

LEARNING OBJECTIVES

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

- describe enterprise resource planning (ERP) systems
- identify ERP modules and components
- understand the process of the evolution of ERP
- understand the integration of and the need for ERP applications
- identify various technologies related to ERP systems
- understand the characteristics and benefits of ERP systems
- understand the technological background of ERP systems
- assess the direct and hidden costs for ERP implementation
- anticipate and describe the likely challenges during ERP implementation

1.1 Defining Enterprise Resource Planning

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

As explained in Figure 1.1, enterprise resource planning (ERP) is the industry term used to describe a broad set of activities supported by a multi-module application software that helps a business manage the important parts of its business. These parts can include product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. ERP can also include application modules for the finance and human resources aspects of a business.

In today's globalised economy and increasingly competitive environment, there is a need for the implementation of a total business solution—a solution that not only supports various business processes within the organization but also integrates its value chain with its suppliers and

customers. Organizations nowadays want to anticipate and exceed customer expectations in terms of quality, time, service, availability, and efficiency. Increasingly, the major tool that innovative and progressive organizations have come to depend upon is enterprise resource planning (ERP) solutions. ERP is a software solution that integrates the various functional spheres in an organization—a link through the entire supply chain, aimed at adapting the best industry and management practices for providing the right product at the right place and at the right time at minimum cost. This system has, thus, proved to be a corporate marvel, with a huge impact on both businesses and information technology. ERP systems, if implemented successfully, can provide strategic, operational, and information-related benefits to the adopting organizations.

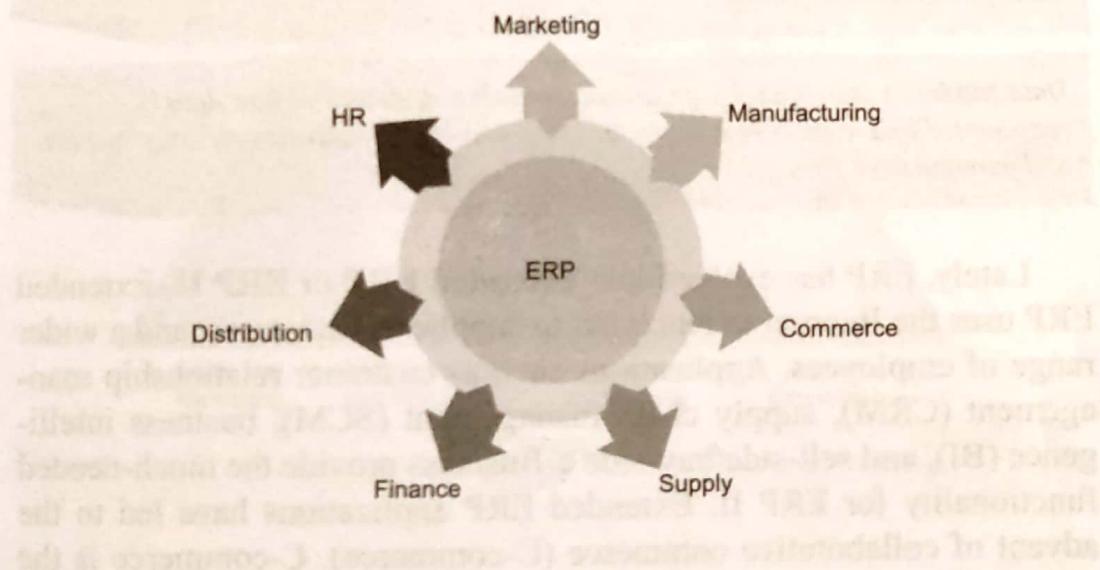
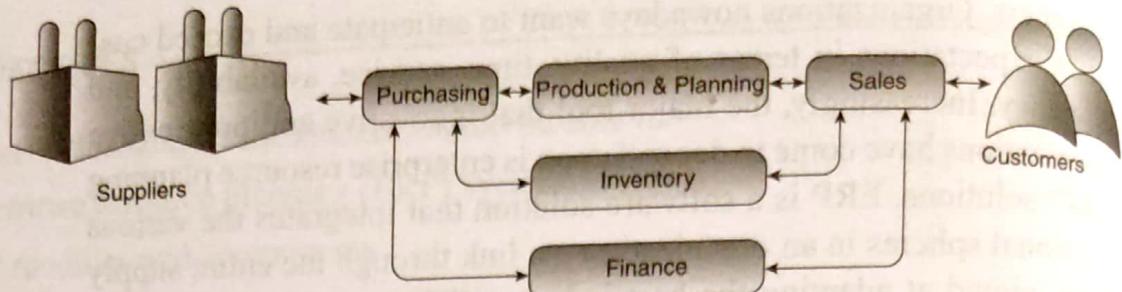


Figure 1.1
ERP system
(Multi module system)

ERP is essentially an integrated software system consisting of multi-module applications and a common **database**. Such software systems help coordinate business activities and facilitate the flow of information across an enterprise. ERP systems help an organization to manage crucial business processes such as planning, production, inventory, purchasing, sales, customer support, etc. ERP systems provide not only the core functionality that most large corporations depend on, but also a number of financial applications. The ultimate aim of ERP is to integrate the various departments within an organization based on the enterprise-wide **data model**. This eliminates data redundancy, enhances accuracy, and facilitates online information retrieval. Figure 1.2 shows how information is integrated within an organization using the ERP system.

Figure 1.2
Business integration through ERP systems.



Database: A database is a structured collection of records or data stored in a computer system so that a computer program or person using a query language can consult it to retrieve related information. The records retrieved in answer to queries provide information that can be used to make decisions. The computer program used to manage and query a database is known as a database management system (DBMS).

Data Model: A data model is an abstract model that describes how data is represented and used. It has three main components: structural part, integrity part, and manipulative part.

Lately, ERP has evolved into **extended ERP** or **ERP II**. Extended ERP uses the Internet to reach out to suppliers, customers, and a wider range of employees. Applications such as customer relationship management (CRM), supply chain management (SCM), business intelligence (BI), and sell-side/buy-side e-Business provide the much-needed functionality for ERP II. Extended ERP applications have led to the advent of collaborative commerce (C-commerce). C-commerce is the electronic interaction of different businesses within the supply chain or an industry.

The primary impetus for the origin of ERP II stems from the need to provide access for various stakeholders, i.e., customers and business partners, to internal data regarding scheduling, delivery, inventory, manufacturing, invoicing, and planning information. Over the past few years, solutions such as CRM and SCM have leveraged the Internet to support these processes. ERP II incorporates all these processes in a single package. Figure 1.3 indicates the enterprise wide architecture of extended ERP application.

To be globally competent, an organization needs to open up and reach out to its collaborative partners. ERP II enables businesses to compete by providing information online and by adding real value to businesses of all types and sizes. Various enterprises are implementing

this cross-functional system. At the same time, most of the ERP vendors are already offering their products with inbuilt extended applications. MySAP and Oracle EBS are two such products that offer inbuilt CRM and SCM applications.

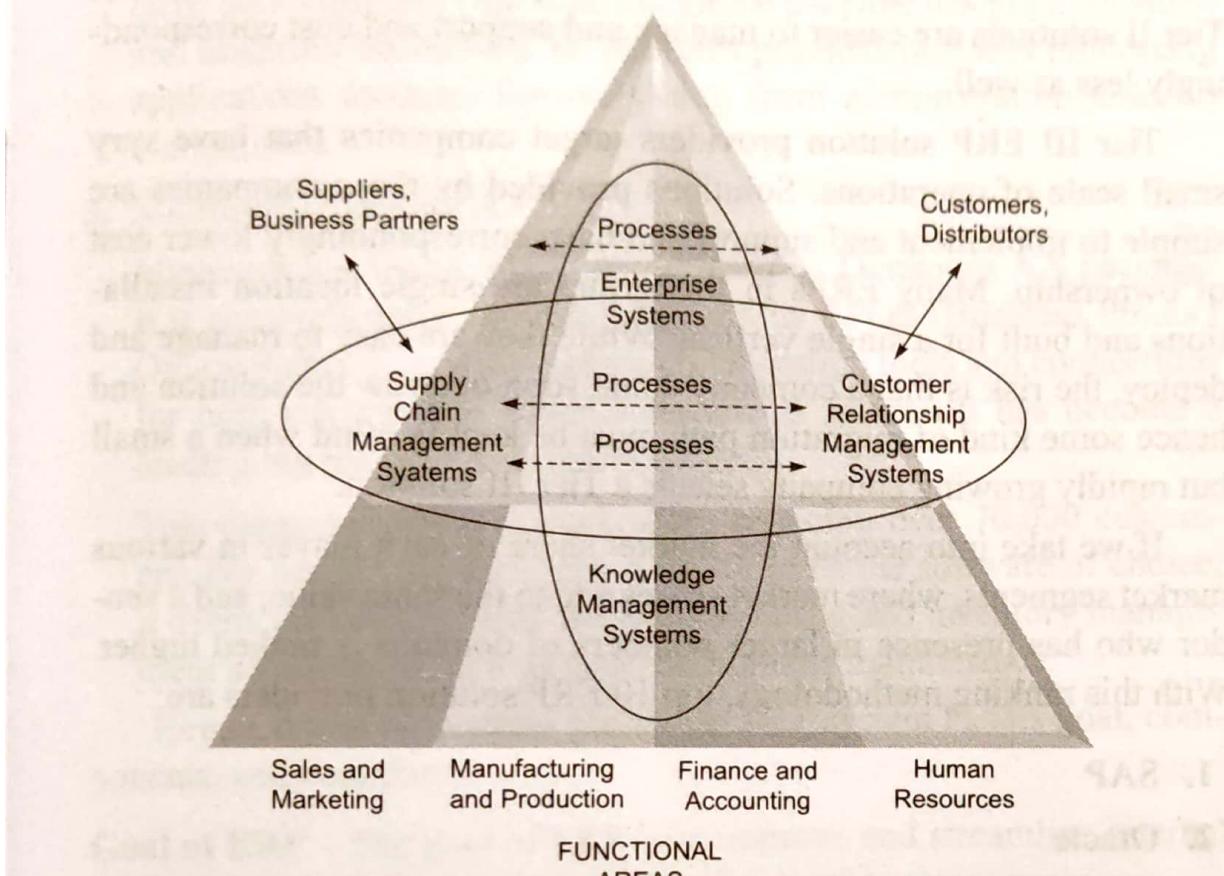


Figure 1.3
Enterprise
Application
Architecture of ERP II

5)

Components of ERP System

ERP system and Management Information System (MIS) have common components:

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

Business processes: As per various management theories, the organizational business processes fall into three levels—strategic planning, management control, and operational control. Typical ERP solutions are designed for supporting and streamlining business processes at all the three management levels.

