CHAPTER 1
INTRODUCTION

1.1 CONCEPTUAL FRAMEWORK
1.1.1 Manufacturing Companies and
Origin of ERP
1.1.2 Enterprise Resource Planning Systems
  1.1.2.1 Meaning of ERP
  1.1.2.2 Architecture of ERP
  1.1.2.3 Modules of ERP
  1.1.2.4 ERP Project Life Cycle
  1.1.2.5 Implementation of ERP
  1.1.2.6 Vendors of ERP
1.1.3 Organizational Performance
1.1.4 Productivity
1.2 RATIONALE OF THE STUDY
1.3 OBJECTIVES
Chapter 1

INTRODUCTION

An understanding of the basic concepts and associated issues is essential because it determines the success of any human endeavor of which, the present research work cannot be an exception. This chapter makes an attempt to describe the variables of the study in terms of basic concepts and associated issues and thereby, provide an introduction to the present research work. Manufacturing companies and its association with ERP, ERP system (meaning, architecture, modules, project lifecycle, ERP implementation and vendors of ERP), organizational performance and productivity have been described in the four sub-sections constituting the section entitled the conceptual framework. This section is followed by the sections on the rationale of the study, indicating the reasons for taking up the research and the objectives of the study, setting up a direction for the study.

1.1 CONCEPTUAL FRAMEWORK

1.1.1 Manufacturing Companies and Origin of ERP

Manufacturing is defined in the Macquarie dictionary as “the making of goods or wares by manual labor or by machinery, especially on a large scale” (Hughes, 2001). Manufacturing is a system that uses inputs, does processes and produces output (products). Manufacturing involves any activity that does manufacturing, belonging to private/public domain (Gunneson, 1997; Batson and Quan, 2004). Manufacturing covers internal and external issues: internal involve processes and technology for products specifications and external include customer preferences and deliveries. (Carnoy et al. 1993; Castells, 1996; Arun, 2007). According to Kaplan (1990), manufacturing organizations can be classified also as labor-intensive (e.g. textile, engineering industries) or as capital-intensive (e.g. ship-building, process industries).
The coordination among men and their jobs define the outflow in the former, whereas the man-machine interface defines the outflow in the latter (Mahadevan, 1999). Manufacturing involves plethora of activities from simple mechanical activities to highly mechanized production lines and deals with production of goods in a huge quantity which range from ships to sugar and to motor vehicles (Krishna, 1988). Unlike, service organizations, the customers of a manufacturing organization form a customer-chain which includes distributors, whole-sellers, retailers, customers and end users (Hasan, 1997; Berger et al, 2001). The existence of this customer chain involves more complexities and has given rise to the new jargons of value-chains and supply-chains (Kohli, 1989) and highly innovative and technological means of management.

Due to the intensified and accelerated competition, manufacturing companies were facing a constantly changing, uncertain environment from external agencies. The pressure on manufacturing companies was to decrease the costs and increase the quality of products and services. Besides, customers’ requirements were becoming more and more challenging. The key success areas of a manufacturing organization such as quality, operations, planning and cycle time were undergoing changes in the previous years and would continue to do so in future also. The significant stages of quality function are inspection, quality control, quality assurance, quality management and total quality management. Similarly, the operations function have evolved through the stages of process based group technology and cellular manufacturing with the agile manufacturing being in its nascent stage. The stages of evolution of planning function are learning from the past experiences, customers, competitors and inter connected systems. The evolution points of different stages of manufacturing organizations are in a constant state of expansion of energy, thereby adding value to customers (Arun and Sathyanarayan, 2001).

Before 1960s, none of the company could have the funds to own a computer. Therefore, both manufacturing and inventories were handled by the companies on the basis of it stock holding capacity to satisfy customer demand; based on the experiences that
customers would order, what they had ordered in the past and quantity was also determined according to previous orders. Due to these problems, companies were constantly searching for efficient information technology tools to gain better control of their business.

Back-office enterprise software started in the 1960s and 1970s, when the growth of information and communication technologies (ICT) was contributed by microelectronics, computer hardware and software systems that have influenced all sectors of computing applications across organizations, thereby making the computing power more affordable. During 1960’s, many companies started developing and implementing centralized information systems, targeting primarily the automation of inventory control systems. These legacy systems were based on computer programming languages such as Common Business Oriented Language (COBOL), ALGOL and Formula Translation (FORTRAN).

Literature of information systems in the 1980’s began to address competitive advantages provided due to information technology (Parsons, 1983; Rochart and Scott, 1984; Benjamin et al., 1984; Cash and Konsynski, 1985; Porter and Millar, 1985; Johnston and Vitale, 1988). The important factor for every manufacturing company was the proper utilization of the continuous changes in technology, thereby satisfying the permanent needs and demands of customers and business. The appropriate selection and implementation of appropriate technology was the key driver to success (Muscatello et al., 2003). Due to these challenges, companies started to automate materials planning, whose main purpose was to reduce inventory by proper coordination of procurement, production and dispatch process, since for determining net material requirements, accurate inventory record files, available quantity on hand, raw materials in process etc. was required (Umble et al., 2003).

MRP system was developed in 1970’s and was concerned with product planning. MRP was a set of procedures that converted predicted requirement for a product into a
requirements schedule for the raw materials and other related to that product. MRP used computer for determining raw material needs based on previous experiences. It gave ability to the management for linking purchasing and production activities with predicted figures. But, MRP was limited only to control the flow of components and materials, and was not engaged with complete production control and coordination (Mendelson, 2000).

MRP, which covered only materials, eventually gave way to the new invention of manufacturing software, known as manufacturing resources planning (MRP II), which was developed to remove this shortcoming of handling only the flow of components and materials (Kakouris and Polychronopoulos, 2005). This software included all the commercial activities by integrating the materials with production requirements into a skeleton, with an importance on optimizing manufacturing processes. MRP II systems usually consist of hardware and software applications that determined and analyzed data and manage information thereby supporting requirement planning. It included project management, finance, human resource, inventory control, production control, customer order management purchasing support, product data management, engineering and accounting etc. Basically, through MRP II, financial accounting and management systems were integrated with the manufacturing and materials management systems (Umble et al., 2003). Extension of MRP, MRP II (Ang et al., 1995; Burns et al., 1991) revolutionized the software industry (Gefen and Ragowsky, 2005).

