophisticated information technology infrastructure. It is said that, the earlier ERP systems were built only to work with huge mainframe computers. The new era of PC, advent of client server technology and scalable Relational Database Management Systems (RDBMS), all have contributed for the ease of deployment of ERP systems. Most of the ERP systems exploit the power of Three Tier Client Server Architecture. In a client server environment, the server stores the data, maintaining its integrity and consistency and processes the requests of the user from the client desktops. The load of data processing and application logic is divided between the server and the client. The three-tier architecture adds a middle stratum, embodying all application logic and the business rules that are not part of the application, enforcing appropriate validation checks.

It is assumed that the companies implementing ERP solutions have multiple locations of operation and control. Hence, the online data transfer has to be done across locations. To facilitate these transactions, the other important enabling technologies for ERP systems are Workflow, Work group, Group Ware, Electronic Data Interchange (EDI), Internet, Intranet, Data warehousing, etc.

ERP Characteristics: An ERP system is not only the integration of various organization processes. Any system has to possess few key characteristics to qualify for a true ERP solution. These features are:

Flexibility: An ERP system should be flexible to respond to the changing needs of an enterprise. The client server technology enables ERP to run across various database back ends through Open Database Connectivity (ODBC).

Modular & Open: ERP system has to have open system architecture. This

means that any module can be interfaced or detached whenever required without affecting the other modules. It should support multiple hardware platforms for the companies having heterogeneous collection of systems. It must support some third party add-ons also.

Comprehensive: It should be able to support variety of organizational functions and must be suitable for a wide range of business organizations.

Beyond The Company: It should not be confined to the organizational boundaries, rather support the on-line connectivity to the other business entities of the organization.

Best Business Practices: It must have a collection of the best business processes applicable worldwide. An ERP package imposes its own logic on a company's strategy, culture and organization.

Features of ERP: Some of the major features of ERP and what ERP can do for the business system are:

- ERP provides multi-platform, multi-facility, multi-mode manufacturing, multi-currency, multi-lingual facilities.
- It supports strategic and business planning activities, operational planning and execution activities, creation of Materials and Resources. All these functions are effectively integrated for flow and update of information immediately upon entry of any information.
- Has end to end Supply Chain Management to optimize the overall Demand and Supply Data.
- 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 activities and increases customer service, thereby augmenting the corporate image.
- ERP bridges the information gap across organizations.
- ERP provides complete integration of systems not only across departments but also across companies under the same management.
- ERP is the solution for better project management.
- ERP allows automatic introduction of the latest technologies like Electronic Fund Transfer (EFT), Electronic Data Interchange (EDI), Internet, Intranet, Video conferencing, E-Commerce etc.
- ERP eliminates most business problems like material shortages, productivity enhancements, customer service, cash management, inventory problems, quality problems, prompt delivery etc.
- ERP provides intelligent business tools like decision support system, Executive information system, Data mining and easy working systems to enable better decisions.

Why Companies Undertake ERP

- **Integrate financial information:** As the CEO tries to understand the company's overall performance, he may find many different versions of the truth. Finance has its own set of revenue numbers, sales has another version, and the different business units may each have their own version of how much they contributed to revenue. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.
- **Integrate customer order information:** ERP systems can become the place where the customer order lives from the time a customer service representative receives it until the loading dock ships the merchandise and finance sends an invoice. By having this information in one software system, rather than scattered among many different systems that can't communicate with one another, companies can keep track of orders more easily, and coordinate manufacturing, inventory and shipping among many different locations simultaneously.
- **Standardize and speed up manufacturing processes:** Manufacturing companies - especially those with an appetite for mergers and acquisitions—often find that multiple business units across the company make the same transaction/ recording/ report using different methods and computer systems. ERP systems come with standard methods for automating some of the steps of a manufacturing process. Standardizing those processes and using a single, integrated computer system can save time, increase productivity and reduce headcount.
- **Reduce Inventory:** ERP helps the manufacturing process flow more smoothly, and it improves visibility of the order fulfilment process inside the company. That can lead to reduced inventories of the materials used to make products (work-in-progress inventory), and it can help users better plan deliveries to customers, reducing the finished good inventory at the warehouses and shipping docks. To really improve the flow of your supply chain, you need supply chain software, but ERP helps too.
- **Standardize HR information:** Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employees' time and communicating with them about benefits and services. ERP can fix that.

Benefits of ERP: The benefits accruing to any business enterprise by implementing an ERP package are unlimited. According to companies like Nike, DHL, Tektronix, Fujitsu, Millipore, and Sun Microsystems, the following are some of the benefits they achieved by implementing the ERP packages:

- Gives Accounts Payable personnel increased control of invoicing and payment processing and thereby boosting their productivity and eliminating their reliance on computer personnel for these operations.
- Reduce paper documents by providing on-line formats for quickly entering and retrieving information.
- Improves timeliness of information by permitting posting daily instead of monthly.
- Greater accuracy of information with detailed content, better presentation, satisfactory for the auditors.

- Improved cost control.
- Faster response and follow-up on customers.
- More efficient cash collection, say, material reduction in delay in payments by customers.
- Better monitoring and quicker resolution of queries.
- Enables quick response to change in business operations and market conditions.
- Helps to achieve competitive advantage by improving its business process.
- Improves supply-demand linkage with remote locations and branches in different countries.
- Provides a unified customer database usable by all applications.
- Improves International operations by supporting a variety of tax structures, invoicing schemes, multiple currencies, multiple period accounting and languages.
- Improves information access and management throughout the enterprise.
- Provides solution for problems like Y2K and Single Monetary Unit (SMU) or Euro Currency.

Business Process Reengineering (BPR)

ERP is a result of a modern Enterprise's concept of how the Information System is to be configured to the challenging environments of new business opportunities. However merely putting in place an information system is not enough. Every company that intends to implement ERP has to reengineer its processes in one form or the other. This process is known as Business Process Reengineering (BPR).

Some Typical processes with descriptions

Process	Description
Forecasting	Shows sales, Fund Flows etc. over a long period of time say next two years
Fund management	The necessity of funds and the way to raise these funds. Uncertainty and Risk factors to be considered. Simulation with 'What if' type analysis
Price Planning	Determines the price at which products are offered. Involves application of technology to pricing support such as commercial database services. Also feedback and sensitivity analysis
Budget Allocation	Using computerized algorithms to estimate desirable mix of funds allocated to various functions
Material Requirement Planning	Process of making new products from raw materials and include production scheduling, requirement planning. Also activities for monitoring and planning of actual production.
Quality control	Takes care of activities to ensure that the products are of desired quality.

What is Business Process Reengineering?

The most accepted and formal definition for BPR, given by Hammer and Champy is reproduced here: "BPR is the fundamental rethinking and radical redesign of processes to achieve dramatic improvement, in critical, contemporary measures of performance such as cost, quality, service and speed." This has a few important key words, which need clear understanding. Here, dramatic achievement means to achieve 80% or 90% reduction (in say, delivery time, work in progress or rejection rate) and not just 5%, 10% reduction. This is possible only by making major improvements and breakthroughs, and not small incremental changes (like those in Total Quality Management (TQM) or suggestion schemes).

Radical redesign means BPR is reinventing and not enhancing or improving. In a nutshell, a "cleanslate approach" of BPR says that "Whatever you were doing in the past is all wrong", do not get biased by it or reassemble your new system to redesign it afresh. Fundamental rethinking means asking the question "why do you do what you do", thereby eliminating business process altogether if it does not add any value to the customer. There is no point in simplifying or automating a business process which does not add any value to the customer. A classic example is that of asking for an invoice from the supplier for payment when the company has already received and accepted a particular quantity of materials physically and at an agreed price. Receiving, processing, and filing of invoices add no value to customer and makes only the supplier unhappy for delayed payments. Thus, BPR aims at major transformation of the business processes to achieve dramatic improvement. Here, the business objectives of the Enterprise (e.g., profits, customer-satisfaction through optimal cost, quality, deliveries etc.) are achieved by "transformation" of the business processes which may, or may not, require the use of Information Technology (IT).

Business Engineering: Business Engineering has come out of merging of two concepts namely Information Technology and Business Process Reengineering.

