In chapter 13-"Resource Requirement Planning", a brief account of "Enterprise Resource Planning" was presented to the readers. Since information technology is revolutionising the way in which we live and work and changing all aspects of our life and life style, we need to manage information both in our personal life as well as in our professional life.

Information technology has ushered in a new era in the management of business organisations. It helps to automate the process of data collection, collation and refinement and to deliver high quality information to the decision-makers at the right time. Hence, to survive, thrive and beat the competition in today's brutally competitive world, managers have to manage the future by managing information.

All organisations, whether engaged in manufacturing goods or rendering services, have certain objectives and goals to be achieved through the coordination and integration of activities of its various business units or departments. Sometimes, there may exist some conflicts between the various business functions. To resolve these conflicts and make them to do what is good for the organisation as a whole, sharing of information is crucial. Organisations should stop functioning as islands of information and the various business units or departments should cease to function in isolation. For this, business units or departments should share information among them and know how the decisions/actions of one unit or department affects other units or departments. Advancements in information technology facilitate this kind of information sharing. The enterprise-wide data sharing has many benefits like automation of the procedures, availability of high quality information for better decision making and faster response time etc.

I WHAT IS ENTERPRISE RESOURCE PLANNING? (ERP)

Before we try to understand the meaning of ERP, we need to understand the importance of resources of a business organisation for its success. The three important factors for any successful business venture are: *(i)* An enterprise *(ii) Its* Resources and *(iii)* Planning the management of the resources of the enterprise.'

Enterprise Resource Planning: Integration of financial, manufacturing and human resources on a single computer system.

An Enterprise, is a group of people with a common goal, which has certain resources at its disposal to achieve that goal.

Resources include money, manpower, materials and all other things that are required to run the enterprise.

Planning is done to ensure that all necessary functions are performed in the right manner at the right time.

Thus Enterprise Resource Planning or ERP is a method of effective planning of all the resources in an enterprise or organisation.

Enterprise Resource Planning includes the techniques and concepts employed for an integrated management of business as a whole, from the view point of the effective use of resources, to improve the efficiency and effectiveness of an enterprise.

ERP is a software package that organises and manages a company's business processes by sharing information across all functional areas in the organisation. It encompasses all business areas such as sales, distribution, accounting, costing, maintenance etc. It includes all, from suppliers to customers. It transforms transactional data like sales into useful information that supports business processes such as invoicing, distribution and accounting, In addition, ERP connects with supply chain and customer management applications, helping businesses share information both inside and outside the enterprise. In this way, ERP serves, as the backbone for an organisation's information needs, as well as its e-business initiatives.

Evolution of ERP

Prior to the development of ERP, most companies employed program developers who developed programs for their business applications from scratch or developed complicated interfaces to allow pre-packaged applications from several vendors for flow of data back and forth as necessary to complete business transactions throughout the enterprise. The drawbacks of this process were: *(i)* costly, time consuming and error prone, *(ii)* communication among various areas of business was difficult and *(iii)* managers could not get a comprehensive view of how the business was doing at any point of time.

SAP AG, a German software company created ERP software to integrate all business processes together for use by any business.

SAP AG, a German software company created generic ERP software package to integrate all business processes together for use by any business in the world. The software was updated to client server architecture in the 1990s and with essentially one product, SAP became the third largest Software Company in the world.

An ERP System

An ERP system is a set of integrated business applications or modules which carryout common business functions such as general ledger accounting, accounts payable, accounts receivables, material requirement planning, order management, inventory control and human resource management. Usually these modules are purchased from a software vendor. In some cases, a company chooses to buy only a subset of these modules from a particular vendor and mix them with modules from other vendors and with the company's existing applications.

With ERP, companies could integrate their accounting, sales, distribution, manufacturing, planning, purchasing, human resources and other transactions into one application software. This enabled transactions to be synchronized throughout the entire system. *For example*, a customer order entered into an ERP system would ripple through the company, adjusting inventory, part supplies, accounting entries, production schedules, shipping schedules and balance sheets.

Exhibit 26.1 shows how information is integrated within an organisation using an ERP system.

Exhibit 26.1 : Information Integration Through ERP System

An ERP system differs from earlier approaches to developing or purchasing business applications in at least two ways.