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

Hardware infrastructure, operating systems and data resources: IT infrastructure in terms of client computers, application servers, networking equipments, operating system, database management systems (DBMS), security applications, etc. are important parts of ERP systems. Many large ERP systems are UNIX based. Windows NT and Linux are other popular operating systems to run ERP software. Legacy ERP systems may use other operating systems. Similarly, large ERP systems support various database like Oracle, IBM DB2, Sybase, MS SQL Server, etc.

The Boundary of an ERP System

The boundary of an ERP system is usually small than the boundary of the organization that implements the ERP system. In contrast, the boundary of supply chain systems and ecommerce systems extends to the organization's suppliers, distributors, partners, and customers. In practice, however, many ERP implementations involve the integration of ERP with external information systems.

1.5 Evolution of ERP Systems

Enterprise resource planning represents the latest stage in the evolution and expansion of production planning and control techniques for manufacturing enterprises, ranging from material requirements planning (MRP) to capacity requirements planning (CRP), and then to manufacturing resource planning (MRP II).

MRP stands for "Material Requirements Planning". It is a computer-based system which takes care of inventory management, taking a product schedule as input and generating works and purchase orders as output.

MRP II (Manufacturing Resource Planning) was later originated from the concept of MRP. The basic objective of MRP II was to take care of various business processes surrounding MRP. Not all of the business processes needed IT support, but others did, hence MRPII systems supported a wider range of business processes than MRP. The name MRPII came about because the new set of business processes was called "Manufacturing Resource Planning", and because the initials were the same as MRP, the II was tagged on.

MRPII systems tended to be so wide in scope that eventually systems developed towards giving IT support to all parts of a manufacturing company. This is when the term ERP came into use to signify its enterprise-wide scope.

From a business perspective, ERP has expanded from the simple coordination of manufacturing processes to the composite integration of enterprise-wide back-end processes. From a technological aspect, ERP has evolved from mere legacy implementation to a more flexible, tiered **client-server architecture**. Figure 1.7 shows how the concept of ERP has changed over a period of time.

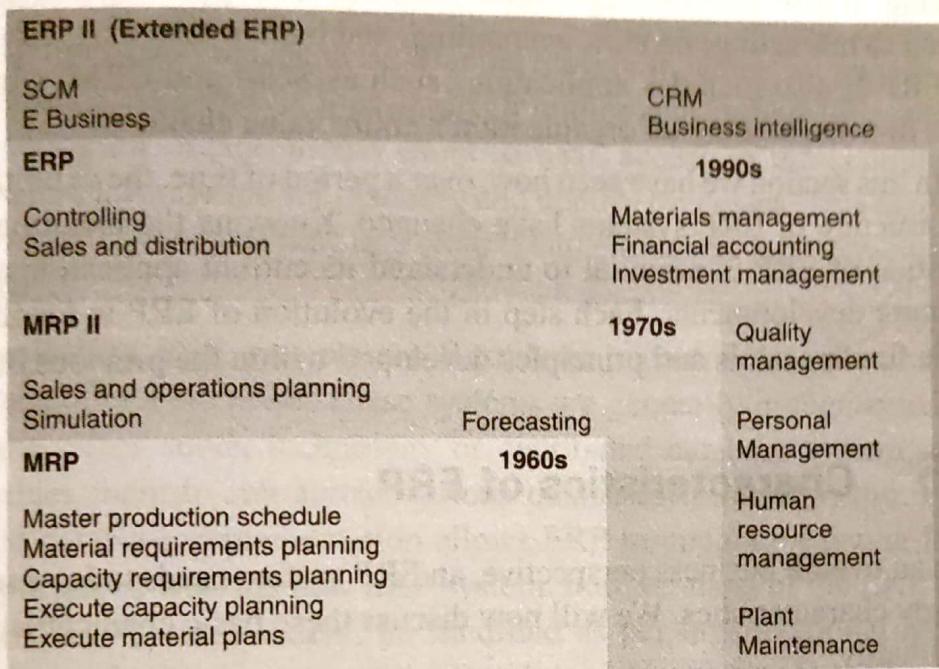


Figure 1.7
Evolutions of ERP systems.

Client-server Architecture: It is a computing architecture that separates a client from a server, and is almost always implemented over a computer network. Each client or server connected to a network is also referred to as a node. The most basic type of client-server architecture employs only two types of nodes: clients and servers.

The basic role of material requirements planning (MRP) includes identifying inventory requirements and, accordingly, scheduling production processes. MRP generates a schedule for operations as also for the purchase of raw material in view of the criteria such as the production requirements of finished goods, the structure of a production system, current inventory levels, and the lot sizing procedure for each operation. In addition, capacity requirement planning and execution of capacity planning are also part of MRP. Manufacturing requirements planning (MRP II) uses software applications for coordinating manufacturing processes, from product planning, parts purchasing, and inventory control to product distribution. Sales and operations planning, simulation, and forecasting are some of the key modules added in MRP II.

ERP, the multi-module application software, is used in organizations to enhance the performance of only internal business processes. ERP II, however, also integrates ERP to the organization's external business partners such as customers and suppliers, thus increasing the overall efficiency of the system. The ERP system often integrates business processes across functional departments, from product planning, parts purchasing, inventory control, product distribution, fulfilment, and order tracking. It also includes application modules for supporting activities related to marketing, finance, accounting, and human resources. Above all, ERP II also includes applications such as SCM and CRM, which helps in consolidating an organization's entire value chain.

In this section we have seen how, over a period of time, the definition and structure of ERP systems have changed. Knowing the history and evolution of ERP is essential to understand its current application and its future developments. Each step in the evolution of ERP is founded on the fundamentals and principles developed within the previous one.

1.6 Characteristics of ERP

From an overall business perspective, an ERP system needs to have several key characteristics. We will now discuss these basic characteristics individually.

Integrated architecture: This is the defining characteristic of ERP systems. ERP is a conglomeration of **transaction-processing** systems that are integrated with the activities of the organization, such as production planning, human resource management, and sales. By implementing standard enterprise processes using a common database that spans the range of all enterprise-wide activities and locations, the ERP system provides integration across multiple locations and functional areas. As a result, the ERP system leads to not only improved decision-making capabilities but also efficient inventory management and human resource management, as also speeding up financial close process and planned manufacturing. Thus, it helps an organization create greater value.

Transaction Processing: In computer science, transaction processing is information processing that is divided into individual, indivisible operations, called transactions. Each transaction must succeed or fail as a complete unit; it cannot remain in an intermediate state. Transaction processing is designed to maintain a database in a known, consistent state. This is done by ensuring that any independent operation carried out on the database is either all completed successfully, or all cancelled successfully.

Real time processing: ERP systems are real-time systems as any transaction processing effects changes directly into an online database, not in any offline content. Earlier, in certain legacy systems, a lot of transaction processing information was initially recorded on paper, and then passed onto another department of the organization, where it was either repackaged or entered into a computer-based format. Consequently, due to the unavailability of information online, decision-making processes were delayed considerably. Now, however, various modules in ERP use a common database wherein most of the information is entered just once. The data is thus available online and in real time, thereby enabling all organizational users to have access to the continuously updated information for planning and control processes. This facilitates more consistent planning and control and eliminates information asymmetries.

Flexibility: ERP systems are flexible to accommodate the changing needs of an enterprise. These systems are generally implemented over some client-server technology or distributed database system, which enables them to run across various databases. Moreover, the distributed database implementation allows ERP to integrate existing legacy applications with the new ERP system. Further, most of the ERP packages can, to some extent, be modified as per organizational requirements, using their own standard tools and languages. For example, a SAP R/3 platform includes an inbuilt 4GL called ABAP 4.0 that allows it to introduce changes into the SAP software.

Modular and open architecture: ERP systems have an open-system architecture. It enables any module to be interfaced or detached, whenever required, without affecting the other modules. ERP software packages can also be integrated to other software applications, tools (CRM, SCM, etc.) and third-party add-ons using **enterprise application integration (EAI)**. These systems generally support multiple hardware platforms for enterprises comprising a heterogeneous collection of systems.

Enterprise Application Integration: It is defined as the use of software and computer systems' architectural principles to integrate a set of enterprise computer applications. In today's competitive and dynamic business environment, applications such as SCM, CRM, BI, and integrated collaboration environments have become imperative for organizations to maintain their competitive advantage. Enterprise application integration is the process of linking these applications and others in order to realize financial and operational competitive advantages.

Best business practices: ERP systems represent an amalgamation of the best business practices and processes applicable worldwide. New business practices are being added all the time to ERP packages. Such practices can be used to improve the manner in which an organization conducts business. These business practices enable organizations to implement process re-engineering, which further increases a system's efficiency and reduces operational cost. The success of implementing an ERP system is predicated upon the implementation of such practices. It has been found that in certain cases organizations implement ERP only for standardization and during implementation, and therefore, the need to customize the package is nullified.

