LEARNING OBJECTIVES

Upon completion of this chapter the student should be able to –

- understand various planning issues in ERP implementation
- develop a justification for ERP implementation
- identify the various resources required for ERP implementation
- understand the role of organizational commitment to change
- identify the total cost of ownership for ERP implementation
- develop an approach for ERP package selection

6.1 Planning for ERP Implementation

Organizations have now realized the potential of enterprise resource planning (ERP) systems, yet they struggle to materialize real benefits from them. Some ERP projects suffer from over budgeting and, consequently, are terminated before their completion. If implemented, some ERP projects often fail to achieve the business objectives within the projected time span. Among several reasons that contribute to the low-success rates, one common feature is the improper planning before implementation. ERP planning is the first phase in the overall ERP implementation life cycle. The planning phase includes the following aspects:

- Understanding the organizational needs and requirements
- Understanding the economic and strategic justification of the project
- Analyzing **project scope** and the broad implementation approach
- **Determining resources** available
- Comprehending the top management's commitment to the change
- Realizing organizational commitment to change and implement ERP
- Matching business processes with the ERP system
- Budgeting for ERP implementation
- Selecting the right ERP package

Project Scope: *It defines the number of ERP modules as well as the number of sites where ERP will eventually be rolled out.*

Determining Resources: *It defines the different resources (personal, infrastructure, skill set, etc.) required for enterprise application implementation.*

The ERP resource determination sub-phase can be quantified as follow:

- Infrastructure resource determination
- Training facilities and education about ERP
- HR planning and commitment to deploy the right people for the job

The mapping among all these factors is shown in Figure 6.1.

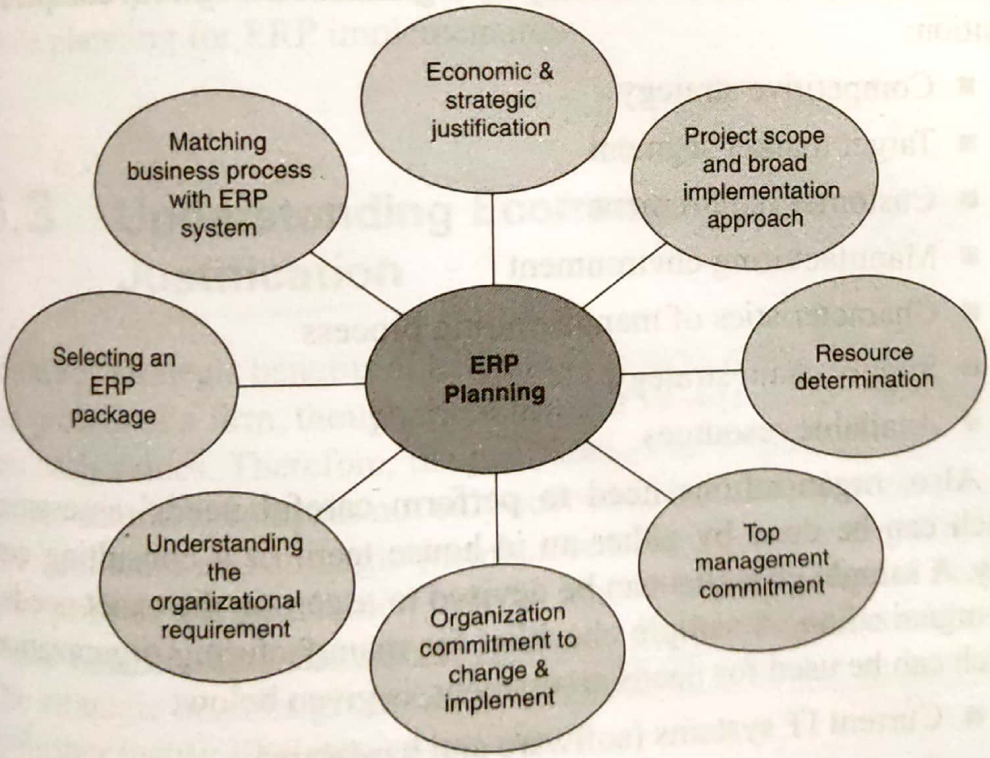

Figure 6.1 ERP planning components.

6.2 Understanding Organizational Requirements

Internal-need assessment is one of the most important steps in ERP planning. Since ERP implementation is a costly affair, prior needs assessment can help determine whether a company should maintain and enhance a legacy system or implement a new ERP system. There

can be many factors that convince an organization to install a new ERP system in place of the legacy system. Some of the key drawbacks in legacy applications, as enumerated below, can be convincing reasons for acquiring new ERP applications:

- Legacy systems use multiple points of input with duplicated effort.
- Most legacy systems are unable to support organizational needs.
- Companies require extensive resources for supporting and maintaining legacy systems.
- Legacy systems are limited by their inability to respond to customer and supplier requests.
- The average legacy system is incapable of incorporating organizational growth.

An organization's actual and desired positions must be considered and compared before deciding on a particular ERP system. The following factors can be used to identify an organization's current competitive position:

- Competitive strategy
- Target market segment
- Customer requirement
- Manufacturing environment
- Characteristics of manufacturing process
- Supply chain strategy
- Available resources

Also, organizations need to perform careful needs' assessment, which can be done by either an in-house team or a consulting company. A sample checklist can be devised to ascertain the exact needs of the organization. A sample checklist for manufacturing organizations, which can be used for needs assessment, is given below:

- Current IT systems (software and hardware)
- Type of business (continuous, repetitive, batch, job shop, etc.)
- Market analysis (demand management, forecasting, CRM, etc.)
- Scheduling (MPS, MRP, and BOM requirements, shop-floor scheduling, etc.)
- Logistics (warehousing, transportation scheduling, etc.)
- Purchasing (**EDI**, the Internet, integration of inventory, **MRP**, etc.)

- Inventory (transactions, bar codes, package types, analysis, etc.)
- Performance measurements
- Finance and accounting (GL, AP, AR, credit, online banking, depreciation, aged inventory, budget control, costing, etc.)

Electronic Data Interchange (EDI): *This is a set of standards for structuring information that needs to be electronically exchanged between and within businesses, organizations, government entities, and other groups, within a particular format.*

Material Requirements Planning (MRP): *This is a software-based production, planning, and inventory control system used to manage manufacturing processes.*

Similar checklists can be devised for all other processes in an organization to understand its current position and needs in view of the necessity of understanding organizational needs and requirements while planning for ERP implementation.

6.3 Understanding Economic and Strategic Justification

Some key strategic benefits of ERP are extremely critical for the survival and growth of a firm, though these benefits cannot readily be converted into cash values. Therefore, the justification for implementing an ERP system should encompass not only economic but also strategic benefits. The economic and strategic justifications for implementing ERP systems prior to the installation help in identifying all potential benefits. These benefits later become a yardstick for performance evaluation. The strategic benefits given below can be used to devise an instrument to further justify ERP implementation:

- Improved response time
- Streamlined communication
- Real-time access to data
- Cost reduction
- Supply/demand chain
- Improved business processes
- System integration and flexibility

Each of these strategic advantages can be quantified in terms of cost savings. Duplicate data maintenance, for example, requires the investment of personnel time for entering data, and possibly managerial time for determining which set of data should be considered for decision-making. These quantified cost savings can also be used to show the over-all impact on financial results. Thus, an ERP system implemented as an integrated software package offers several advantages to the MIS function. The software package can offer a growth path from simple to comprehensive applications built into a database management system. It provides an upgraded path to technology and leads to functional enhancements supported by the software vendor. It can also reduce the development time and cost for software, documentation, and training classes, thereby allowing the MIS staff to focus on organizational change and servicing user needs for customization and professional assistance. These costs, however, have to be incurred before the firm can start reaping the benefits of an ERP system.