(i) The ERP modules are integrated, primarily through a common set of definitions and a common database. As a transaction is processed in one area, such as the receipt of a customer order, the impact of this transaction is immediately reflected in all other related areas such as accounting, production scheduling and purchasing.

(ii) The ERP modules have been designed to reflect a particular way of doing business – a particular set of business processes. ERP systems are based on a ***value-chain view*** of the business in which functional departments co-ordinate their work. To implement an ERP system, then, a company is committing to changing its business processes. If a company purchases an ERP system, it may need to change its processes to conform to those embedded in the software package. The company adapts to the ERP software package, not vice versa, because of the high costs of system modification.

Advantage of ERP Systems

Installing ERP system has many advantages:

(i) ERP systems help companies manage their resources efficiently and at the same time, better serve their customers.

(ii) ERP simplifies customer interaction and speeds production with its configure-to-order capabilities. Customers ordering on-line or through a sales person can quickly choose from a variety of options, for which bill-of-material is automatically generated and sent to production.

(iii) Data entered once into an ERP system, say from manufacturing, need not be reconciled with accounting or warehouse records because the records are all the same.

(iv) With broader, more timely access to operating and financial data, ERP systems encourage flatter organisational structures and more decentralized decision making.

(v) ERP systems also centralise control over information and standardise processes. Standardised transactions make businesses more efficient and shared data makes them more creative.

(vi) The direct advantages of ERP include improved efficiency, integration of information for better decision making, faster response time to customer queries etc.

(vii) The indirect benefits include better corporate image, improved customer good-will, customer satisfaction etc.

Disadvantages of ERP Systems

(i) Implementation of an ERP system is extremely difficult because the company must change its way of doing business.

(ii) ERP systems are very expensive. A typical large-scale ERP implementation costs several crores of rupees and takes a year or more. These implementation costs include not only the software licenses but also hardware and network investments and consulting costs.

(iii) Choosing the right ERP software is a difficult task. The leading vendors are SAP, Bann, TD Edwards, Oracle and People soft. Several small companies also offer ERP software. For ERP purchases, choosing a single vendor may provide the advantage of the tight integration of applications and standardisation of processes. But it will reduce flexibility for the adopting company "A" best-of-breed or mix-and-match approach with multiple vendors may enable the company to meet more of its unique needs and reduce reliance

on a single vendor, but such an approach typically makes implementation more time consuming and complicates system maintenance.

(iv) For multi-divisional firms, implementing an ERP system is a very complex, challenging task that needs the best minds and careful attention of internal information system specialists, internal business managers and external consultants.

However, whatever may be the disadvantages, the potential pay-off of an ERP system in terms of better information for strategic and operational decision making and planning and greater efficiency, profitability, and growth, makes the efforts and costs worthwhile.

An Example of ERP System-SAP R/3

SAP R/3, developed by a German firm SAP AG, is the most popular of ERP systems. SAP is one of the top software firms in the world. SAP R/2 was a main-frame based ERP whereas SAP R/3 is a client/server system employing a common, integrated data-base with shared application modules.

In 1999, SAP launched **"my SAP. com"** which is both an umbrella concept for SAP's strategy of allowing its users to work through the worldwide web and a brand name for its new web-enabled versions of its R/3 software. Included under the "my SAP.com" lable are **"Workplace"** a customisable web portal permitting employees to easily access their own company's information, services and applications and **"Market-place"** an application facilitating electronic procurement over the web as well as collaborative services for on-line trading communities.

SAP R/3 is a tightly integrated system consisting of several modules under the following categories:

(i) Supply chain management category,

(ii) Product life-cycle management category

(iii) Human capital management category

(iv) Financials category

(v) Customer relationship management

(vi) Business intelligence category and

(vii) Electronic commerce.

A company may choose to implement some or all of these modules. Most importantly, implementation of R/3 requires that the company change its business processes to conform with the processes built into the software.

Historically, the strength of the SAP system originated with supply chain management. The logistics subcategory of the supply chain management area includes eight major modules: five modules relate primarily to manufacturing: production planning, project system, materials management, quality management and plant maintenance. Two other modules in the logistics category relate largely to sales and distribution and product data management. The final module-logistics information system provides reports relevant to both manufacturing and sales. These modules provide a complete set of components to monitor and report on the entire logistics process from sourcing of materials and manufacturing through sales and service.