Business Engineering is the rethinking of Business Processes to improve speed, quality and output of materials or services. The emphasis of business engineering is the concept of Process Oriented Business Solutions enhanced by the Client-Server computing in Information Technology. The main point in business engineering is the efficient redesigning of company's value added chains. Value added chains are a series of connected steps running through a business which when efficiently completed add value to enterprise and customers. Information technology helps to develop business models, which assist in redesigning of business processes.

Business Engineering is the method of development of business processes according to changing requirements.

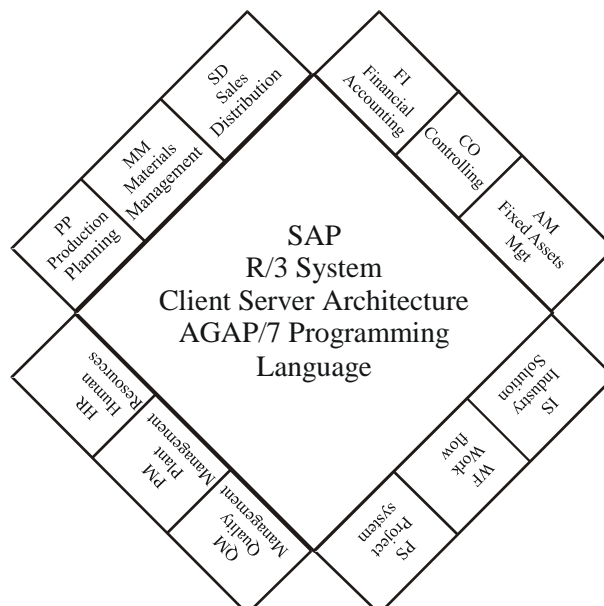
Business Management: ERP merges very well with common business management issues like Business Process Reengineering, total quality management, mass customization, service orientation, and virtual corporation etc. The basic objective of implementing an ERP program is to put in place the applications and infrastructure architecture that effectively and completely support the Enterprise's business plan and business processes. When an enterprise does not have optimized business processes, the ERP implementation needs a process reengineering which enable to capture knowledge of the experts into the system thus gaining considerable benefits in productivity.

The first step in implementation of ERP is the development of a Business process model showing business process as one large system and the interconnection and sequence of business subsystems or processes that drive it.

Business Modelling: The approach of ERP implementation is carried out using MIS planning. First of all, a model consisting of core business processes or activities of the business is to be developed. This is the diagrammatic representation of Business as a large system with interconnection of subsystems or processes that it comprises of. A typical layout is shown in Figure 2. The planning to arrive at the process is from top down whereas the MIS implementation is done from bottom up.

We can model Business as a system making the processes managing their facilities and material as their resources. Information is treated as a vital resource managing other resources.

- Features**
- Business Processes
 - Comprehensive functionality
 - Designed for all types of business
 - Multi-national
 - Business engineering
 - Client server architecture
 - Open System



SAP Modules

The Data model consists of two elements.

1. A diagram describing various Business processes and their interactions.
2. An underlying Data Model.

The Reference model can be used by various companies to list their processes and data entities and if required can be subsequently modified to suit specific nature of requirements. Some typical examples are shown in table.

List of some of the entities forming a data model

Entity	Description
External Data	Entities outside the firm that interact with it such as customers, suppliers, competitors and distributors. Also includes predictive data regarding economy and future events in external environment
Internal Data	Data generated from the firm's transaction processing system, internal forecasts or parameters monitored
Funding Data	Includes information on specific sources of funds as well as availability terms and conditions etc.
Marketing Research Data	Mainly consumer related data that can be used to support marketing decisions and result of surveys
Production Data	Shop floor data on production processes including standards and actual of time and material resources concerned
Inventory data	Includes inventories of raw materials goods in progress and finished goods
Personnel data	Mostly includes profiles of employees, their skill levels, experience and past performance on various assignments
Sales forecast	Product-wise and period-wise forecast for various products sold by the company
Payroll data	Data about salaries, tax deductions, statutory forms and other deductions
General Ledger	Integrated transaction data from pay roll and account receivable. It is the basis for budgeting and planning data

The general principles of Business Process Analysis and classification and methodology of looking at a Business Information system to support a series of interlocking subsystems are universally applicable.

Business modeling in practice: Most of the ERP packages available today enable flow charting business processes using standard flow chart symbols. By connecting symbols used for users, events, tasks/functions, and other organizational information, complex business information can be analyzed. For example SAP which is a popular ERP package uses event driven process chain (EPC) methodology to model Business Process. All ERP packages provide standard template for each of the processes so that actual processes can be compared and deviations analyzed. With the help of the business model, it is possible to check as to how well the model fits into the application so that the degree of suitability of the ERP package can be assessed. Business Modeling is the basis by which one can select and implement a suitable ERP package.

ERP Implementation

ERP implementation is a special event in an organization. It brings together in one platform, different business functions, different personalities, procedures, ideologies and philosophies with an aim to pool knowledge base to effectively integrate and bring worthwhile and beneficial changes throughout the organization. Implementation of ERP is a risky effort since it involves considerable amount of time, efforts and valuable resources. Even with all these, the success of an implementation is not guaranteed.

The success of an implementation mainly depends on how closely the implementation consultants, users and vendors work together to achieve the overall objectives of the organization. The implementation consultants have to understand the needs of the users, understand the prevailing business realities and design the business solutions keeping in mind all these factors. It is the users who will be driving the implementation and therefore their active involvement at all stages of implementation is vital for the overall success of implementation.

An ERP package after implementation is expected to improve the flow of information and formalize and standardize all the business processes and workflow that exist in an enterprise. However the workload of users may not decrease. It is worthwhile to remember that ERP is an enabling tool, which makes one do his work better, which naturally need additional efforts.

During the course of implementation the standard package may undergo changes which may be a simple one or a major 'functionality' change. Implementing such changes is known as Customization. The contents of the package are known as modules and the modules are further divided into Components. However, it is always better to satisfy user requirements and overall objectives within the available framework of the existing package because any change in any functional module will have an adverse impact on the functioning of the other modules of the package. Maximum benefit will be available only when the standard package is implemented in totality with an aim for optimized use.

The roles and responsibilities of the employees have to be clearly identified, understood and configured in the system. The employees will have to accept new processes and procedures laid down in the ERP system. At the same time these processes and procedures have to be simple and user friendly.

The ability of the ERP package to manage and support dynamically changing business processes is a critical requirement for the organization and therefore the package should be expandable and adaptable to meet these changes.

A well-managed and implemented ERP package can give a 200 percent return on investment where as a poorly implemented one can yield a return on investment as low as 25 percent.

Key Planning and Implementation decisions

This discussion looks at a number of the key decisions that need to be made when considering an enterprise integration effort.

ERP or Not to ERP?

The decision to implement an ERP should be based on a business case rational. Possible business cases involve technology, process improvements, productivity improvements and strategic consideration.

Technology justifications include the need to address the Y2K problem (in most cases, this is no longer applicable), integrate the functions of disparate systems, replace poor-quality existing systems and merge acquisitions with new capabilities such as web accessibility into the business environment. Process improvements address actions that result in personal and IT cost reductions. Productivity improvements include the need to close the financial cycle and increase the overall production from an enterprise standpoint. Strategic considerations address the ability to implement new strategies not supported by the current software, improve customer service and satisfaction, respond to competitive pressures and enhance customer responsiveness.

➤ **Follow Software's Processes or Customize?**

This key decision may determine the success or failure of the ERP effort. If the organization decides to follow the process of the software, this will result in the organization following best practices within its sector, thereby giving it a chance to improve and standardize their processes. This approach will also facilitate future change to the ERP software. However, this approach can create significant turmoil by requiring employees to change their ways of doing business.

If the organization decides to stick with its current processes and customize the software to fit these processes, the organization obviously will not have to experience the pain and stress associated with changing its process. However, it will be very costly to customize and maintained the software over time. Interfaces modular compatibility needs to be sustained.

➤ **In-house or Outsource?**

Outsourcing has the advantage of allowing the organization to continue to focus on its core mission, avoid a relative substantial financial commitment (in some cases) and minimize the impact on the MIS department. On the downside, providing opportunities to those external to the organization may poorly impact employee morale and may give rise to security issues.