The vision of developing an enterprise wide system began in the 1970’s, but, was not fully realized due to the technological barriers in that time period. Companies created islands of automation, a term defined by McKenney and McFarlan (1982). These evolved as new IT applications, which were introduced to meet the constantly emerging business needs. But, due to this, a plethora of loosely interfaced systems were formed which ultimately resulted in scattered information throughout the organization, which ultimately resulted in information imbalance between different functional groups and in the organizational hierarchy.
Introduction

Besides, due to isolated focus on functional activities, the same information was collected and processed multiple times in different places, and it was difficult to retrieve the right piece of information. In addition, the organizational costs to maintain these legacy systems began to go beyond the resources available for new systems (Lientz and Swanson, 1980). Thus, in this decade, experts began to realize the major shortcoming and there was a move from customized software systems towards packaged systems that were not developed for a single organization.

Also, as the 2000 approached, software developers originated that in 2000, computer systems could interpret 2000 as 00 which was done earlier for 1900, thereby adversely affecting all the computing work. Besides, many of the older programs were not able to handle dates beyond 2000, and it was suggested that must be fixed at a steep cost or replaced. This year 2000 problem (also known as millennium bug, Y2K bug, or Y2K problem) had brought out a remarkable outpouring of IT spending during the 1990s. Companies around the world spent a huge amount of money to either search for the Y2K bug and fix it through the complete source code, or replace their legacy systems with year 2000 compatible system software. While the Y2K bug was fixed over time for the software in companies', the lack of integration was still a invasive problem.

Besides, since manufacturing companies has got numerous competitive pressures and customers demanding better and timely solutions and services, numbers of ways were suggested. One response was to increase handling production capacity (Thompson, 1967; Galbraith, 1973; Pagell et al., 2000). But, many companies were finding less viability of this option. A second response was to make production and other processes easier (Schonberger, 1982; Krajewski et al., 1987; Huson and Nanda, 1995; Sakakibara et al., 1997). A third response was to increase integration, which may increase the information available to all the business units regarding internal and external environment (Lawrence and Lorsch, 1967; Wheelwright and Hayes, 1985; Adler, 1995; Ettlie, 1995; Hauptman and Hirji, 1996).
Companies which were pursuing the third option (increase in integration) were facing complex decisions like what to integrate and how to integrate. Understanding and improving business processes is a cornerstone of success in these fast-changing environments. The business environment needed efficient information systems to improve competitiveness by proper management. Information integration of internal requirements for improving supply chain management (SCM) was the need of the hour, and the firms expected new information systems to help them to respond to the customers' needs, to share effective and timely information, and to establish excellent relationship with external agencies. ERP systems seem to be a common answer for advanced ISs, able to give a wide-ranging view of the key processes needed in manufacturing organizations. Hence, many mid-size and Fortune 500 companies shifted to ERP systems for increasing integration among different business functions and for simplifying processes (Scott and Shepherd, 2002; META Group, 2004).

According to Akkermans et al. (2003), Klaus et al. (2000) and Caruso (2003) also, currently, a popular approach to the development of an integrated enterprise-wide system, the adoption of ERP, is becoming a dominant enterprise system and is sweeping across industry A historical perspective was also been taken by Chung and Synder (1999) and Kelly et al. (1999), who emphasized on the maturing of, IS leading towards ERP systems for an unambiguous business focus. Gattiker and Goodhue (2002) also highlighted that the majority of American Production and Inventory Control Society members showed that ERP was better than previous systems. However, it was difficult to replace the existing system with ERP.

Sadagopan (1999) says that redesigning the fundamental business processes, successful and rapid transformation of the information system and retraining employees, while also, with the business still having to carry on as usual, was very difficult. ERP came into existence by research and analysis firm Gartner with focus on inter-functional coordination, timely availability and sharing of appropriate information and integration.
among different functional modules, thereby helping the organization to operate in a more efficient and effective manner. Previous to ERP systems, each functional unit in an organization had their own computer system, data and database and hence, these systems were not able to communicate with one another. Laudon and Laudon (2002) says, “ERP systems solve this problem by collecting data from various key business processes and storing the data in a single comprehensive data repository to be used by all parts of the business”.

According to Colmenares (2008), “Enterprise-wide system has become a format for producing full organization integration by inclusion of all functional areas”. Palaniswamy and Frank (2002) based on an exploratory study also stated that, prior to implementation of ERP, many firms faced problems in using the available information because of the incompatibility among the various computer hardware and software systems. Davenport (2000) also asserts that advances in IT and the plethora of mergers and acquisitions in the 1980s and 1990s created a global economy and since in the previous systems, processes cannot communicate effectively with each other, owing to many databases and conversion of data from one system to another was expensive, companies increasingly started investing in ERP systems.

According to Ranganathan and Brown (2006), IT investment has expanded significantly during the past few decades; investment in information processing equipment and software grew at a compounded annual growth rate of about 25 percent between 1980 and 1999 (BEA, 2006), becoming the largest category of capital investment in the US during the past decade. IT investment accounts was the single largest capital expense for American companies, (Bakos, 1992; Davenport, 1998; Teach, 1997). Besides, according to Broadbent et al. (1999), IT infrastructure accounts for high organizational IT budgets and increases on upward side.
To summarize, a number of factors contributed to the growth of the ERP software market. *Solve the Y2K problem* was an important reason for ERP implementation in manufacturing firms (Duplaga and Astani, 2003; Mabert *et al.*, 2000). Also, since the concept of integrated information architecture to improve business performance was developed, *currency consolidation* was also the additional motive for ERP applications (Gupta, 2000; Scott and Kaindl, 2000). The other factor in ERP adoption was *high percentage of failure in information system projects*, which caused a shift from individual development to standardized, prepackaged software solutions (Scheer and Habermann, 2000). Companies were discontinuing legacy software due to the *technological demands of internal and external agencies*. Aging legacy IT systems’ replacement was often mentioned as one of the main reasons for adopting ERP systems (Davenport, 1998, 2000; Mabert *et al.*, 2003). Holland and Light (1999) also argue that other, traditional approaches in systems development have proven to be less beneficial in the long-term than ERP systems. Besides, *Business Process Reengineering, Cost reduction, Taxation requirements, Introduction of Euro, Increase sales, Stock exchange requirements and Government funding – subsidization* were also identified as another reasons for ERP implementation by Spathis and Constantinides (2004). Finally, innovation in information technologies including online sector led many companies to modify their business practices.

Similarly, the ability of ERP-based vertical applications to solve the software requirements of a specific industry has motivated companies to purchase ERP. In this highly automated, IT led business environment, to remain competitive, companies were forced to be up-to-date with the new technology (Palaniswamy and Frank, 2000; Siriginidi, 2000; Al-Mashari, 2000). Oliver and Romm (2002) emphasized the improvement in image as a factor in ERP adoption. In particular, manufacturing companies used ERP due to three major reasons:
(a) *To integrate financial data:* Functional modules in business have their own modules for showing their involvement to revenues. Since ERP uses one single database, it can easily show the company's overall performance.