Global functionality: ERP systems provide both multilingual and multi-currency functionalities. For example, while these systems are flexible enough for customer service representatives in different countries to take orders in different languages, orders get printed or referred back to the customer in their native language. Multi-currency functionality facilitates, for instance, receiving invoices in Indian rupees, splitting the payment into German marks, billing in Italian lire, receiving cash in British pounds, with the General Ledger stated in US dollars.

Beyond organizational boundaries: ERP supports online connectivity with the external business entities of the organization, such as suppliers and customers through CRM and SCM tools. This enables the customers and suppliers to access the system even outside organizational boundaries. As a result, by integrating customers and suppliers with the use of ERP, organizations achieve major re-engineering in their business processes, thereby enhancing systems' capability.

3) 1.7 Process Integration with ERP Systems

ERP brings together the various departments of an organization as a single, integrated software program that runs off a single database, thereby enabling the various departments to share information and communicate with each other more easily. This integrated approach can yield tremendous benefits if the ERP systems are implemented correctly.

To elucidate, generally, when a customer places an order, it travels from inbox to inbox throughout the company, often being keyed and re-keyed in different departments' computer systems along the way. All this can lead to delays and lost orders, while the repeated keying in

of data invites errors. Figure 1.8 shows a typical legacy system with a disintegrated database. Every time a customer places an order with the sales department, the order information is re-keyed individually in sales, accounting, purchase, production, and warehouse databases. Further, due to disintegrated data, every department has to manually ask for information related to any other department. This delays the overall business process cycle, hence increasing the time required for the order to be executed.

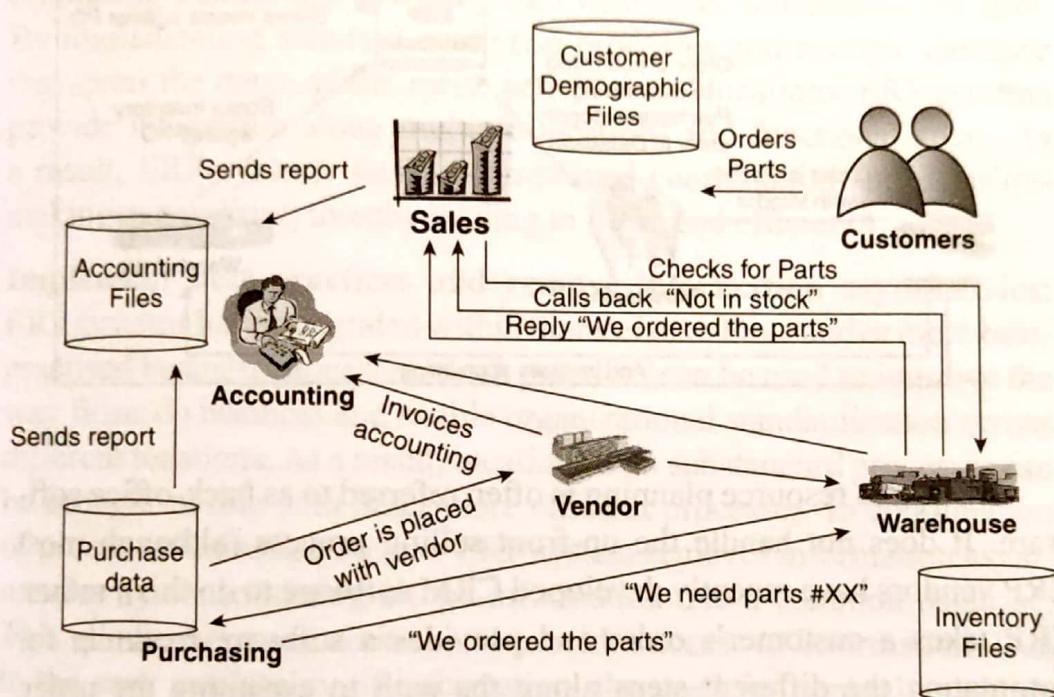


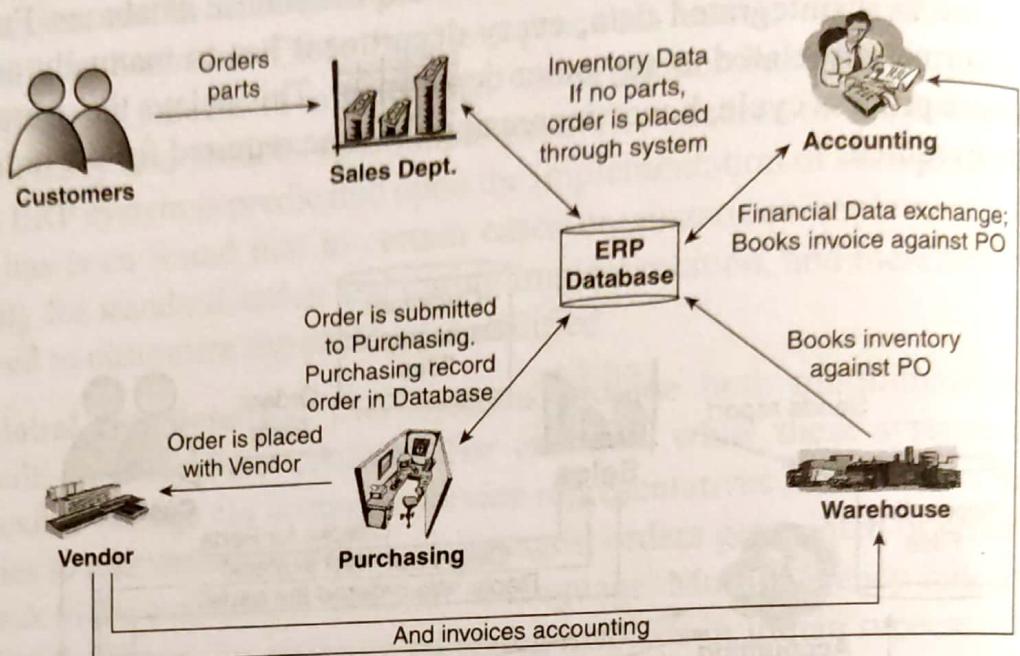
Figure 1.8
Sales order in legacy systems.

The old, stand-alone computer systems in finance, HR, manufacturing, and warehouse are vanquished by ERP and replaced with a single, unified software program, divided into software modules that roughly approximate the old stand-alone systems. Finance, manufacturing, and the warehouse, all will get their own software, but now the software is interfaced so that someone in finance can access the warehouse software to see if an order has been shipped. Figure 1.9 shows a typical ERP application with an integrated and centralized database.

People in different departments can access the same information and update it. When one department completes its role in the execution of the order, it is automatically routed via the ERP system to the next department. To trace the order at any point, you need only to log in to the ERP system to track it down. This expedites the order processing

through the organization, and customers get their orders faster and with fewer errors than before. ERP systems can similarly benefit other major business processes, such as employee benefits and financial reporting.

Figure 1.9
Business with ERP.



Enterprise resource planning is often referred to as back-office software. It does not handle the up-front selling process (although most ERP vendors have recently developed CRM software to do this); rather, ERP takes a customer's order and provides a software roadmap for automating the different steps along the path to executing the order. Once a customer service representative enters a customer order into an ERP system, he has access to all the information necessary to complete the order (namely, the customer's credit rating and order history from the finance module, the company's inventory levels from the warehouse module, and the shipping dock's trucking schedule from the logistics module).



1.8 Benefits of ERP Applications

Various theories have concluded that organizational processes fall into three levels—strategic planning, management control, and operational control. Implementing ERP helps in achieving benefits at all three levels. An ERP attempts to integrate business processes across departments into a single enterprise-wide information system. These systems were originally, and rather ambitiously, designed to support the resource-

planning portion of strategic planning. Some major benefits of ERP systems are improved coordination across functional departments and increased business efficiency. ERP systems also facilitate day-to-day management. Some of the major advantages of ERP systems are discussed below.

Improved organizational efficiency: ERP systems help integrate business processes across departments into a single enterprise-wide information system. These systems provide firms with transactional processing models that are integrated with other activities of the firm. By implementing standard enterprise processes and a single database that spans the range of enterprise activities and locations, ERP systems provide integration along multiple locations and functional areas. As a result, ERP systems facilitate improved coordination and decision-making capabilities, thereby leading to increased efficiency.

Implement best practices and remove information asymmetries: ERP systems have integrated within themselves a thousand or more best-practised business processes. Such practices can be used to improve the way firms do business and enable organizational standardization across different locations. As a result, locations with substandard processes can be brought in line with other more efficient processes. In continuation of process standardization, the ERP system removes information asymmetries by consolidating all the information into a common database. This allows increased control and provides access to information. Due to the easy availability of information, the need for non-value-adding workers, whose primary activity is to prepare information for upward and downward dissemination, is eliminated.

Organizational alignment: ERP systems facilitate better alignment of strategies and operations. Such systems help run the enterprise in accordance with a unifying strategy and plan, accessing the right information in real time to identify concerns and challenges early. These systems help achieve corporate objectives by aligning workforce and organizational objectives. ERP systems minimize organizational risks and maximize productivity and insight by leveraging self-service and analytics across the organization.

Data accessibility: The implementation of ERP systems nurtures the establishment of backbone **data warehouses**. These systems offer greater accessibility to data so that the management can have up-to-the-minute access to information for enhanced decision-making and managerial control.

Data Warehouse: It is the main repository of an organization's historical data stored electronically. It contains the raw material for the management's decision-support system. The critical advantage of using a data warehouse is that a data analyst can perform complex queries and analyses, such as data mining, on the information without compromising the speed of operational systems.

