

2000

## The factors that affect the implementation of enterprise resource planning (ERP) in the international Arab Gulf States and United States companies with special emphasis on SAP software

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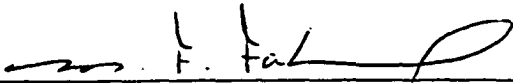
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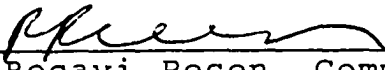
THE FACTORS THAT AFFECT THE IMPLEMENTATION OF  
ENTERPRISE RESOURCE PLANNING (ERP) IN THE  
INTERNATIONAL ARAB GULF STATES AND UNITED STATES  
COMPANIES WITH SPECIAL EMPHASIS ON SAP SOFTWARE


A Dissertation Submitted  
In Partial Fulfillment  
Of the Requirements for the Degree  
Doctor of Industrial Technology

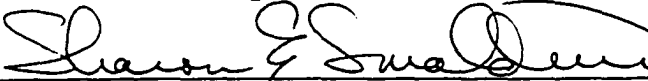
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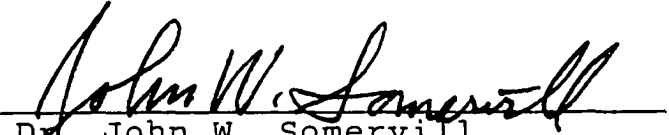
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An Abstract of a Dissertation  
Submitted  
In Partial Fulfillment  
Of the Requirements for the Degree  
Doctor of Industrial Technology

Approved:

  
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## ABSTRACT

The primary purpose of this study was to investigate and determine the factors affecting the implementation of enterprise resource planning (ERP) in companies in the Arab Gulf States and the United States, using SAP software as an example.

A random sample was selected of 150 companies in the Arab Gulf States and in the United States that had implemented an ERP system using SAP software. Of the 150 respondents, 30 were companies from the Arab Gulf States and 120 from the United States. A total of 67 questionnaires were returned, a return rate of 44.7%.

The Statistical Package for the Social sciences (SPSS) was used to analyze the data. Statistical tests were conducted at the (.05) level of significance. Frequencies and percentage were used to compute and analyze the variables. Statistical measures included t-test, chi-square test, and Mann-Whitney U tests.

The respondents reported that the major critical success factor for the ERP implementation was the top management support and involvement.



They were most dissatisfied about the way change was managed. Most of the respondents believed the ERP implementation was successful.

There were no statistically significant differences found between Arab Gulf and U.S. companies in regard to the factors that affect the implementation of an ERP system. The company size did not make any difference in the critical success factors.

Most of the respondents indicated that functional reasons were the main motivation to implement the ERP system. Although the time schedule and training time for implementation were usually estimated accurately, this was less true for cost estimates. Most of the respondents indicated that they implemented an ERP system to address certain specific problems.

The majority of the respondents who have already implemented an ERP system have chosen an all-in-one approach for ERP software selection and the complete system roll-out-at-once strategy. Preparatory steps included establishing a project

team with a strong leader and allocating budget and resources to the implementation.

The major advantage of implementing an ERP system is to have a uniform computer system across the organization. The major disadvantage is the high cost.

Recommendations based on the results of the study include having a clear understanding of the objectives ERP is to serve in the company as well as of the ERP system itself and ensuring that the transition to ERP provides adequate employee training and reassurance for employee concerned about job security.

For my brother

SUNDAH

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CHAPTER I  
INTRODUCTION

Enterprise resource planning software, or ERP, attempts to integrate all departments and functions across a company into a single computer system that can serve all those different departments' particular needs. ERP is a single software program that serves the needs of people in finance as well as it does the people in human resources and in the warehouse. Each of those departments typically has its own computer system, each optimized for the particular ways that the department does its work. But ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other.

That integrated approach can have a great payback if companies install the software correctly. Take a customer order, for example. Typically, when a customer places an order, that order begins a mostly paper-based journey from in-basket to in-



basket around the company, often being keyed and re-keyed into different departments' computer systems along the way. All that lounging around in in-baskets causes delays and lost orders, and all the keying into different computer systems invites errors. Meanwhile, no one in the company truly knows what the status of the order is at any given point because there is no way for the finance department, for example, to get into the warehouse's computer system to see whether the item has been shipped (Christopher, Derek, & Baatz, 1999).

Avraham (1999) stated that in today's dynamic and turbulent business environment, there is a strong need for organizations to become global. The survival guide to competitiveness is to be closer to the customer and deliver value-added products and services in the shortest possible time. This, in turn, demands the integration of business processes of an enterprise. ERP is such a strategic tool, which helps a company to gain a competitive edge by integrating all business processes and optimizing the resources available.

In today's fiercely competitive business environment, there has to be much greater interaction between customers and manufacturers. This means that, in order to produce goods tailored to customer requirements and provide faster deliveries, the enterprise must be closely linked to both suppliers and customers. To achieve this improved delivery performance, decreased lead times within the enterprise, and improved efficiency and effectiveness, manufacturers need to have efficient planning and control systems that enable harmonization planning in all the processes of the organization. ERP equips the enterprise with the necessary capabilities to integrate and synchronize the functions into streamlined business processes.

The top private companies in the Arab Gulf States and the United States have implemented ERP systems to improve their businesses. The future of these companies is full of challenge, which demands strategies to be spelled out to match the future environment. These businesses must have a clear vision of how they, with their different policies, are going to face the future of the economy.

The implementation of an ERP system is a very time-consuming, expensive, and arduous task. Of information technology executives from Fortune 1000 companies who had implemented ERP, 44% reported that they had spent at least four times as much on implementation as they had on the software license itself (Michel, 1997). An ERP system can be expensive, take years to install, force the change of basic business processes, and may not provide a return for years.

The implementation of ERP is a critical issue. Some companies have spent their money and time to implement ERP and then found out the results were not as good as they had expected them to be. McCausland (2000) stated that companies have spent fortunes on ERP software and its implementation only to find that their business performance has not improved at all.

Habermann (2000) reported:

ERP faces many challenges as it continues to grow and move into new markets. First and foremost are the combined challenges of an overly sophisticated implementation with the shortage of trained staff to handle the implementation. Recent trade journals have been filled with ERP horror stories that include

problems with cost and schedule overruns, re-training staff, culture change issues, and poor Return On Investment (ROI). The final challenge that ERP vendors face is the open systems people who doubt market sustainability for anyone offering a proprietary system. (p. 57)

ERP software, such as the package solution from System, Application, Products in data processing (SAP), Oracle, Baan, and PeopleSoft, can offer not only greater efficiencies but also the opportunity for interdepartmental teamwork and communication.

ERP system is one of the best systems on the market to help companies within the Arab Gulf States and the United States to achieve their business objectives and to be strong enough to enter the competitive market. However, some difficulties and problems affect the adoption of such systems. This study emphasized the factors that affect the implementation of ERP on the international Arab Gulf States and United States companies with special emphasis on SAP as an example.

#### Statement of Problem

A number of factors affect the implementation of ERP in an enterprise that has not been fully identified and described. The intent of this study

is to identify, analyze, and investigate factors affecting the implementation of ERP in the international Arab Gulf States and U.S. companies, with special emphasis on SAP as an example. Recommendations to help these companies to make the decision about ERP implementation are also gain.

#### Statement of Purpose

The primary purpose of this study is to investigate and determine the factors affecting the implementation of ERP in international the Arab Gulf States and U.S. companies, using SAP software as an example.

Because a number of Arab Gulf and U.S. companies have already implemented ERP, recommendations and guidelines gleaned from this research can be used to assist other companies in avoiding the potential problems associated with implementation.

#### Significance of the Study

In the Arab Gulf States and the United States, companies have to create an environment of competitive advantage through continuous improvement. Therefore, the deployment of the ERP

system has become a critical issue. Understanding the factors that affect the implementation of ERP is necessary for the leaders of companies considering whenever or not implementing an ERP system is the right decision for them.

More and more companies in the Arab Gulf States and in the United States are implementing ERP. This study will help such companies anticipate the problems they encounter during the implementation process. This study will also contribute to existing knowledge and generate new knowledge regarding factors that affect the implementation of ERP. There are few published studies in this field, and these companies need as much information as possible to assist them in the implementation of ERP.

#### Limitations

The following limitations apply to this study:

1. The study was limited to the Arab Gulf States and United States companies that have implemented ERP, which may limit generalizing of results.

2. Respondents were limited to those companies in the Arab Gulf States and the United States that implemented SAP software, and therefore these results do not apply to other components of ERP.

3. Only the members of the team who participated in the implementation process of SAP and who completed the initial questionnaire were included.

4. The questionnaire was dependent upon self-reported data as well as subjective opinions.

5. The questionnaire was designed for two populations: companies that implemented ERP and use SAP software (a) within the Arab Gulf States and (b) within the United States.

6. Those companies that did not implement ERP were excluded from the study.

7. Those companies that did not implement SAP software were excluded from the study.

#### Assumption

The following assumption were made:

1. The areas represented in the survey instrument were relevant to the factors that affect

the implementation of ERP in the international Arab Gulf States and U.S. companies.

2. The respondents honestly answered the questionnaire.

3. Respondent answers differentiated between actual and desired responses.

4. The data could be obtained by the use of a questionnaire.

5. The respondents had appropriate expertise to correctly state the obstacles of the implementation of ERP.

6. The respondents had primary responsibility for making decisions about implementing ERP in the companies in question.

7. The instrument and statistical procedures were adequate to measure the significance of perceived factors that affect the implementation of ERP.

8. The information obtained from the survey sample might be generalized to represent all the companies in the population.



9. Some companies in the Arab Gulf States and the United States have already implemented ERP and SAP.

### Research Questions

The aim of this study is to identify and describe factors that affect implementation of ERP in the Arab Gulf States and U.S. companies. Each question used to identify various factors that affect the implementation of ERP. The research questions for this study are as following:

1. What are the factors that affect the implementation of ERP?
2. How do factors that affect the implementation of ERP differ between companies in the Arab Gulf States and those in the United States?
3. Does company size make any difference in the factors that affect the adoption of ERP?
4. What was the main motivation behind the decision to adopt ERP?
5. Is there any difference in the motivation between companies in the Arab Gulf States and those in the United States that adopt ERP?

6. What are the advantages and disadvantage of implementing ERP system?

#### Definition of Terms

Terms used throughout the study are defined below to enhance understanding.

Enterprise Resource Planning (ERP): An industry term for the broad set of activities supported by multi module application software that helps a manufacturer or other business manage the important parts of its business, including 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.

System Application Products in Data processing (SAP): Software house specializing in business applications for middle and large size companies.

Material Requirement Planning (MRP) is an information system that determines what assemblies must be built and what materials must be procured in order to build a unit of equipment by a certain

date. It queries the bill of materials and inventory databases to derive the necessary elements.

Manufacturing Resources Planning (MRP-II): An information system that integrates all manufacturing and related applications, including decision support, material requirements planning, accounting, and distribution.

Client/server: An architecture in which the client (personal computer or workstation) is the requesting machine and the server is the supplying machine, both of which are connected via a local area network (LAN) or wide area network (WAN). Since the early 1990s, client/server has been the buzzword for building applications on LANs in contrast to centralized minis and mainframes with dedicated terminals.

Chief Executive Officer (CEO): Often but not always also the president of a company. The CEO reports to the chairman of the board and board members. The CEO is usually the most important spokesperson for the company, the person who is responsible for quarterly results, and the best-paid member of the company.

Local Area Networks (LAN): A communications network that serves users within a confined geographical area. It is made up of servers, workstations, a network operating system, and a communications link.

Computer Aided Design (CAD): The use of computers to design products. CAD systems are high-speed workstations or desktop computers with CAD software. A graphics tablet is used for drawing, and a scanner may be attached for additional input. The output of a CAD system is either printed or electronically transmitted to a CAM system, which builds the objects.

Chief Information Officer (CIO): The executive officer in charge of all information processing in an organization. The CIO's job is demanding but may not receive the same praise and rewards as other executives. Information systems in an organization are often taken for granted until something breaks down, which is when the CIO is held responsible.

Euro: Now the official monetary unit of 11 member nations of the European Union.

Economic and Monetary Union (EMU): The consolidation of European currencies into one monetary unit called the Euro, which began to be phased in on January 1, 1999. Accounting systems that deal with the currencies of the participating countries have to deal with both native and Euro values. On January 1, 2002, Euro notes and coins must be available, with national currencies withdrawn by July of that year. It is expected that public and private companies will spend more than \$150 billion modifying their information systems to accommodate the EMU.

Information System (IS): The formal title for a data processing, MIS, or IS department. Other titles are Data Processing, Information Processing, Information Services, Management Information Systems, Management Information Services, and Information Technology.

Information Technology (IT): The processing of information by computer and the latest title for the information-processing industry.

### Organization of the Study

Chapter I presents the research problem and its development. A review of the literature is included in Chapter II. Chapter III presents the methodology used in the study. Chapter IV discusses data collection and analysis. A summary of the discussion, conclusions, and recommendations for further research are in Chapter V.

## CHAPTER II

### LITERATURE REVIEW

The review of the literature for this research study is organized into four major sections. First, the history of an Enterprise Resource Planning (ERP) in the United States and the Arab Gulf States is summarized. The second section presents the description of ERP: its characteristics, what an ERP system will provide to companies that implement it, how will ERP is working, and the benefits of an ERP system. Third, the factors that affect the implementation of ERP and those that help the enterprise to survive an ERP implementation are reviewed. The fourth section focused on the ERP market, the market leaders, and the future of the ERP system.

#### ERP and Its History

As noted in Chapter I, ERP serves all departments within a manufacturing enterprise by linking business computer systems such as those used for accounting, sales, manufacturing, and materials management, to facilitate the smooth flow of information across an entire organization.

ERP is a very strong system and it can help the enterprise to avoid duplicated jobs. Before Columbia Contech implements ERP system, they manually costed their jobs when they were completed. Now they do it through the system. Overall control, as far as control of information, has gotten much better. (Crowley, 1998, p. 121)

Minahan (1998) indicated that companies such as Compaq, Alcoa, and Hershey Foods, have utilized ERP systems to reduce inventories, shorten cycle times, lower costs, and improve their overall supply chain management practices.

#### ERP History in the United States

The focus of manufacturing systems in the 1960s was on inventory control. Most of the software packages then (usually customized) were designed to handle inventory based on traditional inventory concepts. In the 1970s the focus shifted to MRP (Material Requirements Planning) systems, which translated the master schedule built for the end items into time-phased net requirements for the sub-assemblies, components, and raw materials planning and procurement.

In the 1980s the concept of MRP-II (Manufacturing Resources Planning) evolved, which



was an extension of MRP to shop floor and distribution management activities. In the early 1990s, MRP-II was further extended to cover areas like engineering, finance, human resources, and projects management (i.e., the complete gamut of activities within any business enterprise). The term Enterprise Resource Planning was coined to describe this expanded perspective.