The upsides to an in-house implementation include: a better match between the software and the business, applications optimized for the organization and better maintained security. However, an in-house approach cannot be accomplished if there is a lack of internal expertise and personnel to support such an effort.

➤ **"Big Bang" or Phased Implementation?**

A "big bang" implementation involves having all modules at all locations implemented at the same time. Characteristics of this approach include no need for temporary interfaces, limited requirement to maintain legacy software, cross-module functionality and overall cost if no contingencies arise.

Phased implementation one or a group at a time, often a single location at a time. Benefits of this approach include: a smoothing of resource requirements, an ability to focus on a particular module, availability of existing legacy systems as a fallback, reduced risk, the knowledge gained with each phase and the usefulness of demonstrable working system.

Other implementation approaches include:

The wave approach: This approach involves the application of different waves of change to different business units or regions.

Parallel implementation: This approach involves both ERP and an existing system running together for a period of time. Its attributes include: having a basis of comparison; existing system serves as backup; rewires more computing and human resources ---- more costly; existing system may not be properly maintained during the period; and reengineering not supported by existing systems.

Instant cutovers (flip-the-switch): This approach is lower in cost motivates users to seriously convert to the new system and reduces the need for redundant systems. However, it tends to be risky, stressful to users and requires a high level of contingency planning.

ERP Implementation Methodology

Several steps are involved in the implementation of a typical ERP package. These are:

1. Identifying the needs for implementing an ERP package.
2. Evaluating the 'As Is' situation of the business i.e., to understand the strength and weakness prevailing under the existing circumstances.
3. Deciding the 'Would be' situation for the business i.e., the changes expected after the implementation of ERP.
4. Reengineering the Business Process to achieve the desired results in the existing processes.
5. Evaluating the various available ERP packages to assess suitability.
6. Finalizing of the most suitable ERP package for implementation.
7. Installing the required hardware and networks for the selected ERP package.
8. Finalizing the Implementation consultants who will assist in implementation.
9. Implementing the ERP Package.

Let us examine these steps in detail:

1. **Identifying the Needs:** Some of the basic questions, which are to be answered, are
 - ◆ Why should an ERP package be implemented?
 - ◆ Will it improve profitability?
 - ◆ Can the delivery times of products be reduced?
 - ◆ How does it improve customer satisfaction in terms of quality, cost, delivery time and service?
 - ◆ Will it help to reduce cost of products?
 - ◆ How can it help to increase business turnover and at the same time reduce manpower?
 - ◆ Will it be possible to reengineer the business processes?

Other requirements to satisfy the information management are:

- ◆ Need for quick flow of information between Business partners
- ◆ Effective MIS for quick decision making

- ◆ Elimination of manual working.
 - ◆ High level of integration between various business functions.
2. **Evaluating the “AS IS” situation of the business:** To understand the present situation of the business, the various functions should first be listed. The processes used to achieve business transactions should be listed in detail. The details of business process can be obtained by mapping the processes to the functions:
 - ◆ Total time taken by the business processes.
 - ◆ Number of decision points existing in the present scenario.
 - ◆ Number of Departments/Locations of business processes.
 - ◆ The flow of information and its routing.
 - ◆ The number of reporting points currently available.
 3. **Deciding the desired ‘Would Be’ situation:** The concept of ‘Benchmarking’ is used to see that processes achieved are the best in industry. Benchmarking is done on various factors like cost, quality, service etc. This concept enables to optimize the processes to gain overall benefits.
 4. **Reengineering the business process :** Reengineering of business processes is done to
 - ◆ Reduce the business process cycle time.
 - ◆ To reduce the number of decision points to a minimum.
 - ◆ Streamlining the flow of information and eliminating the unwanted flow of information.
 5. **Evaluation of various ERP packages :** Evaluation of ERP packages are done based on the following criteria:-

Flexibility: It should enable organizations to respond quickly by leveraging changes to their advantage, letting them concentrate on strategically expanding to address new products and markets.

Comprehensive: It should be applicable across all sizes, functions and industries. It should have in-depth features in accounting and controlling, production and materials management, quality management and plant maintenance, sales and distribution, human resources management and plant maintenance, sales and distribution, human resources management, and project management. It should also have information and early warning systems for each function and enterprise-wide business intelligence system for informed decision making at all levels. It should be open and modular.

It should embrace an architecture that supports components or modules, which can be used individually, expandable in stages to meet the specific requirements of the business, including industry specific functionality. It should be technology independent and mesh smoothly with in-house/third-party applications, solutions and services including the Web.

Integrated: It should overcome the limitations of traditional hierarchical and function oriented structures. Functions like sales and materials planning, production planning, warehouse management, financial accounting, and human resources management should be integrated into a workflow of business events and processes across departments and functional areas, enabling knowledge workers to receive the right information and documents at the right time at their desktops across organizational and

geographical boundaries.

Beyond the company: It should support and enable inter-enterprise business processes with customers, suppliers, banks, government and business partners and create complete logistical chains covering the entire route from supply to delivery, across multiple geographies, currencies and country specific business rules.

Best business practices: The software should enable integration of all business operation in an overall system for planning, controlling and monitoring and offer a choice of multiple ready-made business processes including best business practices that reflect the experiences, suggestions and requirements of leading companies across industries. In other words, it should intrinsically have a rich wealth of business and organizational knowledge base.

New technologies: It should incorporate cutting-edge and future-proof technologies such as object orientation into product development and ensure inter-operability with the Internet and other emerging technologies.

It should be Y2K and Euro compliant, group up. Other factors to be considered are:

- ◆ Global presence of package.
 - ◆ Local presence.
 - ◆ Market Targeted by the package.
 - ◆ Price of the package.
 - ◆ Obsolescence of package.
 - ◆ Ease of implementation of package.
 - ◆ Cost of implementation.
 - ◆ Post-implementation support availability.
6. **Finalization of the ERP package:** Finalization of the ERP package can be done by making a comparison of critical factors through a matrix analysis.
 7. **Installation of Hardware and Networks:** This work is carried out in a phased manner depending on the schedule of implementation and need of the hardware components.
 8. **Finalizing the Implementation Consultants :** The factors of selection for consultants are:
 - ◆ Skill set
 - ◆ Industry specific experience.
 - ◆ Cost of hiring the consultant.
 9. **Implementation of ERP package :** The general steps involved in the implementation are
 - ◆ Formation of team.
 - ◆ Preparation of plan.
 - ◆ Mapping of Business Processes to package.
 - ◆ Gap Analysis i.e., deviation of existing processes from standard processes.
 - ◆ Customization.
 - ◆ Development of user-specific reports and transactions.

- ◆ Uploading of Data from existing system.
- ◆ Test runs.
- ◆ User Training.
- ◆ Parallel run.
- ◆ Concurrence from user.
- ◆ Migration to the new system
- ◆ User documentation.
- ◆ Post-implementation support.
- ◆ System monitoring and fine tuning.

Implementation Guidelines for ERP: There are certain general guidelines, which are to be followed before starting the implementation of an ERP package.

1. Understanding the corporate needs and culture of the organization and then adopt the implementation technique to match these factors.
2. Doing a business process redesign exercise prior to starting the implementation.
3. Establishing a good communication network across the organization.
4. Providing a strong and effective leadership so that people down the line are well motivated.
5. Finding an efficient and capable project manager.
6. Creating a balanced team of implementation consultants who can work together as a team.
7. Selecting a good implementation methodology with minimum customization.
8. Training end users.
9. Adapting the new system and making the required changes in the working environment to make effective use of the system in future.

Post - Implementation

To start at the beginning, many post-implementation problems can be traced to wrong expectations and fears. The expectations and fears that corporate management have from an ERP have been greatly published. Of course, some of the blame for this is on the ERP vendors and their pre-implementation sales hype.

A few of the popular expectations are:

- An improvement in processes
- Increased productivity on all fronts.
- Total automation and disbanding of all manual processes.
- Improvement of all key performance indicators.
- Elimination of all manual record keeping.
- Real time information systems available to concerned people on a need

basis.

- Total integration of all operations.

ERP implementation also engenders a host of fears. Some of them are:

- Job redundancy.
- Loss of importance as information is no longer an individual prerogative.
- Change in job profile.
- An organizational fear of loss of proper control and authorization.
- Increased stress caused by greater transparency.
- Individual fear of loss of authority.