6.4 Analysing Project Scope and Broad Implementation Approach

The first step in the successful implementation of ERP is defining an achievable project scope using a phased and focused approach. This may involve a series of limited-scope sub-projects oriented towards quick success, which also provide maximum benefit. This, in turn, may be followed by another round of similar sub-projects, and so on, until all the objectives have been achieved. This incremental approach will help to alleviate the pressures and confusion associated with the **Big Bang approach** and allow end users to familiarize themselves with the software in a live environment with the software functionality of the ERP tool. Moreover, the ERP software should preferably be developed over open and platform-independent technology. This will facilitate the integration of ERP with other software applications in the future whenever the need arises. Implementing a low-cost non-standardized solution could lead to difficulties in the future when integration with ERP partners or software applications is required. Thus, it is quite important to include potential requirements of an organization among other considerations while planning for an ERP system.

Big Bang Approach: *It is a kind of ERP implementation approach where the implementation of different modules starts at the same time.*

6.5 Determining Resources

Resource determination for ERP implementation is in terms of the following:

- Infrastructure resource determination (hardware/software)
- Training facilities and education about ERP
- HR planning and commitment to deploy the right people for the purpose

Now, discussing one at a time, proper IT infrastructure is essential for a business enterprise to operate efficiently. While selecting the hardware for hosting the ERP application, the following factors need to be kept in mind:

- Network downtime and application downtime is time lost to productive activities.
- Irretrievable loss of data can be extremely costly.
- Regulatory non-compliance can be extremely costly.

Furthermore, it has also been found that most ERP software is developed in technically advanced countries. So one needs to identify the criticality of the IT infrastructure components and procedures in terms of the following:

- LAN, WAN, and hardware supporting the application
- Hardware supporting metadata, database, and data storage
- Software versions, service packs, and configurations
- Security and access
- Support functions: data backup and restore, audit trials, maintenance, etc.
- Implementing appropriate communication infrastructure to support global data traffic
- Consolidating multiple instances, and a support-centralized environment available round the clock to facilitate a holistic view of global business from different time zones
- Client/server (client: workstation OS, hardware constraints, connectivity constraints, **OO-Design**, GUI, division of responsibility; server: **scalability**, server interface, gateway, disk space, security and access control, backup-recovery-logging, fault tolerance, performance and system management)

- Network upgrade (bandwidth, **propagation delay**, utilization, diversity)
- Support and backup (providing global support and security, global disaster recovery and failover, round the clock support)

OO-Design: *Object-oriented programming (OOP) is a programming paradigm that uses 'objects' and their interactions to design applications and computer programs.*

Server Scalability: *It indicates a server's ability to either handle growing amounts of work in a graceful manner, or be readily enlarged.*

Propagation Delay: *It is the length of time starting from when the input to a process becomes stable and valid to the time the output of that system becomes stable and valid.*

IT has now evolved from client–computing to the Internet era with the help of multi-tier architecture, which consists of four layers: client, web-server, application server, and database server. This, in a way, compounds the challenge of implementing the technical infrastructure of ERP. Thus, organizational preparedness on all such technical aspects is quite important.

Similarly, organizations must identify and organise training requirements, facilities, and education about ERP at the planning stage itself. Without adequate training, a system can never be used properly nor can it ever achieve the projected returns. Education is, arguably, the most important and widely recognized critical success factor, because understanding the user behaviour and thinking, and buy-in are essential. (Muscatello, et al. 2003). A successful implementation requires a critical mass of knowledge to enable people to solve problems within the framework of the system. This critical mass of knowledge includes general education about the ERP system for everyone, that is, from the top management down to the end users, and this exercise should be completed before the actual implementation begins. It includes a massive amount of end-user training before and during implementation, as well as follow-up training after the implementation. To make end-user training successful, the training should start early, ideally before implementation begins. Thus, an organization needs to identify different sets of employees who would require training. It is also necessary to conduct comprehensive training needs' assessment and skill gap analysis.

6.7 Realizing Organizational Commitment to Change and Implementation

Enterprise resource planning is a package of ideas that requires people to change the way they work in order to realize their full potential. In the absence of a determined and clear-headed leadership and commitment of the top management, the functionaries down the line will always find creative ways to maintain status quo. As a result, the power inherent in the new information technology will be wasted and the benefits it can offer will remain unutilized. ERP systems will clearly alter the normal mode of operations and execution of functions within an organization. They will also impact the various social groups present within the organization. If employees are not properly prepared for this transition, their natural reaction would be resistance to any kind of change, which may sabotage the entire implementation procedure. Consequently, organizations must effectively demonstrate their commitment to change the processes and functions at all levels. For the success of an organization, ERP implementation can be considered a typical approach for the management team overseeing the transition. The captain or the chief executive leading the process of change should, therefore, be a person of high calibre and should be respected by all in the organization. He or she should consider the process a challenge to their personal prestige, and a test of their leadership qualities. Only then will the new system respond and deliver success.

6.9 Creating a Budget for ERP Implementation

Cost overrun is one of the most critical risk factors in ERP implementation. Most of the ERP projects are delayed and end up costing more

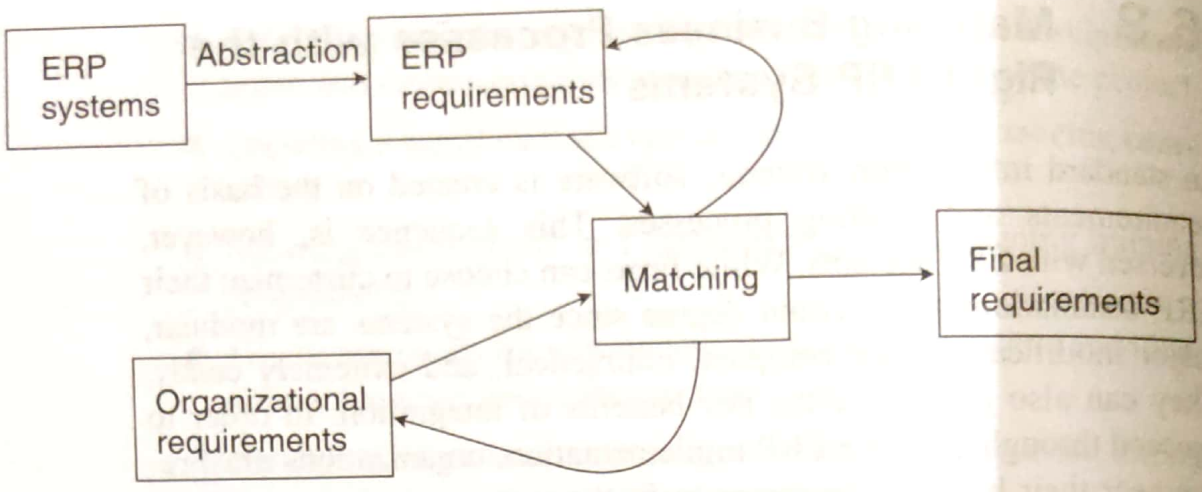

Figure 6.2 ERP requirement-driven process.

than the initial budget. There are a number of hidden costs associated with ERP implementation that contribute to the cost overrun. In addition to hidden costs, sometimes organizations implement ERP without calculating the costs involved and the ROI it delivers. Thus, the management should draw up budgetary guidelines for the ERP project during the planning phase itself and before issuing the RFI (**Request for Information**) to the vendors. The cost estimate should cover the TCO for the new system.