The modules in the human capital management (or human resources) category provide the full set of capabilities needed to hire, manage, schedule and pay company employees. The modules under this category are: organisational management, personnel management, employee self-service, recruitment, personnel development, training and event management, compensation management, benefits administration, personnel cost planning, time management, pay roll and travel management.

The modules in the financial category are designed to permit managers to interpret and work with company financial data effectively. The remaining categories include product life cycle management, customer relationship management, business intelligence and electronic commerce.

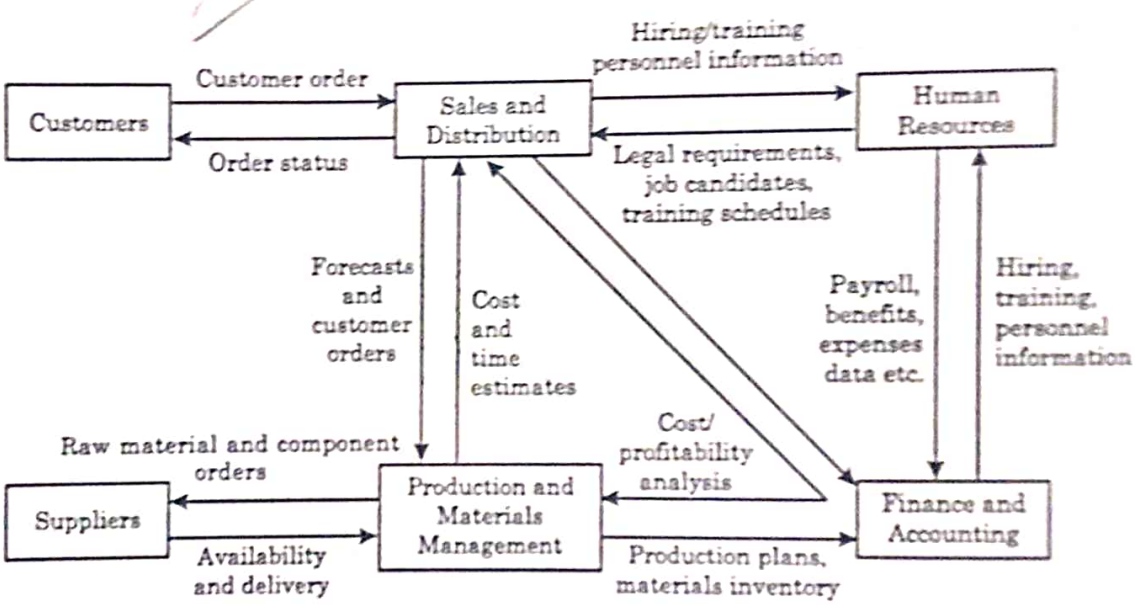
Product life cycle management category includes modules such as program management, life cycle data management, change and configuration management, life cycle collaboration and environmental, health and safety management.

Business intelligence category includes modules such as business information warehouse, knowledge management and strategic enterprise management. Electronic commerce category includes modules such as buying, selling and open catalog interface.

Companies may choose to implement some or all of the SAP R/3 modules. ERP implementation is such a challenging task that most companies employ a consulting firm to assist them.

Exhibit 26.2 illustrates the information flows in a typical organisation with the ERP system.