Lower operational cost: ERP systems optimise IT spending by making redundant a number of legacy applications and by providing integrated business solutions. The immediate benefit of implementing ERP systems is reduced operating costs as well as lower inventory control cost, lower production costs, lower marketing costs, and lower helpdesk support costs. ERP also leads to decreased inventory levels, workforce reduction, speeding up the financial close process, etc. ERP software helps track actual costs of activities and perform activity-based costing, and reduction in the overall operational costs. Further, a part of ERP software systems is designed to support the resource-planning activities of strategic planning.

Additional tangible benefits: The more direct benefits of ERP systems are reduced lead time, enhanced inventory management, on-time shipment, freedom to change manufacturing and planning methods, minimized data transfer time, fewer errors, optimum design productivity, reduced cycle time, and various simulated capacity and resource utilization scenarios. There are many more benefits arising out of using ERP systems such as increased flexibility for the organization, reduced quality costs, enhanced information accuracy and decision-making capability, etc. All these factors are instrumental in one of the most important benefits, i.e. improved customer satisfaction.

Table 1.2 summarizes some of the tangible and intangible benefits of ERP systems.

Table 1.2 ▶
Tangible and Intangible Benefits of ERP Systems

Tangible Benefits	Intangible Benefits
Personnel reduction	Information visibility
Inventory reduction	New/improved processes
IT cost reduction	Customer responsiveness
Productivity improvement	Integration
Order management/cycle time reduction	Standardization
Cash management improvement	Increased flexibility
Revenue/profit maximization	Globalization
Procurement cost reduction	Improved supply/demand management
Financial close cycle reduction	
Minimum maintenance requirement	

Different companies adopt different models for budgeting the ERP implementation costs. Certain costs are often commonly overlooked or underestimated while budgeting, resulting in budget overruns. Given below are some such commonly overlooked or underestimated costs.

1. **Training** This is the most underestimated budgetary cost in ERP implementation. Training expenses are high because ERP users almost invariably have to learn not just a new software interface but an entirely new set of processes. With ERP systems in place, the shop floor people will be using the same software as the warehouse people, and they will both be entering information that affects the other. This means that the employees of any given department need to have a broader and more comprehensive understanding of the job profile and work routines of others in the company prior to the implementation of ERP. Ultimately, it is the responsibility of the

adopting organization's IT and business people to provide that training. Adequate budgetary allocations must be made to cater to this need while estimating the cost of implementing ERP.

2. **Integration and testing** Testing the links between the ERP packages that have to be incorporated and other corporate software is another often underestimated cost. A typical manufacturing company may have add-on applications (e.g., CRM and supply chain) to the minor sales tax computation and bar coding programs. All these require integration links to ERP. If an organization can buy add-ons that are pre-integrated, their integration costs can be avoided. As with training, testing ERP integration also has to be done from a process-oriented perspective.
3. **Customization** Customization is primarily required in the event that the ERP software cannot handle any of the organization's business processes and/or the organization decides to mess with the software to make it work the way it wants. The ERP systems being multi-module systems, customization can affect every module of the system because they are all closely interlinked. The organization will have to hire extra staff to do the customization work and maintain it, thereby increasing the incurred cost.
4. **Data conversion** Corporate information such as customer and supplier records, material data, product design data, etc., recorded in old legacy systems needs to be made available in a format compatible with the new ERP system for it to be operational. Although few organizations will admit it, most data in their legacy systems is of little use. Most companies often deny their **data is dirty** until they actually have to convert it into a compatible format and transfer it to the new client/server-based ERP packages. Consequently, such companies are more likely to underestimate the cost of data conversion. Even clean data may demand some overhaul to match process modifications necessitated by the ERP implementation.
5. **Data analysis** Often, the data from the ERP system must be combined with data from external systems for analytical purposes. Users with heavy analytical needs should include the cost of data warehousing in the ERP budget. And they should make every effort to make it run smoothly. Refreshing all the ERP data every day in a big data warehouse is difficult, and ERP systems do a poor job of indicating which information has changed from time to time, making selective warehouse updates tough. One expensive solution is custom programming, which might completely upset the budget.

6. **Best employee turnover** ERP success depends on staffing the ERP project with the best and brightest from the organization's business and IT divisions. The ERP software is too complex and the business changes too dramatic to trust the project to just anyone. Generally, once the project is over, these exceptional employees are either replaced or removed from the organization, even though the consultancies or companies that have lost their best employees will proceed to hunt other organizations' employees with higher salaries and perks. If an organization allows its employees to leave, it usually ends up rehiring them or having to hire new recruits at a much higher salary, again causing budget overruns.
7. **Implementation teams cannot be replaced** Even after the ERP software is implemented and completely integrated, the implementers remain valuable on account of having worked intimately with ERP. Their familiarity with the sales and manufacturing processes makes them more knowledgeable than the respective departments. Consequently, companies cannot afford to send their project people back into the business because so much remains to be done even after the ERP software has been installed. For example, just writing reports to retrieve information from the new ERP system will keep the project team busy for at least a year. Neglecting this factor could lead an organization to beg for more money and staff immediately after the go-live date and long before the ERP project has begun yielding benefits.
8. **Post-ERP depression** Various surveys show that organizations generally suffer a drop in performance immediately after their ERP systems go live. The true percentage is undoubtedly much higher. The most common reason for the performance problems is that everything looks and works differently from the way it did before. When people cannot do their jobs in the familiar manner and have not yet mastered the new way, they panic, and the business goes into spasms.

Dirty Data: It is a term used by IT practitioners when creating data capture forms. This data is misleading, incorrect, and without generalized formatting.

So, while budgeting for ERP implementation, a thorough understanding of all the above hidden costs helps in avoiding budgetary overruns at later stages.

the time the system has gone live, including training issues. The types of risks and the extent of their impact on the organization vary as we move through the ERP implementation life cycle.

(Daniel E. O'Leary, 2000)

3) Challenges Faced During ERP Implementation

Technical risks refer to the risks that arise largely because of information processing technology. For example, it may depend on:

- Choice of operating system
- Choice of relational database
- Client server technology
- Network requirements
- Software systems
- System security

Generally, technical risk arises with shift in technology which is necessary to employ these systems. As firms adopt ERP systems, they migrate to new technologies and accordingly to the different processes. However, new technologies generate new risks. Similarly, linking ERP to other systems and independence of computing environment generates further risks.

According to Daniel E O' Leary (2000), other kinds of risks which arise in ERP implementation are business risks that come from:

1. Firm's choice of models, artefacts, and processes used in ERP implementation
2. Conformity of mapping the existing processes with the new system in the organization
3. Integration of the existing process with the external partner/firms (e.g. vendors and suppliers).

Besides this, there are several specific risks in each part of the ERP life cycle which starts with:

1. First stage in implementing ERP, "deciding whether or not to do ERP" is influenced by the firm's current technical position. Those firms with substantial advanced technology capabilities are more likely to be in a position to understand the technical risks associated with ERP.

2. Similarly, next phase, i.e. "choosing an ERP system" requires hardware choice as well as software choice. The corresponding risks are likely to vary from company to company.
3. In the third phase i.e. "ERP design, ERP Implementation, and to Going Live", risks arise from a number of sources, including computing and network issues.
4. Similarly in "Training and Personnel" phase, ERP system may require employees with different capabilities and skills, forcing a change in personnel. A major change in personnel is itself a risk.

6) Challenges for Small and Mid-size Enterprises

Small and mid-size enterprises (SMEs) are primarily dictated to by the operating cost pressure. This is perceived as the biggest challenge and organizations find it the greatest impediment to the successful implementation of their strategies. At the same time, SMEs are also concerned about the retention and expansion of a loyal customer base. Additionally, smaller companies also worry about the potential for the commoditization of their products or services. Some of the key challenges reported by small and medium enterprises are as follows:

- Insufficient funding for business initiatives
- Inadequate definition of corporate vision and goals
- Ineffective communication of corporate strategies and initiatives to operational employees
- Insufficient encouragement to employees to support ERP
- Inadequate talent for achieving business and software requirements
- Inability to accurately determine and plan for customer demand

It is also observed that there is a need for greater maturity and growth in the information technology field. Organizations will have to change their business and strategic outlook towards the use of IT if they are to attain any competitive advantage. Organizations require an approach that places less emphasis on the technical aspects of software development. They also need to maintain a balance between the business process design, software, and project management aspects of ERP implementation, as well as the overall strategy and structure of the firm. The knowledge of all such challenges is important for the successful implementation of ERP systems. A complete description of the various risks and challenges in ERP implementation is given in Chapter 7.

LEARNING OBJECTIVES

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

- understand trends in the ERP market
- identify various ERP vendors and their market share
- delineate the specializations of ERP vendors
- describe service-oriented architecture in major ERP packages
- understand ERP vendor selection criteria
- identify various parameters for comparing features in different ERP packages

4.1 ERP Market

The ERP market has benefited from the widespread acceptance of the idea that businesses must have integrated information systems in order to be competitive. Management and IT organizations have realized that the most effective way to integrate information systems is to purchase an ERP package that features broad functionality and inbuilt integration. Thus, ERP systems have become a basic tool for resource management and business integration in most organizations, irrespective of their size or profile. These systems have exhibited considerable growth in recent years. According to Gartner, the worldwide Enterprise software market grew 3.8% in 2013, a slight improvement of 2.2% growth in 2012.

Relying on maintenance revenue streams is how nearly every enterprise software company that sells on-premise software survives today. While this business model is very profitable, it breeds complacency and a tendency to procrastinate about innovation. These market growth figures from Gartner in part reflect complacency on the part of market leaders to make the hard decisions and follow through with excellent execution.

The latest enterprise software forecast from Gartner shows customer relationship management (CRM) increasing to a \$36.5B worldwide market by 2017 from the \$20.6B forecasted in Q1 of 2013. CRM also leads all enterprise software categories in projected growth, showing a 15.1% CAGR from 2012 to 2017, also revised up from 9.7% in the Q1 forecast.