Balancing the expectations and fears is a very necessary part of the implementation process.

Risk and Governance Issues in an ERP

Organizations face several new business risks when they migrate to real-time, integrated ERP systems. Those risks include:

- Single point of failure: Since all the organization's data and transaction processing is within one application system and transaction processing is within one application system.
- Structural changes: Significant personnel and organizational structures changes associates with reengineering or redesigning business processes.
- Job role changes: Transition of traditional user's roles to empowered-based roles with much greater access to enterprise information in real time and the point of control shifting from the back-end financial processes to the front-end point of creation.
- Online, real-time: An online, real-time system environment requires a continuous business environment capable of utilizing the new capabilities of the ERP application and responding quickly to any problem requiring of re-entry of information (e.g., if field personnel are unable to transmit orders from handheld terminals, customer service staff may need the skills to enter orders into the ERP system correctly so the production and distribution operations will not be adversely impacted).
- Change management: It is challenging to embrace a tightly integrated environment when different business processes have existed among business units for so long. The level of user acceptance of the system has a significant influence on its success. Users must understand that their actions or inaction have a direct impact upon other users and, therefore, must learn to be more diligent and efficient in the performance of their day-to-day duties. Considerable training is therefore required for what is typically a large number of users.
- Distributed computing experience: Inexperience with implementing and managing distributed computing technology may pose significant challenges.
- Broad system access: Increased remote access by users and outsiders and high integration among application functions allow increased access to application and data.

- **Dependency on external assistance:** Organization accustomed to in-house legacy systems may find they have to rely on external help. Unless such external assistance is properly managed, it could introduce an element of security and resource management risk that may expose the organizations to greater risk.
- **Program interfaces and data conversions:** Extensive interfaces and data conversions from legacy systems and other commercial software are often necessary. The exposures of data integrity, security and capacity requirements for ERP are therefore often much higher.
- **Audit expertise:** Specialist expertise is required to effectively audit and control an ERP environment. The relative complexity of ERP systems has created specialization such that each specialist may know only a relatively small fraction of the entire ERP's functionality in a particular core module, e.g. FI auditors, who are required to audit the entire organization's business processes, have to maintain a good grasp of all the core modules to function effectively.

More recently, some of the additional risks and good governance issues introduced by the e-enabled ERP environments concern:

- **Single sign on:** It reduces the security administration effort associated with administering web-based access to multiple systems, but simultaneously introduces additional risk in that an incorrect assignment of access may result in inappropriate access to multiple systems.
- **Data content quality:** As enterprise applications are opened to external suppliers and customers, the need for integrity in enterprise data becomes paramount.
- **Privacy and confidentiality:** Regularity and governance issues surrounding the increased capture and visibility of personal information, i.e. spending habits.

Why do ERP projects fail so often?

At its simplest level, ERP is a set of best practices for performing the various duties in the departments of your company, including in finance, manufacturing and the warehouse. To get the most from the software, you have to get people inside your company to adopt the work methods outlined in the software. If the people in the different departments that will use ERP don't agree that the work methods embedded in the software are better than the ones they currently use, they will resist using the software or will want IT to change the software to match the ways they currently do things. This is where ERP projects break down.

Political fights erupt over how or even whether the software will be installed. IT gets bogged down in long, expensive customization efforts to modify the ERP software to fit with powerful business barons' wishes. Customizations make the software more unstable and harder to maintain when it finally does come to life. Because ERP covers so much of what a business does, a failure in the software can bring a company to a halt, literally.

The mistake companies make is assuming that changing people's habits will be easier than customizing the software. It's not. Getting people inside your company to use the software to improve the ways they do their jobs is by far the harder challenge. If people are resistant to change, then the ERP project is more likely to fail.

How does ERP Fit with e-commerce?

ERP vendors were not prepared for the onslaught of e-commerce. ERP is complex and not intended for public consumption. It assumes that the only people handling order information will be your employees, who are highly trained and comfortable with the tech jargon embedded in the software. But now customers and suppliers are demanding access to the same information your employees get through the ERP system - things such as order status, inventory levels and invoice reconciliation, except they want to get all this information simply, without all the ERP software jargon, through your website.

E-commerce means IT departments need to build two new channels of access into ERP systems, one for customers (otherwise known as business-to-consumer) and one for suppliers and partners (business-to-business). These two audiences want two different types of information from your ERP system. Consumers want order status and billing information, and suppliers and partners want just about everything else.

The bottom line, however, is those companies with e-commerce ambitions face a lot of hard integration work to make their ERP systems available over the Web. No matter what the details are, solving the difficult problem of integrating ERP and e-commerce requires careful planning, which is the key to getting integration off on the right track.

Life after Implementation

Effective use of ERP is a direct result of steps taken at the time of implementation toward preparing the organization. Change integration has to be necessarily embedded in the task list for any ERP implementation. The main tool for this is the process of communication in all forms-written, oral, workshops, meetings, etc. The process should start quite early, by educating all layers of the management on the particular ERP product, its relevant functionality, limitations and benefits.

Also, at the start of the project, the critical success factors (CSFs) for the company as a whole should be listed. These should be drilled down to CSFs for respective functionalities or departments. From these CSFs, performance measures required to address these CSFs should be culled out. The numeric figures against these performance measures can be classified as the Key performance Indicators (KPIs). The process of firming up the above is usually done through workshops. This has to be completed before the processes to be configured on the ERP are drawn up.

Envisioning the processes to be configured on an ERP is the critical portion to ensure user buy-in during the post-implementation phase. There are various ways this could be done, but what is important is the following should be born in mind. The important end-users should be involved in evolving the process. This should be done keeping the ERP functionality in mind. The KPIs derived from the organizational goals and CSFs should be kept in mind too.

Having evolved the processes while the configuration, construction and implementation are in progress, the organization needs to ready itself for the post-implementation period. Some of the tasks that are to be performed are:

- Develop the new job descriptions and organization structure to suit the post ERP scenario.
- Determine the skill gap between existing jobs and envisioned jobs.

- Assess training requirements, and create and implement a training plan.
- Develop and amend HR, financial and operational policies to suit the future ERP environment
- Develop a plan for workforce logistics adjustment.

Post-implementation blues: While the above checks would take care of most post-implementation blues, certain problems are bound to be encountered. The major task is to monitor the KPIs and take the correct business decisions to improve them. In most Indian organizations, however, these indicators may be non-existent before the implementation. So the immediate task is to set attainable goals. However, this may be unrealistic to be achieved in the first go. The more realistic path would be to have a stretched target to be achieved in phases. Similarly, certain KPIs, though existing in the system, are better monitored and controlled after the ERP system attains maturity.

The other major problem faced is that, more often, for reasons of data transfer or just to be safe, it is decided that the legacy systems run for a period of time. Many a time, the users, having a choice, display resistance to change. The only panacea to this is a strong management resolve to insist on implementation of the system. Even with all the preparations during the implementation, during post-implementation there will be need for course correction many times. It may be because of the following reasons:

- A change in the business environment requires a change in the CSFs, resulting in a new or changed set of KPIs necessitating reconfiguration.
- A review indicates a need for change in some process.
- Vision changes in the ERP and improvements in hardware and communication technology necessitate changes.
- New additions to the business require extra functionality.

The international trend is to outsource the activity of maintenance and up gradation to enable the company to concentrate on its core business activity. Correcting its course can be done by going in for an ERP audit, which is an emerging trend. This audit could be general in nature or very specific. One of the specialized areas is to evaluate the security, authorization and controls. An audit could be triggered either by a perceived inadequacy in terms of return on investment or by a simple desire to improve existing systems.

To conclude, investment in an ERP system is substantial for any organization. While implementation itself is a challenge, the ultimate test is in proper usage. This can be ensured by integrating the business objectives with the ERP functionality during the implementation stage. The limitations of an ERP must also be recognized to get the right expectation. A periodic independent audit would be a proper mechanism for an organization to ensure that it gets the best return on investment.

Sample List of ERP Vendors

This is only a sample listing of ERP Vendors. It may not be comprehensive.

Baan (The Baan Company): In 1994, a Boeing order catapulted Baan into the global ERP vendor league. Baan has held and built on this position with other major orders and a strategy for simultaneously addressing manufacturers from the largest global player to the smallest ERP user. Baan has a sound technology base and a broad functional scope. It offers credible tools for business process analysis linked to implementation of its software, and is launching workflow capabilities to build on this.