Timeline of ERP (Ptak & Schragenheim, 2000)

- 1960 Enterprise Resource Planning (ERP) is born in the early 1960s from a joint effort between J.I. Case, the manufacturer of tractors and other construction machinery, and partner IBM. Material Requirements Planning (MRP) is the initial effort. This application software serves as the method for planning and scheduling materials for complex manufactured products.
- 1970 Initial MRP solutions are big, clumsy and expensive. They require a large technical staff to support the mainframe computers on which they run.
- 1972 Five engineers in Mannheim, Germany begin the company SAP. The purpose in creating SAP is to produce and market standard software for integrated business solutions.
- 1975 Richard Lawson, Bill Lawson, and business partner, John Cerullo begin Lawson Software. The founders see the need for pre-packaged enterprise technology solutions as an alternative to customized business software applications.

- 1976 In the manufacturing industry, MRP (Material Requirements Planning) becomes the fundamental concept used in production management and control.
- 1977 Jack Thompson, Dan Gregory, and Ed McVaney form JD Edwards. Each founder takes part of their name to create the company moniker. Larry Ellison begins Oracle Corporation.
- 1978 Jan Baan begins The Baan Corporation to provide financial and administrative consulting services.
- 1979 Oracle offers the first commercial SQL relational database management system.
- 1980 JD Edwards begins focusing on the IBM System 138 in the early 1980s. MRP (Manufacturing Resources Planning) evolves into MRP-II as a more accessible extension to shop floor and distribution management activities.
- 1981 Baan begins to use Unix as its main operating system.
- 1982 Baan delivers its first software product. JD Edwards focuses on the IBM System/38
- 1983 Oracle offers both a VAX mode database as well as a database written entirely in C (for portability).
- 1984 Baan shifts the focus of their development to manufacturing.
- 1985 JD Edwards is recognized as an industry-leading supplier of applications software for the highly successful IBM AS/400 computer, a direct descendant of the System138.
- 1987 PeopleSoft is founded by Dave Duffield and Ken Morris in 1987.

- 1988 PeopleSoft's Human Resource Management System (HRMS) is developed.
- 1990 Baan software is rolled out to 35 countries through indirect sales channels. The term Enterprise Resource Planning is coined in the early 1990s when MRP-II is extended to cover areas like engineering, finance, human resources, and project management.
- 1991 PeopleSoft sets up offices in Canada. This leads the way to their presence in Europe, Asia, Africa, Central and South America, and the Pacific Rim.
- 1995 Baan grows to more than 1,800 customers worldwide and over 1,000 employees.
- 1999 JD Edwards has more than 4,700 customers with sites in over 100 countries. Oracle has 41,000 customers worldwide (16,000 U.S.). PeopleSoft software is used by more than 50% of the human resources market. SAP is the world's largest inter-enterprise software company and the world's fourth largest enterprise independent software supplier overall. SAP employs over 20,500 people in more than 50 countries. To date, more than 2,800 of Baan's enterprise systems have been implemented at approximately 4,800 sites around the world.
- 2000 Most ERP systems are enhancing their products to become "Internet Enabled" so that customers worldwide can have direct access to the supplier's ERP system.

#### ERP in the Arab Gulf States

In the past, most Arab Gulf States organizations have grown more by managing the environment, rather than by focusing on internal

efficiencies. This era of licensing, shortages, and low consumer awareness is coming to an end. With the entry of more efficient foreign players in many of the markets, Arab Gulf States industry needs to wake up and put its house in order.

Now more than ever, Arab Gulf States manufacturing organizations need to implement ERP systems as a basic infrastructure for improving their efficiency and effectiveness in the marketplace. Any ERP implementation is expensive and time consuming. Like any other organizational change initiative, it requires the sustained involvement and commitment of top management for it to succeed.

An evolution any approach to ERP implementation could be pragmatic. This means that the entire implementation would move in cycles from basic to sophisticated with the basic features of all the modules being implemented first and the more sophisticated features are implemented later.

According to Saudi Arabian Solutions (1999), ERP software has never been an easy sell in Saudi Arabia; the sheer size, complexity, expense, and the

collection of ERP horror stories being enough to put many organizations off the idea for good. However, the benefits of successful ERP projects are driving organizations such as SABIC and ARAMCO to embark on ERP projects. Statistics from King Fahad University of Petroleum & Minerals indicate that as many as 80% of large business in the Kingdom are evaluating, or at some stage of implementing, an ERP solution.

The \$200 million Zamil Group is just one manufacturing organization that is moving its entire organization toward ERP, in this particular case, Oracle Financials. The vice president of Zamil Air Conditioners (ZAC) indicated that the aim of implementing ERP was to bring in the best business practices to their organization. Also, he indicated that manufacturing must move in this direction to remain in a competitive position.

Saudi Arabian Solutions (1999) stated:

Those organizations that have looked into ERP have realized, the main cost is not necessarily generated by the software licenses, but rather by the mammoth price tag attached to consulting services. Gartner Group statistics indicate that implementation service costs, including consulting, amount to anything from 55% to 70% of the total cost of an ERP project. (p. 32)

According to Saudi Arabian Solutions (1999), the fear of huge consulting bills has led many Saudi businesses to attempt to muddle through ERP implementation on their own, or to deploy ERP on the cheap, resulting in organizations slashing consulting costs to minimize implementation expenses.

Saudi Oracle's acting managing director, Hisham Serry, acknowledges the existence of a severe shortage of quality ERP consultants within the Kingdom. The issue is not the production, it is the human resources, said Serry. To protect our quality of service there are some projects we have had to turn down because we could not provide the required human resources, even with our partners.

Despite organizations being aware of the shortage of quality staff, there is no clear solution at hand. Few of the Kingdom's manufacturing businesses can afford to headhunt talent in the US, but taking low cost talent from India or Egypt does not guarantee organizations will find the consultants with the right blend of technology and business savvy to implement a project. Depending on foreign staff has a negative aspect, warned Abdullah Al Mefdaa, a private sector IT management consultant. (Cited in Saudi Arabian Solutions, 1999, p. 32)

## A Description of ERP

### Characteristics and Components

#### Integrated System

A seamless integration is essential to provide visibility and consistency across the enterprise. McCausland (2000) noted that in addition to system requirements, ERP addresses technology aspects like client/server distributed architecture, RDBMS, object oriented programming and so on. An ERP system is a bandwidth solution that addresses a broad area within any business like manufacturing, distribution, finance, and project management. This integrated approach provides all users, from company CEO to a buyer at a remote plant, with a single, real-time view of their company's available resources and commitments to customers. For example, if a salesperson logs a new order into his laptop computer on the road, the transaction flows through the company, alerting the procurement system that parts need to be ordered and telling the manufacturing system to reserve a spot in the

production queue for the newly ordered product.

Minahan (1998) indicated:

David Caruso, director of enterprise application research at Advanced Manufacturing Research (AMR) Inc. of Boston, describes ERP systems as "a transactional backbone" that gives companies access to the information they need to make more knowledgeable decisions or to fuel more task-specific applications, such as electronic commerce or supply-chain planning software. For purchasing, ERP systems can tie together formerly disparate inventory, order, and procurement systems, helping procurement organizations consolidate buys, reduce inventory on hand, and implement sourcing strategies company wide. (p. 112)

#### Client/Server System

On the technology front, businesses traditionally compiled, stored, and shared information on a mainframe. These systems could handle huge amounts of data, but they were costly to run and offered little flexibility and even less opportunity for integration with other systems. According to Neff (1997), companies began moving to a client-server computing architecture that uses a server linked to a network of PCs, disburses computing power across a company and provides users with access to company-wide information.



On one level, ERP is simply the next logical progression in this business-computing trend. ERP systems employ client/server technology (Taschek, 1999). As shown in Figure 1, the user's (client's system) runs an application (accounting, inventory management, etc.) that accesses information from a common database management system (server). This system reflects the concept of decentralized computing.

The primary strategies for implementing client/server are two-tier, three-tier and Internet/Intranet. Figure 1 shows the difference between two-tier and three-tier. In a two-tier approach, the client machine connects to a single server machine. Usually the server controls the central database and the client controls the user interface. In a three-tier approach, the client machine controls the user interface and some processing logic, an application server manages the enterprise business application processing, and one aid management of version releases and the enterprise business rules. Client/server technology relies on robust communications between the machines that are involved. Local Area Networks become an expense and a management headache for most companies. Moreover, updating software versions, particularly for the numerous distributed PCs, become an almost unsolvable problem. (Langenwalter, 2000, p. 210)

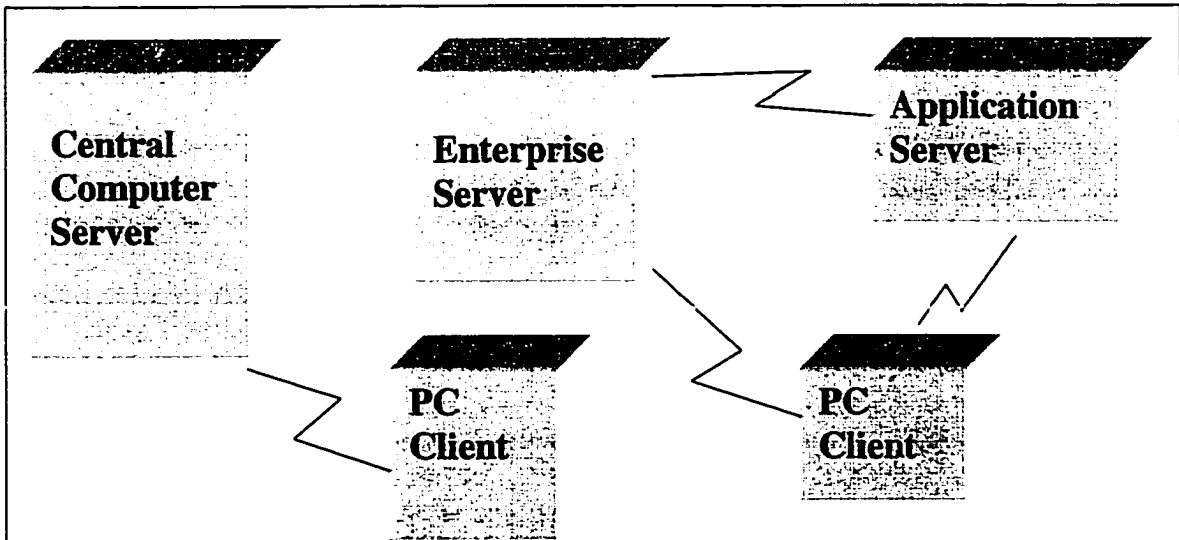


Figure 1. 2-tier and 3-tier client/server approaches (Langenwalter, 2000).

#### Enterprise-Wide Database

ERP operates via a common database at the core of the system (Burt, 2000). The database interacts with all the applications in the system, thus there are no redundancies in the data and integrity is ensured. McCann (1999) noted that there are ERP applications available to fit just about any need a business may encounter. Major areas, which these systems cover, include finance, human resources, manufacturing and logistics, supply chain management, and data analysis. As shown in Table 1

these sectors are components with a variety of functions.

Table 1

Some Components of an ERP System (McCann, 1999)

Components	Descriptions
FINANCE	
General ledger	Keeps centralized charts of accounts and corporate financial balances.
Accounts receivable	Tracks payments due to a company from its customers.
Accounts payable	Schedules bill payments to suppliers and distributors.
Fixed assets	Manages depreciation and other costs associated with tangible assets.
Treasury management	Monitors and analyzes cash holdings, financial deals and investment risks.
Cost control	Analyses corporate costs related to overhead and manufacturing orders.

(table continues)

Components	Descriptions
HUMAN RESOURCES	
HR administration	Automates personnel management processes including staffing, business travel, and vacation time.
Payroll	Handles accounting and preparation of checks related to employee salaries, wages and bonuses.
Self-service HR	Lets workers change their personal information and beneficial allocations online without having to send forms to human resources.
MANUFACTURING AND LOGISTICS	
Production planning	Performs capacity planning and creates a daily production schedule for a company's manufacturing plants.
Order entering	Automates the data entry and process of customer orders and keeps track of the status of orders.
Warehouse management	Maintains records of warehoused goods and processes movements of products through warehouses.
(table continues)	

Components	Descriptions
Transportation management	Schedules and monitors delivery of products to customers via trucks, trains and other vehicles.
Project management	Monitors costs and work schedules on a project-by-project basis.
Plant maintenance	Sets plan and oversees upkeep of internal facilities.
Customer service management	Administers installed-based service agreements and checks contracts and warranties when customers call for help.

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#### SUPPLY-CHAIN MANAGEMENT

Advances planning applications to monitor production constraints, demand forecasting and order delivery promises.

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#### DATA ANALYSIS

Decision support software that lets executives and other users analyses transactions data to track business performance.

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### Applications/Modules

Each ERP vendor provides a number of ERP applications (or modules) for their systems. These are the functional software packages for each individual business unit such as finance, human resources, order processing (Parker, 1999). Most ERP systems start with a set of core modules and offer additional modules from which a company can choose. All of these applications are fully integrated to provide consistency and visibility for all the activities across entire operations (Baan, 1997c). However, ERP systems require users to comply with the processes and procedures as described by the application.

### Industry-Specific Applications

Vendors also offer specialized applications to account for unique processes and procedures within a given industry. These modules service vertical markets such as government, health care, financial services, or the retail environment (McKie, 1997). For example, SAP, an ERP vendor, offers health care specific modules for patient management that support

all patient-oriented processes throughout the hospital (SAP, 1997). The current trend shows vendors moving into even more specialized areas, such as supply chain management, demand forecasting and sales automation and marketing (Sherman, 1999).

#### What Do Manufacturers Expect ERP to Do?

Manufacturers often have very high expectations of their ERP systems. It is anticipated that ERP systems will improve the overall functioning of a business overnight. Manufacturers want an all-encompassing software package that runs every aspect of the business.

ERP provides all users, from company CEO to a buyer at a remote plant, with a single, real-time view of their company's available resources and commitments to customers. ERP combines the needed functions of every application a company requires to do its job and integrates them. An ERP system also can make a difference at the shipping and distribution end of a company by reducing duplications, delays, and mistakes on delivery times, and by allowing manufacturing to become more

flexible. Shipments can go direct and are therefore smaller and cheaper. In addition, there's no need to stock materials or finished units, so stocks do not become obsolete and have to be written off (Loizos, 1998).

### How Do ERP Systems Work?

As shown in Figure 2, the data bucket, called a data warehouse, is in the middle where the common data are housed. This figure depicts chart how information flows from the top management planning activities, through the functional area plan, to the execution and accounting activities.