The latest round of forecasts published in the report, "Gartner Forecast: Enterprise Software Markets, Worldwide, 2012-2017, 2Q13 Update" shows CRM eclipsing ERP in worldwide market size in 2017. The following graph compares the relative growth of CRM, ERP, Business Intelligence (BI), Supply Chain Management, and Web Conferencing, Collaboration/Social Software Suites. (Source: Gartner Forecast: Enterprise Software Markets, Worldwide, 2012-2017, 2Q13 Update.)

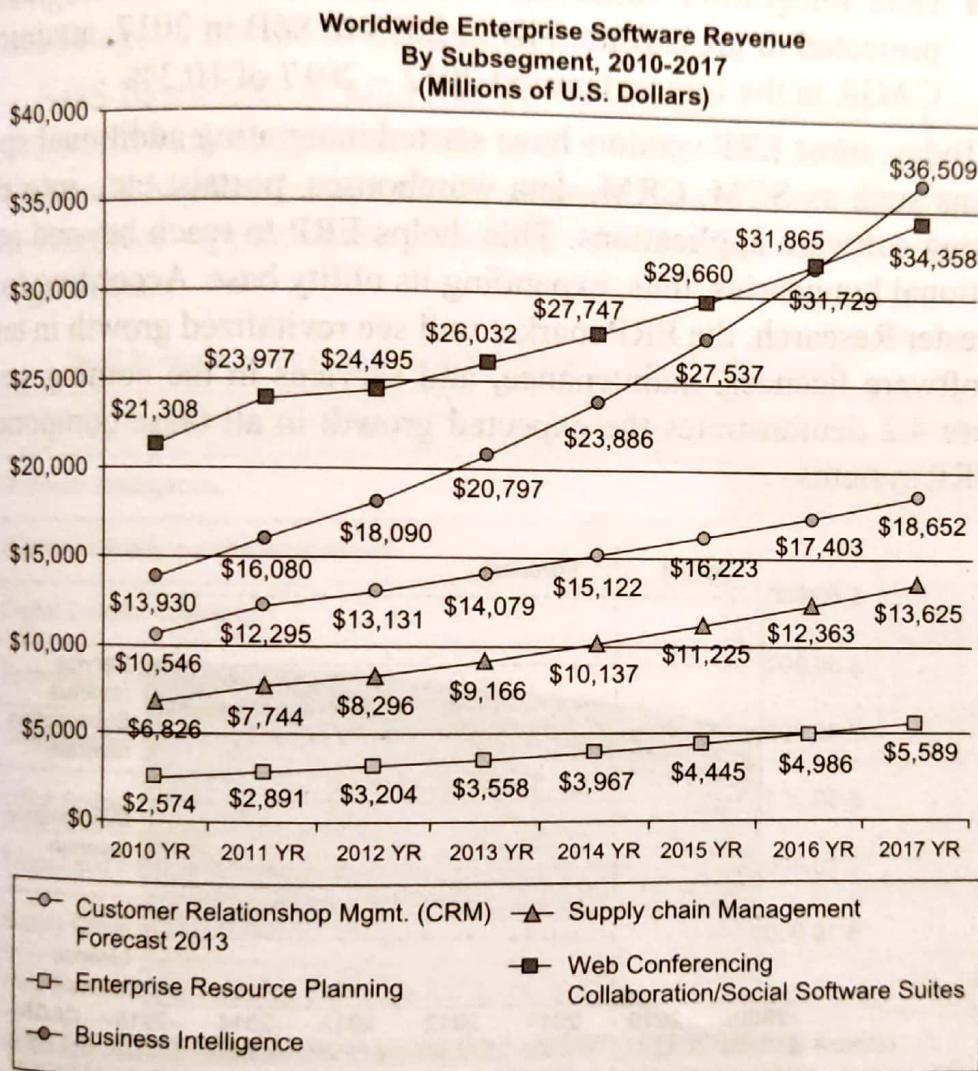


Figure 4.1
Worldwide enterprise software revenue.

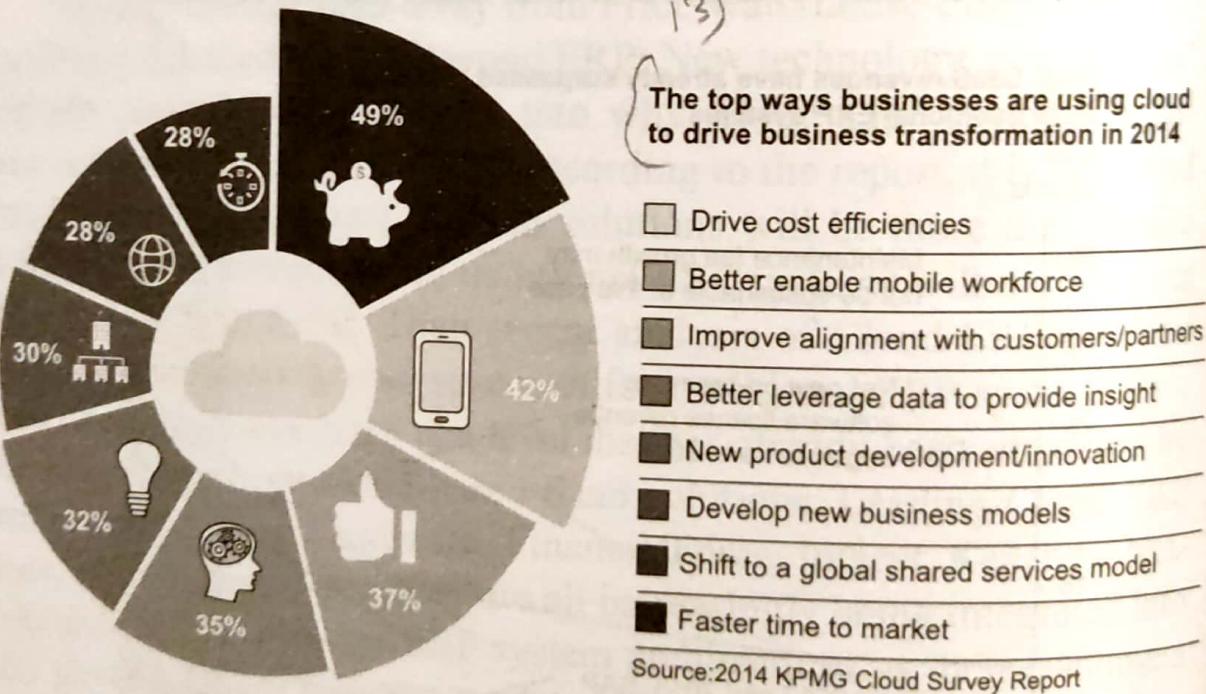
So, some of the key take-away from Gartner report are:

- Worldwide enterprise software spending is projected to be \$304B in 2013 in the latest forecast, an increase from \$279B in the Q1 forecast. Gartner claims stronger demand for CRM, supply chain management and security are leading to accelerating market growth.
- ERP spending worldwide is projected to grow from \$26.03B in 2013 to \$34.3B in 2017, attaining a CAGR in the forecast period 2012 – 2017 of 7%.

- Business Intelligence (BI) worldwide is projected to grow from \$14B in 2013 to \$18.6B in 2017, attaining a CAGR in the forecast period 2012 – 2017 of 7.3%.
- Supply Chain Management (SCM) worldwide is projected to grow from \$9.16B in 2013 to \$13.6B in 2017, attaining a CAGR in the forecast period 2012 – 2017 of 10.4%.
- Data Integration Tools and Data Quality Tools worldwide are projected to grow from \$4B in 2013 to \$6B in 2017, attaining a CAGR in the forecast period 2012 – 2017 of 10.3%.

A recent KPMG study “2014 Cloud Survey Report: Elevating Business in the Cloud” found that better enabling mobile workforces (42%) is the second-highest priority CIOs are planning to use cloud computing for in 2015 (see Figure 4.6).

Figure 4.6



The bottom line is that mobility is one of the onramps for new business models now and in the future. The most effective Hybrid ERP systems are deliberately designed to streamline selling, serving, and retaining customers over the long-term. Scale and speed need to be measured from the customers' perspective, not just from internal perspective. Monolithic legacy, on-premise ERP systems have often been designed to match a predictable drumbeat of production. That's not

going to work in 2015, when customers are redefining the cadence of entire industries daily and non-standard is becoming quickly the new normal.

There is wide acceptance of ERP in developed countries such as the USA, Canada, the UK, and Australia, whereas developing countries lag far behind in this aspect.

(Huang & Palvia, 2001)

Developing countries in Asia have become the major markets for big ERP vendors in view of the recent economic growth seen in this sub-continent. The ERP vendors have also experienced the impact of globalization in many developing countries due to rapid economic expansion, especially in Asian countries. It is primarily the fierce competition and pressure from the Western corporations that has forced organizations in developing countries to vigorously pursue and implement information technology (IT) applications. However, ERP is still in its nascent stages in the developing countries. The inadequate IT infrastructure, government policies, small size of companies, lack of IT experience, and low IT maturity act as an impediment in adopting ERP in most Asian organizations. India has registered significant economic growth in recent years, and its IT industry's growth is quite high and admirable. It is also the largest base for global software outsourcing and continues to grow rapidly. India also produces some of the best software engineers of the world. Furthermore, English has become the official business language of India. As a result, the IT staff members of organizations can easily communicate with their counterparts elsewhere in the world or in India. However, IT diffusion and implementation are still embryonic, and ERP growth in India had been quite slow till recent years. ERP penetration has remained limited due to several reasons. First, the infrastructure is below any organization's requirements. Second, organizations lack IT culture. For example, the Indian State Excise Authority refuses to accept excise returns in any format other than manual registers. The country's PC penetration and IT maturity are also quite low. To make matters worse, local corporations lack the will and competitive edge to adopt technology. A widespread misconception is that ERP systems are only for large companies/businesses in view of the high costs of acquisition, implementation, and maintenance. As a result, service and support services are rudimentary. Most organizations are first-time users and perceive a lack of expertise. Finally, some companies that may not have had a very successful and positive experience with ERP do not see many benefits in adopting it.