(b) *To standardize manufacturing processes:* Functional modules across the manufacturing company manufacture the same product using different methods. Standardizing those processes, using single software will increase organizational performance and productivity.

(c) *To standardize and integrate information:* In manufacturing companies with multiple functional modules, information is not a unified, simple method for tracking records, which ERP does due to its integration abilities.

In short, to meet organizational needs and automatically coordinate the activities among the different departments; computerized information systems in manufacturing firms have evolved over the past 40 years from accounting and simple inventory control, through MRP (material requirement planning) and MRP II manufacturing resource planning), to today’s focus on ERP systems (Markus *et al.*, 2000; Jacobs and Bendoly, 2003; Kumar and Hillegersberg, 2000; Kennerley and Neely, 2001; Fang, 2005; Sarkis and Gunasekaran, 2003; Deshmukh, 2006).

1.1.2 Enterprise Resource Planning Systems

1.1.2.1 *Meaning of ERP*

ERP is a new generation of software which provides internal and external agencies real-time access to the system's data. ERP integrates the data and processes of an organization into one single system. It facilitates the availability of information among the different departments within a company. It has many hardware and software components for achieving integration and has single database to store data from various departments throughout the organization in a comprehensive manner.
Introduction

According to ERP Research Group (1997), An ERP system has four main characteristics: First, ERP can be regarded as a *multinational system*, since it contains the national laws and representative businesses of various countries. Second, reference models in the ERP system *embody best business practices*; the reference models supposedly reflect the most preferred business models in terms of the data employed and business processes, as well as organizational structures. Third, because ERP integrates all business processes of an organization with one *database*, all departments throughout the organization can access the same information in real time. Fourth, the parameters of ERP provide room for a firm to be able to *customize the system* to fulfil its specific circumstances.

According to Ushasri (1999), “ERP solutions use technology to address business issues, at the same time striving to *keep technology transparent for the users*. Users do not need to learn more about bits and bytes but they need to know how operational and long-term business issues could be effectively addressed with technology, with a *user-friendly interface*”. ERP systems are configurable information system packages that integrate several business functions into a single system with a *shared database*. In the manufacturing industry, the supply chain concept has been one model for improvements in efficiency. Supported by IT-based software systems, holistic production philosophies such as lean production and *comprehensive planning methods* such as enterprise resource planning (ERP) are used to manage parts of or the entire supply chain (Crowley, 1998).

Literature of information systems is full of definitions of ERPs stated by different authors. Robey *et al.* (2002) says, “ERP systems are integrated cross-functional systems containing selectable software modules that address a wide range of operational activities in the firm, such as accounting and finance, human resources, manufacturing, sales, and distribution”. “ERP systems consist of a software package that uses *database technology* to control and integrate all the information related to a company’s business including customers, suppliers, products, employees, and financial data” defines Falk (2005).
Introduction

ERP is defined as an asset of a combination of software programs based on the organization's needs and tying all the separate systems in one system, one screen, so it ties the systems of human resources, accountants, finance, inventory, production, marketing, all in one system; it facilitates the job's run, raises the efficiency of employees, giving more reliability, flexibility, saving time and effort of all the people and managers who work in the organization. It will be really a better way to run the job in the turbulence environment, also being ready for receiving and development of the coming future, in parallel with the development of information technology which is also changing from time to time (Karen, 2007).

One of the major features of ERP software is the integration between modules, data storing/retrieving processes, and management and analysis functionalities (Hoffman, 1998; Markus et al., 2000). ERP systems are required by an enterprise in order to function properly as an integrated coordinated business unit. Boudreau (2003), Ragowsky and Gefen (2008) and Yeh (2006) defines ERP system as, “A single integrated and packaged business information system. The aim of an ERP system is to seamlessly integrate and manage the different business processes and information flows within an enterprise”.

ERP systems are software packages that manage and integrate all the enterprise’s data, and provide information based on this data on a real-time basis. According to Sheikh (2003), “ERP is a method for effective planning and control of all resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company”. ERP systems have also been defined as commercially available, modularly packaged business software that enables an enterprise to efficiently and effectively manage its resources, products and services, personnel, capital assets, etc. by virtue of being an integrated application (Nah et al., 2001). According to Knolmayer and Ro’thlin (2006),” ERP systems have been promoted as a panacea for dealing with lack of data integration by replacing inadequately coordinated legacy systems”.

11
Buckhout et al. (1999) define as, "Enterprise systems provide a backbone of information, communication, and control for a company". Esteves and Pastor (2000) states as, "ERP embody the current best business practices for organizational processes". Soh et al. (2000) states, "ERP software packages enable companies to integrate business processes across organizational functions and locations and hence facilitate such management. It enables decision-makers to have an enterprise-wide view of the information they need in a timely, reliable and consistent fashion". ERP systems are enterprise-wide application packages that are designed to provide information systems integrated supports to various business functions such as manufacturing, inventory management, financial and accounting, human resource management (Tarn et al., 2002).

Three elements defining ERP are identified in Akkermans et al. (2003), namely, a technical, a functional, or a business perspective. From the technical and functional perspectives, material requirements planning (MRP), manufacturing resource planning (MRP II), and ERP represent the development of methods and software tools for the planning and controlling of resources for manufacturing companies (Bergström and Stehn, 2005). MRP systems could initially be used for calculating material requirements and handling orders, but were expanded to handle capacity planning and scheduling (Umble et al., 2003). In the business perspective, ERP can be viewed as a business approach integrating strategic and operational functions through the entire organization.

Hsu and Chen (2004) discussed the importance of ERP into an integrated, process-oriented, information-driven and real time organization. Since ERP is new software, its implementation methodologies are in the developing stage. ERP implementation involves amendments in business process and software configuration for better compatibility (Davenport, 2000; Holland and Light, 1999; Gibson et al., 1999). Yen et al. (2002) prefer to define ERP as "software that can be used to integrate information across all functions of an organization to automate corporate business processes a business management system that integrates all facets of the business".
Introduction

The researchers defined ERPs as integrated software used as a whole or partially in business organization to facilitate function's best of use to put the business organizations in a good position and to achieve its goals in flexibility, accuracy and speed. ERP systems are commercial software systems which are customizable, standard application software which integrates business solutions for the core processes (e.g. production planning and control, warehouse management) and the main administrative function (e.g. accounting, human resource management) of an enterprise (Rosemann and Wiese, 1999; Skok and Legge, 2002).