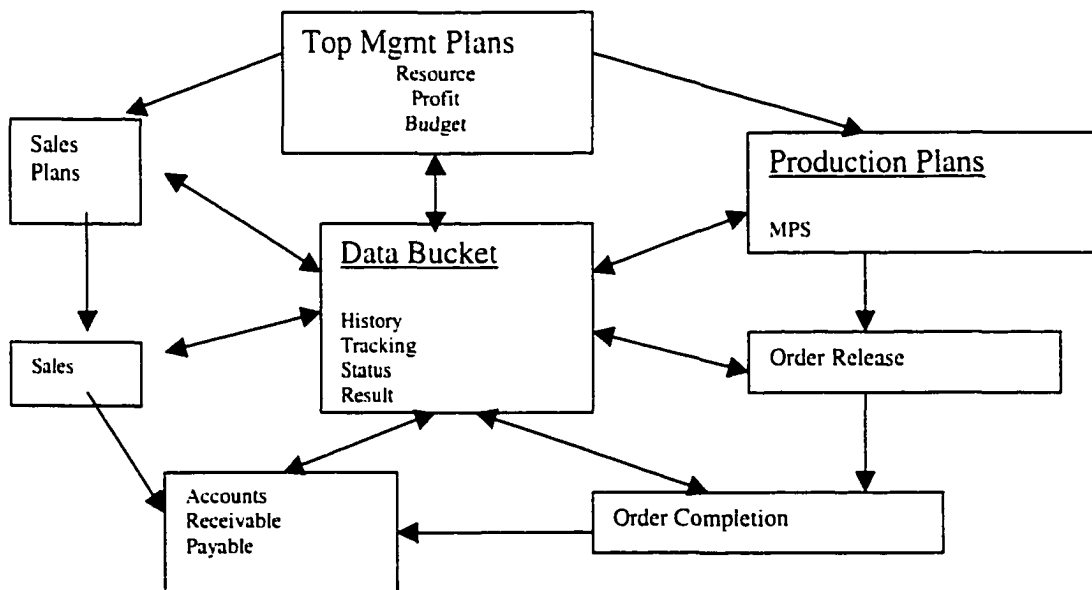


Figure 2. How ERP system works. (Jacobs & Whybark, 2000)



### What Does ERP Really Do?

ERP provides a backbone for the enterprise. It allows a company to standardize its information systems (Lieber, 1995). Depending on the applications, ERP can handle a range of tasks from keeping track of manufacturing levels to balancing the books in accounting. The result is an organization that has streamlined the data flow between different parts of a business (Lieber, 1995). In essence, ERP systems get the right information to the right people at the right time (Sheridan, 1995).

### Benefits of an ERP System

#### Easier Access to Reliable Information

Traditionally, companies have utilized incompatible systems, like CAD and MRP systems, which had important data stored in them, with no easy way to find the data or transfer it between systems (Sheridan, 1995). ERP uses a common database management system. Thus, decisions on cost accounting or optimal sourcing, for example, can be run across the enterprise rather than looking at

separate operational units and then trying to coordinate the information manually or reconciling data across multiple interfaces with some other application (Collett, 2000). An integrated system provides an opportunity to improve data reporting and to ensure accurate, consistent, and comparable data (Gilbert & Sweat, 1999).

#### Elimination of Redundant Data and Operations

Driven by business processes re-engineering, the implementation of ERP systems reduces redundancy within an organization. With functional business units utilizing integrated applications and sharing a common database, there is no need for repetition of tasks such as inputting data from one application to another. In non-integrated systems, a piece of data might reside in six different places (Sheridan, 1995). ERP can help the company eliminate the redundant processes. The CIO of Steelcase Inc., a \$3 billion maker of office furniture, remarked that we can achieve an \$80 million reduction in operating expenses just by getting rid of redundant processes

and cleaning up our data (Cited in Stein, 1997b, p. 89).

#### Reduction of Cycle Times

ERP systems recognize that time is a critical constraint variable, the driving variable for both business and information technology (META Group, 1997). Time reductions are achieved by minimizing delays and by retrieving or disseminating information (Sherman, 2000). Stevens (1997) noted how Colgate Palmolive dealt with and tracked customer orders before and after ERP implementation.

#### Increased Efficiency, Hence Reducing Costs

ERP allows business decisions to be analyzed enterprise-wide. This results in timesavings, improved control and elimination of superfluous operations (Habermann, 2000). Appleton (1997) noted that, a year after implementing ERP, Par Industries in Moline, Illinois, reduced lead time to customers from six to two weeks, delivery performance increased from 60% on time to more than 95%, work-in-progress inventory dropped almost 60%, and the life of a shop floor order went from weeks to hours.

Granados (1997) cited another example of increased efficiency:

In Boise, Idaho, JR Simplot Co., a potato product manufacturer recently achieved significant benefit at minimal cost from implementing an ERP system. Because they are a low-margin business, Simplot opted to run a trial ERP implementation. Within four months of initiation, the project went live. The trial was conducted for \$100,000 including training costs. The benefits were achieved almost immediately: redundant paperwork was eliminated; control was improved through more rigorous lot control of their products; costs were reduced by more efficiently ordering packaging supplies; yield improved by more effectively scheduling to maximize raw materials inventories. It is estimated that the trial paid back more than 400% of their original investment. (p. 18)

#### Easily Adaptable in a Changing Business Environment

Recognizing companies' need to reduce the time it takes to bring goods and services to market, ERP systems are designed to respond quickly to new business demands and can be easily changed or expanded without disrupting the course of business. The time required to deploy and continuously improve business processes will be greatly reduced (SAP, 1997). The companies are always finding new ways to go to market. Larry Ferrere, industry marketing manager for manufacturing at J.D. Edwards, pointed

out, "Your business may not always involve the same products. Internally you will have new business requirements, so you have to be positioned for change" (cited in Gurley, 1999, p. 142).

#### Y2K Enabled

The year 2000 problem (Y2K) was one of the most important business information technology issues of the decade. The problem stemmed from date fields that only used two digits to define the year instead of four digits. Computer systems failed to recognize and process the year 2000, resulting in accounting, inventory, and other critical data-related problems (Baan, 1997a). ERP software is Y2K enabled. This means that these systems support a four-digit-year numbering system (for example, 01/01/1999 versus 01/01/99). Thus, ERP customers avoided the burden, expense, and resource drain of converting current systems to support the year 2000. These companies are able to administer multi-year contracts and orders that extend beyond the year 2000, as well as conduct market research that requires extrapolation of data beyond the year 2000 (SAP, 1997).

### Euro Enabled

Europe introduced a new currency, the Euro, also known as the EMU. Though not much more than a blip on the computer screens in North America, the new currency will have a significant impact on the way enterprises are doing business. It is estimated that the Euro will cost corporations two to six times more than did Y2K conversions (Knowles, 1997).

ERP software systems already comply with the dual currency requirements of the Euro (Knowles, 1997) or are developing tools to support the change. For example, SAP will offer a set of tools and functions as well as information sessions in order to support its customers in transitioning smoothly to the new currency (SAP, 1997).

#### Factors Affecting the Implementation of ERP

The percentage of ERP implementations that can be classified failures ranges from 40% to 60% and higher (Langenwalter, 2000). If companies understand the factors that affect the implementation of ERP, it can increase their chances of success. The following are the factors that lead to failure of implementation.

### Speed and Difficulty of Implementation

The success of an ERP solution depends on how quick by benefits can be reaped from it. This necessitates rapid implementation, which leads to shortened ROI periods. The implementation of an ERP system is a very time-consuming, expensive, and arduous task. For example, before a several-billion-dollar company with operations all around the world can begin the physical implementation of ERP, it must first deal with organizational issues, internal politics, and the need for general consensus (Vowler, 1999). In an interview with IT executives from fortune 1000 companies that had implemented ERP, 44% reported that they had spent at least four times as much on implementation help than they did on the software license itself (Michel, 1997).

Avraham (1999) noted that two implementation scenarios of could be distinguished:

1. Comprehensive Implementation Scenario: Here the focus is more on business improvement than on technical improvement during the implementation. This approach is suitable when: Improvements in business processes are required. Customizations are necessary

Different alternative strategies need to be evaluated. High level of integration with other systems is required. Multiple sites have to be implemented.

2. Compact Implementation Scenario: Here the focus is on technical migration during the implementation with enhanced business improvements coming at a later stage. This approach is suitable when; Improvements in business processes are not required immediately Change-minded organization with firm decision making process. Company operating according to common business practices. Single site has to be implemented. (p. 121)

However, ERP vendors are trying to take the pain out of implementation. SAP has introduced a program called Accelerated SAP (ASAP) that takes the knowledge gained from thousands of R/3 (SAP flagship software suite) implementations to date and encapsulates this expertise into a product called Business Engineer. This product assists implementation teams configure SAP modules to conform to the processing style of some 100 business operating scenarios (Collins, 1999).

Adopting ERP is not an easy decision. In addition to the difficulties noted, the software itself is complicated to install.



Another gripe about ERP systems is that they're difficult to install. The typical ERP implementation takes between two and three years. Larger, more complex installations can stretch to five or six years. In addition, most of these systems aren't very user-friendly, requiring companies to spend significant time up front establishing rules for using the system and training employees to follow them. [ERP] provides you with this great data warehouse system, says Chuck Beck, vice president of global materials and sourcing for Colgate-Palmolive, which is implementing SAP R/3 as part of its global, supply chain management initiative. The data is in there, but there's this excruciatingly painful effort to make sure that what you pull out is what you need. (Cited in Minahan 1998, p. 112)

#### Selection of the Wrong ERP Software

ERP systems force their customers to re-engineer current practices to fit within the processes described by their modules. Selecting the wrong ERP software could result in an unwilling commitment to architecture and applications that do not fit with the organization's strategic goals (Hecht, 1997). Software has taken over the defining role that hardware used to have. "We used to be an IBM shop. Now we are an SAP shop," said David Edelstein, vice president of information management at Bristol-Myers (cited in Weston, 1997).

However, not everyone views these conformed functions as hindering their proprietary processes. Steelcase Inc. formerly relied on its own customized applications for its manufacturing operations. However this customization route was taking too long and costing too much. SAP R/3 system provided the day-to-day order fulfillment and addressed processes required to build the products. Says CIO Mark Greiner; we have always been able to make higher quality furniture now we realize it's not just how well we make it, but how well we sell it. (Cited in Stein, 1997b, p. 89)

### Commitment to a Single Vendor

Letting one vendor provide most or all of company's enterprise systems is an attractive but risky proposition (Weston, 1997).

If you depend on a single vendor, you get a common architecture, lower support costs and cheaper seats, argues Vinnie Mirchandani, an analyst with Gartner Group Inc. On the other hand, upgrades become a bear because you have to do everything at once. Also, as you become more dependent on a single vendor, you risk outsourcing your entire Integrated System (IS) department to them. (Cited in Stein, 1997a, p. 45)

System improvements and upgrades are not in sync with the business cycle; systems have to move with the vendor. ERP systems must remain current (latest versions) to ensure continued support from the vendor (Loizos, 1998).

### Too Many Features

Fully integrated ERP systems have a lot of features and functions. People tend to use all of the features that their software provides, regardless of if those features are actually helpful in moving the company toward profitability, high quality, and efficiency. For example, a common feature of a production module in an ERP system is dynamic lot sizing. Even though the system is capable of recalculating the lot size value daily, this would cause huge disruptions in the production cycles and actually have negative effects on the company (Appleton, 1997).

### Cost of an ERP System

ERP doesn't come cheap. As with most software, the price is based on the functionality of the system needed and the number of seats or users who will access it.

The complexity of ERP (and the threat of a failed installation) generally demand that companies hire a cadre of consultants and technical gurus whose fees can run as high as five to 10 times the price of the software. It's not unusual for the big, complex deals to be \$50,000 to \$75,000 per concurrent user," says Chris Jones, vice president and research

director for the manufacturing and logistics division of The Gartner Group, a Stamford, Conn based research house. Jones emphasizes that the cost of ERP installations can vary by more than 20%, depending on the scope and complexity of the installation. However, to say a typical ERP installation is never less than \$25,000 per concurrent user is probably not true. (Cited in Minahan 1998. p. 112)

According to Saunders (1998) the cost of an ERP system is extremely variable, depending on factors such as the size of the company, the number of users, the number of modules purchased, whether first-year support is included or not. There are also costs associated with upgrading hardware to support the system, consulting costs for implementation, and training costs for users. Loizos (1998) indicated that the initial software costs are anywhere between \$8,000 and \$20,000 per user. Thus, a company with approximately 30 users can expect to pay about \$400,000 for a basic ERP system. Consulting and training costs are estimated at a 2:1 ratio with software costs. The same company would have a minimum of \$800,000 in consulting and training costs. Bear in mind that 30 users is a very small company; a larger company must

expect to spend several million dollars on their ERP system before it goes live.

Due to the nature of ERP systems, implementation is almost always accompanied by business process re-engineering. The largest part of (ERP) project cost, up to 70% to 80%, is doing the business process re-engineering itself (Stevens, 1997).

However, several opportunity costs must be considered when evaluating the true costs of an ERP system. Returns on investment may not be immediately apparent, but the costs associated with continued use of legacy systems are also very high. Legacy systems must be adjusted to keep up with software and hardware developments (Stedman, 1998). However, the implementation of ERP systems usually requires the elimination of legacy systems. All of these factors must be considered when estimating true costs of an ERP system.

#### Unrealistic Expectations

One of the primary causes of unsuccessful ERP implementations is that the expectations of the

company greatly exceed the capabilities of the system.

The biggest mistake companies make is that they think, if I buy this big software package, it will fix my problem, says Mark Orton, assistant director of the New England Supplier Institute (NESI) in Boston. Unless a company does a lot of thinking about what its supply chain strategy is and articulating what its business processes are, these tools are going to be of little use. (Cited in Minahan 1998, p. 112)

An ERP system is not all-powerful, it cannot change a company immediately, and by itself, it will not make a company more competitive. When consultants are utilized in the implementation of ERP, their first task is often diminishing the expectations of the company and setting them at a realistic level (Petersen, 2000).

The sales pitch by the vendor is quite different from the reality of the project (Wah, 2000). A fully integrated system is very technically difficult to effect. It requires not only an effective information system, but also the corporate philosophy to support it. For example, the number of completely integrated ERP systems in Europe is greater than the number in North America.

This is due to the essence of the respective corporate philosophies. Culturally, European companies tend to be more integrated by nature, as opposed to the more autonomous business units in North America (Loizos, 1998).

#### Lack of Attention to the Infrastructure Planning

When it comes to implementing ERP applications, organizations that ignore infrastructure planning management and application availability issues could be in for a costly and frustrating surprise. It is extremely important to consider all of the issues and develop a clear, concise, and thorough project plan before starting the implementation (Gurley, 1999).