> ***Request for Information (RFI):*** *It is a standard business process, the purpose of which is to collect written information about the capabilities of various suppliers. Normally, it follows a format that can be used by the adopting organization for the purpose of comparison.*

The TCO begins with an estimate of all direct, indirect, and hidden costs that might be associated with all life cycle stages of ERP implementation. There are five major ERP life cycle components for TCO analysis: acquisition, implementation, operations, maintenance, and replacement. The most common cost drivers within each category are:

- The nature of the organization (e.g., large, public, multi-campus system versus a small, private institution)
- The quality and types of technologies (e.g., mainframe versus client-server system)
- Management practices (e.g., centralized vs. decentralized IT operations)

Too often, the initial acquisition cost alone drives the decision concerning ERP deployment. However, various indirect, unbudgeted, and contingency costs of implementation and operations also need to be

considered. For example, the direct or budgeted costs include all expenditure related to hardware, software, networking, capital, fee, and labour in each area. The indirect or non-budgeted costs include downtime and service to end users. These costs are hidden, variable, and, therefore, difficult to identify or measure. The identification and measurement of direct and indirect costs is a critical requirement for TCO analysis. Cost calculation should also involve some assumptions about the future, and subsequent simulation of various scenarios to arrive at alternative cost estimates. On the basis of these factors, a good assumption of ERP cost can be arrived at.

Thus, organizations need to invest considerable time into the vendor evaluation and project planning phases. Moreover, non-IT executives must be involved in vendor selection and planning. Such factors will help the management team to identify all hidden costs involved in ERP implementation. It is also important to develop an actionable and realistic project plan and implementation timeframe, which will help in controlling the cost involved in ERP implementation.

6.10 Selecting the Right ERP Package

The ERP package an organization selects will impact the organization's market presence, life span, and quality of life. Selecting the application package(s) that is best suited to the organization's needs can be challenging, and reaching a corporate-wide decision may take a long time. There are several things to consider when selecting the right ERP package for an organization. For example:

- Do the features and functions meet your needs?
- How compatible is the ERP package with the organization's business?
- Should an integrated package be bought from a single vendor, or best-of-breed solutions be purchased from several vendors?
- Have you considered the implications of the package on your IT infrastructure?

The factors given below can also be used to devise an instrument while comparing or selecting an ERP package:

- Strategy fit
- Technology (computing environment)

- Change management
- Risk involved
- Implementation time required
- Business functionality and integration
- Vendor credentials
- Flexibility
- Cost (direct and hidden)
- Upgradeability and maintenance

In case of SMEs, there are certain additional factors to be kept in mind while finalizing the ERP vendor. These factors are:

- **Affordability:** Attractive prices, including implementation support
- **Domain knowledge of suppliers:** It is important that the software developer or supplier knows the industry, and is willing to implement the software for the industry. If the industry is a manufacturing enterprise, procure the software from people who have experience in manufacturing industries.
- **Local support:** Low-end software packages developed abroad and sold in India are not likely to be adequately supported with regard to implementation. For effective implementation, such packages would need more support from suppliers, both in terms of IT expertise and domain knowledge.
- **Technically upgradeable:** Ensure that the suppliers undertake to upgrade the products to make the best use of technologies that are likely to become available in the future. With the advent of the Internet, Intranet, and EDIs, the ability to upgrade is important. Obviously, no supplier would do it free of cost. But a contract that binds the supplier to do it for an annual cost of up to, say, 15% of the software, is indeed worthwhile.
- **Use of latest technology:** It is useful to choose a product that is designed with object-oriented technology and GUI in mind. These are easy to implement, user-friendly, and amenable to modifications in the future.

Before selecting an ERP software package, an organization must document the functionality required to support its current business processes. This effort should also include, wherever possible, functionality to support its business objectives in the future. These requirements will be used as two of the criteria for evaluating and selecting the most

appropriate software package. This task is generally taken up by the implementation team. Requirement gathering can be done by conducting interviews with people from different departments, and by requesting written requirements from different departments of the organization. Furthermore, an organization's requirement can be classified into standard or special-interest requirements. Standard requirements, by definition, are those requirements that most companies require and most systems provide, whereas special-interest requirements are specific to an organization or system. Thus, based on the organzation's requirements, an RFI is created and forwarded to various vendors.

On the basis of organizational requirements, an initial candidate list can be prepared. While developing this potential-candidates' list, an organization must look for ERP vendors selected by other organizations with similar businesses. In case the list of vendors is long, then based on the information available and the market reputation of ERP vendors, the adopting organization can shortlist a few vendors. For the final selection of ERP vendors, the organization must see a detailed demonstration of various short-listed packages. The selection committee can also visit the actual ERP implementation sites provided by the vendors. This will enable the organization to check, at first hand, the success rate and limitations of the package. On the basis of all these observations, the project committee can finally select the right ERP package.

7.1 Designs of ERP Systems

Some of the common ERP system design and configuration approaches are -

- Single vendor ERP (Vanilla implementation)
- Best-of-breeds (multi-package implementation)
- Application service provider (ASP)

Single vendor-based ERP systems (plain Vanilla) dominate the IT landscape in comparison to the other two approaches. But this approach has proved to be problematic for some organizations, whereas the best-of-breeds approach is a multi-package ERP system configured largely as per the organization's requirement.

Single vendor or Vanilla ERP Implementation

In this approach, a single-vendor ERP package is implemented through the whole organization. For example: a complete SAP business suite, or Oracle EBS implemented in the organization. A complete Vanilla ERP package is easiest to implement because it allows the organization to follow the vendor-prescribed methodology and use the available consultants with specialized vendor expertise. A key ingredient of this package is the use of a single, unified database to store data for the various system modules.Vanilla implementation can increase development speed, reduce the development staff requirement, and offer a constant state-of-the-art IT capability. Some advantages of using the single-vendor approach are the following:

- Lower risk involved in implementation and integration
- Minimum customization required
- Less stress on the implementation team
- Ability to use the best practices built into the package
- Integration of all functional areas

Some disadvantages of using single-vendor approach are the following:

- Software may be lacking in terms of the functionality available as functionality will be limited.
- Software's business model may not be truly representative of the organization's business model.

- Single-vendor ERP may become a straight jacket rather than being able to implement new functionality in order to take advantage of business opportunities and remain competitive.
- As all the modules of the ERP package are implemented, the budget for the implementation will also rise.
- The organization will be dependent on the vendor for every other upgrade.

Generally, organizations keep ERP implementation as Vanilla as possible with minimum customization required so as to avoid complexity.

Best-of-Breed ERP Implementation

In this implementation approach, the applications and platforms used throughout an organization are different. The best-of-breed (BoB) approach is based on the integration of standard software from a variety of vendors. For example, the financial solution of SAP is integrated with the HR modules of PeopleSoft and the SCM solutions of Siebel. Some organizations have even developed custom components due to the absence of class software functions. The strengths of the BoB approach centre on the ability of organizations to benefit from the most appropriate, best-in-class software functions available. This approach also provides an infrastructure that accommodates the implementation of new or improved applications, thereby providing companies with constant state-of-the-art capability. This philosophy is also relevant for the integration of systems on an inter-organizational basis following any merger/acquisition activity, or e-commerce initiatives. The key enabler of the move towards this approach relates to the middleware that integrates the applications chosen to support the business processes. To integrate two applications at the data level, developers traditionally needed to write a low-level **applications program interface (API)** to read data from the first application. In addition, a code had to be written to transform the data to prepare it for transportation to the receiving application. Finally, more code had to be written to write the data into a file in the second vendor's format, and a different API had to be written for each connection made between different vendors' applications.

Applications Programming Interfaces (API): *It is a source code interface that an operating system or library provides to support requests for services to be made of it by computer programs.*

A BOB approach involves several vendors' applications. There are complex and costly interfaces that are difficult to maintain in terms of upgrades and a system's development efforts, such as the introduction of a new application.

Differences between Vanilla and Best-of-Breed ERP implementation

A comparison between the two implementation approaches is shown in Table 7.1. Single-vendor ERP systems promise multiple synergies. High levels of technical integration are created, and the large-scale re-engineering that often accompanies an implementation process improves organizational cohesion. Vendors of ERP software offer current technologies to the companies through upgrades and reduced reliance on internal IT functions.