APICS (American Production and Inventory Control Society) (2001), has defined ERP systems as, “A method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company”. An ERP system provides the enterprise with the capacity to plan and manage its resources based on an integrated approach (Turban et al., 2003). Some authors in IS field like Davenport (1998) and Turban et al. (2003) call them ‘enterprise information systems’.

The concept of ERP can also be analyzed from different perspectives. As stressed by Klaus et al. (2000), firstly, ERP is like a software product. Secondly, it is a means of mapping multiple processes to generate an integrative and comprehensive structure. He defined ERP as “A comprehensive package of software solutions which seek to integrate the complete range of business processes and functions in order to present a holistic view of the business from a single information and IT architecture”.

O’Leary (2004) defines ERP as, “ERP systems are computer-based systems designed to process an organization’s transactions and facilitate integrated and real-time planning, production, and customer response”. According to Burton (1999), enterprise systems can integrate the key business processes of an entire firm into a single software system that allows information to flow seamlessly throughout the organization. ERP system is a
standardized off-the-shelf information technology (IT) package providing the first real opportunity for modern organizations to integrate their business processes and functions (Klaus et al., 2000; Davenport, 2000). With an ERP environment, transactions are treated as part of the inter-linked business processes (Gupta, 2000). Kumar and Hillegersberg (2000) defined ERPs “Configurable information system packages that integrate information and information-based processes within and across functional areas in an organization”. ERP is a driver of comprehensive change, business process improvements, and process orientation (Akkermans et al., 2003).

ERP has become the vital need for today’s business environment. Although conventional IS offer managers, services in transaction processing, reporting and provide information for decision-making purposes, these functions appear insufficient in the new business environment where automation, effectiveness and efficiency in operations, plus real-time data are considered important factors for business success (Al-Mashari, 2001; Themistocleous et al., 2001). ERP overcome these problems by integrating as many business functions and applications as possible (Franke, 2007). The technologies are developed to address the fragmentation of information across an organization’s business and to intra- and inter-enterprise information (Sharif et al., 2005). ERP systems have quickened the pace of daily activities, affected the structure and mix of organizations, changed the type of products bought, influenced the nature of work and made information and knowledge vital economic resources. O'Leary (2000) defines ERPs as packaged software designed according to a client server environment.

According to Boykin and Martz (2004), ERP systems forced the organization from a task-oriented approach to the newer process view. Davenport and Brooks (2004) emphasized that enterprise systems are main drivers to apply a cross-functional process management. According to Miller (2003), the important elements of ERP are: one comprehensive real-time database for reducing data redundancy and better accuracy; integrated business process and seamless transitions between business transactions.
Introduction

Wylie (1991) defined ERP as a set of applications designed to bring business functions into balance. According to Markus and Tanis (1999), from a base in manufacturing and financial systems, ERP systems may eventually allow for integration of interorganizational supply chains. Paradoxically, ERP projects are often considered to be strategic imperatives, but are usually justified using operational factors (Murphy and Simon, 2002). Scapens and Jazayeri (2003) define the characteristics of ERP systems as integration, standardization, routinization and centralization; which facilitate and reinforce processes of management accounting change (Rom and Rohde, 2006). Markus et al. (2000) asserted that ERP integrates inventory data with financial, sales, and human resources data, enabling organizations to price their products, produce financial statements, and manage people, materials, and money better. ERP systems has also been defined from four different perspectives by Yan et al. (2008): Business process perspective: ERP systems are instruments for helping companies manage and streamline through integration, all processes of business smoothly; Technology perspective: Configurable on-line interactive system packages; Multi-module application software: Use a single comprehensive database to store data and support cross-functional processes (Esteves, Pastor and Casanovas, 2002); Communication perspective: An enterprise-wide information system that integrates all the information flowing through a company (Davenport, 1998) and provides access to real time information and Functionality perspective: An integrated programs that provided support for core organizational activities (Aladwani, 2001).

It can be noted that these definitions have one thing in common - integration. This is what ERP does. The goal of an ERP system is to integrate all functional areas within an organization in order to allow for effective operations and communication between and among departments. All the functions and processes of a business are integrated and a comprehensive view of the entire company is generated. This is facilitated via a single database approach through which data records are integrated and data redundancies eliminated. Also, ERP not only provides access to information in a single organizational
unit but it spans over multiple organizational units and multiple business functions (Everdingen et al., 2000; Soh et al., 2000). Another major advantage of ERP is related to online services. As stated by Brown and Vessey (1999) and Jenine (2001), ERP is online interactive system that can provide total solution to an organization's information systems needs by addressing a large proportion of business functions.

In short, definitions for ERP focus on ERP properties like integrating processes, enabling optimization across organization, elimination of complexity, providing a common IT infrastructure, linking supply chain, adapting best management practices for providing right product at the right place at the right cost, keeping track of the company’s day-to-day activities, achieving consistency through standardization, enhancing of market value and firm performance through effective gains, providing a quicker response to customer requirements (Hirt and Swanson, 1999; Rao, 2000; Bendoly and Jacobs, 2004; Hunton et al., 2003; Moller, 2005).

Fig 1.1 : Concept of ERP

Source: Hossain et al. (2002). Enterprise Resource Planning: Global Opportunities and Challenges
Introduction

1.1.2.2 Architecture of ERP

Figure 1.2 Architecture of ERP

Source: Vaidyanathan T.R., Enterprise Resource Planning – Architecture
1.1.2.3 Modules of ERP

ERP systems are integrated cross-functional systems containing selectable software modules that address a wide range of operational activities in the firm. According to Nah (2007), Umble and Umble (2002), Gefen and Ragowsky (2005), Raymond et al. (2006), Robey et al. (2002), Karen (2007), Zhang et al. (2005), Boubekri (2001) and Nah et al. (2001), ERP is a software which integrates all of the activities including recording, processing, monitoring and reporting among functional departments including finance, HRM, accounting, manufacturing, marketing, distribution, accounting, financial, project management, inventory management, service and maintenance, and transportation, thereby providing convenience and uniformity across the enterprise and for showing an integrated view of business activities.

ERP is regarded as a software module family where each module shares a database and closely connects with each other in order to support the operational procedure of the enterprise (Hammer, 2002). Each module is business-process specific, interacts with a single company-wide database, and represents a single application from user and systems perspectives (Poston and Grabski, 2001). This structure enables users to develop module-specific competencies and vendors to swiftly modify software structure with new release updates (Rizzi and Zamboni, 1999).