Loizos (1998) noted that according to an in-depth survey of senior technology executives at large and mid-sized companies sponsored by Comdisco, Inc. (NYSE: CDO), issues such as application availability and protection, network infrastructure, application user training, desktop hardware and configuration, and help-desk support must be addressed in detail early in the implementation process and are critical to ERP implementation

success, according to the survey, which was conducted by OmniTech Consulting Group.

Companies generally realize the financial commitment required for an ERP implementation, but often they fail to recognize the amount of other resources also necessary. Sufficient time and education are crucial factors for a successful implementation (Kumar & Hillegersberg, 2000). ERP systems are very technically complex. The enormity of the ERP project is regularly underestimated. By forcing the project completion by a specified deadline, the probability of the project being ineffectual greatly increases. Thus, ample time for project completion should be allotted (Bassirean, 2000).

Adequately trained users are also critical for the success of an ERP project. It may only take days to change hardware and software, but it takes weeks or months to scale learning curves (Crowley, 1998). And the 'best' ERP system in the world can be of no benefit to a company if no one knows how to use it (Stedman, 1998). Significant investment must be made in training employees on new business



processes. As Michael (1999) said, evaluate your business strategy and ERP plan before you commit to software acquisition and installation.

#### Centralized Decision-Making

Campos (2000) indicated that the users of ERP systems agreed that the risks are countered by the benefits of centralized management of business processes. Having the implementation led by a senior executive who has authority to make change happen and happen quickly will help a lot to make the change without wasting time (Michael, 1999).

#### Lack of a Strategy

As Minahan (1998) noted that the biggest mistake companies make with implementation is that they do not have a strategy for how to go about it. They do not understand what ERP is all about and underestimate what it takes to implement it.

#### Insufficient ERP Experience

Another critical mistake is not having the company' staff prepared to use the ERP system. Senior operating management cannot relegate critical decisions to personnel who may not have the background or the temperament for this type of

decision making (Michael, 1999). Welty, (1999) indicated that organizations that had previous experience implementing ERP applications tended to conduct a full review of infrastructure needs early in the implementation process. However, less experienced organizations, often first-time ERP implementers, put a secondary focus on infrastructure and support or disregarded those areas of implementation altogether.

The personnel should be in the high level of knowledge about ERP to save the company a lot of money and time. Owens Corning took similar care to train its people to use ERP. In fact, the company, which schooled personnel on how to properly input data into SAP and use various modules, expects nearly 13% of its total implementation budget to go to training. Our people weren't given access to a particular [SAP] module until they completed the certification and were authorized to access it, says Sheets. (Cited in Minahan 1998, p. 112)

#### Undue Haste

Hecht (1997) indicated that ERP systems often cost millions of dollars to purchase and implement. Thus, it would make sense to spend a small fraction of this money investigating the various software options available. Unfortunately, many companies use a quick-pick scheme when choosing an ERP vendor.

Allowing vendor hype, fear, and internal political agendas to focus the selection on a single vendor often results in a search conducted without data, with no evaluation criteria, and no vision of the value of the system. Hasty decisions can result in an ERP system that does not reflect a company's objectives. If in the end the computer system does not match the business's goals, cost is irrelevant (Markus, Tanis, & Fenema, 2000).

#### How to Survive an ERP Implementation

Keeping ERP projects on track and on budget is often very difficult. The following are some guidelines for a successful ERP implementation, regardless of the vendor and the project:

1. Provide high support from top management for the project. Without commitment of resources (money, time, education) from upper management, the ERP project is not going to get very far. Management must be visibly supportive of this project.

2. Communicate to the outside world. The progress of the ERP project should be readily

discernible to all of the employees in the organization. Involve the user community on the front end and keep users involved (Langenwalter, 2000).

3. Manage expectations. In some cases, ERP may not perform as well as the system currently being used. Because ERP is being implemented for of its ability to integrate applications, reduce cycle times, plus other benefits, there may be a trade-off in functionality (Stedman, 2000).

4. Do not force going live on a specific date. The system should be taken live only when the data and users are ready. An implementation of this magnitude will often take more time than anticipated. User training should include problem solving as well as how-to training on routine functions (Cooper & Kaplan, 1998).

5. Do not change basic software code. The vendor's code should be used as much as possible, even if this means sacrificing functionality, so upgrades from release to release can be done easily.

There is always a possibility of influencing the vendor to provide that functionality later on (Stevens, 1997).

6. Do not expect to fix a bad data. Problems with business processes cannot be fixed by running the data they produce through a different system. If problems are not fixed, they will be apparent in the new system as well (Vowler, 1999).

Perhaps the most important skills needed for a successful ERP implementation are team-building and communication skills. Effective implementation of an ERP system requires integration of unlike departments within a company. Thus, people are required to create new work relationships, share information that was once closely guarded, and make business decisions they were never required to make before. Failure to recognize this can result in unintended consequences, such as apprehension and emotional fallout among the employees. About half of ERP implementations fail to achieve hoped-for-benefits because managers significantly underestimate the efforts involved in change management. (Appleton, 1997, p. 50)

#### ERP in the Market Place

ERP is one of the fastest growing segments of the software market (Scannell & Jastrow, 1999). This year, the top 10 ERP vendors have earned more than

\$5.8 billion in revenues, up from \$4.8 billion in 1996. Analysts estimate an annual growth of more than 30% in the ERP market through the year 2000 (Michel, 1997). As the functionality of ERP increases and becomes more diversified, more industries will consider ERP implementation imperative for a continued competitive edge.

According to the AMR Research, the ERP software market will grow at a compound annual growth rate of 37 percent over the next five years. It also predicts ERP penetration will grow from the current 10-20 percent (percentage of total employees currently using the ERP system) to 40-60 percent within the next five years. ERP originated in the manufacturing market and has spread to nearly every type of enterprise including retail, utilities, the public sector and healthcare organizations. (Cissna 1998, p. 43)

#### Today's Market Leaders

Five providers control nearly two-thirds of the ERP software market. According to Copeland (1998), the top ERP vendors include SAP AG, People-Soft, Baan, J.D. Edwards, and Oracle. These companies, which account for 64% of the ERP market revenue, have grown over the past year at the swift pace of 61%, according to an ERP software report by AMR Research Inc. Several vendors have entered the ERP

market with complete enterprise solutions, whereas some have tried to focus on the market by offering more industry-specific applications. However, five companies dominate the ERP market.

#### SAP AG

According to Minahan (1998) SAP has emerged as the dominant leader in ERP, commanding 31% of the market. In fact, in most business circles, the Walldorf, Germany, company's name has become synonymous with ERP, like Scotch tape or Q-tip have for certain consumer products. SAP's R/3 software package is a favorite among big users, and the company has been selling manufacturing software for 25 years. SAP was unknown before it introduced its R/3 product in 1993, the first enterprise resource planning software suite to hit the market (Menezes, 1999). This new technological development put SAP in the number-one spot in terms of ERP; other vendors have been playing catch-up ever since. Even with zero growth at SAP, it would take any competitor a couple of years of triple-digit growth to overtake this German powerhouse (McKie, 1997).

SAP may not provide complete solutions for everyone. Despite its successes with SAP R/3, Steelcase's CIO Greiner says, we found SAP was weak with scheduling plant operations, and focuses on make-to-stock but we make-to-order (Stein, 1997b, p. 89).

### Oracle Corp

Stedman (2000) noted that Oracle, the leading provider of relational database management systems, is a distant second in the ERP race, commanding 14% of the market. Its complete package, known as Oracle Applications, is also available.

Oracle Corp. introduced its first application modules approximately three years ago (Wilson, 2000). With original software roots in financial applications, Oracle now has more than 35 modules covering every facet of enterprise computing, from manufacturing and production control to human resources and sales force automation (Michel, 1997). Recently, Oracle has focused more attention on its applications business as a growth engine and seems to be reaching aggressively into the territory



targeted by middle-market accounting players (Stedman, 2000). General Electric is one of the companies standardizing its business units on Oracle's applications.

#### J.D. Edwards

Stedman (2000) indicated that J.D. Edwards, established in 1977 to develop software for small- and medium-size computers, has quickly advanced in the ERP ranks. The Denver-based company offers users a total ERP solution in World (AS400 based) and One World (client-server based) or a process-based solution with modules for areas such as finance, manufacturing, and logistics/distribution. The company distributes, implements, and supports its products worldwide through a network of direct offices and over 190 third-party business partners. Its products are available in 18 languages and are supported around the globe through a worldwide network of support 24 hours a day, 7 days a week (J.D. Edwards, 1997). The company's greatest vulnerability is its current reliance on the momentum of IBM's AS/400 platform. J.D. Edwards needs to transition to new product lines and new

platforms to maintain its market-leading position (McKie, 1997).

### PeopleSoft

Founded in 1987 as a provider of human resources software, PeopleSoft Inc. has expanded its offerings to become a leading ERP provider. Controlling 7% of the ERP market, the Pleasanton, California company offers Enterprise Solutions for finance, materials management, distribution, and manufacturing (Minahan, 1998). PeopleSoft is one of the newer players in the ERP market. Barely 10 years old, the company has experienced annual growth rates during the past 5 years exceeding 100% (Southwick, 1996). One of its biggest advantages was being first to offer human resources and payroll applications for client/server model systems. PeopleSoft then expanded into the financial software arena, and in the fall of 1996, it offered its first integrated ERP system (Southwick, 1996).

PeopleSoft's nine industry-specific ERP definitions cover most possible industries. We have every one of our target markets into one of those nine definitions, says Albert Duffield, PeopleSoft's

senior vice-president of operations (cited in Daniel, 1997, p. 38). The nine units are service industries, financial services, communications, transportation and utilities, health care, public sector, higher education, retail, and manufacturing.

#### Baan Co

Baan Co. has two corporate headquarters, one in the Netherlands and one in Menlo Park, California. While there have not been any grand pronouncements from either site, Baan's actions over the past three years are a clear indication of a desire to be the dominant force in worldwide enterprise resource markets (Baan, 1997a). Baan entered the North American market in 1994 with its Baan IV ERP suite and promptly sold major companies like Boeing on its ability to support complex, multi-national manufacturing operations. In 1995, it expanded further, establishing sales and distribution centers in over 40 countries (Michel, 1997). Moreover, Baan also announced this spring that it signed on 27 new distributors in Europe and North America that will concentrate on securing small and mid-sized companies.

### Future of ERP

According to Sprecher (1999) the Internet represents the next major technology enabler, which allows rapid supply-chain management between multiple operations and trading partners. Most ERP systems are enhancing their products to become Internet-enabled so that customers worldwide can have direct access to the supplier's ERP system.

Today, the big trend among manufacturing companies is the expansion of their ERP systems by integrating the entire company with supply-chain and front office software (Mullin, 1998). These companies are subsequently linking their ERP systems directly to the diverse applications of their suppliers and customers (Wilder & Stein, 1997). By mixing existing enterprise systems with custom or best-of-breed software, manufacturers are expecting to add functionality and provide companies with an important competitive edge (Penelope, 1998).

Gumaer (1996) noted that recognizing the need to go beyond MRP-II and ERP, vendors are busy adding new stuff to their product portfolio. BAAN for

example, has already introduced concepts like Intelligence Resource Planning (IRP) and MRP-III (Money Resources Planning) and has acquired companies for strategic technologies like Visual Product Configuration, Product Data Management, and Finite Scheduling.

As the number of larger enterprises without client/server ERP systems decreases, vendors are forced to find new markets for their products. This pressure is causing ERP vendors to increase their appeal to "small business" clients (McKie, 1997). By the end of the year 2000, it is expected that the annual growth rate of the high-end ERP market will decrease by 3.2%. Conversely, the annual growth rate for middle and lower-end markets will increase 1.7% (Baan, 1997b). The growth rate for sales of ERP systems and services is forecasted as 22.1% annually (Loizos, 1998).

ERP has evolved due to a shift in focus from inventory control to material requirement planning (MRP) to manufacturing resources planning (MRP-II) and finally to ERP. Through each stage, more and

more modules have been linked together to result in one uniform application.

#### Summary

Enterprise Resource Planning is best suited for industries. ERP systems are able to save money, improve efficiency, and allow companies to remain competitive. Countless companies have implemented ERP systems and have been able to save millions of dollars in operating costs, reduce cycle times, maintain continuous improvements, and increase the overall efficiency of their businesses. Today, manufacturers realize that many core processes that run their business are often best handled with an enterprise application package that is cheaper and more up-to-date than anything.

Integrated systems reduce the need to reconcile data across modules, support more extensive analysis, and allow for easier cross training of staff. The Internet represents the next major technology enabler, which allows rapid supply-chain management between multiple operations and trading partners. Most ERP systems are enhancing their

products to become Internet-enabled so that customers worldwide can have direct access to the supplier's ERP system (Stevens, 1997).

## CHAPTER III

### METHODS AND PROCEDURES

#### Overview of the Study

The purpose of this study was to determine the factors affecting the implementation of Enterprise Resource Planning (ERP) in the Arab Gulf States and U.S. companies, using SAP software as an example. The differences between companies in the Arab Gulf States and those in the United States in regard to factors that affect ERP implementation were analyzed. Additionally, the relationship between the size of a company and factors affecting the adoption of ERP was examined. This study also investigated the difference in the motivation between companies in the Arab Gulf States and those in the United States that adopted ERP.

Because a number of companies in both regions already have implemented ERP, this research can be used to assist other companies in avoiding problems leading to ineffective implementation.

A number of factors that affect the implementation of ERP were selected based on the review of literature and included on the survey for



the respondents to individually evaluate. The respondents were asked to indicate their perception of those factors that affect ERP adoption. A cover letter described the confidential nature of the research and was emailed along with the survey instrument. Examples of each are found in Appendix A.

#### Population and Sample

The population included all companies that have implemented an ERP system using SAP software in the Arab Gulf States and the United States. The names and addresses of the population were obtained from the website of SAP.

The SAP customer directory classified these clients as automotive, chemical, consumer products, engineering and construction, financial services, health care, high-tech, oil and gas, pharmaceutical, service providers, and utilities. From the population of those listed in SAP's customers directory, 150 companies were randomly selected to be the respondents to the survey. The 150 respondents consisted of 30 companies from the Arab Gulf States and 120 from the United States.

### Instrumentation

Fraenkel and Wallen (1990) stated that survey research has the potential of providing a great deal of information from a small sample of individuals. Therefore, the survey method was used in this study. The survey instrument was developed for the purposes of this study. The questionnaire was divided into four sections and based on the problems identified from literature sources.

The first section of the questionnaire was developed to collect general information pertaining to the company's location and size, the position held by the respondent, company classification, current implementation status of ERP, and the ERP modules the company has implemented.