ERP for Small and Mid-Sized Enterprises (SMEs)

Over the last few years, ERP systems' developers, integrators, and consultants have consistently turned their sights on small-scale enterprises. These small-scale manufacturers would be adversely affected if they fail to upgrade their existing IT applications into a system that can readily communicate with their larger supply chain partners or with corporate headquarters. While ERP installations often help small and mid-sized manufacturers improve their strategic and competitive capabilities, there are still several reasons that restrain these firms from seeking ERP solutions. The ERP implementation efforts of many of their larger counterparts have resulted in partial failure, and, in some cases, total abandonment, which dissuades these companies from experimenting with an obviously expensive system. Also, small manufacturers often work with limited financial resources, which may force them to adopt, at best, a piecemeal approach to integrating the typically expensive ERP systems into their functionalities. In most cases, it is also found that the ERP implementation budget exceeds the annual turnover of such mid-sized organizations. This means that ERP projects are large, costly, and difficult to manage, as they require large investments in terms of capital, staff, and management time. Therefore, smaller firms with their limited resources are less likely to survive or overcome the failed implementation of an expensive ERP system than their larger counterparts. Consequently, it is extremely important for them to gather, analyse, and disseminate information that will help them in selecting appropriate ERP systems, or even design and implement their own ERP system successfully.



From the above discussion, it is clear that the implementation of ERP is affected by two major factors, namely, environmental factors and organizational factors.

- Environmental factors comprise the following five variables:
 - Economy,
 - Economic growth,
 - Infrastructure,
 - IT maturity, and
 - Computer culture.
- Organizational factors comprise the following five variables:
 - Business size,

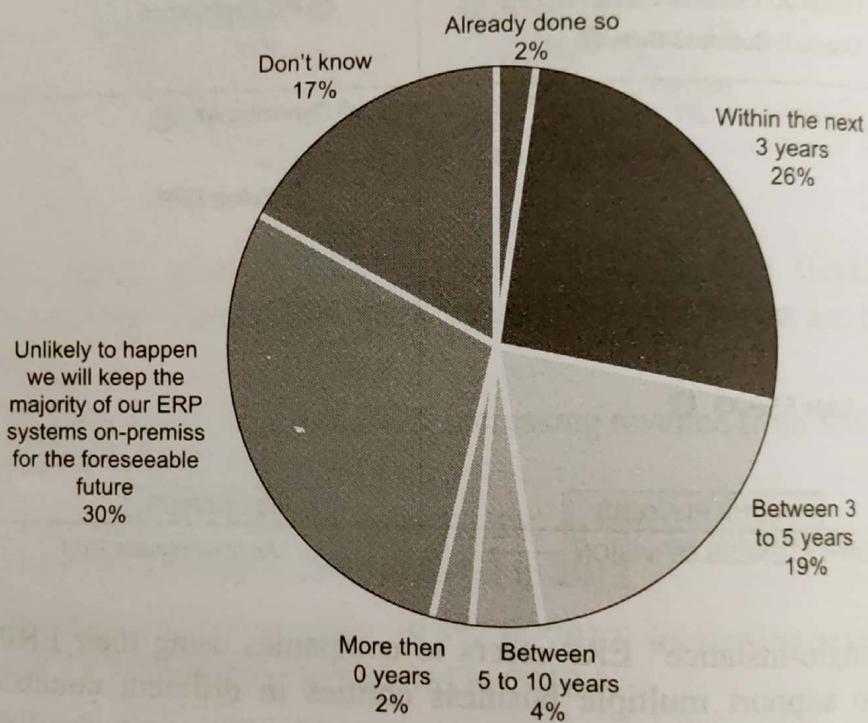
- BPR experience,
- Manufacturing strengths,
- Government regulations, and
- Management commitment.

Cloud ERP Vendors (5)

A recent study completed by Gartner titled "Survey Analysis: Adoption of Cloud ERP, 2013 Through 2023", advises CIOs and application leaders of financial services institutions to consider cloud ERP as a potential replacement for aging core ERP systems that are out of support or running on an old technology platforms (such as mainframes). The methodology is based on a survey of Gartner Research Circle members from North America, EMEA, APAC, and Latin America from companies that range in size from \$10M to \$10B. Some of the key take-aways of the study include:

- Including the 2% that already have core ERP in the cloud, a total of 47% of organizations surveyed plan to move their core ERP systems to the cloud within five years. This is because their ERP requirements tend to be focused around administrative ERP (financials, human capital management, and procure-to-pay) where there is a wider range of cloud options (compared with manufacturing).
- In aggregate, 30% of respondents say that the majority of their ERP systems will be on-premises for the foreseeable future as can be seen from the following graphic.

Figure 4.9
Survey on Cloud
ERP as potential
replacement (Source:
Gartner, January
2014).



30% of organizations surveyed said they planned to keep the majority of their ERP systems on-premise for the foreseeable future. Manufacturing organizations dominated this survey segment.

Cloud ERP vendors are becoming increasingly more and more competitive as the “SaaS Wars” continue to expand across the world of Enterprise software. The cloud is quickly becoming a dominant choice of deployment for ERP software and because of that it has invited many newcomers to the industry. As a result, the competition among Cloud ERP vendors has heated up over the past several years and it can be hard for buyers to separate, compare, and contrast all the different offerings. To make that process a little easier, here is list of the important 5 Cloud ERP vendors:

1. Acumatica	 Acumatica THE CLOUD ERP	Windows, Mac OS	Cloud or On-Premise	Distribution, Accounting
2. NetSuite	 NETSUITE	Windows, Mac OS	Cloud	Services
3. Plex Systems	 PLEX ONLINE	Windows	Cloud	Manufacturing
4. Ramco	 ramco	Windows, Mac OS	Cloud or On-Premise	Manufacturing (Discrete and Process)
5. Workday	 workday.	Windows, Mac OS	Cloud	Human Resources, Payroll

Figure 4.10
Potential Cloud based
ERP providers.

Gartner mentions that Workday, Workforce Software, Cornerstone OnDemand, and NetSuite are the five fastest-growing ERP vendors worldwide from 2012 to 2013. Each of these are cloud-based vendors who have a rapid development and delivery approach to new feature enhancements and major new releases. Each of them can also scale quickly to changing business model shifts with their customers, are elastic in how their pricing and resource allocation models work, and must deliver value to keep their subscription revenue streams growing.

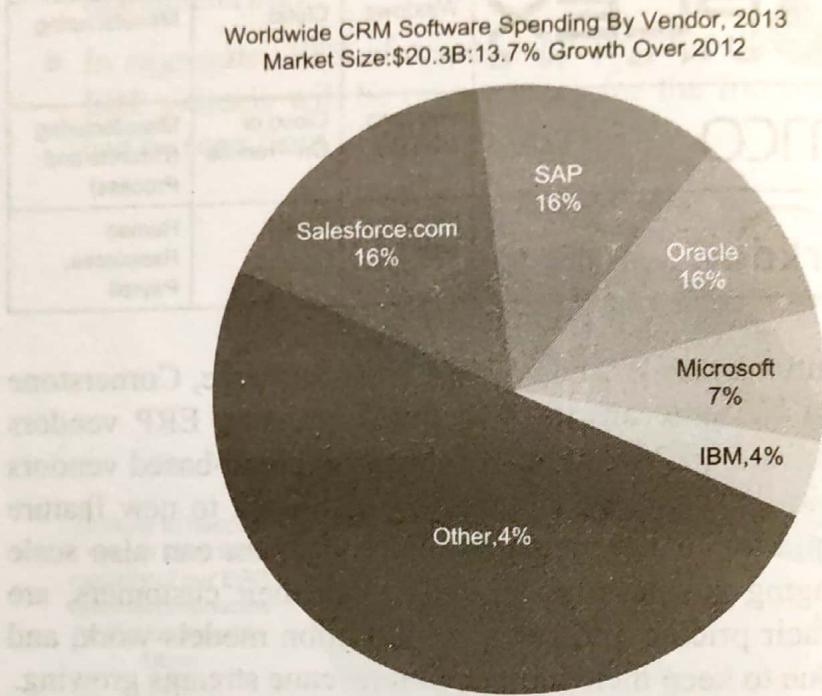
CRM Vendors (6)

According to Gartner's report titled, "Market Share Analysis: Customer Relationship Management Software, Worldwide, 2013", the worldwide CRM market grew 13.7% from \$18B in 2012 to \$20.4B in 2013, with 41% of all systems sold in 2013 being SaaS-based. Primary growth drivers were enterprise investments in digital marketing and customer experience initiatives. Some of the key findings of the report include:

- Communications, media, and IT services industries spent the most on CRM systems in 2013, with analytics being a high priority for improving and bringing consistency to customer experiences.
- Manufacturers were second in CRM spending, with their investments being primarily in product and channel management.
- Banking and securities were the third-largest spending industry, with customer service and upselling financial products being the highest priority.

- Salesforce is the worldwide leader in CRM software, with 16.1% market share. Salesforce grew 30.3% from 2012, when the company attained revenues of \$2.52B, outdistancing SAP's 12.7% growth, Microsoft's 22.8% and IBM's 22% yearly growth. Market shares are illustrated in Figure 4.11, Worldwide CRM Software Spending by Vendor, 2013.