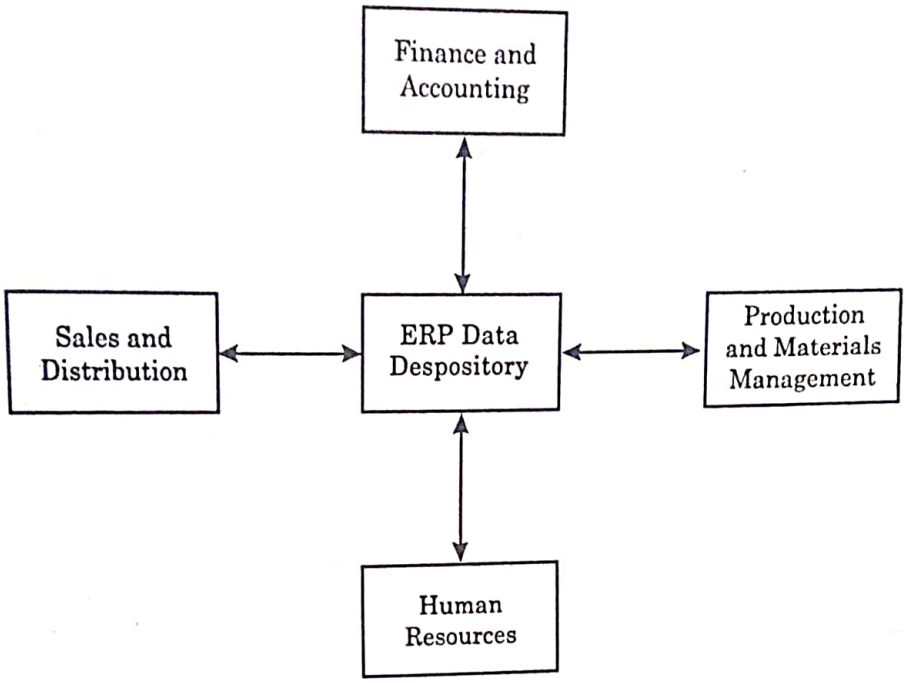
Exhibit 26.2 : Information Flows in an ERP System



ERP system provides an integrated information technology strategy for effectively managing the entire enterprise.

Together with the modules mentioned earlier, the ERP system provides an integrated information technology strategy for effectively managing the entire enterprise. ERP connects processes that belong together, giving every employee fast, convenient access to the information required for their jobs. As shown in *Exhibit 26.3*, ERP creates a central depository for the company's data which enables the company to perform various business analyses. A company can quickly access data in real time related to forecasting and planning, purchasing and materials management, product distribution and accounting and financial management so that it can deploy its resources quickly and efficiently. It can help schedule its production capacity to meet demand and reduce inventory levels.

Exhibit 26.3 : ERP System's Central Database



ERP Implementation

In the past, many companies have failed to achieve the desired results after spending huge amounts of money and time for ERP implementation (*for example,* Dow chemicals USA spent half a billion dollars and 7 years implementing an ERP system which was found to be ineffective). As a consequence, the second generation ERP systems (known as ERP II) were developed. These are different from the first generation ERP systems. They offer stand-alone modules and open architecture. Companies can choose the modules they want to install and can even choose a collection of modules from different vendors – the *"best-of-breed"* approach, But single source ERP systems are easier to integrate while "best-of-breed" systems may provide a better match with organisational needs.

Two steps involved in the implementation of ERP are :

- **Analysing the business processes.**
- **Determining which ERP modules to be implemented and how to configure them.**

Analysing business processes is the first step in the implementation of ERP, Because ERP is an integrated technology that pervades and connects all parts of an enterprise, it usually changes the way a firm makes decisions. Therefore, its implementation requires major changes in a firm's organisational structure and business processes. To guide the firms to implement ERP, vendors of ERP packages have designed their own softwares around best practices for specific industries. *For example,* many industries such as aerospace, defense, apparel, automotive, chemicals, consumer products, engineering and construction, health care, high-tech industries, insurance, media, oil and gas, pharmaceuticals, the public sector, real estate, retail, telecommunications and utilities have successfully implemented ERP Systems. Companies have two choices in their effort to implement ERP *(i)* use the software as a blue print for how their processes should operate and adjust their processes or *(ii)* map out their own business processes and customize the software accordingly.

The second step is to determine which ERP modules to implement and how they should be configured. It is a process-oriented decision rather than a technology oriented decision. Questions to be answered before taking the decision regarding the ERP modules to be selected and their configuration to be used are :

(i) which processes have the biggest impact on customer relations?

(ii) which processes would benefit the most from cross-functional or inter organisational integration?

(iii) which processes should be standardized throughout the organisation and which should be allowed to vary?

Knowing the level of sophistication needed for the firm's business is also key to effective ERP implementation.

For example, QAD (for quality, application, delivery) offers MFG/PRO and eQ software to manufacturing firms and international clients. QAD is known for both its ease of implementation (weeks instead of months) and ease of use.