The second section of the questionnaire focused on (a) a company's business strategy and ERP plan before a commitment was made to software acquisition and installation and (b) the current status of ERP implementation. This section was designed to measure the level of preparation activities before adopted each company the ERP system. These preparation elements included the main reasons for implementing

ERP, the decision-making conditions for implementing ERP, the estimate of the cost, the specific problems that ERP was to address, the approach of selecting ERP software, the implementation strategy, and the preparatory steps taken before installing the ERP system.

The third section of the questionnaire was designed to assess the perceptions of the respondents about the factors affecting the implementation of ERP. This section measured the critical success factors for the ERP implementation projects, those aspects that were not implemented satisfactorily in a company, pitfalls to avoid in ERP implementation, the measures of success, the main indicators of failure, the level of satisfaction toward consultants, the influence of client/server systems and ERP upon the IT department, and the effect of users' skills on implementation.

Items in the fourth section dealt with the advantages and disadvantages of implementing ERP systems.

The instrument consisted of 30 items and was designed to be completed in less than 15 minutes. Items for the instrument were gleaned from the literature relating to the factors that affect the implementation of ERP. The literature included dissertations, business magazines, and journals. The questionnaire was developed through the following procedures:

1. A first draft was submitted to the researcher's dissertation advisory committee for review and recommendations.
2. A second draft was designed based upon the critique and recommendations of committee members.
3. A third draft was subsequently approved by the committee for validation purposes.

#### Validation of the Instrument

For the pilot test, a panel of five ERP system experts from the SAP field was selected as representative of the study population. The group assessed the readability, and validity of the questionnaire. The panel included information technology management personnel and general management with experience of ERP implementation.

Feedback from these experts led to modification in the survey instrument. In the based of the panel's suggestions, additions and revisions were made in the items dealing with factors affecting the adoption of ERP systems.

#### Data Collection

The survey instrument was on-line at <http://fp.uni.edu/alsehali>. To ensure the accuracy of data collected, a password was necessary to access this survey, thus limiting access to target group. During August 2000, an e-mail was sent to the sample population of companies in the Arab Gulf States and the United States with a message briefly explaining the purpose of this study, the format of the survey instrument, and the time required to complete the survey.

According to Berdie and Anderson (1974) follow-ups are an essential phase of any mail questionnaire study. The use of follow-ups, or reminders, is certainly the most potent technique yet discovered for increasing the response rate. Therefore, follow-ups, or reminders, were used for increasing the response rate. After one week, the first

follow-up e-mail was sent to those who had not responded. About one week after the first follow-up e-mail, a second follow-up e-mail was sent to those who did not respond. A total of 67 questionnaires were returned out of the 150 that were e-mailed.

#### Data Analysis

The Statistical Package for the Social Sciences (SPSS) was used to analyze the data. The statistical test was conducted at the .05 level of significance. Frequencies and percentages were used to compute and analyze the variables.

The statistical measures of  $t$ -test, chi-squares, and Mann-Whitney U tests were used to determine the differences in factors that affect the implementation of ERP, the differences in motivation, and the relationship of company size to the factors affecting ERP adoption.

## CHAPTER IV

## RESULTS OF THE STUDY

This chapter presents the results of the study. The initial e-mail and subsequent follow-up resulted in a total of 76 responses (see Table 2). Nine of these were not used for data analysis because they were either returned blank or were incomplete. The usable returns totaled 67, representing a return rate of 44.6%. Table 2 illustrates the distribution of respondents to the questionnaire.

The first section of this chapter describes the general characteristics of the respondents, based on the data they provided. Characteristics include location of the company, income of the company, position of the respondent, classification of the company, implementation status of ERP in the company, and ERP modules implemented.

The second section of this chapter, statistical analyses related to the research questions are discussed. For the reader's convenience the research questions, referred to by number in the body of the chapter, are repeated.

1. What are the factors that affect the implementation of ERP?
2. How do factors that affect the implementation of ERP differ between companies in the Arab Gulf States and those in the United States?
3. Does company size make any difference in the factors that affect the adoption of ERP?
4. What was the main motivation behind the decision to adopt ERP?
5. Is there any difference in motivation between companies in the Arab Gulf States and those in the United States that adopt ERP?
6. What are the advantages and disadvantage of implementing ERP system?

Table 2

Respondent Population

Population	First e-mail		First follow up		Second follow up		Usable	
	n	%	n	%	n	%	n	%
Arab Gulf States	30	20	15	10	11	7.3	21	31.3
United States	120	80	33	22	17	11.3	46	68.7
<u>Total</u>	<u>150</u>	<u>100</u>	<u>48</u>	<u>32</u>	<u>28</u>	<u>18.6</u>	<u>67</u>	<u>100</u>

Note. Nine returns were not included in the data analysis because they were either blank or incomplete.



## General Characteristics of the Respondents

Information was collected on the location of the company, the income of the company, the position of the respondent, the classification of the company, the current implementation status of ERP in company, and the ERP modules that have been implemented. Tables 2-6 present these results.

### The Location of the Companies

The location of the responding companies is presented in Table 2. The respondents from the Arab Gulf States numbered 21 (31.3%) and those from United States, 46 (68.7%).

### Income of the Companies

As Table 3 shows, the income of almost half of the respondents is over \$1 billion. For about 28.3% of the respondents, income ranges between \$0 and \$100 Million.

Table 3

Income of the Companies

<u>Income</u>	<u>n</u>	<u>%</u>
\$0-\$100 Million	19	28.3
\$100 Million-\$1 Billion	17	25.0
\$1 Billion-Over	31	45.8

Position of the Respondents

Table 4 reports the position in the company of the respondent. More than a third selected "other." The next largest group was system analyst at 26.9%.

Table 4

Position in the Organization

<u>Position</u>	<u>n</u>	<u>%</u>
Board member	3	4.5
Information Technology Manager	9	13.4
Chief Executive Officer	3	4.5
Chief Finance Officer	1	1.5
Chief Information Officer	1	1.5
System Analyst	18	26.9
Senior Manager	9	13.4
Other	23	34.3

Classification of the Companies

The respondents were asked to indicate the classification of their company. As shown in Table 5, about 43.3% of the respondents' companies are in the manufacturing sector, and 23.9% did not fall within the classification listed.

Table 5

Classification of the Companies

<u>Classification</u>	<u>n</u>	<u>%</u>
Banking & finance	1	1.5
Computer software & services	11	16.4
Education	2	3.0
Food & beverage	2	3.0
Manufacturing	29	43.3
Retail	1	1.5
Telecommunications	1	1.5
Utilities	2	3.0
Wholesale/distribution	2	3.0
<u>Other</u>	<u>16</u>	<u>23.9</u>

Current Implementation Status of ERP in Companies

The respondents were asked to indicate the status of ERP implementation in their companies. As reported in Table 6, about three quarters of the respondents indicated that they had already implemented an ERP system using SAP software within their companies. Over 22% had implemented an ERP system within the past 2 years. Some indicated they currently are in the process of implementation, and 4.5% of respondents had ceased implementation.

Table 6

Current Implementation Status of ERP in Companies

<u>Implementation Status</u>	<u>n</u>	<u>%</u>
Under Implementation	13	19.4
Implementation ceased	3	4.5
Implemented since:		
1 year or less	13	19.4
2 years	15	22.4
3 years	8	11.9
4 years	10	14.9
5 years and over	10	9.0

ERP Modules Implemented

The respondents were asked to indicate the type of module they have implemented in their companies (see Table 7). Most of the respondents (91%) reported that they had implemented operations and logistics modules, and 86.6% had implemented finance modules in their companies. Sales and marketing modules had been implemented by 73.1% of respondents. The next most commonly implemented module was production at 67.2%

Table 7

ERP Modules They Have Implemented

Type of module	Yes		No	
	n	%	n	%
Operations and logistics	61	91.0	6	9.0
Production	45	67.2	22	32.8
Human resources	36	53.7	31	46.3
Finance	58	86.6	9	31.4
Sales and marketing	49	73.1	18	26.9
Research and development	8	11.9	59	88.1
Other	17	25.4	50	47.6

Statistical Analyses Related to the Research  
Questions

Research Question 1

The Critical Success Factors for ERP Implementation  
Projects

The respondents reported that the major critical success factors for the ERP implementation projects were top management support and involvement (55.2%) and the clear definition of scope and strategy (43.3%, see Table 8). Strategic alignment of the exercise (38.8%) was another critical success factor for the ERP implementation projects, followed by training (29.9%) and end-user involvement and support (28.4%).

Table 8

Critical Success Factors for the ERP Implementation Projects

Ranking	factors	n	%
1	Top management support and involvement	37	55.2
2	Clear definition of scope and strategy	29	43.3
3	Strategic alignment of the exercise	26	38.8
4	Training	20	29.9
5	End user involvement and support	19	28.4
6	Careful change management	17	25.4
7	Capability of the IT Consultant chosen	14	20.9
8	Experienced in-house IT team	10	14.9

Note. Rank order scaled from 1 = most to 8 = least.

Critical Success Factors Not Implemented Satisfactorily

The respondents were asked to identify the critical success factors that were not implemented satisfactorily in their companies. As shown in Table 9, careful change management, with due consideration

to cultural and political aspects, was the factor that the highest percentage (37.3%) were not satisfied about. Other factors receiving high percentage were end-user involvement and support, clear definition of scope and strategy, and training.

Table 9

Critical Success Factors Not Implemented Satisfactorily

Factor	Yes		No	
	n	%	n	%
Strategic alignment of the exercise	11	16.4	56	83.6
Clear definition of scope and strategy	19	28.4	48	71.6
Experienced in-house IT team	12	17.9	55	82.1
Capability of the IT consultant chosen	11	16.4	56	83.6
Top management support and involvement	13	19.4	45	80.6
Careful change management	25	37.3	42	62.7
End user involvement and support	20	29.9	46	68.7
Training	19	28.4	48	71.6
Other	5	7.5	62	92.5



Success of Implementation

The respondents were asked whether or not ERP implementation in their organization was successful. As shown in Table 10, 61 of the 67 (91%) respondents believed their implementation was successful.

Table 10

Success of Implementation

Status	Yes		No	
	n	%	n	%
Success	61	91.0	6	9.0

Most Important Elements Affecting the ERP Implementation

The respondents were asked to indicate their level of agreement on a scale ranking from strongly agree to strongly disagree in regard to the most important elements that affecting ERP implementation (see Table 11). On the availability of qualified consultants to help with the implementation, 37.3% of the respondents agreed on the importance of this element, but 23.9% did not agree.

The importance of the consultants' understanding of the product was considered to be very critical. As shown in Table 11, 44.8% of those surveyed agreed that their consultants understood the product. Only 4.5% of the respondents strongly disagreed.

As shown in Table 11, 37.3% of the respondents disagreed that the implementation of ERP was completed on schedule, whereas the 29.9% opposite. One of the questions in Table 11 focused on accuracy of the cost estimates. Of the respondents 41.8% indicated that the cost of implementation was not what they expected, and 20.9% agreed that the cost was what they expected.

Table 11

Most Important Elements Affecting the ERP Implementation

Elements	SD		D		N		A		SA	
	n	%	n	%	n	%	n	%	n	%
Availability of qualified consultants	3	4.5	16	23.9	11	16.4	25	37.3	12	17.9
Consultants of understanding the product	3	4.5	10	14.9	18	26.9	30	44.8	6	9.0
Completion of implementation on schedule	4	6.0	25	37.3	8	11.9	20	29.9	10	14.9
Accuracy of cost estimate	14	20.9	28	41.8	9	13.4	14	20.9	2	3.0

Note. SD = strongly disagree, D = disagree, N = neutral, A = agree, SA = strongly agree.

Effects of Attention on IT Issues

The respondents were asked to indicate if the concentrating on IT issues, lead the organization to lose focus on core issues critical to its business (see Table 12). Most respondents (71.6%) answered in the affirmative.

Table 12

Concentrating on IT Issues, at the Expense of Core Issues Critical to the Business

<u>Response</u>	<u>n</u>	<u>%</u>
Yes	48	71.6
No	19	28.4
Total	67	100.0

Effect of the Implementation of Client/Server System and ERP on the IT

The respondents were asked if the implementation of a client/server system and ERP increased the power and influence of the IT department at the expense of conventional departments such as production, projects, marketing, and finance. As shown in Table 13, slightly more

than half of the respondents (52.2%) indicated that the client/server system did not increase the power and influence of the IT department at the expense of conventional departments.

Table 13

Effect of Client/Server System on the IT Department

<u>Response</u>	<u>n</u>	<u>%</u>
Yes	32	47.8
No	35	52.2
Total	67	100.0

Need for Computer Proficiency Among Employees

The respondents were asked if the implementation required employees to be computer proficient (see Table 14). About 92.5% of respondents agreed that it did.

Table 14

Need for Computer Proficiency Among Employees

<u>Response</u>	<u>n</u>	<u>%</u>
Yes	62	92.5
No	5	7.4
Total	67	100.0

Increased Employee Turnover

The respondents were asked if the employee turnover increased after the implementation of ERP. As shown in Table 15, 53.7% of the respondents answered in the affirmative.

Table 15

Increased Employee Turnover After ERP Implementation

<u>Response</u>	<u>n</u>	<u>%</u>
Yes	36	53.7
No	31	46.3
Total	67	100.0

ERP Implementation and Employee Layoffs

The respondents were asked if the ERP implementation eventually led to employee layoffs

(see Table 16). Over 80% indicated that ERP implementation did not lead to employee layoffs.

Table 16

ERP Implementation and Employee Layoffs

<u>Response</u>	<u>n</u>	<u>%</u>
Yes	13	19.4
No	54	80.6
Total	67	100.0

Cost of Implementation as Percentage of Annual Revenue

Most of those responding indicated that the total cost of implementation was less than 10% of their annual revenue. However, over 40% did not provide this information (see Table 17).

Table 17

Total Cost of Implementation as Percentage of Annual Revenue

<u>% of the Annual Revenue</u>	<u>n</u>	<u>%</u>
0% -10%	31	81.6
11% - 50%	6	15.8
51% - 100%	--	--
101% - over	1	2.6
<u>Total</u>	<u>38</u>	<u>100.0</u>

Note. Of the respondents 29 did not provide the total cost of implementation as percentage of annual revenue.

Research Question 2Critical Success Factors for ERP Implementation Projects

The Mann-Whitney U test was used to determine whether or not there were any differences between companies in the Arab Gulf States and those in the United States in regard to the ranking of the critical success factors for ERP implementation projects. No statistically significant differences were found. However, they were nearly significant differences in regard to end user involvement and support (see Table 18).



