Critical Success Factors (CSFs) in ERP Implementation in Pakistan

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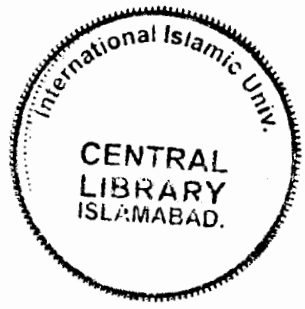

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Final Approval

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In
the
Name
of

ALLAH

The Most Merciful
The Most Beneficent

A Thesis Submitted to the Department of Computer Science, Faculty of Basic and Applied Sciences, International Islamic University, Islamabad, Pakistan, as a Partial Fulfillment of the Requirements for the Award of the Degree of

MS in Software Engineering

To
The Holiest man ever born,
PROPHET MUHAMMAD (PEACE BE UPON HIM)
& To
OUR DEAREST PARENTS & TEACHERS

DECLARATION

We hereby declare and affirm that this thesis neither as a whole nor in part thereof has been copied from any source. It is further declared that we have completed this thesis entirely on the basis of our personal efforts made under the sincere guidance of our supervisor. If any part of this thesis is found to be copied or reproduction of some other's, we shall be responsible for the consequences. No portion of the research work presented in this thesis has been submitted in support of degree from any other University or Institute.

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ABSTRACT

Organizations need information previously fragmented within its different Information Systems (IS) which are in use in different business areas to be integrated for its timely availability. Enterprise Resource Planning (ERP) systems are capable to automate and integrate the key business processes (i.e. develop and retire products and services, fulfill orders, issue customer invoices, manage financial aspects of the business, develop human assets of the business) throughout the organization. Consequently, the information may flow among different parts of the organization freely and helps the management in making strategic decisions. The implementation of ERP systems is a challenging task and it is not just a technical exercise but a socio-technical challenge (the social aspects of people and society and technical aspects of software and technology). This research focused on the Critical Success Factors (CSF) that may contribute to a successful ERP implementation in organizations in Pakistan. Research findings are based on survey research conducted in Pakistan. Questionnaires were sent to 202 Managers/Project Directors in 8 organizations which were implementing or had implemented ERP systems for automation of their business processes. However, 116 positive responses to these questionnaires were received. Among the 24 factors, those had been considered in the past research were studied, however fourteen factors found more critical regarding the ERP implementation. The top five most critical success factors Professional Man Power, Project Scope Definition, Business Process Re Engineering, Top Management Support and Change Management were found in the research. The research findings showed that various factors relating to users, organization and ERP software are critical towards successful implementation of ERP systems. The findings may be a valuable contribution to the existing knowledge and handy for the practitioners.

CONTENTS

CHAPTER 1

INTRODUCTION

1. Introduction

Organizations need information previously fragmented within its different Information Systems (IS) that are in use in different business areas to be integrated for its timely availability. All departments need to upgrade their capabilities to generate and communicate required information whenever they needed. Enterprise Resource Planning (ERP) systems are integrated enterprise wide systems that automate core enterprise activities such as human resources, manufacturing, finance and supply chain management etc. Such system have capabilities to automate and integrate an organization business processes, share common data (related to human resource, products and customers) and practices across the entire enterprise, and generate and access information in real time environment (Rasmy et al, 2005; Nah and Lau, 2001). Keeping in view the changing business environment, the organizations need to improve their business processes to achieve competitive edge. ERP systems may help to manage organizational resources and their use by providing integrated solution for processing needs of an organization and automation of its business processes. ERP systems are not built but adopted and may cause major changes to the existing work flows on their implementation.

The implementation of ERP systems is expensive. However, the organization those have successfully implemented ERP systems are gaining the expected benefits (Markus, 2000). Enterprise Resource Planning utilizes ERP software applications to improve the performance of organizations resource planning, management control and operational control (Zhang, 2002). The implementation of ERP system is defined as "the process of developing the initial business case and planning the project, configuring and implementing the packaged software, and subsequent improvements to business processes" (Shanks and Parr, 2000). ERP software is multi-module application software that integrates activities across functional departments. It may include application modules for the finance, accounting and human resources aspects of a business (Rasmy et al, 2005). The implementation of ERP systems usually require organizational work processes to be changed to adopted best business practices which are encapsulated in

ERP systems for smooth running of the business processes. Consequently it improves the work processes and decrease costs. Researcher claims that success of ERP systems is very much concerned with the degree of mutual fit between the ERP solution and business processes (Olson, 2004; Nah et al, 2001). The fit between business processes and ERP solution need redesign of business processes as a prerequisite for ERP adaptation (Law & Ngai, 2007). The organization which has adopted ERP systems reported encouraging and disappointing outcomes (Devonport, 1998). The implementation of ERP systems requires drastic change to the existing work processes and such change need to be managed for its success. Various challenges have been faced by organizations in implementing ERP solutions leading to project failures (Spitze, 2001). There exist different stories of ERP successful implementation and failures (Thavapragasam, 2003; Zhang, 2002). The high failure rate in implementing ERP systems have been widely cited in the literature (Davenport, 1998). The rate of successful ERP systems implementation is low and not all ERP implementation have always been successful.

The past research reflects that 90% of ERP systems implementation was found behind schedule or over budget whereas the success rate is approximately 33% (Zhang, 2002; Holland and Light, 1999). Griffith (1999) mentioned that 75% of the ERP systems are failure. Parr and Shanks (2000) mentioned that many ERP systems implementation are not completed on time, and within budget. The past studies reflect that failure percentage of ERP systems is ranging from 40 to 90 percent (Langernwalter 2000; Ptak and Schragenheim, 2000). The higher failure rate of ERP implementation invites researcher's attention to better understand the critical success factors that may contribute towards successful implementation of ERP systems in organizations (Somer et al, 2000).