Another issue in ERP implementation is the help provided by the Internet. Some ERP vendors (Oracle, People-soft and SAP) now offer their products through portals. The vendor hosts the application which the customer accesses over the Internet with their browser.

Table 26.1 gives some selected enterprise software vendors and their area of expertise.

Table 26.1 : Selected Enterprises Software Vendors and their Area of Expertise

Vendor	Specialty
1. SAP America	Large enterprise, discrete manufacturing
2. Oracle Corporation	Large enterprise, discrete manufacturing and services.
3. Invensys software systems	Electronics industry
4. Siebel systems	Customer relationship management
5. People Soft Inc.	Employees and customer relationship management.
6. i 2 Technologies	Supply Chain management
7. J D Edwards	Mid-market manufacturing
8. QAD	Multinational mid-market manufacturing

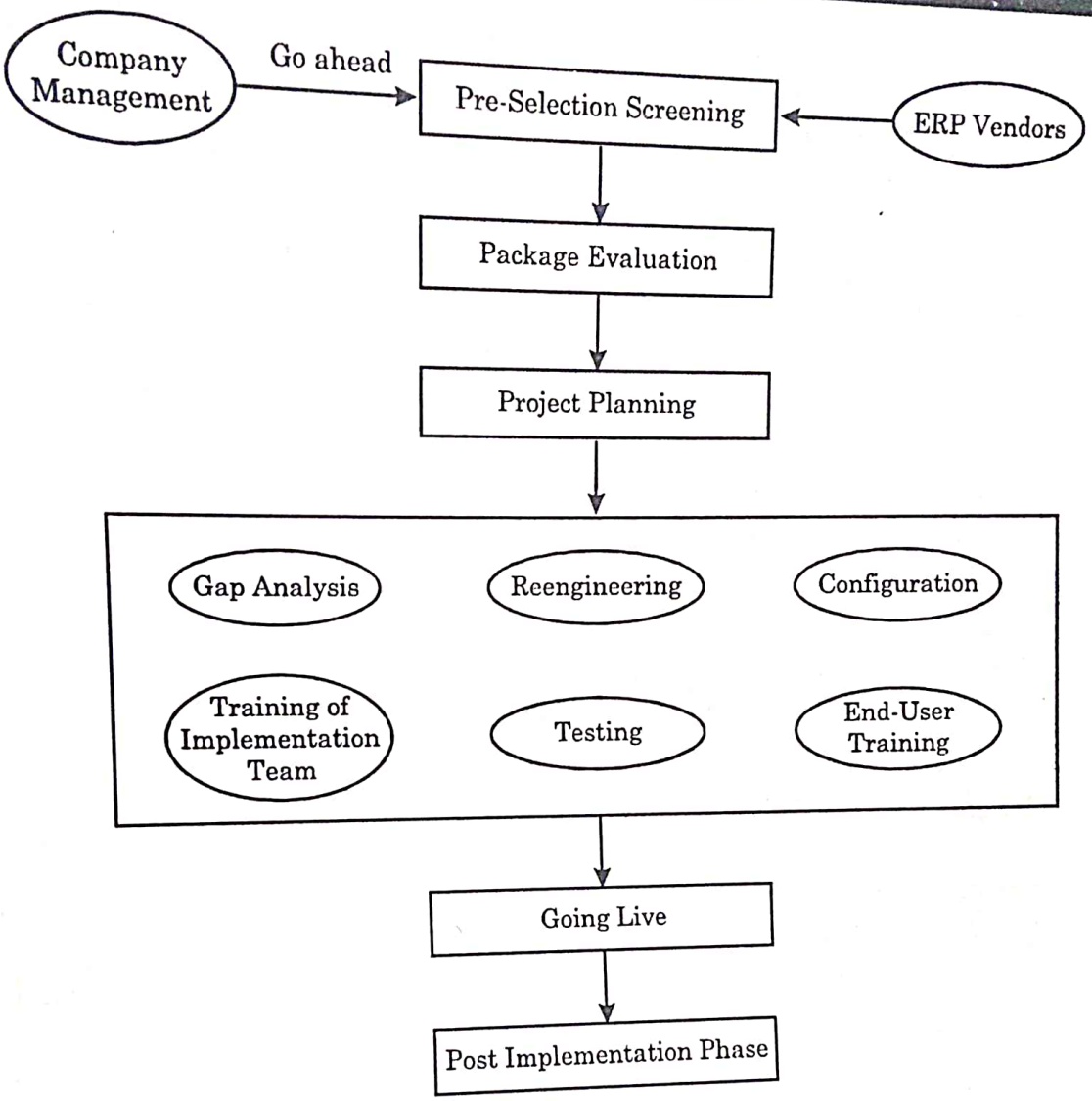
ERP Implementation Life Cycle

ERP Implementation project has to go through different phases like any other project. Even though there is no clear demarcation between the phases, which may overlap to some extent, these phases have a logical order to follow. The various phases of the ERP implementation are:

(i) Pre-evaluation Screening
(ii) Package evaluation
(iii) Project planning
(iv) Gap Analysis
(v) Reengineering
(vi) Configuration
(vii) Training the implementation team
(viii) Testing
(ix) Going live
(x) End user training and
(xi) Post-implementation

Exhibit 26.4 illustrates the different phases of the ERP implementation life cycle;

Exhibit 26.4 Phases of ERP Implementation Life Cycle



The above phases of ERP implementation life cycle are briefly discussed in the following paragraphs:

1. Pre-evaluation Screening

After taking a decision to go in for the ERP system, the company starts searching for a perfect package. Since there are hundreds of ERP vendors who claim to have the ideal solution for the company (client) analyzing all the packages to select the best vendor is a very time consuming process and hence not a viable solution. Hence it is better to limit the number of potential vendors to five and then do a thorough and detailed evaluation of their packages. Pre evaluation screening involves limiting the number of packages to be evaluated by the committee. Those packages that are not suitable to the company's business processes are eliminated and few best packages are selected.

2. Package Evaluation

The evaluation/selection process is one of the most important phases of ERP implementation, because the success or failure of the project depends on the package

scheduled. Huge investments involved in the purchase of ERP packages makes switching from one package to another almost impossible, hence the necessity for "doing it right the first time" approach in this phase.