Table 7.1 ▶
Comparison between best-of-breed and single-vendor ERP

Best-of-Breed ERP	Single-vendor ERP
Integration of applications is time consuming and becomes more complex when changes are made to components.	Integration of applications is pre-coded into the system and is maintained via upgrades.
Good flexibility in process redesign due to a variety in component availability	Limited flexibility in process redesign, as only one business process map is available as a starting point
Organization requirements determine the functionality.	Functionality of ERP is dependent on vendors.
The IT department may require multiple skill-sets due to the presence of multiple applications and platforms.	A single skills-set is required by the IT department because of a single package.
A context sympathetic approach to BPR is taken.	A clean-slate approach to BPR is taken.
Reliance on numerous vendors distributes risk.	Reliance on one vendor may concentrate risk.
Flexibility and competitiveness leads to the implementation of best-in-class applications.	Reliance on one vendor may concentrate risk.
Detrimental impact of IT on competitiveness can be dealt with, as individualism is possible through the use of unique combinations of packages and custom components.	Single-vendor approaches are common and result in common business process maps throughout industries. Distinctive capabilities may be impacted.

However, as the ERP market has matured, the problems with the implementation process and system functionality have also sprung up. Generally, ERP systems costs more than predicted, and, as a result, there are difficulties in the associated levels of organization. A key factor in the ERP market has been the need for BPR implementation, often in a one-step shift exercise. Organizations are also questioning whether single-vendor ERP systems represent the best practices in the core functional areas. Organizations, perhaps more importantly, have begun to realize the strategic consequences of these best practices. The implementation of single-vendor ERP systems results in broadly similar business processes and IT infrastructures. This has considerable implications in terms of the competitive advantage.

Application service provider

Some organizations even use the ERP system hosted by some third party, that is, an application service provider (ASP), on their own infrastructure. An ASP leases access to software applications to the organization. This is a very attractive possibility for many companies, especially those that are undergoing rapid growth or other changes. The organization that chooses to use an ASP out sources its applications. The applications run on the server of the ASP, and can be accessed by the company with a web browser via the Internet. Some key advantages of outsourcing ERP applications are the following:

- Less money needed for in-house ERP application
- Availability of an experienced and skilled set of workers for providing expertise to the organizations for implementing ERP

However, there are certain significant disadvantages of using ASP, which are as follows:

- ASP often offers a one-size-fits-all approach, which might not always fit the business scenario.
- ASP might discontinue the product features that the company relies on.
- ASP might inadvertently disclose sensitive business information of one's company, thereby compromising confidentiality.

So, this kind of approach is generally opted for when an organization has limitation of funds, skills, and expertise to host a completely independent ERP system. Now, ASP offers applications that can be integrated with an existing ERP system. This is a partially outsourced application, which -

- reduces the dependency on the ASP
- allows more flexibility in choosing a mix of applications that fit the business scenario
- keeps control over sensitive data in-house
- often requires less money than a pure in-house ERP system

Integrating the custom and outsourced applications requires Internet-savvy middleware that can work across **firewalls**. But, the integration between the ASP application and the in-house ERP is critical, and might cause problems. In this case, the implementation team needs to analyse two systems, map the application, and discover the missing data links, if any.

Firewall: *It is a dedicated appliance or software running on another computer, which inspects the network traffic passing through it, and denies or permits passage based on a set of rules.*

Big Bang implementation

In the Big Bang implementation approach, the entire suite of ERP applications is implemented simultaneously at all different locations of an organization. The implementation is quite rapid and covers new system suddenly and simultaneously. But massive resources are required to accomplish this implementation. This approach generally requires a large amount of testing before cutting over from the legacy system to the new system. It mandates six to eight months of testing prior to going live and actually using it for process transactions. Small firms generally use this approach with reasonable success. According to Daniel E. O'Leary (2002), during the Big Bang ERP implementation, all relevant processes and artifacts are chosen and implemented in the software. Then, all the modules are tested individually for their interfaces with other modules. If any problem is found during the testing stage, it is solved before developing and fixing the module. Finally, the legacy system is replaced with the new system. After implementation, there may be certain changes that need attention.

There are several advantages of using the Big Bang approach, as given under:

- Less time consumed for implementing ERP
- Less cost incurred to implement ERP
- Inadequate need to maintain the legacy system
- Full ERP functionality available at the start

'Time overrun' is one of the primary reasons for the failure of ERP projects. In longer implementation, the system requirement keep on changing, which negatively impacts implementation. Similarly, personnel turnover may be high, which will further impede system implementation. Since the Big Bang strategy handles the design, development, testing, and implementation of all modules simultaneously, it generally takes shorter duration to implement. Similarly, due to the abbreviated implementation time, limited work on the existing legacy systems, and the removal of temporary interfaces, the Big Bang approach will also cost less. Additionally, it also condenses the pain and difficulty of an ERP project into a shorter period of time.

According to Daniel, E. O'Leary (2002), since Big Bang entails an immediate migration from the legacy system to the new ERP system, there is little need to spend time or resources maintaining or changing the legacy system. Furthermore, since all modules are implemented at the same time and the desired functionality is linked between modules,

all functional features required will be available at once. Associated with the advantages, there are also a number of disadvantages of choosing the Big Bang approach as given below:

- Greater chances of system failure
- Significant amount of resources required
- Less resources available per module
- Inability of system to function properly till complete implementation
- Less possibility to go back to the legacy system

Since all modules are implemented simultaneously on all sites, the risk involved increases, and the chances of system failure are high. Furthermore, resources such as manpower, top management's involvement, external people's involvement, and various other organizational resources are also required. In this case, ERP implementation becomes the primary activity for the entire organization.

Phased Implementation Approach

In phased ERP implementation, the package is implemented in phases and sequentially. Either a single module is implemented at all sites, or a single module is implemented further in multiple phases at all sites. Sometimes a group of modules is implemented site-wise. Mostly, large firms choose to phase in implementation, module by module, or by site. Compared to the Big Bang approach, phased implementation requires substantial attention to the legacy system in order to facilitate integration with the new system. Similarly, compared to Big Bang implementation, phased implementation requires relatively fewer resources during implementation, and necessitates less risk. In this approach, organizations generally prefer to implement the easiest module first. For example, modules with minimum re-engineering effort required are implemented first. Some of the advantages of using the phased implementation approach are:

- Low risk involved during implementation
- Systems to be periodically checked for success rate
- Less resource requirement when compared with the big bang approach
- Availability of legacy system until the complete implementation of ERP systems
- More knowledge gained during the implementation process

Since every module is implemented in a phased manner, it can be individually tested. This directly reduces the risk involved during implementation. In the phased approach, the implementation team can show the working of the module implemented to the entire organization much before the implementation process is complete. This helps in building an organization's confidence as a whole towards the new system. The success of each phase can be used to demonstrate to the management that the system will work. Moreover, the resource requirement is less in case of the phased approach as the peak resource requirement is spread over multiple phases. Thus, the resource requirement at each stage of implementation can be limited and made feasible even for the most constrained organizations. This makes implementation easier. The big bang approach completely switches off the legacy system, leaving no alternative to come back to the earlier system in case of failure. Since the phased approach installs each module individually, it gives an organization the backup of the legacy system till the time the entire implementation is complete and successful. The knowledge gained in one phase during ERP implementation can be transferred to other phases. This results in a higher success rate of implementation at a later stage in the organization.

Given below are the disadvantages of using the phased implementation approach:

- Higher coordination required among people of different departments during the implementation process. This coordination is important since uncoordinated personnel increase the risk to an ERP project.
- Longer duration to install an ERP system
- Higher costs involved in the implementation process as the project takes longer to implement
- Higher risks due to the personnel turnover as the project is stretched over a longer duration
- Greater need to maintain the legacy system till the entire ERP system is operational

Based on the existing literature and surveys on ERP systems, it has been found that a large percentage of organizations use the big bang approach or the mini-big bang approach. Table 7.2 gives the percentages of the implementation approach adopted by the organizations.