Table 18

Critical Success Factors for ERP Implementation Projects

Ranking	Factors	Arab Gulf States		U.S.		p*
		n	%	n	%	
1	Top management support and involvement	10	14.9	27	40.2	.234
2	Clear definition of scope and strategy	8	11.9	21	31.3	.505
3	Strategic alignment of the exercise	6	8.9	20	29.8	.498
4	Training	5	7.4	15	22.3	.256
5	End user involvement and support	4	5.9	15	22.3	.058
6	Careful change management	4	5.9	13	19.4	.279
7	Capability of the IT Consultant chosen	4	5.9	10	14.9	.779
8	Experienced in-house IT team	3	4.4	7	10.4	.278

Note. Rank order scaled from 1 = most to 8 = least.  
All p values > .05, no statistical difference.

Critical Success Factors not Implemented Satisfactorily

As Table 19 shows, there were no statistically significant differences between companies in the Arab Gulf States and those in the United States in regard the critical success factors not implemented satisfactorily.

Table 19

Critical Success Factors not Implemented Satisfactorily

Factor	Arab Gulf States		U.S.		p'
	n	%	n	%	
Strategic alignment of the exercise	5	7.4	6	8.9	.270
Clear definition of scope and strategy	5	7.4	14	20.8	.577
Experienced in-house IT team	5	7.4	7	10.4	.395
Capability of the IT consultant chosen	6	8.9	5	7.4	.070
Top management support and involvement	2	2.9	11	16.4	.167
Careful change management	5	7.4	20	29.8	.123
End user involvement and support	4	5.9	17	25.3	.143
Training	4	5.9	15	22.3	.253
Other	2	2.9	3	4.4	.664

Note. All p values > .05, no statistical difference.

Most Important Elements Affecting the ERP Implementation

The t-test was used to determine whether or not there were any differences between companies in the Arab Gulf States and those in the United States in regard to most important elements affecting the ERP implementation. No statistically significant differences were found (see Table 20).

Table 20

Most Important Elements Affecting the ERP Implementation

Elements	Arab Gulf States		U.S.		p*
	mean	SD	mean	SD	
Availability of qualified consultants	3.38	1.20	3.41	1.17	.270
Consultants of understanding the product	3.38	.80	3.39	1.08	.577
Completion of implementation on schedule	3.14	1.15	3.09	1.28	.395
Accuracy of cost estimate	2.38	1.07	2.46	1.17	.070

Note. All p values > .05, no statistical difference.

### Research Question 3

#### Critical Success Factors not Implemented Satisfactorily

A chi-square was used to determine the effect of company sizes on the critical success factors not implemented satisfactorily. No statistically significant differences were found (see Table 21).

#### Critical Success Factors for ERP Implementation Projects

The Mann-Whitney U test was used to determine whether company size makes any difference in the critical success factors for ERP implementation projects. No statistically differences were found (see Table 22).

Table 21

Critical Success Factors not Implemented Satisfactorily

Factor	Company's Size (Income)						p
	\$0-\$100Million		\$100 Million-\$1Billion		\$1Billion-Over		
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Strategic alignment of the exercise	4	5.9	3	4.4	4	5.9	.662
Clear definition of scope and strategy	8	11.9	5	7.4	6	8.9	.057
Experienced in-house IT team	5	7.4	2	2.9	5	7.4	.257
Capability of the IT consultant chosen	4	5.9	4	5.9	3	4.4	.429
Top management support and involvement	5	7.4	2	2.9	6	8.9	.153
Careful change management	5	7.4	9	13.4	11	16.4	.575
End-user involvement and support	5	7.4	4	5.9	12	17.9	.296
Training	8	11.9	3	4.4	8	11.9	.166

Note. All p values > .05, no statistical difference.

Table 22

Critical Success Factors for ERP Implementation Projects

Ranking	Factor	Company's Income						p
		\$0-\$100Million		\$100 Million-\$1Billion		\$1Billion-Over		
		<u>n</u>	%	<u>n</u>	%	<u>n</u>	%	
1	Top management support and involvement	10	14.9	10	14.9	17	25.3	.400
2	Clear definition of scope and strategy	10	14.9	9	13.4	10	14.9	.756
3	Strategic alignment of the exercise	6	8.9	10	14.9	10	14.9	.834
4	Training	6	8.9	5	7.4	9	13.4	.088
5	End-user involvement and support	6	8.9	7	10.4	6	8.9	.261
6	Careful change management	6	8.9	5	7.4	6	8.9	.738
7	Capability of the IT Consultant	5	7.4	5	7.4	4	5.9	.245
8	Experienced in-house IT team	5	7.4	4	5.9	1	1.5	.429

Note. Rank order scaled from 1 = most to 8 = least.

All p values > .05, no statistical difference.

Research Question 4

Reasons for Implementing ERP

Respondents were asked to identify their reasons for implementing ERP system. As shown in Table 23, over 65% cited functional reasons, over 62% cited business reasons, and 61.2% cited financial reason.

Table 23

Reasons for Implementing ERP

Reason	Yes		No	
	n	%	n	%
Financial	41	61.2	26	38.8
Functional	44	65.7	23	34.3
Technical	37	55.2	30	44.8
Business	42	62.7	25	37.3
Other	8	11.9	52	88.1

Typical Decision-Making Process Toward Implementing ERP

Respondents were asked to indicate the typical decision-making process toward implementing ERP. As Table 24 shows, over 61% indicated that the decision was made by top management, and only 9% noted that

the decision-making process was proposed by functions.

Table 24

Typical Decision-Making Process Toward Implementing ERP

Process	Yes		No	
	n	%	n	%
Strategic business planning exercise	27	40.3	40	59.7
Consensus at operational level	27	40.3	40	59.7
Top management	41	61.2	26	38.8
Proposed by functions	6	9.0	43	64.2
Recommended by outside consultant	27	40.3	39	58.2
Other	3	4.5	64	95.5

Accuracy of Estimates

Respondents were asked to respond to the statement, were the cost, time schedule, and training time correctly estimated? Over 50% of the respondents said cost was correctly estimated, but 46.3% did not estimate the cost correctly (see Table 25). Only 25 respondents provided the percentage of



the cost overrun. Of these, 11 had overruns of 21%-50% (see Table 26).

Most of the respondents (88.1%) correctly estimated the time schedule of the implementation. Schedule overruns were 21%-50% for 9 of the 25 respondents. Only 2 of the respondents were under the time schedule estimated by less than 20% (see Tables 25 and 26).

Two thirds of the respondents (67.2%) indicated they correctly estimated the training time. Six of respondents had overruns by 11%-50%. Only 3 of the respondents were under the time estimated by 21%-50% (see Table 25 and 26).

Table 25

Accuracy of Estimation by Type

Estimate	Yes		No	
	n	%	n	%
Cost	36	53.7	31	46.3
Time schedule	59	88.1	8	11.9
Training time	45	67.2	22	32.8

Table 26

Accuracy of Estimate by Percentage

%	Cost			Schedule			Training					
	Overrun n	%	Under n	Overrun n	%	Under n	Overrun n	%	Under n			
0-10	5	7.5	2	3.0	7	10	1	1.5	0	3.0	0	0
11-20	7	10.5	0	0	1	1.5	1	1.5	3	4.5	0	0
21-50	11	16.5	1	1.5	9	13.5	0	0	3	4.5	3	4.5
51-100	1	1.5	0	0	4	6	0	0	2	3.0	1	1.5
101-Over	1	1.5	0	0	1	1.5	0	0	0	0	0	0

Specific Problems as a Factor in the Implementation Decision

As shown in Table 27, the decision to implement ERP was taken to address certain specific problems by over 65% of the respondents.

Table 27

Specific Problems as Factor in Implementation Decision

<u>Response</u>	<u>n</u>	<u>%</u>
Yes	44	65.7
No	23	34.3
Total	67	100.0

Specific Problems for ERP to Address

Among the specific problems cited was inefficient information flow across internal and external boundaries, cited by almost half of the respondents. The next most common problem was non-availability or delayed availability of critical information for decision making (see Table 28).

Table 28

Specific Problems for ERP to Address

Type of problem	Yes		No	
	n	%	n	%
Inefficient information flow	33	49.3	34	50.7
Lack of information for decisions	30	44.8	37	55.2
Falling profitability	6	9.0	61	91.0
Stagnant growth	5	7.5	62	92.5
Others	13	19.4	54	80.6

Approach to ERP Selection

Most of the respondents (85.1%) now implementing an ERP system have chosen an all-in-one approach for ERP software selection. Only 10.4% respondents have selected a best-of-breed approach (see Table 29).

Table 29

Approach to ERP Selection

<u>Type of approach</u>	<u>n</u>	<u>%</u>
Best-of-breed	7	10.4
All-in-one	57	85.1
Other	3	4.5
Total	67	100.0

Implementation Strategy in Respect to Roll Out

The respondents were asked about their implementation strategy in respect to roll out. As shown in Table 30, over half of the respondents have chosen the complete-system, roll-out-at-once strategy.

Table 30

Implementation Strategy in Respect to Roll Out

<u>Type of strategy</u>	<u>n</u>	<u>%</u>
Complete system, roll-out-at-once	35	52.2
Gradual roll out	32	47.8
Total	67	100.0

### Preparatory Steps Taken

Most of the respondents (91.0%) have chosen to institute a project team with a strong leader as one of the preparatory steps before implementing an ERP system. The same percentage allocated budget and resources as a major preparatory step (see Table 31).

Table 31

### Preparatory Steps Taken

Strategy	Yes		No	
	n	%	n	%
Institute a project team with a strong leader	61	91.0	6	9.0
Define project procedures	56	83.6	11	16.4
Allocate budget and resources	61	91.0	6	9.0
Set up a detailed schedule	45	80.6	13	19.4
Provide extensive internal information	48	71.6	19	28.4
Other	11	16.4	56	83.6

### Research Question 5

#### Reasons for Implementing ERP

As shown in Tables 32, the chi-square test did not reveal any statistically significant differences

in the motivation between companies in the Arab Gulf States and those in the United States.

Table 32

Reasons for Implementing ERP

Reason	Arab Gulf States		U.S.		p*
	n	%	n	%	
Financial	11	16.4	30	44.7	.317
Functional	16	23.8	20	29.8	.220
Technical	12	17.9	25	37.3	.831
Business	13	19.4	29	34.2	.929
Other	3	4.4	5	7.4	.689

Note. All p values > .05, no statistical difference.

Typical Decision-Making Process Toward Implementing ERP

As shown in Tables 33, the chi-square test did not reveal any statistically significant differences in the typical decision-making process toward implementing ERP between companies in the Arab Gulf States and those in the United States.

Table 33

Typical Decision-Making Process Toward Implementing ERP

Process	Arab Gulf States		U.S.		p*
	n	%	n	%	
Strategic business planning exercise	8	11.9	19	28.3	.804
Consensus at operational level	11	16.4	16	23.8	.173
Top management	11	16.4	30	44.7	.317
Proposed by functions	3	4.4	3	4.4	.721
Recommended by outside consultant	7	10.4	20	29.8	.268
Other	2	2.9	1	1.4	.177

Note. All p values > .05, no statistical difference.

Accuracy of Estimation by Type

Chi-square test was used to determine whether or not there were any differences between companies in the Arab Gulf States and those in the United States in regard to the cost, time schedule, and training time and if they correctly estimated. No statistically significant differences were found (see Table 34).



Table 34

Accuracy of Estimation by Type

Estimate	Arab Gulf States		U.S.		p
	n	%	n	%	
Cost	14	20.8	22	32.8	.151
Time schedule	18	26.8	14	20.8	.689
Training time	16	23.8	29	43.2	.288

Note. All p values > .05, no statistical difference.

Research Question 6Advantages of Implementing an ERP System

As shown in Table 35 most of the respondents (80.6%) cited uniform computers system as the major advantage of implementing an ERP system. Other advantages seen as important were real-time information as the basis for decision making (79.1%), standardization and better quality control across the organization (77.6%), efficient use of resources (62.7%), and the improvement of internal communication in large complex organizations (61.2%).

Table 35

Advantages of Implementing an ERP System

ERP system's advantage	Yes		No	
	n	%	n	%
Real-time information as the basis for decision making	53	79.1	4	20.9
Diagnostic controls	35	52.2	32	47.8
Efficient use of resources	42	62.7	25	37.3
Improves internal communication	41	61.2	26	38.8
Uniform computer systems	54	80.6	13	19.4
Removal of communication problems	37	55.2	30	44.8
Standardization	52	77.6	15	22.4
Improved customer satisfaction	26	38.8	41	61.2
Identification process bottlenecks	33	49.3	34	50.7
Other	4	6.0	63	94.0

Disadvantages of Implementing an ERP System

As Table 36 indicates more than half of the respondents (56.7%) recognized that the major disadvantage of implementing an ERP system is its expense. Another 41.8% cited expensive outsourcing for maintenance as a disadvantage. Almost 39% found

the ERP system to be rigid, time-consuming, and disruptive exercise. Only 10.4% of respondents indicated that the ERP system does not improve a collaborative effort.

Table 36

Disadvantages of Implementing an ERP System

ERP system's disadvantage	Yes		No	
	n	%	n	%
Time consuming and disruptive exercise	26	38.8	41	61.2
Extremely expensive	38	56.7	29	43.3
Rigid and not easy to change	26	38.8	41	61.2
A passive system	14	20.9	53	79.1
Does not improve collaborative effort	7	10.4	60	89.6
Cannot handle subjective issues	22	32.8	45	67.2
Expensive outsourcing for maintenance	28	41.8	39	58.2
Other	6	9.0	61	91.0

## CHAPTER V

## SUMMARY, DISCUSSION, AND RECOMMENDATIONS

This final chapter summarizes the finding of the study, presents conclusions based on the finding, and offers recommendations.

## Summary of Findings

The primary purpose of this study was to investigate and determine the factors affecting the implementation of ERP in companies in the Arab Gulf States and in the United States.

The sample consisted of 150 randomly selected companies in those countries that implemented an ERP system and using SAP software. A total of 44.7% of the respondents returned the survey instrument, which was developed for this study.

Data analysis, including t-test, chi-square test, and Mann-Whitney U test, was conducted at the .05 level of significance.

Almost half of the companies who responded are in the manufacturing sector, and similar number had implemented an ERP system within the past two years or less. Operation and logistics modules had been implemented by most of the respondents.

Top management support and involvement was seen as the major critical success factor of ERP implementation by the majority of respondents. Almost all of the respondents believed their implementation was successful. Estimates of the costs and time needed for implementation were not always accurate. The need for employee proficiency in computer field was seen as critical. Although most respondents did not believe that ERP implementation led to employee layoffs, the majority did agree that employee turnover increased after implementation.

In the ranking of critical success factors and factors not implemented successfully, there were no statistically significant differences between companies in the Arab Gulf States and those in the United States.

Functional reasons were most often cited as the main motivation for implementing ERP. The decision to implement an ERP system was usually made by top management, often to address specific problems. In many cases, the problem was the inefficient flow of information across internal and external boundaries.