Business Planning and Control System (BPCS): BPCS remains the market-leading manufacturing ERP solution in terms of sites. SSA only targets manufacturing companies. It offers good functionality for process, discrete and Kanban manufacturing, but not for project management. It lags in the areas of process-oriented implementation tools and workflow. Some users are concerned by SSA's stated objective of being the object oriented technology leader. SSA has made mistakes, its developments have not run to schedule and it has incurred enormous losses. However, there are signs that it has turned the corner.

Mapics XA (Marcam Corporation): Mapics has been around for a long time, and many view it as a dated, legacy application. Mapics is a suite of 40 modules with 'good enough' functionality. Many users report that Mapics now offers more functionality than they need. It offers robustness, easy implementation and reasonable value for money.

MFG/Pro (QAD): QAD's strength is in repetitive manufacturing. Originally designed to meet the MRP II criteria published by Oliver Wight, MFG/Pro's reputation includes reliable manufacturing functionality and straightforward implementations.

Oracle Applications (Oracle): Oracle's Manufacturing Applications will tempt IT departments, with its vision of Internet-enabled, network-centric computing. As a one-stop shop, it offers the database, tools, implementation, applications and UNIX operating systems running on a wide choice of hardware. Oracle has invested heavily to enhance functionality but production managers should still check that it delivers all the functionality they want.

Prism (Marcam Corporation): Prism is a specialist process manufacturing solution for the AS/400. Its production model, which is akin to a flowchart, handles process industry problems elegantly. Although out dated, it does the job.

R/3 (SAP): In five years, R/3 is the market leader in new sales. Its philosophy of matching business processes to modules is excellent. It offers a wide range of functions and its major shortcomings are yet to be identified. However, it remains complex, because it offers much; few people know how to get the best from it. R/3 will be around for a long time; few people get fired for buying it.

System 21 (JBA): JBA develops and implements System 21. Its software license revenues are small compared to those of other major ERP vendors. Nevertheless, it is a world player. It does not offer leading-edge technology, but does offer a rugged, reliable manufacturing solution.

ERP Software Package

SAP AG has developed an ERP package called SAP. It will be worthwhile to look into this package in detail because SAP looked at the entire business as a single entity when developing this software. Therefore, it is a unique system that supports nearly all areas of business on a global scale.

SAP has a number of Application Modules in the package. Some of these modules are shown in figure given earlier.

1. Financials
2. Controlling
3. Investment Management
4. Treasury
5. Integrated Enterprise Management
6. Sales and Distribution.
7. Production Planning and Control
8. Materials Management
9. Human Resources Management
10. Internet and Intranet

Each of these modules has a number of components, each taking care of specific functionalities of any normal business. Let us examine these modules and the components within them in detail.

Financials: The financial application components cover all aspects of financial accounting.

Financial Accounting: Company-wide control and integration of financial information is essential for strategic decision making. SAP financial accounting covers an international framework of multiple companies, languages, currencies and charts of accounts. Central tracking of financial accounting data is possible. For example when raw materials move from inventory to manufacturing the system reduces quantity values in inventory and simultaneously subtracts currency values for inventory accounts in the balance sheet.

Financial accounting component complies with international accounting standards such as GAAP and IAS. It also fulfills the local legal requirements. Though financial transactions are processed individually, they are integrated with all other relevant financial areas.

General ledger: General Ledger is essential both for financial accounting system and for strategic decision making. The functions of General Ledger are as follows:

1. Active Integration with business processes in R/3 logistics and in the accounting sub ledgers.
2. Serves as a central pool of financial data for financial reporting as well as for other accounting areas.
3. Supports all the functions needed for financial accounting systems such as :
 - a. Flexible structuring of chart of accounts at group and company level.
 - b. Distributed application scenarios using Application Link Enabling (ALE).

- c. Real time simultaneous update of sub ledgers and the general ledger.
- d. Elimination of time consuming reconciliation.
- e. Parallel views of data in both general ledger and managerial accounting applications.
- f. Provides summary information from other components at a user-defined level of detail by creating a special ledger.
- g. Create data summaries that can be used in planning, allocation, distribution and reporting.
- h. Can take advantages of more functions in GL and in Cost Centre Accounting.
- i. Can create own database tables and define non-standard fields to suit specialized accounting or reporting requirements.

Accounts receivable and payable: R/3 offers a financial overview of global business partner relationships in the Accounts Receivable and Payable sub ledger functions. These sub ledgers are integrated both with the G/L and with areas in sales and distribution (SD) and materials management (MM) where financial data originates. Accounts Receivable and Payable transactions are performed automatically when related processes take place in other R/3 SAP components.

This component uses standard business rules for procedures ranging from data entry and reporting to processing payments and bank transactions.

Accounts receivable and payable functions include the following:

Integration with Internet. Document Management. Support for EDI processing.

Integration with cash management.

Flexible reporting using Customer and Vendor Information System. Flexible dunning.

Enterprise-wide credit management with workflow integration.

Payment automation with EFT and cheque processing and document parking with various approval procedures.

Fixed asset accounting: Asset Accounting manages the company's fixed assets. With the financial Accounting, fixed asset accounting serves as a sub ledger to the General Ledger, providing detailed information on asset related transactions.

Main features of asset accounting are:

Country specific charts of depreciation complying with local legal requirements. Full support throughout the asset life cycle from acquisition to disposal.

Depreciation simulation and interest calculation. Integration with Project Management.

Order accounting for management of Capital Assets.

Integration with plant maintenance for management of machinery and equipment.

Management of leased assets and assets under construction.

Mass processing with Workflow integration. Interactive Reporting.

Controlling Cost

Overhead Cost Control: This component focuses on monitoring and allocation of overheads. This cost cannot be directly assigned to the products manufactured or services given. Overhead cost allocation needs a transparent method of allocation.

Cost center accounting: Cost center accounting analyses where overhead occurs within an organization. Costs are assigned to the sub areas of the organization where they are originated. A number of methods are available for allocating posted amounts and quantities. Activity accounting permits allocation of costs to products based on cost resources enabling assignments which were not possible.

Overhead orders: Overhead order collects and analyzes costs based on individual internal measures. It can monitor and automatically check budgets assigned to each measure.

Activity based Costing: Activity based Costing is developed as the response to the need for monitoring and controlling cross departmental business processes in addition to functions and products.

The system automatically determines the utilization of business processes by products, customers and other cost objects based on the cost drivers taken from the integrated accounting environment.

Product cost control: Product cost control determines the costs arising from the manufacture of a product or providing a service. A control plan and standard values serve in evaluating warehouse stock and for comparing revenues received with costs. In addition, the values in product cost controlling are crucial for determining the lowest price limit for which a product is profitable. It is possible to study the cost patterns by simulating the effects of changes in different production methods for a particular product and arriving at the lowest cost method.

Cost Object Controlling: This helps in monitoring manufacturing orders.

Integration with R/3 Logistics component results in a logistical quantity flow that provides instant information on actual cost, object costs, allowing ongoing cost calculations at any time. Follow up calculations determine and analyze the variances between the actual manufacturing costs and plan costs resulting from Product cost planning.

The system can evaluate work in process and post results to Financial Accounting.

Profitability analysis: Profitability Analysis examines sources of returns.

As part of sales control, Profitability Analysis is the last step in cost based settlement, where revenues are assigned to costs according to market segment.

The Market segment can be defined between products, customers, orders, sales organizations, distribution channels, and business areas and evaluate it according to contribution and revenue margins. Information from Profitability analysis can be used for determining prices, selecting customers, choosing distribution channels etc.

Investment Management

Corporate wide budgeting: Investment management facilitates investment planning and budgeting at a level higher than specific orders and projects.

Specific investment measures are assigned to different levels of hierarchy and therefore available funds, planned costs, and actual costs already incurred from internal and external activities can be made up to date at the appropriate levels.

The investment program allows to distribute budgets which are used during the capital spending process. The system helps to monitor and prevents budget overruns.

Appropriation requests: Investment management provides tools to plan and manage projects at the earliest stages. For this, first an appropriation for spending for the project is to be made. It is also necessary to define an evaluation and approval process during which the system keeps a detailed history of the status of the appropriation request. When the request is approved for implementation, the data from the appropriation request is transferred to the investment. It is also necessary to enter the planned values with its different variants in the appropriation requests.