Table 7.2 ▶
ERP implementation strategies

Strategy	Months	%age
Big Bang	15	41
Phased rollout by site	30	23
Phased rollout by module	22	17
Mini Big Bang	17	17
Phased rollout by module and site	25	2

Source: Mabert et al. 2000

7.3 ERP Implementation Life Cycle

The process of ERP implementation is referred to as the ERP implementation life cycle. In Chapter 5, the various planning stages of ERP implementation have been discussed. After planning and selecting the right package to be implemented, the following steps in the ERP implementation life cycle should be undertaken:

- Team setting up
- ERP design
- **Gap analysis** and business process re-engineering
- Installation, testing, and configuration
- Training

After training the users about the implementation package, once the system goes live, the process of 'enhancement' continues for a longer duration of time. Figure 7.1 illustrates the ERP implementation life cycle. This life cycle is built on works that identified the factors that lead to the successful implementation of ERP systems.

Gap Analysis: *An analysis to identify the gaps between the definition of process in the ERP system and its definition in an organization.*

Team set-up

Constituting an ERP implementation team is highly important in the overall ERP implementation life cycle. The team should be composed of multi-disciplinary professional individuals from the vendor's side, from the consulting firm, and the organization itself from the implementation

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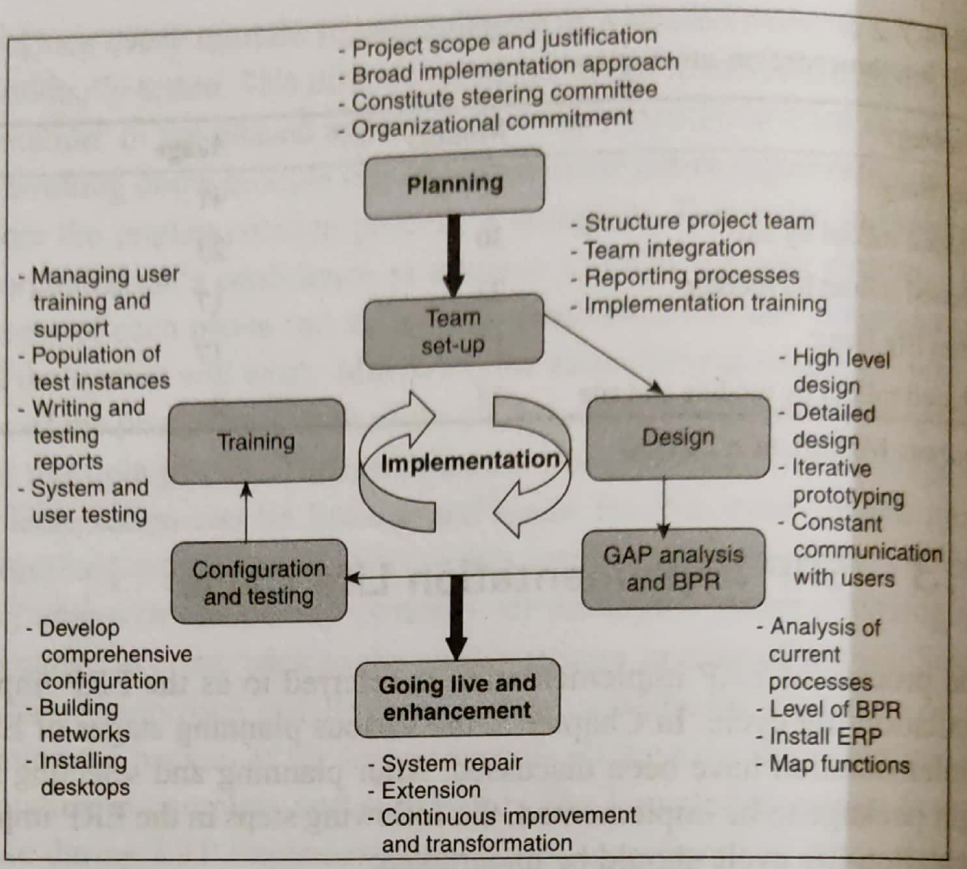

Figure 7.1 ERP implementation life cycle.

team. The division of responsibilities among the three depends on each one's experience in ERP implementation: in implementing IS applications in general and in managing organizational change.

The responsibility of establishing a team is on the ERP project leader together with the steering committee. The role of the steering committee itself is quite important in ERP implementation. Only the people from the top management of the organization, the ERP project leader, **CIO** of the organization, the top people from the consulting firm, and the software vendor serve as members of the steering committee. The key responsibilities of the steering committee are:

Chief Information Officer (CIO): *This is a job title for the head of the information technology group within an organization. The CIO typically reports to the chief executive officer.*

- Creating an overall blueprint of organizational integration and automation
- Budget approval for implementation; reallocating the budget in case of deficit at later stage
- Approving changes in the existing processes during re-engineering
- Managing and evaluating project progress

Depending upon project size, organization size, and implementation scope, the implementation team can further be divided into sub-teams. The key responsibilities of implementation teams are as follows:

- Selecting the right ERP package
- Administering the project
- Analyzing the gaps between an organization's requirements and package functionality
- Identifying the process re-engineering requirements and implementing those requirements
- Evaluating the system's performance after installing ERP
- Creating the framework for end-user training
- Participating in the training process
- Setting guidelines for the system's maintenance

In addition to the ERP implementation team, a technical team composed of similar personnel is established to install the technological infrastructure. The technical support team is composed of technical people having clear understanding of computer networks, database administration, software installation, etc. For example, while installing SAP R/3, the team that understands the SAP basis is responsible for installation, configuration, and support over the system. The key responsibilities of the technical team are -

- Installing the software of the ERP server
- Installing and servicing client software
- Administering the database
- Administering and installing the ERP network
- Supporting the post-implementation phase

Considering ERP implementation a highly important project for organizations, the HR departments must release the best, and most dedicated and experienced people from various departments to be a part of the ERP implementation team. These employees play a vital role in the organization as they help in implementing the ERP package at ground level, and also help external consultants in understanding the organizational processes. As far as general administrative requirements are concerned, the entire organization, as a whole, must support the ERP implementation team.

Once the implementation team has been set up, the training of this implementation team becomes a major task. The objective of training the key users and management trainees is to make them comfortable and confident with the new systems. This will enable them, in the next step, to compare the current work processes with those offered by the ERP systems. It also helps them in understanding the new ERP systems in terms of flexibility, data model, configuration issues, and the like. The training is facilitated by the software vendor, and includes the understanding of the following aspects:

- Working of major components of the package
- Understanding the data model
- Developing flexible and customizable parts of the system
- Evaluating system configuration details
- Recognizing the strengths and weaknesses of the system

ERP Design

This phase is applied in case an organization wants to design its own ERP system instead of implementing the standard packaged software. The approach for ERP system design shall be independent of platform and technology. It must separate the specifications of system functionality from the specifications of implementation of that functionality to a particular technology platform (Figure 7.2).