In a company where the human resources department, designers, planners, the warehouse, and accounting department all use different software, the ERP system help each department to access and transfer information between and among departments efficiently. Davenport (1998) and McAlary (1999) suggested that ERP has modular hardware and software units and services that communicate on a local area network. The modular design allows a business to add or reconfigure modules (from different vendors also), while preserving data integrity in one shared database that may be centralized or distributed.
Enterprise resource planning (ERP) is based on the concept of identifying and implementing the set of best practices, procedures and tools that different functions of a company can utilise to accomplish total organisational excellence through integration. ERP automates all the tasks involved in a business process, such as taking an order from a customer, making a purchase order for it, buying the raw material accordingly, manufacturing the product and shipping it and billing for it. ERP helps the employee in the company to take an order from a customer and provides the entire necessary information such as the status of the inventory, credit status of the customer, the production and shipping. Besides, since there is a single database that holds the customer's new order, when any department finishes with their work, ERP system helps to shift the work to the next department. Also, any information related to the order can be tracked by simply entering the order-id into the ERP system. This helps customers to get their orders accurately and on a timely basis.

There are many software system available for organizational process, a software can be considered as ERP, if, it provides an organization with functionality for two or more systems. According to Duff and Jain (1998) and Hardy and Reeve (1999), all management functions were stand alone software applications earlier, having with their own database. But, ERP helps to fit all of them under one umbrella. Though, there are some ERP packages that cover only two organizational functions namely payroll and accounting, but most of the ERP systems cover several functions.

Growth of computing power and the internet asked the ERP vendors to redesign ERP products. ERP vendors has added more modules and functions as add-ons to the core modules giving birth to the extended ERPs for better functionality of the integrated business over the different types of network. However, it is a never ending process of business process reengineering and modification of existing modules and development of bringing new modules of ERP.
Introduction

An ideal ERP system is when a single database is utilized and contains all data for various software modules. According to many vendors and researchers including Madapusia and D’Souzb (2011), Shahneel et al. (2008) and Mendelson (2000), the different software modules are:

**MM - Material management module** comprises all activities related with material acquisitions such as purchasing, inventory, and warehouse. It enables automated supplier evaluation and can lower warehousing costs with accurate management.

**PP - Production planning** module supports production planning, manufacturing processes execution, analysis and production control. This module addresses the different phases, tasks, and methodologies used in the planning and process of production. Some of the functions include; engineering, capacity, workflow management, quality control, bills of material, manufacturing process, etc.

**SD - Sales and distribution** module has a direct interface to the MM and PP modules. This module enables the management of all sales and distribution activities such as ordering, sales leads, promotions, competition, marketing, planning, campaign and billing.

**FI - Finance module** constitutes the operational aspects of the general accounting and financial information for a business unit. Common functions are: Accounts payable, accounts receivable, fixed assets, general ledger, cash management, etc.

**CO - Controlling module** includes a variety of planning and control tools for enterprise control systems, following a system of reporting and representing business cost structures.

**GL - General logistics module** contains the tools and reports necessary to analyze and manage the status in supply-chain forecasts.

**TR - Treasury module** is an integrated solution for treasury management.

**PM - Plant maintenance module** will ensure that the machines are working at most advantageous capacity and are being constantly monitored with regular checks.
PMG – Project management group module will help the operations manager to set up deadlines, do allocation of resources and update the project status. This also helps the clients to check the online current status of their orders.

SCM - Supply chain management module includes inventory handling, supply chain management, scheduling, claim processing, order entry, purchasing, etc.

DW - Data warehouse module is usually accessed by an organizations customers, suppliers and employees.

CMF - The cash management and forecasting module will keep information of all incomes and expenses. It will basically be an automated version of the cash book.

QM - Quality management module handles tasks involved in quality planning, inspection and control, and compliance with international quality standards to ensure that a business unit employs a unified approach to total quality management.

EC - Enterprise controlling module continuously monitors metrics and performance indicators on the basis of prepared management information.

IM - Investment management module provides integrated management of investment projects. Projects are tracked from planning through execution to settlement, including pre investment analysis and depreciation simulation.

HR - Human resources module includes all business processes required to efficiently manage a business unit’s human resources needs such as personnel, payroll, recruiting, time management, training, benefits, workforce deployment and analytics etc.

SCM - Supply chain management module extends the scope of ERP systems to include planning and execution capabilities to manage inter-business unit supply chains operations.

CRM - Customer relationship management module include automating functions such as sales, marketing, customer service, collaborative order management., commissions, customer contact, calls center support, etc.

AA - Asset accounting module will calculate the depreciation at the end of the year according to the set parameters of the fixed assets of the organization.
Introduction

PA - *Profitability analysis module* will provide a view of the profit earned based on the investment per project. The main aim of profitability analysis in ERP is external market segment reporting.

IM - *Inventory management module* will provide updates on the status of the inventory, planning, documentation of goods movement, physical inventory check.

Thus, ERP ties all the different information systems used in the departments of the companies in one integrated system for a comprehensive view of the organization. Besides, companies that implement ERP systems have the opportunity to redesign their business practices using templates embedded in the software (DeLone and Mclean, 2003; Chesley *et al.*, 1999; Huang *et al.*, 2004; Scheer and Habermann, 2000). Christopher (2003) expresses that it is not necessary for an organization to buy the whole ERPs package for its activities, but these companies may go for separate modules of ERP. Besides, the technological advances are providing challenges for software houses to stay relevant and keep their ERP hardware upgraded so that they can handle the latest ERP software technology.

### 1.1.2.4 ERP Project Life Cycle

Spanning multiple phases of the ERP life cycle is the suggestion of an ERP knowledge management framework, to aid companies in optimally handling information and expertise in relation to implementation, operation and enhancement of a system (Rosemann and Chan, 2000). In general, a software project lifecycle follows five steps (Pressman, 2003): *analysis; design; implementation; testing and debugging;* and documenting. But, the ERP system lifecycle involves more ladder than a software project lifecycle because it is a complete flexible business solution while a software solution is a limited and fixed approach to a particular business need. According to an ERP Guru, ERP implementation involves three requirements: a proper ERP product, a competent project team and hardware for installing ERP configuration.
Gable et al. (1997) expressed that ERP lifecycle consists of consulting, selection and implementation of the software and learning and knowledge transfer. Esteves and Pastor (2001) proposed ERP implementation process comprises of adoption decision, acquisition, implementation, use and maintenance, evolution and retirement phases. Markus and Tanis (2000) ERP implementation model is based on the four phases namely: (a) Chartering—decisions defining the business case and solution constraints (b) Project—getting system and end users up and running (c) Shakedown—stabilizing, eliminating bugs, getting to normal operations (d) Onwards and upward – maintenance systems, supporting users, getting results, upgrading system extensions. SAP (2000, 2003) proposes to increase the value during the entire life cycle constituting of three phases namely discovery and evaluation, implementation and operations and continuous improvement.