Once the packages to be evaluated are identified, selection criteria should be developed by the company to evaluate all the alternative packages on the same scale. To choose the best system, the company should identify the system that meets the business needs, matches the business profile and identifies with the business practices of the company. While it is impossible to get a system that will perform exactly as the company does its business, the aim should be to select the system that has the least number of differences.

Some of the factors that should be considered while evaluating and selecting the ERP software are :

(i) Functional fit with the company's business processes
(ii) Degree of integration between the various components of the ERP system
(iii) Complexity
(iv) Flexibility and scalability
(v) User friendliness
(vi) Implementation time
(vii) Technology
(viii) Amount of customization required
(ix) Total costs (including cost of license, training, implementation, maintenance, customisation and hardware requirements).

3. Project Planning

In this phase the implementation process is designed and the details of how to go about the implementation are decided. (*i.e.*, determining time schedules, dead lines etc.). The project plan includes the following:

(i) Identification of roles and assignments of responsibilities to individual members of ERP implementation team.
(ii) Decision regarding the organisation resources to be used.
(iii) Identification of person to head the ERP implementation team.
(iv) Selection of implementation team members and allocation of tasks to them.
(v) Decision regarding when to begin the project, how to do it and when the project should be completed.

Also answers to the following questions must be found and included in the project plan.

(a) What to do in case of contingencies?
(b) How to monitor the progress of the implementation?
(c) What control measures should be installed? and
(d) What corrective actions should be taken when things go out of control?

4. Gap Analysis

This is the most crucial phase in the ERP implementation. Gap analysis helps companies to create a complete model of where they are now and in which direction they want to head in the future. Even the best ERP package, custom-tailored to a company's functional requirements meets only 80% of the company's functional requirements and the remaining 20% of the requirements should be met by the company's business reengineering efforts.

5. Reengineering

The human factors are considered in this phase. "Reengineering" has two different connotations in ERP implementation settings. They are:

(i) using ERP to aid in downsizing efforts

(ii) using ERP for business process reengineering involving a technical implementation and a business process implementation.