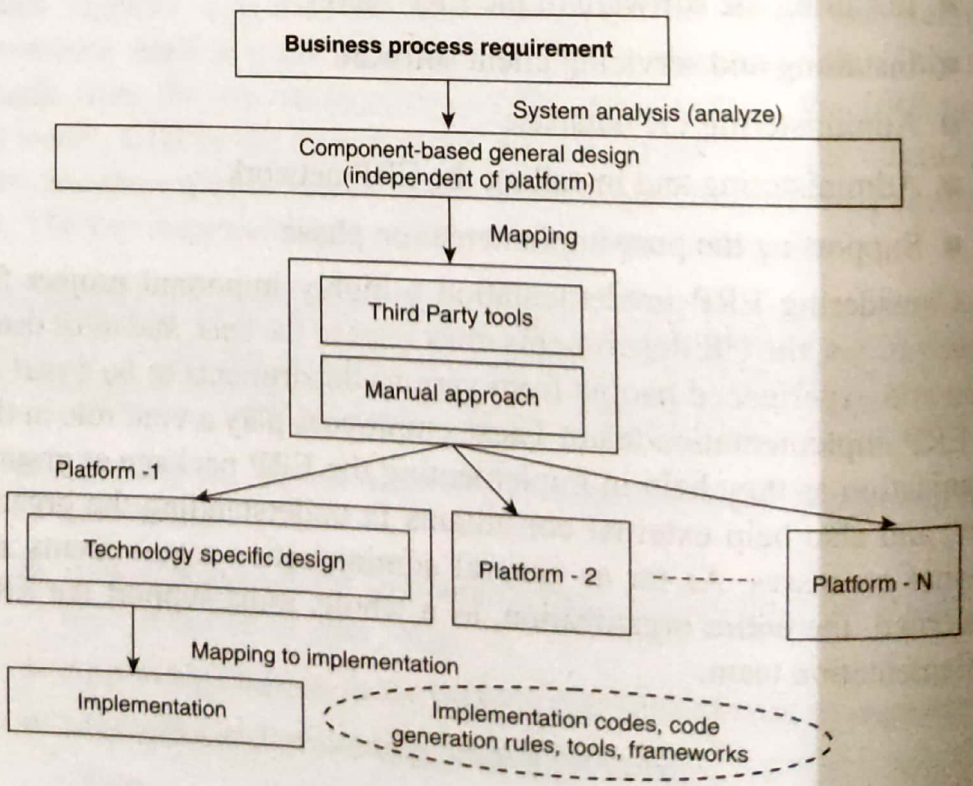

Figure 7.2
ERP design model.

This approach allows the same model-specifying system functionality to be realized on multiple platforms through auxiliary mapping standards, and allows different applications to be integrated by explicitly relating their models.

Specific ERP designs are platform dependent, whereas some general designs are independent of the platform. The term platform refers to the technological and engineering details that are irrelevant to the fundamental functionality of a software component.

The above framework explains how the functionality specified in generic design is realized in a platform-specific design, which is derived from generic design via some transformation or modification (Figure 7.3). Generic design provides formal specifications of the structure and function of the system that abstracts away technical details. It describes computational components and their interactions in a platform-independent manner. The components and interfaces, in turn, are a way of realizing some more abstract information systems or application, which itself helps realize a computation-independent business model.

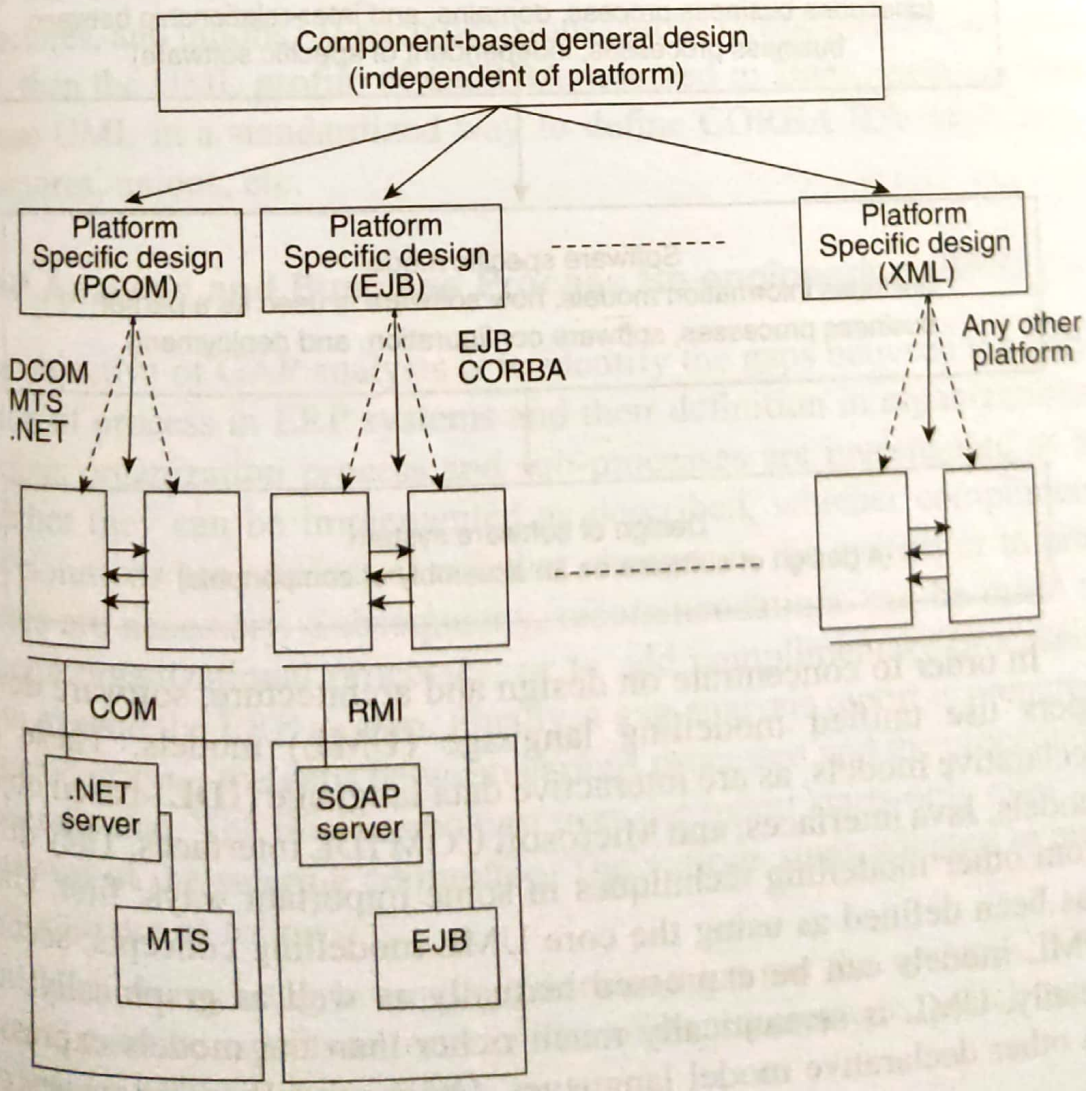

Figure 7.3
Generic component-based design for an ERP system.

Figure 7.4 shows the structure of the specifications, realizations, and refinements from business domain to code domain, covering the granularity of the system, sub-system, etc. Abstracting the fundamentally precise structure and behaviour of a system from the implementation-specific issues has certain important benefits:

1. It becomes easy to validate the correctness and implementation methods of an ERP system. For example, in a software-specific model, the concepts of exception mechanism, parameter types, platform-specific rules of objects, etc., have to be taken care of. So the business process model (generic design), does not need these distinctions and can instead use a simpler, more uniform modelling.
2. It becomes easy to produce implementation effects on different platforms while conforming to the same essential and precise structure and behaviour of the system.
3. It becomes easy to define the forms of integration across the systems and then map them down to the platform-specific mechanisms.