Figure 4.11



- In Figure 4.11, market share for CRM software vendors salesforce grew 24.7% faster than its nearest competitor from 2012 to 2013, attaining 30.3% growth in worldwide revenues. Microsoft achieved 22.8% growth, followed by IBM (22%), SAP (12.7%), other companies (9.9%) and Oracle (4%).
- 41% of all CRM systems sold in 2013 were SaaS-based. Gartner's analysis shows that companies of all sizes are looking for easier-to-deploy CRM systems capable of replacing legacy systems, quickly implement net-new applications and providing complementary CRM system functionality.
- North American CRM sales were 52.9% of the worldwide market in 2013, with Western Europe being the fastest growing with a 15.2% increase in spending from 2012 to 2013. Together these regions contributed 80% of worldwide CRM revenues and technologies in 2013.

- Gartner reports that Asia/Pacific (APAC) and China still achieved double-digit growth rates while noting that these are nascent markets also experiencing uncertain economic conditions including currency fluctuations.

The major ERP vendors, such as SAP, Oracle, SSA Global, and Sage Group, support all the critical areas of business, and target large-scale organizations. Some of the vendors that cater to SMEs, not only in India but throughout the world, are Baan, Microsoft Great Plains, Microsoft Navision, and Sage Group. On account of the growth of ERP systems in the mid-size market segment, bigger ERP vendors such as SAP and Oracle have launched different applications specifically meant for SMEs. ERP vendors are innumerable in terms of service and efficiency. Section 4.5 gives brief vendor profiles and details about their ERP packages.

Service-Oriented Architecture (SOA): It is an architectural style that guides all aspects of creating and using business processes, packaged as services, throughout their life cycle. It also defines the IT infrastructure that allows different applications to exchange data and participate in business processes loosely coupled from the operating systems and programming languages underlying those applications.

Middleware: It is a software that sits 'in the middle' or between the applications (for example, a word-processing program) working on different operating systems (UNIX, Windows, z/OS, XML, SOAP, and many more).

4.3 Service-Oriented Architecture

Service-oriented architecture (SOA) is an architecture that relies on service orientation as its fundamental design principle. Service orientation is a design paradigm that makes use of loosely coupled services to support the requirements of business processes and users. The resources on a network in an SOA environment are made available as independent services that can be accessed without the knowledge of their underlying platforms. These concepts can be applied to business, software, and other types of producer-consumer systems. Service-oriented architecture is not tied to a specific technology. It may be implemented using

a wide range of technologies, including **DCOM**, **CORBA**, or **web services**.

Distributed component object model (DCOM): It is a Microsoft proprietary technology for software components distributed across several networked computers to communicate with each other.

Common object request broker architecture (CORBA): It is a standard defined by the Object Management Group (OMG) that enables software components written in multiple computer languages and running on multiple computers to work together.

Web service: It is defined by the W3C as a software system designed to support interoperable machine to machine interaction over a network.

Adopting SOA allows companies to

- enable systems to adopt processes, but not vice versa
- improve usability of services
- allow connectivity to external data and services
- leverage the best practices and industry knowledge
- reduce custom coding through configuration
- reduce integration costs by adopting **open standards**
- provide more flexibility to use the best-of-breed and composite applications

Open standard: It is a standard that is publicly available. These technologies are royalty free. The term 'standard' refers to those technologies that are approved by formalized committees, are open to participation, and operate on a consensus basis. It also deals with the idea that a standard is not truly open if a complete free/open source reference implementation is not available.

SOA, however, comes with some challenges. Some of these are as follows:

- It is relatively expensive, and is disruptive in upgrades.
- With its lock-in to middleware platforms, there are fewer applications/vendor choices available.
- It has unproven benefits.
- Most ERP vendors over-promise and under-deliver.

Currently, SAP's new ERP packages are the most advanced as far as SOA is concerned. These packages are called **SAP Enterprise Ser-**

vice Architecture (ESA). Figure 4.12 gives the proposed architecture for SAP ESA. The middleware platform and business process platform for SAP ESA is NetWeaver. The scheduled year for the completion of the ESA version of mySAP was 2007. It is not supposed to be a total rewrite of the existing SAP application, and a considerable amount of proprietary ABAP has been retained.

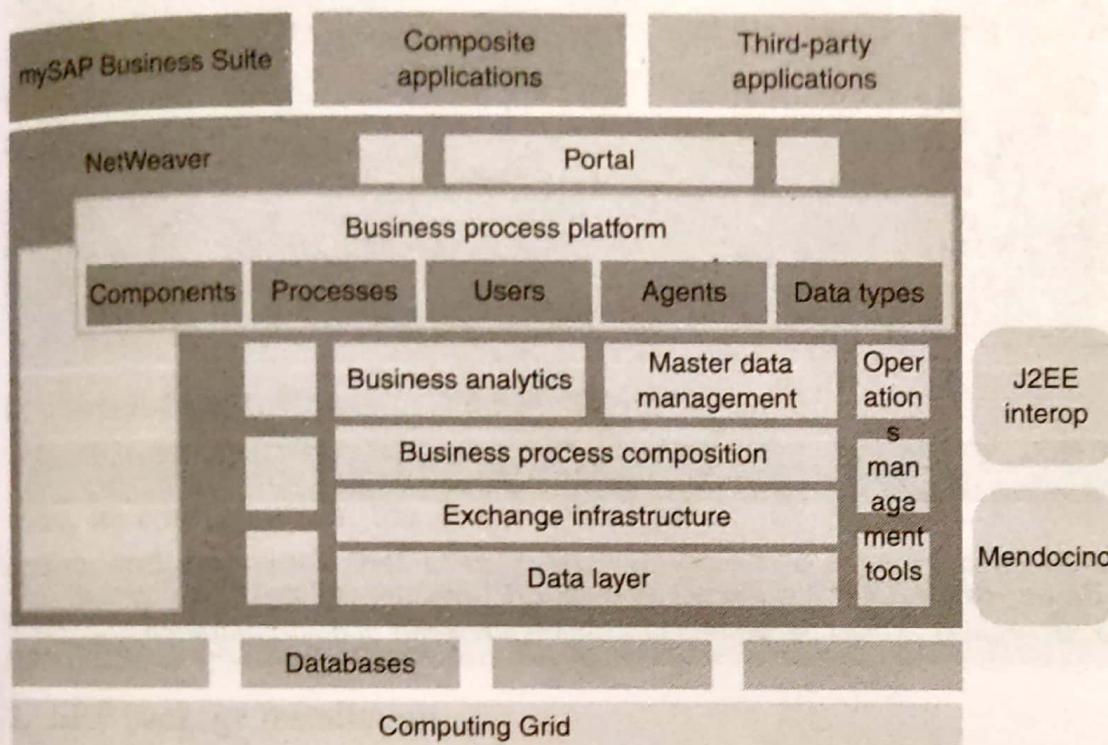


Figure 4.12
SAP ESA
architecture.
(Source: SAP AG)

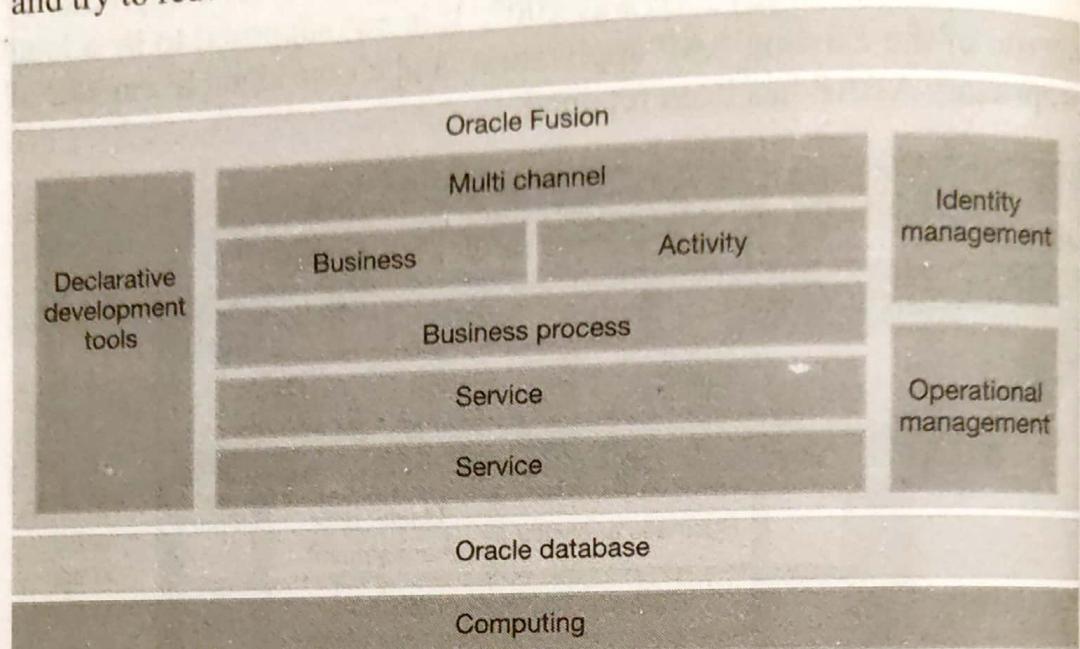
Similarly, Oracle's Fusion architecture will be based on SOA plus Oracle's grid computing database platform. Figure 4.13 gives the proposed architecture of Oracle Fusion. The Fusion application will be based on Oracle's next-generation application suite, which is based on the convergence of more than five product lines. Furthermore, Fusion is not a total rewrite but EBS schema, but some Java and PL/SQL code is retained.

Microsoft's MBS features .NET-based SOA and a process-centric design. Microsoft's transition strategy will be based on user interface alignment within existing Microsoft products such as MS Office and MS SharePoint. The Microsoft's MBS is again not a total rewrite; it substantially leverages code from Microsoft Axapta and its other products.