Widely taken preparatory steps included forming a project team with a strong leader and allocating sufficient budget and resources for the implementation. There were no statistically significant differences between companies in the Arab Gulf States and those in the United States in regard to motivation.

The major advantage of ERP implementation was seen as making computer system uniform across the organization. Cost was cited as the major disadvantage.

#### Conclusions and Discussion

Because top management support and involvement is seen as critical, it is important to have the implementation led by a senior executive with the authority to make change happen and happen quickly (Michael, 1999).

Change affect everyone in an organization; even the organization culture change (Marion, 2000). Chief executives, chief financial officers, IT managers, and ERP project managers who fail to recognize these facts are setting themselves up for failure.

Scheduling and organizing ERP projects is like herding cats. There are many people, many subprojects, and many potentially conflicting political and organizational issues. It is extremely important to consider all of the issues and develop a clear, concise, and thorough project plan before starting the implementation (Gurley, 1999).

Such a plan would also give a more realistic picture of the cost of implementation, which may include many hidden costs. As Minahan (1998) noted, these systems might also require companies to convert data, tweak existing systems, and overhaul networking infrastructure. In addition, the complexity of ERP (and the threat of a failed installation) generally demand that companies hire a cadre of consultants and technical gurus whose fees can run as high as 5 to 10 times the price of the software. In a related point, Michael (1999) noted that the IT infrastructure changes required to implement a new ERP system are not given the high priority these technology issues deserve.

Adequately trained users are also critical for the success of an ERP project. It may only take days to change hardware and software, but it takes weeks or months to scale learning curves (Crowley, 1998). Sufficient training may also help retain employees. Graig (2000) noted that every organization with an ERP project either in progress or about to begin must reconsider its employee retention strategy. Organizations that fail to address retention issues today will face turnover rates 50% to 100% above the industry average through 2000 (0.7 probability).

Hecht (1997) indicated that ERP systems often cost millions of dollars to purchase and implement. It follows that it would make sense to spend a small fraction of this money investigating the various software options available. Unfortunately, many companies use a quick-pick scheme when choosing an ERP vendor. A majority of the respondents chose a complete system, roll-out-at-once strategy. However, implementation strategy must be carefully selected according to particular limitations, which may include the availability of human resources, of



specialized expertise, of financial resources, and of time (Wolti, 1999).

Daniel (1997) indicated that organizations with previous experience of implementing ERP applications tended to conduct a full review of infrastructure needs early in the implementation process. However, less experienced organizations, often first-time ERP implementers, put a secondary focus on infrastructure and support or disregarded those areas of implementation altogether. Most of the study respondents have taken some preparatory steps: forming a project team with a strong leader and allocating budget and resources.

Implementing an ERP system is generally a costly and time-consuming operation requiring extensive re-organization of internal structures to fulfill company expectations. Therefore, without commitment and responsibility from top management, ERP is unlikely to succeed. Organizational willingness and preparedness make the key difference between success and failure. Understanding the critical processes and their component parts is of

the greatest importance in achieving sound implementation results.

Implementation strategy is background-dependent: What is successful in one company may not yield similar results in another organization. The strategy and approach of an ERP implementation must be carefully tailored to suit the needs of the particular company.

The companies that in Arab Gulf States and in the United States that had implemented ERP system have no statistical significant difference in regard to the factors affect the implementation of ERP and the motivation behind implementing ERP system. However, the reason behind that is because most of the respondents' companies had chosen all-in-one approach for implemented ERP system in their companies and therefore, the factors that have affected the implementation of ERP were similar. Also for the same reason, which is chosen all-in-one approach to implemented ERP system, the mean motivation behind implemented ERP system was the same.

## Recommendations

The results of this study suggest the following recommendations should be taken into consideration:

1. Identify business objectives and establish business goals before implementing an ERP system. Determine a strategy for adopting the system and have a full commitment from top management.

2. Understand and prepare for the fact that every process in a company will be affected by the ERP implementation.

3. A company should have a clear vision about all functions in the ERP system. Extensive planning and an understanding of the concepts of ERP system will result in the company saving much time in the implementation. Be ready by examining all business processes and having accurate data on hand before the software arrives. This will reduce cost and lead-time.

4. Evaluate cost estimates before committing to a software installation. Clear planning, including the resource models and overall assumptions made for the project, will help to determine the budget required.

5. Do not focus on information technology at the expense of core issues such as preparation and education for new information technology

6. Educate the project team and allocate a budget for a training program.

7. Assure employees that implementation of ERP system will not jeopardize their jobs.

8. Make decision about adopting an ERP system on the basis of the selection team's extensive internal discussions at the operational level.

9. Select the right software for the company's particular needs.

10. Choose the features that you need and do not install a whole package if you do not need it.

11. When developing an implementation strategy, take into account the particular limitations of your company, such as availability of human resources, of specialized expertise, of financial resources, and of time.

12. Appoint a project team with a strong leader as a preparatory step to implementation. The team will help employees understand the various options offered by an ERP package.

13. Set up a project budget with enough reserves to cover unforeseeable cost. A budget shortfall may delay the project very much, as financial resources are not easy to obtain during a project period.

#### Suggestions for Further Study

Considering the complexity of ERP implementation, further study is needed. The following suggestions for further research are based on the results of this study:

1. A future study might explore the differences in the factors affecting ERP implementation, including motivation, in companies in the public sector versus those in the private sector.

2. Another question worth examining would be the effect of the ERP implementation approach used on implementation itself.

3. Whether or not a company's classification has any impact on the factors that affect ERP implementation would be an interesting research topic.

4. A future study could investigate if the factors that affect ERP implementation differ by the type of module that a company is implementing.

5. Future research could focus on preparation activities, describing what tasks and when they are carried out, in order to arrive at a recommended action plan for pre-ERP implementation activities.

6. After studying the perspective of companies in regard to ERP implementation, it would be interesting to determine if the views of the ERP consultants toward factors affecting implementation are the same.

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APPENDIX A  
QUESTIONNAIRE AND COVER LETTER

**SURVEY FORM**

All information and responses in this form will be used only for academic research purposes. Your responses will be kept in strict confidence. The results of the survey will be reported in summary form only, no individual company information will be revealed.

**Part I**

1. In which country is your organization based?

- Gulf States    Saudi Arabia    Oman    Qatar  
 Bahrain    UAE    Kuwait
- United States

2. Please select your company income

- \$0 to \$10 Million
- \$10 Million to \$100 Million
- \$100 Million to \$250 Million
- \$250 Million to \$500 Million
- \$500 Million to \$1 Billion
- \$1 Billion to \$5 Billion
- Over \$5 Billion

3. What best describes your position in the organization?

- Board Member
- Information Technology Manager
- Chief Executive Officer
- Chief Finance Officer
- Chief Information Officer
- Chief Technology Officer
- Chief Operation Officer
- System Analyst
- Senior Manager
- Internet Specialist

4. Please select your organization classification.

- Banking & Finance
- Computer Software & Services
- Education
- Food & Beverage
- Government
- Manufacturing
- Retail
- Telecommunications
- Transportation



- Utilities
- Whole sale/Distribution
- Other, please be specific

5. What is the current implementation status of ERP in your organization?

- Implemented since:
  - 1 Year or less    2 Years    3 Years
  - 4 Years    5 Years and over

Under Implementation

Implementation ceased. Please indicate reasons

6. Which ERP modules have you implemented? (Choose all that apply)

- Operations and Logistics (e.g., inventory management, MRP, purchase, etc.)
- Production (e.g., production management, quality management, etc.)
- Human Resources (e.g., payroll, personnel planning, etc.)
- Financials (e.g., accounts, general ledger, costing, etc.)

- Sales and Marketing (e.g., order management, sales management, etc.)
- Research and Development
- Other, please list

**Part II**

7. Which of the following were reasons for implementing ERP in your organization? (Choose all that apply)

- Financial reasons (e.g., cost saving, productivity increase, etc.)
- Functional reasons (e.g., process automation, process redesign, etc.)
- Technical reasons (e.g., global corporate decision, etc.)
- Business reasons (e.g., global corporate decision)
- Others (please describe)

8. What typified the decision making process towards implementing the ERP? (Choose all that apply)

- Decision evolved out of Strategic Business Planning Exercise.
- Extensive internal discussions and general consensus at operational level.
- Decision made by Top Management.
- Proposed by functions:  By IT;  By Operations;  By others (please list)

- Recommended and assisted by outside consultant.
- Others (please describe)

9. Were the following requirements for implementation of ERP correctly estimated?

Cost:  Yes  No %overrun by  %under by

Time Schedule:  Yes  No %overrun by   
%under by

Training time:  Yes  No %overrun by   
%under by

10. Was the decision to implement ERP taken to address certain specific problems?

Yes  No

11. If the answer to the above is yes, which of the following specific problems the organization intended to address through implementation of ERP? (Choose all that apply)

- Lack of communication within a complex organization
- Inefficient information flow across internal and external boundaries
- Non-availability or delayed availability of critical information for decision making
- Falling profitability
- Stagnant growth
- Others (please describe)

12. What approach have you selected for ERP software selection?

- Best-of-Breed (combining modules from different vendors)
- All-in-one (buying modules from a single vendor)
- Other (please describe)

13. What was the implementation strategy in respect to roll out?

- Complete system roll out at once
- Gradual roll out (implement functional applications one by one)

14. Were there any specific preparatory steps that were taken? (Choose all that apply)

- Institute a project team with a strong leader
- Define project procedures
- Allocate budget and resources
- Set-up a detailed schedule
- Extensive internal information and education campaign
- Others (please describe)

### Part III

15. Which of the following in your view are critical success factors for the ERP implementation projects? Please rank them in a numerical order of importance by filling in the ranking number in the check boxes below. [1 is the highest rank]

- Strategic alignment of the exercise (i.e., the decision evolves out of strategic business plan)
- Clear definition of scope and implementation strategy

- Experienced in-house IT team
- Capability of the IT Consultant chosen
- Top management support and involvement
- Careful change management with due consideration to cultural and political aspects
- End user involvement and support
- Others (please describe)

16. Which of the above critical success factors were not implemented satisfactorily in your organization? Please check the appropriate boxes below.

- Strategic alignment of the exercise (i.e. the decision evolves out of strategic business plan)
- Clear definition of scope and implementation strategy
- Experienced in-house IT team
- Capability of the IT Consultant chosen
- Top management support and involvement
- Careful change management with due consideration to cultural and political aspects
- End user involvement and support
- Training

Others (please describe)

17. What are the pitfalls that you would advise others to avoid in the process of ERP implementation?

18. Would you consider the ERP implementation in your organization to be a success?

Yes  No

19. If yes, what are the main parameters that indicate that it has been a success?

20. If you think it was a failure what are the main indicators of this failure?

21. If you think it was a failure what were the main reasons for the failure?

22. Please indicate your level of agreement with the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Qualified consultants were available to help with the implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our implementation consultants understood the product	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our implementation was completed on schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The cost of the implementation was what we expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. Do you feel that, concentrating on IT issues, organization might lose focus on core issues critical to its business?

Yes  No

24. Has the implementation of client server system and the ERP increased the power and influence of IT department at the expense of conventional departments such as production, projects, marketing, finance etc.?

Yes  No



25. Has the implementation necessitated requirement of a new skill set among employees, in terms of computer proficiency?

Yes  No

26. Did employee turnover increase after the implementation of ERP?

Yes  No

27. Did ERP implementation eventually lead to an employee lay-off?

Yes  No

28. What was the approximate total cost of implementation as percentage of your annual revenue?

--

**Part IV**

29. After implementation, which of the following, in your experience, are distinct advantages of implementing ERP systems? (Choose all that apply)

Decision-making is based on real time information

Diagnostic controls and response to aberrations are improved

- Efficient use of resources, (reduces waste of manpower, material and capital)
- Improves internal communication in large complex organizations
- Uniform computer systems across the organization
- Removes the coordination and communication problems of different geographical locations
- Leads to standardization and better quality control across the organization
- Improves customer satisfaction
- Possible to identify process bottlenecks and remove them
- Others (please describe)

30. Which of the following in your view are the distinct disadvantages of ERP systems?

- It is time consuming and disruptive exercise as far as implementation is concerned
- It is extremely expensive
- It is rigid and not easy to change once it is implemented
- It is a passive system and it does not prompt the managers to take certain actions, instead it does give them the information if and when they want to have it
- Does not improve or promote collaborative effort

- Cannot handle subjective issues which are developed through interaction and team work
- Expensive outsourcing for maintenance and updating of the systems
- Others (please describe)

Thank you for taking the time to complete this  
survey

August 24, 2000

Dear :

I am undertaking a study for my doctoral dissertation of industrial technology. The intent of this study will be to identify, analyze and investigate those factors that will affect the implementation of Enterprise Resource Planning (ERP) in companies located in the international Arab Gulf States and the United States with special emphasis on SAP software. You have been randomly selected to be part of this study, and I am requesting your help. **Since the study is about those factors that affect the implementation of ERP, it is important that each member who has been involved in the deployment of an ERP system complete the questionnaire as well. I am hoping that you forward this questionnaire to all such members of the team who contributed in the implementation process of SAP too.**

It is very important that we receive your responses because of your experience in the implementation of ERP software. Your contributions will undoubtedly assist us and lead to the ultimate success of our research project in this area. This instrument has been tested by a panel of experts in the area of ERP and hence was revised in order to obtain the necessary data while using a minimum of your time. The instrument is concise, and should require a few minutes of your time to complete.

It will be appreciated if you will complete the instrument and submit it as soon as possible. Your participation and contribution to this study is a vital part of the data needed in this study. Any comments that you may have concerning the factors related to the implementation of ERP which may not be covered in the instrument will be welcomed. Your response will be held in strictest confidence. To view this survey, please go to: <http://fp.uni.edu/alsehali/>

Thank you in advance for your assistance. I will be pleased to send you a summary of the study if you desire.

Sincerely Yours,

Saud Alsehali  
Doctor of Industrial Technology Candidate

September 5, 2000

Dear :

On August 24, 2000, a brief questionnaire was e-mailed to you. The questionnaire pertained to those factors that affect the implementation of Enterprise Resource Planning (ERP) in companies located in the international Arab Gulf States and the United States with special emphasis on SAP software. Many companies across the Gulf States and the United States have already responded, but I have not yet heard from you. If you have e-mailed your response, disregard this second e-mailing and please accept my apology and if you did not e-mail it yet, would you kindly take a few minutes to complete the survey? To view this survey again, please go to: <http://fp.uni.edu/alsehali/>

It is important that each identified respondent complete the questionnaire. Your response is vitally important to the study.