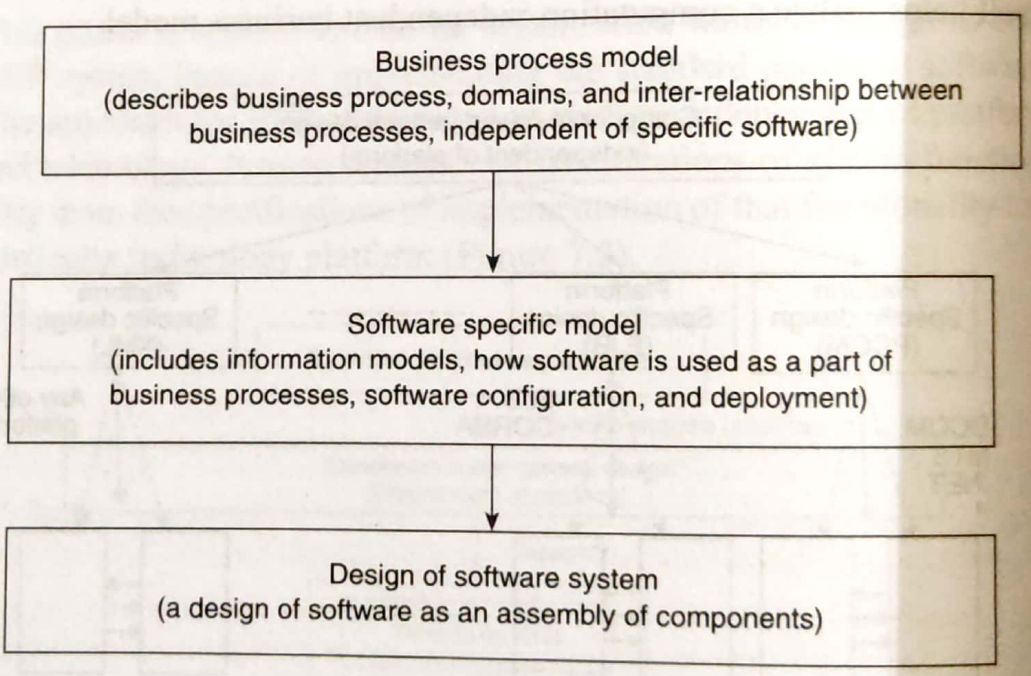

Figure 7.4
Generic design model preview for an ERP system design.

In order to concentrate on design and architecture, software developers use unified modelling language (**UML**) models. These are declarative models, as are interactive data language (**IDL**)-based object models, Java interfaces, and Microsoft COM IDL interfaces. They differ from other modelling techniques in some important ways: first, UML has been defined as using the core UML modelling concepts; second, UML models can be expressed textually as well as graphically; and finally, UML is semantically much richer than the models expressed in other declarative model languages. Other modelling languages can

express syntax, but cannot express the constraints on usage and behaviour at length. Defining constraints by using UML makes life easier for a programmer. It provides precise instructions and decreases the amount of work required to get different implementations done from the same specifications. So, UML models can be applied to generate generic designs of different ERP modules.

UML (Unified Modeling Language): *It is a standardized specification language for object modelling. UML is a general-purpose modelling language that includes a graphical notation used to create an abstract model of a system, referred to as a UML model.*

IDL (Interactive data language): *It is a programming language that is a popular data analysis tool among scientists.*

Moreover, since UML is independent of middleware technologies, the transformation of generic design to software/platform-specific design can be automated. For example, in order to transform a generic design to CORBA-specific design, certain discussions need to be had. Are the UML classes representing CORBA interfaces, value types, structures, and unions? If such decisions can be defined by a UML profile, then the UML profile of CORBA, adopted in 2000, specifies how to use UML in a standardized way to define CORBA IDL interfaces, structures, unions, etc.

GAP Analysis and Business Process Re-engineering (BPR)

The objective of GAP analysis is to identify the gaps between the definition of process in ERP systems and their definition in organizations. Various organization process and sub-processes are investigated as to whether they can be implemented as described, whether complimentary solutions are needed, or whether changes in the system or in processes are necessary. Subsequently, recommendations can be made to change organizational processes, or to add complimentary processes, or to expand the ERP system. Finally, a gap analysis report is prepared, which describes the gaps between various processes and the procedures to handle that. The implementation over the report starts only after the approval of the steering committee. The various steps adopted to analyze gaps are as follows:

1. Check the existing business system and list out the system's flaws and positive aspects to form an idea of its requirements, which could help in ERP implementation:

2. Evaluate and decide the additions that need to be made to the business in view of ERP implementation. The objective is to eliminate the difference between ERP and the organization's commercial activities.
3. Rate the existing level of performance to set a benchmark or standard for the business as on date. This helps in realizing the benefits of ERP implementation.
4. Conduct an in-depth study of the regulations and statements provided by the organization and suggest modifications.
5. Define the roles of the employees that help them in meeting the priorities and retaining the structure of the organization. This is also done to make things clear for an ERP function.
6. Check if the objectives in discharging duties are being met because they are the ultimate solutions to any issue. If they are not met, the gaps should be made known and corrected. Only then can the organization achieve the benefit of ERP.
7. Ensure that functions are executed properly and, if need be, personnel can be rewarded to boost and encourage performance.
8. Take into account all the factors of the study and give the collated results. It either recommends the implementation of an ERP system or rejects the idea in totality.

This whole process takes about three to four months, depending on the complexities and the technicalities involved. Gap analysis requires the proper understanding of the firm and the ERP product. The analysis should fully focus on how the business process and software can be mutually beneficial to one another. GAP analysis becomes instrumental in deciding ERP implementation.

Business process re-engineering is the analysis and design of various workflows and processes of an organization in order to achieve positive change in the procedures as per an ERP package. It is concerned fundamentally with rethinking and redesigning the business processes to obtain drastic and sustainable improvements in quality, costs, service, lead times, outcomes, flexibility, and innovation. In support of this, technological changes through the implementation of simulation modelling are being used to improve the efficiency and effectiveness of many companies. These technological changes also play a major role in BPR initiatives. Performing BPR is the most important and crucial part in ERP implementation as it starts immediately after gap analysis. Re-engineering of business processes involves changes in people,

processes, and technology. The interaction of people with processes and technology may prevent effective BPR implementation. Some of the key obstructions in a BPR implementation are:

- Lack of focus and commitment to change
- Senior management is comfortable with existing processes.
- Human and organization issues like user resistance to change
- Organizational culture, attitudes, and skills
- Resource restriction and fear of IT

Re-engineering of a process can be done by combining similar processes, reducing checks and controls, developing centralized processes, and the latest involvement of technology, etc. Some of the key activities involved in applying BPR during ERP implementation are the following:

- Constituting a re-engineering team having diversified people with clear roles while applying re-engineering.
- Identifying processes to be re-engineered with respect to new objectives.
- Identifying the cause of resistance in implementing change.
- Understanding technology involvement and information flow with respect to the new system.
- Modelling the re-engineered process in terms of process flow, data flow, and control.
- Defining the new organizational structure and personnel management system.
- Identifying different roles in various processes and mapping them with the corresponding skill-set.
- Developing a migration plan and strategy.
- Involving the implementation team and business consultants.
- Following an iterative and phased implementation approach.
- Conducting staff training in respect to new process and new technology.

Installation, Configuration, and Testing

In this phase, the actual installation of ERP software, configuring various ERP modules, and finally, performance and integration testing are done. The installation activity includes—

- Building networks
- Server installation (e.g., database, application, and web-server installation)
- Configuring middleware and integrating with back-end and **front-end** applications
- Migrating data from legacy application to new ERP system
- Installation of user desktops, defining user roles, and access methods

Front End: *It refers to the initial and the end stages of a process. The front end is responsible for collecting inputs, in various forms, from the user and processing it to conform to a specification that the back end can use. The connection of the front end to the back end is a kind of interface.*

The performance-testing approach comprises the following steps:

1. Selection of **use-case** scenarios relevant to performance
2. Mapping of the selected use cases to the actual ERP system
3. Execution of the test

Use-case: *The use-case technique is used in software and systems engineering to capture the functional requirements of a system.*

Table 7.3 classifies the main parameters for the performance testing of the ERP application.