Investment measures: Investment measures that are to be monitored individually can be represented either as internal orders or as projects.

These orders or projects provide the means for actually carrying out the capital investment.

They serve as the objects for collecting primary and secondary costs, for calculating overhead and interest, for managing down payments and commitments, and for handling other related tasks. As a result of having an asset under construction assigned to it, the investment measures also benefits from all of the required asset accounting functions. Settlement is both flexible and almost fully automatic.

This kind of settlement ensures complete integration with business planning and control and provides consistently up-to-date values.

Automatic settlement to fixed assets: In this module, the system automatically separates costs requiring capitalization from costs that are not capitalized, debiting the correct costs to the assets under construction. For different accounting needs, the system can use different capitalization rules for making this split.

At completion, the investment measure can be settled to various receivers by line item.

Asset accounting provides precise proof of origin for all transactions affecting acquisition and production costs.

Depreciation Forecast: Balance sheets and cost planning are always based on current values. Planned depreciation values for investment measures and appropriation requests can be transferred directly to ongoing overhead cost planning. The system recalculates expected depreciation amounts whenever planning data is updated.

Treasury

Cash Management: The Cash Management component allows the analysis of financial transactions for a given period. Cash management also identifies and records future developments for the purpose of financial budgeting.

In Treasury cash management, the company's payment transactions are grouped into cash holdings, cash inflows and cash outflows. Cash Management provides

- a. Information on the sources and uses of funds to secure liquidity to meet payment obligations when they become due.
- b. Monitors and Controls incoming and outgoing payment flows.
- c. Supplies data required for managing short-term money market investment and borrowing.
- d. Enables to know current cash position, short term cash management and medium and long term financial budgeting.
- e. Enables analysis of liquidity.
- f. Helps in cash management decisions.
- g. In bank accounting, helps in electronic banking and control functions for managing and monitoring of bank accounts.
- h. The liquidity forecast function integrates anticipated payment flows from financial accounting, purchasing and sales to create a liquidity outlook from medium to long term.
- i. Covers foreign currency holdings and foreign currency items.

Treasury Management: Before making any concrete financial decisions, it is necessary to consider current liquidity, currency and risk positions and consider the prevailing conditions on the money and capital markets. The treasury management component offers functions for managing financial deals and positions from trading through to transferring data to Financial Accounting.

Treasury management also supports flexible supporting and evaluation structures for analyzing financial deals, positions, and portfolios.

For short term liquidity and risk management, one can use money market or foreign exchange transactions to smooth out liquidity squeezes and gluts or to eliminate currency risks. Securities and loans come in the medium and long term.

Active management of interest rate and currency risks is facilitated by derivative financial instruments. The trading area contains functions for recording financial deals, exercising rights, performing evaluations and calculating prices.

In back office processing, the additional data required for processing deal confirmations is entered. These deals can be account assignment and payment details and generate automatic confirmations. Position management functions such as securities account transfers or corporate actions relating to securities are supported in the back office area.

The General Ledger is updated in the accounting area, which also offers flexible payment processing functions in addition to valuation and accrual/deferral methods.

By using common organizational elements throughout, various organizational structures can be represented in the system such as central enterprise-wide treasury department or 'in-house banks'.

This also ensures full integration of treasury with other SAP components.

Market risk Management: Market risk management is a process which involves a complex feedback loop encompassing data collection, risk measurement, analysis, and simulation as well as active planning of financial instruments.

This process fits closely into other treasury and corporate functions.

Market risk management acts as an integrated, central risk control station with monitoring and management functions. Access to information on current and future cash flows and on financial deals already processed is an absolute necessity. Cash management which pools all cash flows from the business sectors such as sales and distribution or purchasing forms the basis.

Consequently all cash flows from the company's operating business can be accessed for the purpose of risk management. Furthermore, all financial transactions managed in Treasury Management can be evaluated together with the cash flows generated by various operating divisions.

The component provides various measurements for analyzing and assessing interest rate and currency risks. Market to market, effective rate and effective yield calculations are based on up-to-the minute market data, uploaded via data feed, and financial transactions or positions.

By simulating the market data, one can determine the risk structure of 'What If' analysis (such as crash scenarios or worst case scenarios). It is also possible to measure and compare the impact of alternate strategies using simulated transactions.

Funds Management: Funds Management supports the funds management process from budgeting all the way through to payments, including monitoring expenditures, activities, resources and revenues.

Budgeting function serves many useful functions such as:

- a. Original Budget approval and release.
- b. Budget supplements, returns, transfers.
- c. Can cover as much management levels as required.
- d. Fund centers and their hierarchical structures provide a base for top down budgeting and represent responsibility areas within the budget control.
- e. Commitment management system enables to control various funds commitments and determine how much of the budget has already been utilized via availability checking.

The information system can supply information at any time depending on when, where and how the funds commitment arose.

- f. Analyses by responsibility area and commitment items allow identification of any budget bottlenecks.

Enterprise Controlling: Enterprise can be managed by using an Integrated Enterprise Management. This consists of getting accounting data prepared by subsidiaries for corporate reporting which will be automatically prepared simultaneously within the local books of each subsidiary. This data is transferred to a module called Enterprise Controlling (EC).

It is easy to transfer the data to the EC module to automatically set up consolidated financial statements including elimination of inter-company transactions, currency translation etc.

Enterprise Controlling consists of 3 modules.

1. EC-CS.
2. EC-PCA
3. EC-EIS.

1. EC-CS: This component is used for financial statutory and management consolidation which also allows fully automated consolidation of investments-even for many companies and complex investment structures.

2. EC-PCA: Allows to work with internal transfer prices and at the same time to have the right values from company, profit center, and enterprise perspectives in parallel. Any transaction that touches an object such as customer order, plant or cost center allocated to a profit center will be automatically posted to EC-PCA.

It is also possible to take data directly from EC-PCA to EC-CS consolidation to prepare complete financial statutory statements and management reports in parallel. This provides the management with a consistent view of external and internal financial management reports.

3. EC-EIS (Executive Information System): Executive Information System allows to take financial data from EC-PCA ,EC-CS or any other application and combine with any external data such as market data, industry benchmarks and /or data from non-SAP applications to build a company specific comprehensive enterprise information system .

Enterprise Controlling: It allows to control the whole enterprise from a corporate and a business unit perspective within one common infrastructure. It helps to speed up provision of business control information by fully automated corporate reporting from operative accounting via financial consolidation to management reporting.

From EC-EIS top-level reports, end users can drill down to more detailed information within EC or any other R/3 application.

EC can work with data from SAP and non-SAP sources.

Product Data Management (PDM): PDM supports in creating and managing product data throughout product lifecycle. SAP supports two basic scenarios in PDM environment.

1. To support a third party PDM system supported by SAP's complementary program to the R/3 system.
2. To implement the single source PDM solution provided within the R/3 system.
3. PDM keeps track of all master data.
4. The Document management system allows managing a wide range of technical, commercial and administrative documents consistently. Original documents can be linked to all types of objects in the R/3 system (for example material master records, BOMS, or change master records). External optical archiving system can be accessed from this system.
5. PDM organizes the design and change processes. This feature is known as Engineering Change Management and is fully integrated in the logistics process chain of company.
6. Engineering Change Management ensures that planned changes to master data are automatically available in the productive functions of sales and distribution, demand management and MRP, production control, product costing, quality management and materials management at any given time.
7. PDM gives product structure information at a glance.
8. BOM management solves the problem of distinguishing between engineering BOMS and production BOMS in the company.
9. To maintain the distinction between different uses of a BOM, separate BOMS can be created or different views on the same BOM can be developed.
10. PDM are supported for large product development projects in the R/3 project system.

Sales and Distribution: The system's Sales and Distribution application offers access to real-time, online information from sales support to the billing process.

The sales support component has easy to use tools to manage information on sales leads, sales calls, inquires, quotations, marketing campaigns, competitors, and their products.

Sales and marketing personnel can access this data at any time to perform sales activities or carry out direct mailings. Sales support not only makes existing sales process more efficient but it can identify new sources of business as well.