In the first connotation, companies usually purchase an ERP package with the aim of reducing significant numbers of employees (*i.e.*, downsizing). While every ERP implementation involves some change in job responsibilities due to automation and efficient processes; it is best to treat ERP as an investment as well as a cost-cutting measure rather then a tool for downsizing. In the second connotation, ERP is used as a means for business process reengineering which involves two closely linked implementations: the technical implementation and a business process implementation. This approach emphasizes the human element of necessary change within organisations.

6. Configuration

This is the main functional area of the ERP implementation project. What is desired in ERP implementation is "synchronizing existing company practices with the ERP package rather than customizing it to suit the company:. In order to do so, business processes have to be understood and mapped in such a way that the arrived at solutions match with the overall objectives and goals of the company.

A prototype – a simulation of the actual business processes of the company is tested in a controlled environment. This helps to solve any logical problems inherent in the business process reengineering before the actual "go-line" implementation.

Configuring a company's system reveals the strengths and weaknesses of a company's business process. This would help in explaining what won't fit into the package and where the gaps in functionality occur.

7. Training of implementation team

The implementation team must be trained regarding how to implement the system and later run the system. After the implementation is over, the ERP vendors and hired consultants will leave the company and the company should be able to run the ERP system on its own. Hence a good in-house team should be developed to run the ERP system.

8. Testing

The ERP system is tested using real case scenarios such as system overloads, multiple users logging on at the same time with the same query, users entering invalid data, hackers trying to access restricted areas etc. The test cases must be designed specifically to find the weak links in the system so that these bugs could be fixed before 'going-live".

9. End User Training

Actual users of the system are given training on how to use the system. The employees who are going to use the new system are identified and are grouped based on their current shifts. Then each group is given training on the new system. The training should provide the participants an overall view of the system and how individual actions would affect the entire system. Also each employee is trained on the job or task that he/she is supposed to perform once the system "goes-live". End user training is very crucial as the success of the ERP system is in the hands of the end users.

10. "Going-live"

At this phase, the work is almost complete –data conversion is done, databases are up and running, the prototype is fully configured and tested and ready to go operational. Once the new system is "live", the old system is removed.

11. Post implementation

Once the implementation is over, the vendors and hired consultants will leave the company. To get the full benefits of ERP system, the system should get companywide acceptance. Enough trained employees should be available to handle the problems that might crop-up. There should be people who have the technical competency to make the necessary improvements in the system as and when required. The system must be upgraded as and when new versions or new technologies are introduced. The company should analyse the costs and benefits of any new version of ERP system offered by the vendors.

Everyone who uses the systems needs to be trained on how they work, how they relate to the business process and how a transaction ripples through the entire company. The post implementation training is a continuous, never-ending process as new people will always be coming in and new functions will always be entering the organisation.

WEB based ERP and Related E-Business Software

The value of e-business relies on a company's ability to integrate their internal processes with external suppliers, customers and other companies. First-generation ERP systems did not have the ability to interact outside the company with other ERP systems, with e-businesses or directly with suppliers or customers. The second generation of ERP (called ERP II , or extended ERP or XRP) enabled the vendors to create web-centric systems by consolidating data and allowing dynamic access from various clients.

ERP systems provide vast amounts of data for analysis. Powerful new analytic tools and applications that capitalize on ERP's central depository of data have been developed by software vendors, *for example,* software system such as Customer Relationship Management (CRM) Supply Chain Management (SCM) and Collaborative Product Commerce (CPC)

Customer Relationship Management (CRM)

Software plans and executes business processes that involve customer interaction such as marketing, sales fulfillment and service. CRM shifts the focus from managing products to managing customers. Prospect information, customer profiles, sales force automation, and campaign modules for direct mail and special sales promotions are managed with CRM. CRM also provides decision support for forecasting demands, demand management, pricing products and services, quoting order delivery dates and planning for customer service needs. CRM interacts with supply chain management (SCM) software and ERP to ensure prompt and accurate order fulfillment and to plan for future requirement.