Other parameters of performance testing can be used after discussions within the testing team. Different ways of using the middleware facilities, services, resources of middleware, and deployment environment correspond to varied performance results. For example, performance will vary if the database is accessed several times or never. Similarly, a given middleware may perform adequately, or quite poorly, for applications that stress persistence and transaction activities.

For the execution of a test, an initial prototype can be constructed. The execution of the prototype is to test system design and the integration of new processes. The prototype facilitates the testing of new workflows and the user's expectations regarding the designed processes. It also reduces the risk associated with the final model of operation at a relatively early stage.

Table 7.3 ▶
ERP application performance testing parameters

Parameters	Related issues
Workload	Number of clients
	Client request frequency
	Stimulus–response time
Middleware configuration	Database connection, pool size
	Application component **cache** size
	Number of middleware servers and their integration
Application specific	Interaction with middleware
	- use of transaction management
	- use of security service
	- component replication
	Interaction with persistent data
	- database access
System administration specific	Data back-up and recovery methodology
	Data partitioning and placement service
	Data migration

Data Partitioning: *A partition is a division of a logical database or its constituent elements into distinct independent parts. Database partitioning is normally done for manageability, performance, or availability reasons.*

Cache: *It is a collection of data duplicating the original values stored elsewhere or computed earlier, where the original data is expensive to fetch (owing to longer access time) or to compute, compared to the cost of reading the cache.*

Training

Training is the key phase in the overall implementation life cycle. The employees in the organization will be taught to make use of the system on the day-to-day and regular basis to ensure that it becomes a part of the system in the organization. Without proper training, the system cannot be optimised. Training can be done by lectures or by self study while working with the implementation team. Since the training cost is very high, it is recommended to prepare a training plan that will provide an overall framework and facilitate control of the activity. The following steps are suggested for training on ERP system implementation:

- Identify training needs; analyse corporate business plans and business processes.
- Team training that focuses on teamwork and team decision-making. The teams must develop the ability to -
  1. Understand the concept of an integrated process and interaction between its different components
  2. Establish common goals and performance measures
  3. Develop policies based on the understanding of the system as a whole: its environment, its goals, its performance measures, the different aspects of competition, and the dynamic interactions among these aspects
  4. Implement a monitoring system and the use of its signals to control the whole process
  5. Develop problem-solving skills at the group level. Implement the policies, controls, and solutions to specific problems, and evaluate the results
- Integration of business procedures and tasks into content for training sessions.
- Training ownership: functional area, control, training, resource allocation.
- Implementing continuous conceptualization: use support mechanisms, people networks, business coaches, and reward structure.
- Implementing a proactive stance: establish permanent cross-functional teams, and set up work groups for projects.
- Implementing strong links with business units: ensure presence of business unit managers in training unit policy-making bodies, develop specific roles such as relationship managers.
- Offering business process training: embed business process in technical training, use business area personnel as trainers.
- Creating, distributing, and delivering both traditional and online context.
- Teaching the integrated, dynamic approach to operations: users should learn how to utilize ERP for automatic decision-making.

Based on these steps, an instrument can be devised for user training on the ERP system.

7.4 Examples: ERP Implementation Life Cycle

[I] SAP R/3 Implementation Approach at Dabur

Dabur with its legacy ERP system from BAAN and MFG/PRO has enjoyed a lot of success in the past. But in terms of optimized output, Dabur found the following problems with the system:

1. Inventory control was not up to the mark.
2. Problem of slobs
3. Cluttered processes
4. Authorization problem
5. Inconsistency in data

As a result, the organization decided to replace the legacy application with the new ERP system. So, after looking at the requirements, an ERP selection committee was formed that decided to implement the Vanilla version of SAP. The initial planned budget was approximately INR 10 crores, which went up to 12 crores when actually implemented. It took around one year to implement SAP at Dabur.

The implementation process started with the formulation of a 30-member core team. In the team were 20 people from various departments of the organization, and 10 from the consulting partner. These 30 members formed four teams of four different, but core, departments of the organization. These four departments were sales and distribution, marketing management, finance/costing, and product planning/quality management. The actual implementation process was divided into the following steps:

1. Developing a business blueprint and a 'to-be' document
2. Implementing the design, configuration, and installation phases
3. Integrating the test results and preparation of master data
4. Training top-level users
5. Training core users
6. Going live

On April 1, 2006, the organization went live with the new ERP system. The legacy system was rendered redundant, but its database still existed for reporting purposes and future references. Since the Vanilla

version of SAP was implemented, the organization did not face any major integration issue. Some of the future challenges faced by the organization were as follows:

- Forward integration of SAP with distributors and stockists
- Backward integration of SAP with suppliers
- Implementation of new point-of-sale (POS) system at stockist point and integration with SAP-ERP
- Implementation of SAP HR and payroll
- Implementation of SAP in other new businesses

[II] SAP Implementation Life Cycle in a Leading Power Distribution and Generation Organization

SAP has global presence in various business verticals. This case is a classic example of the SAP R/3 implementation life cycle in one of the world's leading power generation and distribution organizations, conducting most of its operations out of Asia. The organization is a world-class integrated power major with increasing global presence. The power generation capacity of the company is primarily based on its coal-based thermal power generation and hydroelectric power generation. The combined capacity of power generation can be estimated by the company's over 15 thermal power plants, 8 cycle power generation plants, and 5 hydroelectric plants, and that too in different geographical locations.

The organization's total installed capacity is more than 30,000 MW, including different joint ventures that it has signed with other companies. Furthermore, the organization is considering participation in different elements of the LNG value chain, and nuclear power generation through equity participation/strategic investments with prospective partners across the globe. In order to manage such a large setup and operations, the organization is divided into 5 subsidiary units.

With such diversified and widespread operations, and considerable employee strength across the globe, the organization was facing severe problems in some of the following areas:

- Lack of standardization of processes
- Inappropriate resource placements in different units
- Lack of clarity of roles and timely training of end users
- Redundant jobs and asymmetric data in different parts

- Lack of effective and prompt end-user support
- Lack of adequate hardware and connectivity at locations
- Disintegrated purchase and distribution management systems

The organization was supported by different MIS applications in all the departments, but there was minimal integration among those applications. Consequently, the organization needed an integrated ERP application to simplify and integrate most of its operations. In order to plan and implement ERP, the organization initially constituted a high-level strategic and screening committee in order to gauge the viability of ERP implementation, and identify a suitable ERP package. The committee reviewed different ERP packages for over 6 months. Ultimately, the contract for the "Procurement of ERP and its Implementation" was awarded to SAP in 2005 with a leading consulting company as their implementation partner. Some of the primary reasons for choosing SAP were:

- It provided consulting support for the implementation. Most of the leading consulting groups were supporting SAP implementation as co-partners in the implementation.
- It supported most of the business requirements of the organization
- The package was offering multi-currency and multi-language support.
- In addition, SAP was also helping the organization integrate its operations with suppliers and major clients.

Many global power majors, such as ESKOM, Reliant Resources, RWE Empower, AEP, Enel, etc. had implemented SAP. These organizations were contacted for sharing their experience and feedback on SAP's ERP implementation. The overall implementation process for ERP was divided into five broad steps with pre-defined objectives, as given below:

Project Preparation
- Project organization and standards
- Prepare project charter
- Initial project planning
- Level ½ training for project team
- Technical requirement planning
- Prepare executive kick-off meeting

Business Blueprint	- Customer requirement gathering - Gap analysis - Create business blueprint - System installation - Management review of business blueprint
Realization	- Level 3 training - Baseline configuration - Final configuration/integration test - Design, develop, and test interfaces, reports, and conversions
Final Preparation	- Go-live plan - End-user training - Integration, volume, and stress testing - Establish internal helpdesk - Data migration - Cut-over to productive environment
Go Live and Support	- Application support - Verify accuracy of productive system - Measurement of business benefits