Order entry in the system is automatic. By referring the information in the simple user interface, the system assembles information such as terms of payment and identity of delivering plant. It then programs this information in the sales order. It deals with materials very easily. The materials can be entered manually and then customer based product proposals can be chosen.

It is also possible to configure a product to meet customer requirements.

Pricing is carried out automatically in the sales order. To determine relevant predefined prices, surcharges and discounts, the system works from price lists and customer agreements or it determines an amount according to the product, product group, or product cost. The pricing function is very flexible and can manage even the most complicated price structures. The pricing information can be maintained with data from sales promotion.

The system carries out a dynamic credit limit check checking against credit, financial and sales data to verify the customer's credit limit. The system can be set automatically to alert credit or sales personnel when a sales order fails to realize.

The system can perform availability check. It is run using materials management module (MM) and Production Planning Applications. It verifies that sufficient quantities of items are available to satisfy a sales order. If the requested delivery date cannot be met, the system determines when the desired quantities will become available so that a new date can be quoted to the customer. It is possible to ensure delivery in multiple locations. In the case of customers requiring specific quantities of products, the make-to-order production features can be used.

Sales and Distribution supports a wide range of contracts from general to more specific contracts.

The features of this module are:

- a. Can specify delivery quantities, delivery dates, and prices.
- b. Scheduling agreements and more complex requirements such as just in time delivery schedules are supported.
- c. The products can be followed up with the service management components with functions such as call management, warranty management, service and maintenance contract processing.

Shipping Management System: This offers easy to use functions for managing picking, packing and loading tasks and monitoring delivery deadlines. The system provides a list of all sales orders due for delivery and gives the option of delivering the order completely or partially, individually or collectively. It is also integrated with Warehouse Management System.

The Transport Module: The transport module offers functions for transportation planning and processing as well as monitoring and control functions. The items can be sent by land, air and sea. The transportation chain are for individual shipments or stop off shipments involving several deliveries and several destinations. It is possible to select forwarding agents and track shipments.

Foreign Trade Processing: SD offers support for foreign trade processing offering automated export control to determine whether specific products can be exported to a particular country, to a specific customer, and at a specific time. The system handles all the custom forms automatically. To declare shipment of goods to the government authorities, the system collects all the data required for the declarations and create the necessary forms. Preference agreement is another feature. It helps to manage the shipments of products that are eligible for custom tariff preferences, track the origin of component parts and assign a tariff classification to materials.

Billing: On the basis of orders and deliveries, the system automatically carries out billing for all due items. The system then creates an invoice, debit memo, or credit memo for each item or collectively for several transactions. The billing

document can be send directly by mail, fax or EDI.

Revenues and Receivables are immediately visible in the Financial Accounting and Controlling components. It can also process rebates based on a customer's purchase volume.

Sales Information System: The information in the Sales Information is always up to date. The information is displayed by customer, material, or region in an easy to use interpret list or informative graphic.

This information also enables to address market trends and changes.

Production Planning and Control: This module is used for planning, executing and controlling production. This covers the complete production process starting from creation of master data, production planning, MRP, capacity planning, production control and costing.

Production planning modules:

Sales and operation planning (SOP): Using Sales and operations planning, it is possible to create realistic and consistent planning figures and data on the basis of expected sales or other key figures.

In Demand management, these planning figures are split down to product level and a demand program is created.

In Materials Requirement Planning (MRP), the system calculates the quantities and procurement dates for the necessary materials, right down to the raw materials.

It is also possible to do capacity planning ahead of the planning phase.

Production control modules: Depending on the method of production, various choices are available like Production Order Processing, Repetitive Manufacturing or KANBAN production control is available.

Production order is primarily a tool for discrete job-shop production. It provides extensive status management functions, controlling per order as well as various operation-related functions. Repetitive manufacturing is designed for manufacture of products that are typically produced repetitively on a particular production line over a longer period. Here production planning and control as well as controlling are usually carried out based on periods and quantities.

Capacity planning is integrated with production order processing as well as with repetitive manufacturing.

Quality Management: This interfaces with PDC systems, distributed control systems, laboratory information systems as well as extensive data analysis functions in the Open Information Warehouse are all integrated with Production Control.

Production Planning covers the complete production process from the creation of master data to production planning, MRP, and capacity planning right down to production control and costing. It can be used in all sectors of industry and provides a whole range of production methods from make to order production / variant processing to repetitive manufacturing /mass production.

Production Planning also provides an easy to use Information System that one can adjust to suit particular needs.

Project System: Project objects and business areas involved form a multifaceted network of which Project Management is one part. This is called WBS (Work Breakdown Structure).

R/3 project system matches this network of relationships by permitting any link between project management and commercial information processing.

Work breakdown structures can use the project system in many different areas such as Investment Management, Marketing, Software and consultancy services, Research and Development, Maintenance tasks, Plant engineering and construction, make to order production etc

The central structures in the Project system are work breakdown structure and networks with their activities and milestones. These structures can be used for sales and distribution and with BOMS for production and procurement to model complex projects in the system.

Project systems graphical interface can be used to create structures quickly and easily. The following additional functions are also available.

- Cost and Schedule planning.
- Integration with other modules i.e. planning of resources in cooperation with Purchasing, Inventory Management and Materials Requirement Planning.
- Assigning human resources in individual employee or group terms.
- Checking and monitoring availability of funds, capacities, and materials.
- Controlling project expenditures using tools for approving and releasing projects. SAP business workflow is available to improve communications within large projects.

Project Information System: Project information system contains Listings and Graphical Analysis to supply all the information needed on the planned budget cost and actual costs, revenues, commitments, schedules of payments received and made and resources.

Materials Management: The system's materials management module contains all functions required to simplify business processes in Requirements planning, Purchasing, Inventory Management, Warehouse management and Invoice Verification. It also introduces a high degree of automation into standard procedures.

Purchasing: Consumption based planning provides one with up-to-the minute order proposals for purchase requisitions, based either on reorder levels or on forecast data. Logistics applications such as Sales and Distribution, Plant Maintenance, Production Planning or the Project system can also require materials or services to be procured externally.

Individual departments enter purchase requisitions manually. The system passes these purchase requisitions directly to purchasing application where they are converted into purchase orders. Buyers use tools from special purchasing master data, requests for quotations and outline agreements. The prices can be compared during the procurement process or automate vendor selection or order creation processes. Purchase documents can be part of a release and approval procedure before they can be further processed. The purchase orders can be send to vendors on paper or electronically (by EDI for example).The Purchase order allows to monitor status of order and track deliveries or invoices already received.

Inventory Management: The stock of materials is managed on a value and quantity basis in Inventory Management.

This application component supports all the most common types of receipts, issues, and stock transfers and allows managing special stocks (such as batches, consignment stocks, project stock, returnable transport packaging, or components with a subcontractor).

Goods movement postings automatically result in an update of values in Financial Accounting, Asset Accounting, and Controlling. The system also supports a number of convenient aids for entering the data and with a variety of inventory valuation such as LIFO (Last in First out) or FIFO (First in First out) for balance sheet valuation.

Warehouse Management: The Warehouse Management (WM) module provides flexible automated support that enable to process goods movements and maintains current records of all materials stored in highly complex warehousing structures. Using advanced put-away and picking techniques, WM optimizes material flow and capacity in the warehouse storing goods in the most favorable locations so that they are readily available when needed. WM can be interfaced with hand held terminals, bar code terminals and many other automatic processes that are available in WM component.

Invoice Verification: Invoices received on paper or EDI are checked automatically by the system. If an invoice is entered referring a purchase order, the system can automatically generate the invoice it expects to receive. An invoice is automatically blocked for payments if variances occur that are not allowed such as in the delivery date, the quantity delivered and agreed price.

The Evaluated Receipt Settlement (ERS) functionality allows to do away with vendor invoices altogether. The system automatically creates invoices periodically based on the goods receipt posted in the system for purchase orders.

Invoice verification provides a special method of entering vendor invoices, which is much faster than standard procedures.

MM application comprises countless additional functions that can help shape the materials management system efficiently. For example

1. A pipeline material that flows directly into the production process can be entered in the system for an order, a cost center or a network and is managed in a manner similar to consignment stock.
2. Stock transfer function can be used to model stock movements among different plants in the system.
3. It is possible to enter a stock transport order with or without a purchase order or delivery.
4. Transport orders are made with a whole suite of functions, such as shipping point determination and route determination.
5. To ensure smooth and efficient foreign trade processing, the necessary data can be prepared for export and import activities.