Mandal and Gunasekaran (2003) described ERP implementation experience using a case study. The case study reveals some of the intricacies during the planning and implementation stages that may occur in a company. The success of ERP implementation depends on closely following pre-implementation, implementation and post-implementation stages. According to Chang and Gable (2002), improved understanding of ERP life-cycle issues is required for both fruitful research and effective implementation of ERP. The stages of their model are the following three: pre-implementation, implementation and post-implementation, involving respective activities such as (a) requirements definition, business case and software selection; (b) gap analysis, custom modification, project and change management; and (c) roll out, upgrades and payback review.

Shanks et al. (2000) anticipated to differentiate between planning, implementing, stabilization and improvement. The ERP lifecycles described above can be consolidated and simplified to four phases: business engineering, system selection, system implementation, and system use and change. Bancroft (1996) proposes an ERP lifecycle
with emphasis on the stages including, constructing, testing, and actual implementation. Gable (1998) suggests a lifecycle approach that consists of the consulting process, selecting the ERP software, implementing, user learning and knowledge transfer.

Thus, on the basis of research papers by Markus and Tanis (2000), Esteves and Pastor (2001), Shanks and Parr (2000), Bancroft (1996), Gable (1998) and Mandal and Gunasekaran (2003), we can say that the different phases of ERP life cycle are:

(1) *Acceptance decision phase:* In this phase managers identify the need for a new ERP system by using best approach to solve the critical business opportunities and develop the organizational strategy.

(2) *Acquirement phase:* This phase includes product selection, best suitable according to the organization requirements and minimizing the need for customization.

(3) *Project phase:* In this phase, ERP software is configured and rolled out to the organization. Kirchmer (1999) refers that ERP implementation ties up substantial corporate resources for a relatively long period of time, sometimes years and an organization cannot afford to suffer a total project failure.

(4) *Shakedown phase:* In this phase, the company goes through the post-implementation adjustment period - these measurements are concerned with improvements in BP performance (Reijers and Van der Aalst, 2005).

(5) *Onward and upward phase:* Hayes (1998) refers that managers who make ERP systems, the strength of corporate information technology environments, are discovering that it affects all other technical decisions. In this phase, the company captures the majority of business benefits from the ERP system and plans the next steps for technology implementation and business development.

(6) *Retirement phase:* In this phase, managers decide to substitute the ERP software with other information system because some new technologies are emerging or they found that ERP system is inadequate to the business needs.
Introduction

1.1.2.5 Implementation of ERP

ERP systems are very wide in scope and it is extremely complex to implement an ERP system. It takes lots of time for planning, consulting and implementation because ERP systems can also push an organization towards generic processes, even when customized processes may be a source of competitive advantage (Davenport, 1998). ERP systems are not only ambitious, but they also require a significant capital investment and require substantial time to implement. Umble and Umble (2002) conducted a survey for 63 companies and the results indicate that the average implementation cost was $11 million and took 23 months to complete. META Group (2003) reported that the average cost of an ERP system was $17.5 million and required 20 months to implement.

Peslak, Subramanian and Clayton (2008) has explored a phased model for ERP implementation and found four distinct phases – training, transition, usefulness, and maintenance. Krantz et al. (2005) opinioned that ERPs implementation is a complex issue because it is an integrated way of business processes and consumes time and results in valuable changes in the organization.

Customizations results in increased information systems costs and longer time in implementation and maintenance. Robinson and Dilts (1999) argued the minimal customization which involves using the vendor’s code as much as possible has been associated with successful ERP implementations. A survey of Fortune 1000 companies regarding ERP customization policies indicates that 41% of the companies re-engineer their business to fit the application, 37% of the companies choose applications that fit their business and customize a bit, and only 5% customize the application to fit their business (Davis, 1998). According to Ross and Vital (2000), ERP implementation involves five stages namely design stage which involves selection of the right system, consultants etc., implementation stage that describes aspects of real implementation of ERP, stabilization stage that focuses on familiarity with software and reports, continuous...
**Introduction**

*Improvement stage* by adding new modules and *transformation stage* for planning expected upgrades and additional skills.

A *project size* is measured in terms of the *number of ERP modules and sub-modules* that are implemented, while complexity is defined as the organizational scope of the project in terms of users involved and overall company size (Francalanci, 2001). For implementation cost and complexity, it was found that the majority (60 per cent) of the project cost is devoted to setup, installation, and customization of the software (Osterle *et al*., 2000). However, according to Kremers and Dissel (2000), the value of an ES lies in effective and efficient usage rather than the product and new versions ERP system.

Holland and Light (1999) highlighted that ERP implementation may follow two paths, the choice of a standardized with little adjustments required, and the customization of an ERP system to tailor it to the organization’s needs. The first option appears to be more likely than the second one (Gulledge and Sommer, 2003), especially because it is less expensive (Lindley *et al.* 2008). ERP vendors designed their packaged ERP systems to be the universal package software for various industries and organizations (Teltumbde, 2000). However, this enforced standardization may not fit the organization’s characteristics and, may lead to the failure of the ERP system’s implementation (Morton and Hu, 2008). According to Huang *et al.* (2008) and Lui and Chan (2008), from the technical aspect in ERP implementation, there is a need to find best possible strategy between customization of the ERP system and changing the organizational procedures. From the organizational aspect, there is a need to manage change and develop processes.

According to Rao (2000), implementing a trial version of the ERP system and proper customization after six-months, will decrease implementation time significantly. Parr and Shanks (2000) discussed strategies adopted for implementation e.g. the comprehensive, middle road or vanilla implementation strategy. Piturro (1999) argued that the consultants may have experience in specific industries, comprehensive
knowledge which suit will work best for a given company. Customization should only be requested when essential (Appleton, 1997) or when the competitive non-standard processing can be clearly demonstrated (Escalet al., 1999). SAP, has pre-configured processes because they require organizations to comply with standard business processes.

However, implementing ERP system requires significant changes on employees and organization procedures. ERP systems differ from traditional in-house or custom development systems in three ways; The user may have to make changes to business processes and procedures; the user may need to introduce customizations and the user becomes dependent on the ERP vendor for assistance and updates (Somer and Nelson, 2003). However, usually organizations use ERP vendors to implement their customized ERP system and they provide three types of professional services through ERP implementation - consulting, customization and support.