Sincerely Yours,

Saud Alsehali  
Doctor of Industrial Technology Candidate

APPENDIX B  
RESPONDENTS COMMENTS

In order to acquire the respondents' view about some importance issues, we allocated some items in the questionnaire for this purpose. These items as listed below are 5, 8, 11, 12, 14, 15, 16, 17, 19, 20, 21, 29, and 30.

What was the main reason for the ceasing of the implementation?

1. Vendor concerns on deliverables and other 3rd party contractual issues.

2. We are only providing implementation support.

3. During implementation the company lost control of their financial position and filed Chapter 11.

What typified the decision making process towards implementing the ERP?

1. Largely an outcome of Y2K compliance efforts and requirements for process improvements.

2. Assisted by middle management

What were the specific problems the organization intended to address through implementation of ERP?

1. Y2k upgrade required.
2. Replacement for an aging financial system and consolidation of IT efforts.
3. Cheapest way to fix Y2K problem.
4. Multiple Currencies.
5. Systems consolidation & maintenance.
6. Y2K considerations.
7. Too many legacy systems and Y2K.
8. Redundancy in legacy systems Outdated technology in legacy systems
9. Achieving Y2K compliance
10. Need for one single IT platform
11. Millennium rollover, Technology
12. Ending life cycle of previous product, Y2K issue.
13. Ailing complex in-house obsolete systems
14. Lack of integration and on spot update
15. Avoid Y2K problems

What approach have you selected for ERP software selection?

1. Combination of SAP and best of breed as SAP does not support GIS etc.



2. All-in-one with interfaces to legacy systems or other systems to meet business requirements.

3. All but two of ERPs I worked on were SAP applications but some retained legacy systems that were better than SAP's BBPs (best business practices) or non-existent in SAP (specialized maintenance) or too sensitive and difficult to migrate to; i.e. an in-house payroll system.

Were there any specific preparatory steps that were taken?

1. Change management
2. Consultant as integrator
3. Define sponsorship and ownership for master data from business units.
4. Heavy Business Process Re-engineering focus/education.
5. External training for team members
6. Selected an implementation partner and training development partner
7. Project team training and full time commitment.

8. Hire professionals to institute the knowledge base.

9. Study the Business Scenarios and Select what best suites the organization.

10. SAP education of client top mgmt ESSENTIAL to timely success!! SAP 020 and 040. And other steps such as the preparation of the area where this work would be done. And others.

Which in your view are critical success factors for the ERP implementation projects?

1. Middle management support and buy-in
2. An Emergent Philosophy
3. Put in order of importance.
4. Post implementation support for end user
5. ACCOUNTABILITY AFTER IMPLEMENTATION - walk the walk and talk the talk.
6. Plant with a system that has good data in it. Makes the conversion much easier.
7. Constant communication and involvement between modules, and a well-defined strategy of pre-testing of all critical components.
8. Can not rank as some of the CSF are equal in importance

9. Project team full time commitment

10. Consistent implementation schema

11. This is a difficult task because many of these are equal in weight of importance. But I have given my honest opinion as requested. #9 would include hardware choices, legacy migration & numerous other requirements.

Which in your view are critical success factors were not implemented satisfactorily in your organization?

1. Business unit buy-in & support.

2. They were successful but not as successful as they could have been. Technical documentation planning for the handoff from the consulting provider to the IS Staff is most critical for ongoing support once the provider leaves the project.

3. After implementation, we have not continued a strong focus/holding employee accountable for following global workflows.

4. This factor is limited to configuration only.

5. Clearly the highest risk factor for each implementation is lack of support and fear for being held responsible for making the wrong decision.

6. Qualified consultant

7. Best practices of SAP were customized

What are the pitfalls that you would advise others to avoid in the process of ERP implementation?

1. Take more time to plan and develop key resources. Executive sponsorship and strong project management are an absolute must.

2. Incomplete Planning

3. Have at least 3 in house strong ERP personnel, study the success of you consultants, and do not let the consultants think the implementation is over until at least 3 months after everything is "in their minds" complete.

4. The implementation strategy should include intended end end users at every stage. Very important.

5. When negotiating ERP packages, get ALL of the details, including the ones that aren't covered in the sales "pitch".

6. Do not skimp on training and do not underestimate the change management that is critical to the success of the project. Without these the return will take far longest to achieve and the risk factor will increase significantly.

7. Do not underestimate how much time it takes to reengineer and reexamine business processes affected by the ERP.

8. Ask all users, what you want to do on SAP?

9. Cost and training is always underestimated, and big culture change must be expected.

10. Hurry decision by project managers

11. Make sure that the budget is large enough. Take key, respected people from the business and make them stakeholders in the success of the ERP implementation.

12. I believe business processes should be re-engineered around the ERP, and improved, instead of trying to force the ERP to adapt to existing business processes.

13. Always have users to participate and top management involve.

14. Change management is a critical factor.

15. No scope creep.

16. Manage scope. Do not underestimate training costs and effort.

17. Customization, rewriting code, best-of-breed, underestimating the need for change management.

18. You must train everyone adequately so that day one is not a disaster. The users must know that since these systems are connected (i.e. Finance to Purchasing and vice versa) the implications of hitting "enter" and "save" have serious ramifications outside of their department.

19. Training strategy and change management.

20. The soft stuff is the hard stuff (to quote Michael Hammer) People, change and behavior is more critical than systems and flowcharts.

21. Don't select an implementation partner because it's a big name. Be very strict with your selection, and ensure proper buy in from the organization.

22. Planning and planning and planning after that comes training.

23. Isolated design team that is not in touch with the operational requirements.

24. Don't underestimate the business resources required and make the ERP implementation the Critical Operation Task for the entire organization (avoid competing priorities).

25. Teams tend to operate in a modular fashion (e.g., FI, MM, PP, PM, SD). Integration testing is very important.

26. An ERP system benefits the organization as a whole. You have to ensure that it meets the strategic business requirements even when it does not meet the requirements of the end user.

27. Ensure availability of key users for the duration required on the project. Develop a Change Management strategy and implement it. Assess organization's state of readiness, and prepare the organization adequately by training and creating buy-in.

28. You must have top management support and involvement throughout the project. End users must be involved early on in the project. Plan for longer formal training periods before actual

implementation. Plan for technical documentation and handoff from consulting provider to IS staff responsible for each modular area.

29. Management buy-in is essential. End user involvement and training are VERY important.

30. Please choose a IT support leader with strong experience to guide the team.

31. As an organization careful planning is essential. Have as much in-house support staff as possible very little outside.

32. Make sure proper training is followed and try not to rush.

33. Designing functionality without defining clear business requirements

34. Lack of ownership from the business units to maintain master data integrity

35. Undefined post-implementation user support within each business unit

36. Not managing design scope during initial design and implementation.

37. Change management.

38. Do not under estimate training time and depth. Lack of adequate commitment to the cultural



changes that will take place within the implementation time frame.

39. Don't underestimate the amount of effort required to make these huge, sweeping changes. Staff the project team amply.

40. Everyone needs to understand it is not just an IT implementation - business processes are being re-engineered and it impacts EVERYONE.

41. Train end users extensively. Verify legacy data before conversion. Maintain a good site team.

42. Plan the business unit strategy well in advance. Define company needs i.e. planning, configuration, and uploading legacy data.

43. Define the decision making process first, choose a strong AND capable external project manager.

44. Trying to implement everything all at once.

45. Scope increase, lack of knowledge transfer, low users participation and commitment.

46. Concentrate on End User Training and making sure that the Management is fully aware of the implementation and backing you up 100%.

47. Form in-house project team and training.

48. Don't rely on one source for implementation and don't ignore the skill transfer.

49. Prepare the company personal for the change, make them willing to unlearn the old method and learn the new one, be familiar with of the challenge that you are going to face.

50. Weak Coordination with end users outside the implementation team.

51. Keep exiting financial system in tact while implementing. Do not partially implement.

52. Need experienced in-house IT team or good Consultant.

53. Define the scope of the project clearly

54. Recruit experienced staff

55. Go for the phased implementation

56. Stress on training and knowledge transfer from consultants.

57. Under estimate the effort that required from your staff.

58. Follow the SAP plan.

59. Top-level support, end user involvement early and process ownership by executive.

60. Ensure that users have a clear expectation of what is being delivered. Do not promise the full moon and deliver a half one. Also be careful in the choice of a consultant partner.

61. Make sure all consultants are well qualified.

62. Education and training in ERP systems at least from a conceptual view so the training may have some context to the individuals receiving the training. More thought into reporting - what are the metrics which you will want to extract information on when the system is running.

63. It is Vague Objectives, Bad Consultants, and Poor cost estimates & budgetary/project control etc.

64. Top down commitment and an extremely high-ranking champion in the client ranks is necessary. Scope creep is also VERY detrimental to schedules and budgets.

65. End users MUST be involved. Management MUST give full support. Company implementing software MUST take advice of experienced consultants NO customization, or very little, if necessary.

66. Choose the right consultant and develop an in house consultant by educating the business & IT employees.

67. Study well before implementation

What are the main parameters that indicate that it has been a success?

1. Data processing fully relies on the ERP system in my office.

2. Financials and reporting.

3. Kept to the plan.

4. Output of goods and efficiency of work.

5. No downtime due to implementation.

6. All sites are operating in a more synchronized manner.

7. Informational flow and systems availability has been increased dramatically.

8. It was implemented on time and replace many aging systems that would not have been Y2k compliant. It also aided in the data cleanup that was necessary as there were so many systems.

9. Number of rising users.

10. People are beginning to accept it and it works.

11. It is teamwork job and all work either ERP or not is only successful only when it is completed by teamwork.

12. The implementation was on time and meets the needs of our business. We not yet received full ROI.

13. Because data is hard to retrieve back out of SAP in a reasonable manner.

14. No delay in information flows for reporting and always online up-to-date information.

15. All metrics are at or better than established targets.

16. We are going as planed.

17. Proper change management. Skilled IT staff with functional knowledge.

18. It works. It is a very user "unfriendly" system, but the day-to-day business goes on.

19. Open reporting, accountability and transparency.

20. Ability to make major improvements in efficiencies. Cost savings in many areas.

21. Business commitment.

22. The business was able to successfully operate on day one.

23. I would call it a success for no other reason that the sheer magnitude of the implementation.

24. High management commitment, strong project management, good quality of process owners and consultants.

25. All critical business processes that were planned were totally functional on the first day of implementation. The implementation date was met within the time frame planned.

26. It's neither success nor a failure because it needs a person who is having strong functional experience in the business not merely in IT field alone. So it needs strong leadership (project leader).

27. It's working well and functioning as intended to meet goals and objectives.

28. Up and running and client is happy.

29. Business processes did not break during implementation.

30. Short-term reliance on legacy data to manage business processes.

31. Minimum integration problems were reported during implementation.

32. Security assignments linked to user roles required minimal changes.

33. No downtime and excellent fit with our business process.

34. No delay in shipments at start-up. No revising files or tables to correct bad info. Improvement in on-time shipments right away.

35. From day 1 after implementing the ERP software, we manufactured and shipped product with only a few minor difficulties.

36. Excellent consultants.

37. Improved cash flow, increased productivity, better information available for decision-making.

38. Quality of people, methodology, level of consultants, training of team members, management involvement and commitment.

39. Consulting Partner did not have a good understanding of the scope and the cost.

40. Company could convert to the new system with full capacity with no problems at all.

41. We are on schedule. Users are seeing the benefits. Top management support getting stronger.

42. ERP (SAP) solution been utilized by the business as planned for.

43. Management commitment & Support.

44. The Implementation Team and management support.

45. Smooth Flow of Information for Decision Making.

46. Excellent teamwork.

47. Cooperation from top management.

48. Keeping up the project schedules.

49. Meet the deadline, and end user happy with your product.

50. Top management involvement.

51. Large amounts of money and flexible management, which allows for the slippage of the project. Without the management allowing slippage and pumping large amounts of money into our project the first two implementations would probably not have occurred.



52. System is running smoothly and all staff are well trained on the software.

53. The company is using it and we are profitable but not using the system to its fullest extent. We have room to improve.

54. System is up and running; minimum downtime during changeover.

55. Cost reductions, Process efficiencies, and Users satisfaction.

56. The measure of a successful ERP comes a year after "go live" if it is doing what you wanted it to do, you got what you paid for and you are able to operate it yourself after the consultants leave.

57. Significant benefits from accurate and timely information flow, which helps the decision-making.

58. Improves internal communication.

59. Better quality control.

60. Standardized all computer system software & hardware.

61. Control of material movement.

62. Assets control.

63. Minimize the traditional process, support decision-making, and clear-cut communication.

If you think it was a failure what are the main indicators of this failure?

1. Inability to ship product to our customers.

2. Not in the slightest.

3. Total misunderstanding by middle management and the end users as to the capabilities of the system.

4. Financial returns have not been realized and we lost many good people.

5. The company went into Chapter 11.

6. Lack of appropriate usage and confusion of the end users.

If you think it was a failure what were the main reasons for the failure?

1. Unanticipated problems with software.

2. Not applicable.

3. Lack of time spent by middle management understanding the system. Lack of understanding of the capabilities of the system. The middle management does not accept to change business processes to take advantage of system efficiencies.

4. Design was not reflect the business needs.

5. Due to the absence of good project leader and higher cost involved.

6. Giving too much power to the consulting partner. Not trusting the In-House employees over the consultants.

7. Too expensive to implement and maintain.

8. Extensive customization.

After implementation, which in your experience are distinct advantages of implementing ERP systems?

1. There were no advantages.

2. Highlights business process issues for resolution.

3. Supporting one ERP system reduces overall IS costs. With one ERP system cross-functional responsibilities are easier to implement.

4. Takes the politics out of inter-plant business transactions.

Which of the following in your view are the distinct disadvantages of ERP systems?

1. Too complex to be fully understood.

2. Forced ongoing cost to maintain current version & vendor support.

3. The fact that we just went through a merger and we may not implement across the whole organization.

4. Must keep updating the system with legal changes to keep Vendor support.

5. Upgrades are disruptive and the testing of hot packs is difficult without consultants that understand what has changed.

6. It takes an enormous amount of time to implement and train the staff to understand and operate.

7. It is risky.

8. While one "could" raise all of these objections, I maintain that a well-executed ERP (esp. SAP) also is implementing "Best Business practices" as a "free" "ride-along" benefit. And, well-executed projects often show an ROI of 1 to 2 years and a 20% reduction in operating costs!! It is THE way to go if you expect to remain in business (at a profit) in today's business environment.

9. All of the above can be disadvantages to ERP systems if not handled correctly. Once again, management must support the full implementation, or

the system will not work to its fullest potential. What I would like to add is that the first installation of SAP was a failure mostly due to the customization involved. Since, a "redo" with an upgraded conversion has been implemented in the company, and is working wonderfully. Lessons learned were very expensive, but now have paid off.