Inventory Control using Purchase Information System: With the purchasing information system, all the facts and figures necessary for negotiating with vendors are at hand. Choosing which data is to be included in reports and how the information is to be presented becomes easy.

It is also possible to determine stock values, to find out inventory turnover rates and carry out analysis.

Quality Management: Quality management module is tightly integrated with

all modules of an enterprise. Implementing it in a logistics system provides a number of advantages. Some of these advantages are:

1. Verification of the quality of procured goods.
2. Reduction of administrative tasks through company-wide quality planning.
3. Recording of all pertinent quality data during the quality inspection.
4. Using the comprehensive functions for quality control. Managing problems efficiently through quality notifications.
5. Creating a quality management information system.

Plant Maintenance: The various components of a plant maintenance module are

1. Structured technical systems.
2. Maintenance planning.
3. Systems for technical and cost accounting data.
4. Creation of a plant maintenance information system.

Service Management: R/3 system's service management module provides highly integrated functionality and is suitable for many types of industries.

The following are the main features of Service management module.

1. Installed base management.
2. Service agreements
3. Call management
4. Invoicing and billing
5. Service information system.

Human Resource Management (HR): HR provides comprehensive process driven solutions that can address organization's human resources needs worldwide. The module consists of various components such as Personnel Management, Personnel administration, Recruitment management, Travel Management, Benefits administration, Salary administration etc. Let us examine these in detail.

Personnel administration: Information is not owned by specific departments but is shared by multiple entities across an organization. The package eliminates duplicate entries across an organization. It offers a global and fully integrated data without compromising the control over the individual segments of the operations.

Employee master Data: This is a centralized data-base with integration to multiple components for processing employee information.

SAP R/3 contains "information types" for storing any desired information about employees. One can enter data through the time saving "fast entry" feature processing data in two modes- online or background.

Original documents can be scanned into HR for optical storage with SAP's Archive link.

Recruitment Management: SAP has designed the recruitment component, which enables to place people in the right job at the right time and with the right skills and education. This component contains processes for managing open positions/requisitions, application screening, selection and hiring, correspondence, reporting and cost analysis.

Open positions: The R/3 HR recruitment component allows direct access to data stored in other components of HR including personnel administration, payroll and personal planning. These links eliminate duplication of data entry and improve productivity.

Some examples of shared data related to job openings include position open date, location and reporting specifics, job descriptions and skills and education requirements. This information can be used for both internal job postings and external advertisements with newspaper, magazines, or recruitment firms.

Selection and hiring: HR recruitment interfaces directly with Microsoft word for windows to generate standard applicant letters. SAP's office communication link is used to send e-mail messages to internal applicants. SAP provides tools to analyses costs during advertising and interviewing for each open position.

With HR recruitment component, one can effectively manage job openings, applications and applicant data, costs and hiring process. Once a selection has been made and an applicant has been hired, the data gathered during the recruitment process becomes new information.

Travel Management: HR travel management allows the processing of a business from start to finish – from the initial entry through to posting in Financial accounting and controlling. This includes subsequent corrections and all retroactive accounting requirement. Travel data can be entered by a person travelling or by the relevant department before or after the trip. The entry of a travel request automatically generates a work flow that makes the work of HR department easier. Business specific, employee specific and country specific trip provisions can be implemented via system settings.

Benefits Administration: This component provides capabilities and flexibility to effectively manage benefits programs for diverse employee populations. It can maintain unlimited number of benefits types and individual plans that are offered to employees. Also, benefits groups based on specific employee demographics can be established.

Personnel cost planning: HR organization and planning assists to maintain an accurate picture of organization's structure no matter how fast it changes. A graphical environment makes it easy to review additions or changes in employee positions. Planning features assist in making graphical organization chart, staffing schedules by head counts percentage, working hours, job and work center descriptions.

R/3 personnel cost-planning enables to perform cost comparisons between target and actual personnel costs and create cost previews. It is possible to forecast wages, salaries and other cost elements for open and filled positions based on simulated, planned or actual payroll figures. The results can be displayed in R/3 business graphics which is linked to Microsoft Excel in a spreadsheet format. The results are transferred to SAP R/3 cost accounting.

Payroll accounting; R/3 HR payroll accounting addresses payroll functions from a global point of view. It is possible to centralize or decentralize payroll processing based on country or legal entities. It also enables to establish business rules without modifying existing payroll.

Payroll processing: Payroll accounting date reminder feature provides with an online tickler system that notifies when transactions are due for processing. When the process is completed, a built-in audit trail date stamps the record for future reference. The system automatically creates a history record for every

payroll transaction. It can create standard reports and user specific reports.

Integration: Payroll accounting maintains information on employees in a master file shared with all other HR components. R/3 system writes payroll data into controlling, financial accounting and logistics.

Global solutions: SAP R/3 has country-specific versions and therefore payroll accounting can fulfill language, currency and regulatory requirements.

Time management: Time management is a powerful tool that helps to administer and evaluate data related to time that the employees spend on working.

Time data: Time management manages works schedules efficiently and effectively by automatic schedule generation and allowing flexible definition of time models and schedules for each location and organizational level. It is possible to set flexible working hours and process work notices as times are recorded. Calculation for employee incentive wages is also available.

Time evaluation: The time evaluation component allows daily processing of employee time data. It is a flexible tool designed to handle complicated evaluation rules to fulfill regulatory requirements and determine overtime and other time related data. The time evaluation component stores organization's business rules and automatically validates hours worked and wage types. The results of time evaluation can be shown on a time sheet.

Time Management review: With HR time management, special transaction capabilities designed to support time clerks in their daily tasks are available. Error handling feature makes necessary corrections.

Integration and Interfaces: Time Management is integrated with Payroll Accounting, Production planning, Plant maintenance, Project system, External services and Shift planning.

SAP has standardized communication channels and protocols for many external data entry systems. Plant Data Collection (PDC) serves as an integration tool linking plant system to all business applications. As employee, machine and work order details are received, PDC automatically assigns it to the appropriate system.

Shift planning: HR shift planning enables to arrange a target plan that can be drafted for any given period. Shifts can be planned taking into consideration all criteria including absence due to leave or sickness and employee requests for time off. A convenient planning board is provided for guidance when entering and copying shifts for any designated period of time. Temporarily assigning an employee to another organizational unit is also possible.

Other additional components, which are available with HR module, are

1. Profiling of qualifications of employees and matching with available positions.
2. Career and Succession planning of employees
3. Additional education and training programs
4. Training and event management
5. Training programs and business events

Other SAP Components:

1. Internal and external communications
2. SAP business workflow helps to distribute tasks automatically at the right time to the right employee
3. Employee self-service increases efficiency and service

Internet and Intranet: The R/3 system offers a special Internet functionality for large number of business processes. It also gives an opportunity to advertise vacancies to potential applicants all over the world. The application itself could be carried out online by calling up an application form filling it out and returning it by e-mail. The application would be processed automatically in R/3 HR

An internal search activity to find the required employee information is also possible in R/3 HR.

SAP Business workflow: This component enables to create work routines. Business workflow coordinates and monitors business processes step by step. All users automatically receive a list of their tasks in their R/3 mail system inbox. Once the work is completed, the workflow starts the next predefined work-step and sends relevant messages. For example, in HR recruitment the following processes are automatic:

1. Submission of application forms
2. Planning and holding of interviews
3. Drawing up contract offers
4. Preparing appointments
5. Monitoring of rejected applications

A range of workflow techniques such as optical archiving mailing and office communication can be used at every stage. It has also included other business processes in R/3 business workflow component. It is also possible to create new processes suited to a particular business.

Employee self-service: HR department no longer has to perform time consuming and costly activities such as issuing information and maintaining data. The employees themselves carry out these functions. This enables to increase the quality of information in any organization.

Conclusion: The success of any organization today depends on its ability to look at business in totality without being influenced by strict departmental boundaries. ERP, which is an integration of components such as Business models, Operating Processes, Control Processes, and Changing Strategic Business Processes, enables the Organization to realize its vision and objectives in an optimized way.