According to Markus, Tanis and Fenma (2000), Companies whose structure are complex, geographically scattered, and culturally alive gives different challenges during ERP implementation. In case of multinational companies, where parent sites are geographically separated has unique issues of managing changes. Nah, Zuckweiler, and Lau (2003) expresses that complexity in ERP implementation involves business strategy, software configuration, technical platform, and management execution.

All these approaches for describing ERP life cycle have a common implementation stage, which is further divided into pre- and post-implementation stages. This stage is important because it is the longest phase of the ES lifecycle. ERP systems are anticipated to improve both backbone and front-end functions. Besides, it is generally a ambiguous perception that ERP implementation will improve organizations’ functionalities overnight, increase profits and improve services, but these are dependent on choosing ERP system that better fits according to the organizational functionalities, culture, strategy and structure.
1.1.2.6 Vendors of ERP

Most ERP systems were typically procured from software vendors and were subsequently supported by consultants and experts than were designed in house (Ettlie 2000). ERP market has companies that provides integrated suite of all organizational applications and that address specific business module. The main group in industry parlance is known commonly as JBOPS - J.D. Edwards, Baan, Oracle, PeopleSoft, and SAP. These companies attempted to create end-to-end solutions for the complete organization, anticipating that corporate customers will like to purchase from a single vendor for most of their software needs, because this will simplify contracting and relationship management and offer a single point of accountability for all software problems. Besides, these ERP companies offer software that can be bolted on to the existing ERP software and, together, provide best solutions for the different departments. Different vendors and their details according to Hossain, Patrick and Rashid (2002), Mendelson (2000) and official websites of SAP, People Soft and Oracle are:

**SAP**: It is the important ERP software vendor, having 32% market share in 1999. SAP stands for “Systeme, Anwendungen, und Produkte in Datenverarbeitung” or Systems, Applications and Products in Data Processing. SAP was founded by five engineers in Germany in 1972 who desired to frame integrated business application software especially for the manufacturing organizations. It is the market and technology leader in business management software, solutions, and services for improving business process. SAP offers largest number of functional modules and provides a wide range of expertise and highly adaptable solutions to the customers for a better and appropriate selection.

**Oracle**: Oracle (Oracle, 2005), founded in 1977 in the USA has its expertise in database management and related software applications. After Microsoft, it is the largest software company in the world. Oracle is the software industry leader and specialist in financial applications. It has launched stream of e-commerce and Internet-based B2B applications.
Introduction

**People Soft:** Pleasanton-based, it started as a software firm for human resource management in 1987, but, now has gradually expanded its software to cater to other corporate functions also. PeopleSoft with about 10% market share is the third largest ERP vendor after SAP AG and Oracle.

**Baan:** The Baan Company was founded in Netherlands in 1978. Baan’s products have been simpler to use than SAP’s, leading to the company’s growth in the early nineties. Baan’s flagship product is BaanERP and was launched in 1998. Other innovative product from Baan is the Orgware tool that reduces implementation cost significantly by configuring the organization software automatically. Baan’s ERP software is used primarily in the aerospace, defense, automotive and electronics industries.

**J.D. Edwards:** Founded in 1977, J.D. Edwards’ flagship ERP product called ‘oneworld’ can be executed on different platforms and databases. It has revolutionized enterprise software by providing users flexible and dynamic technologies. J.D. Edward’s products are very flexible since the users become proficient with its technology and can execute a significant part of installation of maintenance expertise system in the software. It is mainly focused on the e-commerce and e-business aspects of ERP system.

1.1.3 Organizational Performance

Performance appraisal is an initial and critical part of management (Evans *et al.*, 1996), as it can clearly describe the past and current situations, and function as the reference for future management (Stadtler and Kilger, 2000). Therefore, in order to manage the system well, the enterprise must initially have a proper performance appraisal model to assess its system. Performance appraisal theory has been consistently evolving since its inception (Chang *et al.*, 2009). In the beginning, it was conceived of as univariate effectiveness measures; however, Steers (1977) indicated that univariate effectiveness measures tended to merely assess one facet of performance and could not reveal the whole situation. The
Introduction

theory further evolved to include financial statement analysis, which was focused on short-term assessment instead of long-term appraisal (Booth, 1996). The theory then further evolved into overall analysis. It focuses on all aspects of the enterprise; it could not convert the enterprise’s overall goals into performance appraisal indicators.

Hence, Epstein and Manzoni (1997) indicated that there will be three major trends with respect to the development of a prospective performance system - enterprise will support the implementation of strategies, *performance systems must include non-financial indicators* and these systems must be promoted to the departments, which actually create the performance for the organization.

Besides, advances in technology have created new opportunities for using more accurate and reliable data for performance management in public sector organizations (Smith and Kavanagh, 2008). According to the study of Gaiss (1998), *the performance system developed by modern organizations must connect with the prospective strategic goals of the organizations*. Thus, the overall analysis evolved into the strategic performance assessment. Kaplan and Norton (1992) proposed the concept of the Balanced Scorecard, which included four facets: learning and growth, customers, internal process, and finance.

1.1.4 Productivity

Productivity is a multidimensional term, the meaning of which can vary, depending on the context within which it is used. However, there are common characteristics that tend to be embraced by the term. In industrial engineering, productivity is generally defined as the relation of output (i.e. produced goods) to input (i.e. consumed resources) in the manufacturing transformation process (Sumanth, 1994). Tangen (2005) has compiled various definitions of productivity by different authors. According to Littre(1883), productivity is faculty to produce, Sink and Tuttle (1989) says that it is the ratio of actual output to expected resources used, Chew (1988) says that is the ratio of units of
Introduction

output to units of input, Aspe’n et al. (1991) expresses that it is the ratio of value added to input of production factors, Fisher (1990) suggests that it is the ratio of total income to cost of goal profit, Jackson and Petersson (1999) opined that it is the product of efficiency and effectiveness or it is the ratio of value adding time to total time and Al-Darrab (2000) says that it is ratio of output to input multiplied by quality or it is the product of efficiency, utilization and quality. Moseng and Rolstadas (2001) expresses that it is the ability to satisfy the need for goods and services with least use of resources.

According to Hill (1993) and Kaplan and Cooper (1998), it compares between output (goods and services produced) and input (human labour, capital, material and other resources). Thurow (1993) suggests that it determines population’s average of living. According to Koss and Lewis (1993), it means quantity and quality of goods manufactured from the available resources. If more or better goods are produced from the same resources or same goods from lesser resources are produced, we increase productivity. Resources include both human (people who produce the goods or provide the services) and physical (assets with which the people can produce the goods or provide the services) resources (Bernolak, 1997).