It is, therefore, recommended that the organizations with ERP systems should be aware of the new releases to keep migration options open. Their decisions must be dictated by their business needs as against

by the vendor's promises. They can supplement their ERP systems with complementary **best-of-breed** solutions (e.g., reporting, compliance), and try to reduce maintenance fees and support costs.

Figure 4.13
Oracle Fusion
Architecture.



Best-of-Breed ERP: It is a set of different ERP modules collated from different ERP vendors to meet the desired process requirements of an organization.

4.4 ERP Package Features: Comparison and Selection Criteria

According to researchers, the growing concern over the total cost of ownership (TCO) of enterprise software is one of the key factors in the decline of IT investments. As a result, software vendors are trying to develop better-structured ownership experience strategies and, in some cases, have focused R&D effort and resources on improving the ownership experience for customers. In addition to the cost of ownership, ERP packages can also be compared on the basis of several key parameters across three major phases of the application life cycle, which are as follows.

- Implementation phase
- Application usage phase
- Ongoing support and maintenance phase

Every phase of the ERP application life cycle has potential pitfalls that can affect the ultimate success or failure of the ownership. For example, if an enterprise software application is not installed properly, the rest of the implementation will have resonant problems. The maintenance costs of ERP systems often reflect repetitive tasks undertaken by the adopting organization. For example, the usage of poor diagnostics tools leads to unpredictable **downtimes** and business disruption. Some upgradations in software can also impact the maintenance costs. The usability features affect end-user adoption, and poor usability can lead to increased costs due to low productivity.

Downtimes: This is also known as outage and refers to a period of time (or a percentage of a time span) during which a system is unavailable or offline.

Implementation Phase

The implementation phase includes the initial installation of the software, its configuration, the initial uploading of data to the new application, and any work that is required for the application to interface properly with the IT environment of the organization. The implementation phase is typically staggered over three major steps:

1. ERP package installation
2. Configuration
3. Integration

The installation of ERP systems is important since an incomplete or incorrect initial installation of the software can lead to significant loss of time during the implementation process. Similarly, streamlined configuration tools are critical for accomplishing an application implementation project on time, because during configuration, all the specifics of customer business requirements are captured and shared across the implementation staff. The integration step is typically one of the most challenging steps and can throw up some hidden and unanticipated costs.

For the analysis and comparison of vendor approaches in the implementation of ERP, the following seven steps can be used:

1. Installation of the application wizard
2. Advanced configuration
3. Process modeller

4. Advanced data loading and moving techniques
5. Process-oriented integration
6. Built-in integration among applications provided by a single vendor
7. Built-in web services

Application Usage Phase

Usability is a critical parameter in the user-friendliness of an application. It covers functions such as the ability to perform tasks with minimum errors, the use of the application, enhanced end-user productivity, ability to adapt to the use of the application with minimum need for training, number of screens, or clicks required to perform a specific task, support for the novice as well as advanced users, alignment with industry-standard interfaces, response time, and ease of adapting the application terminology to customer business requirements.

Usability, in fact, can impact, positively or negatively, the total ownership experience. First and foremost, usability has a direct impact on end-user adoption. Poor usability can lead to ongoing hidden costs in the form of lower end-user productivity, error-prone applications, or applications that are misaligned with a company's business processes. The following criteria can be used to judge the usability functions of ERP systems:

1. Process-based navigation
2. Customization options
3. Task-oriented dashboards
4. Web client
5. Integrated departments of the organization

Process-based navigation allows users to use business processes based on navigation to complete the tasks. Specific tools are provided to the technical staff and the implementation team to customize the application interface in order to better fulfil the business needs and business processes of the customer. The task-oriented, pre-built dashboards organize key tasks, such as applicant job tracking and reporting. The web client represents fully web-enabled clients that do not require the download of any **application code** on the end-user workstation. This feature facilitates the upgrades that are transparent to the end-users and do not require the attention of either the end-user or the technical staff regarding client-related issues. The integrated departments of the orga-

nization represent integration points between business applications and their desktop applications such as Microsoft Office and Outlook.

Application Code: It is a sub-class of computer software that leverages the capabilities of a computer directly and thoroughly for a task that the user wishes to perform.

Ongoing Support and Maintenance Phase

Maintenance includes all the post-implementation activities that are required to keep the application operational under normal and even stressed conditions. It includes ongoing support, upgrades, patches, all diagnostics, and tuning activities managed by the administrators to keep the application running. It also includes the cost involved in archiving of historical data. Due to the labour intensive and repetitive nature of these activities, the maintenance costs create a huge impact on the overall ownership experience. Diagnostics and tuning facilitate the upgrade process by staying current on releases. Poor diagnostics tools lead to unpredictable downtimes and consequent business disruption. The following criteria can be used for assessing the maintenance phase:

1. Diagnostic and technical support
2. Remote and online support
3. Performance diagnostics and tuning support
4. Patch management system
5. Automated upgrade process and toolsets
6. User-centric performance testing
7. **Data archiving**

Data Archiving: It refers to the long-term storage of useful data and methods.

- Performance diagnostics and tuning provide a built-in, instrumented performance monitoring tool that tracks the application performance in real-time. The tool provides average performance levels to proactively identify and troubleshoot non-performing components. Similarly, since applying patches to enterprise applications can be a very time consuming and disruptive activity, patch management provides information on the availability of patches on the web and offers limited guidance along with automated tools that help in selecting patches that are relevant to

a specific configuration. The user-centric performance-testing criterion allows customers to submit test cases, which are used as part of the application testing and release process.

Package Selection Criteria

Generally, the software selection criteria start with an assessment of the intended user's internal needs. The next step is to identify and form a team that will provide the best ERP solution. At this stage, the team has to decide whether to purchase an integrated solution or go for a best-of-breed solution. A large number of enterprises prefer an integrated solution in order to minimise integration issues. The selection of an ERP system involves more than merely interviewing a few vendors. The right ERP provider must be a long-term strategic partner. The choice of the package also involves important decisions related to budgets, time frames, goals, and deliverables that will shape the entire project. It is important to choose the right ERP solution that best matches an organization's information needs and processes to ensure minimal (or no) modification costs and smooth implementation and use. Therefore, an organization should decide on some criteria for choosing the most suitable ERP solution. The organization must develop a matrix and assign weights and scores for each criterion. Given below are some of the key

ERP selection criteria:

- Functionality
- Technical criteria
- Cost
- Service and support
- Compatibility with other systems
- Ease of customization
- Market position of the vendor and domain knowledge
- Cross-module integration and fit with organization structure
- Reference of the vendor
- Implementation time
- Consultancy
- Methodology of the software
- System reliability

Functionality is largely dependent on the functional area covered by the ERP product and its flexibility with respect to adaptability and

openness to change. It depends on the comprehensiveness of the package and the number of modules in it. A cross-functional team representing all the departments of an organization should be responsible for the functional evaluation of an ERP package.

The **technical criteria** for the selection of an ERP package are primarily dependent on the choice of hardware and software, as well as on the current IT trends addressed by the package. It is very important to look at the environment in which the application is available (database, middleware). Along with the environment, the user interface capabilities, the software architecture, the development and management tools associated, and the **data and process models** available with the application (Hecht, 1997) should be kept in mind. Also the issues of upgrades of software application must be taken into account.

Data Model: *It is an abstract model that describes how data is represented and used.*

Process Model: *A process model is roughly an anticipation of what the process will look like.*

The **cost** of implementing ERP includes various components such as software, hardware, consultancy, training, implementation, and many others. The cost strategy for ERP implementation also includes maintenance and upgrade methods for the system. Generally, the actual cost of ERP projects far exceeds the anticipated cost and allocated budget. This cost overrun is primarily due to the neglect of hidden cost factors such as training, data migration, and consultancy. Hence, arriving at a realistic and actual overall cost figure for ERP implementation is crucial.

The **service and support** methods associated with an ERP application are vital for the success of the partnership between the end-user and the application vendor. Organizations generally face technical and other application-related problems during various phases of ERP implementation. Integration, security, and software customization are some key areas where enterprises implementing ERP systems require service and support facilities.

The **compatibility of ERP packages with other systems** such as legacy application and other specified software products such as CRM, SCM, data warehouse, and others is also a key selection criterion. The integration of ERP systems with such tools helps in optimising the

value chain of an organization. Therefore, the selected ERP packages must support standard integration models and objects such as enterprise application integration (EAI).

Ease of customization means the ease with which a generic ERP system can be tailored to accommodate a company's specific needs. An ERP vendor should provide tools and utilities that will allow an organization's in-house IT personnel or independent consulting firms to customize the software.

Market position of the vendor and their domain knowledge is among the most important criteria. In the vendor-evaluation process, criteria such as vendor strength/reputation, financial stability, vendor's market position, experience in ERP systems, service infrastructure, and the like, are very important. The world's leading ERP vendors have implemented the best global practices in their ERP products; therefore, organizations can look at the ERP product as a process advisor.

Cross-module integration is also critical. The real benefit of an ERP system is its integration with the entire organization's systems. Complete integration among the various modules of ERP is very important. Any integration problems can increase implementation time and cost, as also compromise the system's effectiveness.

Implementation time is closely correlated with the implementation cost. It is one of the critical risk factors in ERP implementation because it keeps the organization's key resources occupied. Any time overrun will mean that these resources are to be utilised for some extra time not budgeted for, which invariably means increased cost. Generally, industry-specific applications streamline the implementation time considerably and are very effective.

The consultancy's role is of great importance in both the selection and implementation processes of the ERP system. The lower the IT experience of an organization, the higher is the role of consultants in ERP implementation. The consultants should have experience in specific industries, comprehensive knowledge about certain modules, and the ability to assess which suite will work best for the company.

Furthermore, the methodology for selecting software is of great importance, too. As ERP implementation frequently leads to the re-engineering of organizational processes, the package selected should have an effective software strategy. It must avoid unnecessary activities and additional hassles for an organization.