Supply Chain management (SCM)

Software includes supply-chain planning, supply-chain execution and supplier relationship management. ***Planning*** involves designing the supply chain network, demand planning and collaborative production planning. ***Execution*** involves fulfillment, manufacturing, and delivery. ***Relationship management*** handles all the interactions with suppliers, from supplier certification to quality assurance, contracts and agreements.

Collaborative Product Commerce (CPC)

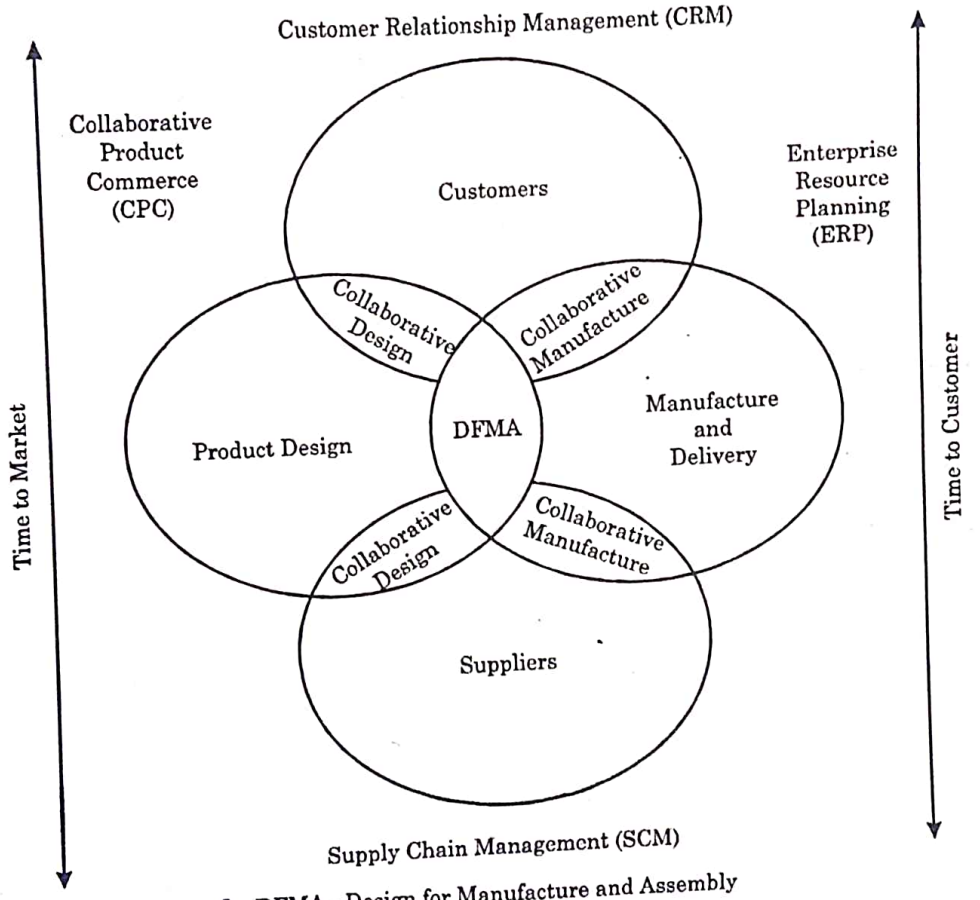
CPC is concerned with new product design and development as well as product life-cycle management. CPC manages product data through the life of the product, co-ordinates

product and process redesign and collaborates with suppliers and customers in the design process.

CPC, CRM and SCM make a powerful combination. *Exhibit 26.5* shows how these types of software systems can work together.

Customer and supplier collaboration on design with CPC can reduce ***time to market*** for new products and services. Likewise, customer and supplier collaboration in manufacturing via ERP helps to reduce the ***time to customer*** (*i.e.*, speedy delivery of the product to the customer).

Exhibit 26.5 : ERP and Related Software Systems



Legend : DFMA - Design for Manufacture and Assembly

QUESTIONS

1. Define the term "Enterprise Resource Planning" (ERP).
2. Discuss the role of information technology in modern business.
3. Give a brief account of the evolution of ERP.
4. What are the various functions within an organisation which are integrated through an ERP System?
5. Discuss the advantages and disadvantages of ERP systems.
6. Explain the features of "SAP R/3" ERP system.