The research by Grunberg (2004) discussed difference between performance and productivity. It provided a generic framework for developing improvement initiatives for the proper identification of strengths and weaknesses of operational activities. Performance of an organization was related to the results with respect to the strategic plan of an organization, while productivity was referred to the relative value of the inputs with respect to outputs desired in the performance. However, productivity is a relative concept: it cannot be said to increase or decrease unless a comparison is made, either of variations from a “standard” at a certain point in time or of changes over time (Tangen, 2005). Moreover, as stated by Misterek et al. (1992), improvements in productivity can basically be caused by five different relationships: Output increases faster than input: the increase in input is proportionately less than the increase in output (managed growth);
Introduction

More output from the same input (working smarter); More output with a reduction in input (the ideal?); Same output with fewer inputs (greater efficiency) and Output decreases, but input decreases more; the decrease in input is proportionately greater than the decrease in input (managed decline).

According to Galbraith (1973), sophisticated productivity analysis techniques measure the long term impact of strategic decisions as well as measuring specific aspects of operations. These techniques include: total productivity, total factor productivity and partial productivity measures which compares one or more inputs against one or more outputs. Total productivity measures are useful for continuous assessment of productivity, whereas partial productivity measures are useful for identifying possible problem areas.

1.2 RATIONALE

ERP projects always contain a high level of risk and uncertainty. The purchase of ERP software is a high-expenditure activity that consumes a significant portion of their capital budgets (Verville, Bernadas and Halingten, 2005) and since ERP system are profoundly complex pieces of software and costly systems (Al-Mashari et al., 2003; Luo and Strong, 2004, King and Burgess, 2006; Kumar et al., 2003, Somers and Nelson, 2003, Hsu and Chen, 2004), installing them requires large investments of time and expertise (King and Burgess, 2006).

An ERP project failure may threaten the existence of an organization. A wrong ERP project selection would either fail the project or weaken the system to an adverse impact on company performance (Wei and Wang, 2005). While approximately one-third of all information systems projects are cancelled before completion (Severance and Passino, 2002), the failure rate for ERP implementation is 25% (Kozak-Holland, 2007). Soh et al. (2000) reported that many large organizations that have installed ERP system had to
abandon their implementation. Chakraborty and Sharma (2007) also reported that 90 percent of all initiated ERP projects failed, since the project was not managed properly. Thus, for both researchers and executives, one of the key questions is will investments in ERP pay off? Therefore, it is critical for organizations to have as much information as possible prior to embarking on an ERP project and require an evaluation of ERP.

Reviews by Esteves and Pastor (2001), Jacobs and Bendoly (2003), Møller(2005), Brynjolfsson and Yang (1996), Bharadwaj et al.(2000), Poston and Grabski (2001), Esteves and Bohorquez (2007) and Moon (2007) indicate that a majority of ERP research focuses on ERP selection, success factors, and the implementation phase, but seldom on post-implementation impacts. This highlights a critical research gap, as there is a great need for continued improvement and assessment as ERP use evolves over time. Due to the imbalance in the ERP literature, Ifinedo (2006b) have also called for more studies. Laudon and Laudon (2000) stressed on viewing ERP system from a comprehensive perspective. Besides, according to Wieder et al. (2006), there are a number of such studies that do not clearly distinguish between organizational or business process performances. Brynjolfsson and Hitt (1998) observe that the IT payoffs are contingent; therefore they encourage the research of factors that leverage the impact of IT on firm performance.

Hedman and Borell (2004) explained that evaluating ERP systems is an important tool for improving selection, development, implementation and usage since, implementing ERP systems is not as much a technological exercise as it is an organizational revolution (Bingi et al.,1999; Davenport, 2000) since it interacts with actors of the organization(Boudreau and Robey, 2005). According to Uwizeyemungu and Raymond (2010) also, the ex-post evaluation of ERP systems is necessary not only to justify the investments made in these systems, but also and above all to better manage the benefits sought by organizations from these systems.
Introduction

Thus, an extensive study of research done with respect to ERP, points at the scarcity of studies on ERP and its effect on organizational performance in the post-implementation stage. In India, the empirical studies on the ERP are almost negligible and very few have focused mainly on pre-implementation. To fill this void, the present study is undertaken with an aim to reassess possible benefits, which could further clarify the myriad of factors affecting the ERP and firm performance and productivity relationship. Based on the study by Shanks *et al.* (2003), where he described the first ERP wave as acquisition and implementation of ERP system, while the second wave focuses on making improvements and maximizing the benefits from the ERP system, this study would also contribute to understand the complete model of ERP implementation in both the waves.

Most of the research on ERP benefits has been in the form of *individual case studies* (e.g., Dolmetsch *et al.*, 1998; Cotteleer, Austin, and Nolan, 1998; McAfee, 2002; Gibson, Holland, and Light, 1999; Westerman *et al.*, 1999), product testimonials (SAP Press Release) and *industry surveys* (AT Kearney, 1996, 1998, 2000; Morgan Stanley Dean Witter CIO Surveys, 2001). Here, I extend previous work of ERP by providing clear metrics to gauge the impact of ERP on organizational performance by focusing on manufacturing organizations. Focus of my analysis was on manufacturing organizations for three reasons: (a) As ERP was first adopted in the manufacturing sector; systems developed for this sector would be more mature than those developed for the services sector or the public sector. (b) ERP implementation seemed to be particularly prevalent among these, thus providing for more companies that are richer in data and also have more potential for discovery and (c) Focusing on a specific industry has an advantage because each industry is different and I wanted to minimize potential confounding effects due to industry variations.
1.3 OBJECTIVES

Markus et al. (2000) underpin three issues, when measuring the success of an ERP implementation. First, the way in which success is measured must be determined - success as perceived by the managers, end-users etc. Secondly, the phase in the ERP lifecycle where success is measured must be established. Third, criteria for implementation success must be established. In technology-based evaluations, success is measured through user perceptions. Accordingly, the study is being carried out with the following objectives:

• To determine parameters for measurement of organizational performance and productivity in the post implementation phase and study the effects of ERP on organizational performance and productivity.
• To study the effect of demographic variables on changes caused by ERP on organizational performance and productivity.
• To ascertain different components of ERP in the implementation phase and study the perception of ERP users.
• To develop and test a quantitative model for depicting the relationship between components related to ERP in implementation phase and changes caused by ERP on organizational performance and productivity.
• To study the general characteristics related to ERP in different manufacturing companies.
• To unlock new vistas of research to provide guidelines and develop a base for applications of the findings in terms of the implications, as these can provide a blueprint for a higher level of success in similar projects in the future.