Critical Success Factors (CSFs) approach was first used by Rockhart (1979) in the area of Information System. The common factors on the basis of which a project is considered to be successful is known as Critical Success Factors (CSF). Yogi (1996) stated that factors which frequently contribute to either a success or a failure are termed as critical success factors. Within the ERP implementation context, CSFs are defined as "factors needed to ensure a successful ERP project" (Gibson, 1999). The factors are mentioned in table 3.2.

1.1 Research Objectives

The past research shows a higher rate of ERP systems implementation failure (Habermann, 2000). The objective of this research is to explore the Critical Success Factors (CSF) that may contribute to successful ERP implementation in an organization in Pakistan. This research investigates various factors concerning user, organization and the ERP software which may play an important role in implementing ERP system in the organizations. Following research questions are used to limit the research work.

1.2 Research Questions

The research questions are as under.

Primary questions

Q1. What success factors are critical in implementation of ERP systems successfully in Pakistan?

Q2.Which are top most critical factors contribute to ERP systems implementation success in Pakistan?

Secondary questions

Q3. Which of the user related factors contribute ERP systems implementation success?

Q4. Does organizational culture play a role in ERP systems implementation success?

Q5. Is selection of ERP software important in achieving ERP implementation success?

Research Methodology

This research attempted survey research to examine the critical success factors. The data collected from those firms that are implementing the ERP systems or have implemented ERP systems in Pakistan. The questionnaire was sent to the Senior Project Managers, Project Manager, Business Process Reengineering Specialist, Master Trainers, and Master Scheduler, Production and Inventory manager, Material handling manager, and Production manager. The items used in the questionnaire were adapted from prior research.

Thesis Layout

Chapter two describes literature review regarding the ERP systems and their evolution, effects on organizations and the challenges that organizations are face in the successful implementation of the systems. Chapter three explains the Critical Success Factors (CSF) and the frameworks proposed in past research for successful ERP implementation. Moreover, it also explains the potential critical success factors that are supposed to be useful in successful implementation of ERP systems implementation.

Chapter four is concerned with adopting a suitable Research Methodology for this study. The survey research method has been explained along with its suitability for the current study. It also explains Reliability Analysis, Factor Analysis, Content Validity and Construct Validity Analysis that may help in validating the instrument such as questionnaire. Chapter five explains data collection, analysis, and research finding regarding success factors which appeared as critical for successful implementation of the ERP systems in various organizations in Pakistan. It also discusses the limitation of this study and provides guidelines for future research.

CHAPTER 2

LITERATURE REVIEW

2. Enterprise Resource Planning (ERP)

ERP systems promise to integrate diverse business workflows, improving organizational coordination, efficiency, decision making and changing dimensions of business such as firm structure, management processes, technology platform and business capability. However, the ERP systems require large investments in terms of money and time, and change in business processes for smooth flow of information. Information that was previously maintained by different Information Systems within different functional areas in an organization requires to be integrated and be made available to the organization as a whole. The goal may be achieved as a result of successful ERP systems implementation. No doubt, implementation of ERP system is a challenging task. An organization may take two to five years to fully implement the required technological and organizational changes required by the ERP system to be implemented (Laudon and Laudon, 2002).

2.1. Defining Enterprise Resource Planning (ERP) System

Kumar (2000) defines ERP system as configurable Information Systems packages that integrate information and information based processes with and cross functional areas in an organization.

An ERP system is the automation of core corporate activities such as manufacturing, human resource, finance and supply chain management, by incorporating best practices to facilitate rapid decision making, cost reduction and greater managerial control (Shanks and Light, 1999; Bingi et al., 1999). It focuses on business processes design and human elements (Gibson, 1999). ERP systems should fulfill the requirements of all the departments of an organization with unique database and one application, and a unified interface and it may replaces many legacy systems by one which is easy to maintain and support various work processes of the organization (Markus, 2000; Shanks and Light 1999).

2.2 Evolution of Enterprise Resource Planning (ERP) Systems

Enterprise Resource Planning is not software; however software packages support effective resource planning. Enterprise Systems are described as "Packages of computer applications that support many, even most, aspects of a company's information needs (Davenport, cited in Wallace and Kremzar, 2001).

In the era 1960-70, the companies realized that large volumes of inventory was a luxury and so, unaffordable. This led to the introduction of Material Requirements Planning (MRP) systems. MRP had been a great improvement in the materials planning process (Oden et al, 1993). The birth of ERP may be traced back as Material Requirements Planning (MRP) in the 1960s which led to MRP-I and MRP-II. MPR-II was expected to incorporate all resource planning for the entire enterprise. The various areas included into MRP-II were such as product design, information warehousing, materials planning, capacity planning, communication systems, human resources, finance, and project management. The fundamental of ERP are the same as with MRP-II, however, ERP is a set of business processes broader in scope and more effective in dealing with multiple business areas in an organization (Wallace and Kremzar, 2001). Motwani (2005) defined ERP as "a method for effective planning and control of all resources needed to take, make, ship, and account for customer order". ERP system implementation in an organization affects all the areas such as business processes, people and the product. An ERP system is the software that deals with one of the categories of e-business software (Bing, 1999). It may be termed as an Information System (IS) that manages through integration all aspects of a business including production planning, purchasing, manufacturing, and sales, distribution, accounting, and customer service. Markus (2000) argues ERP systems as more than a software package suggesting that it represents a specific paradigm. ERP systems are comprehensive, fully integrated and support common, global business process. Shanks and Light (2000) proposed that ERP provides automated support for most of the standard business processes within an organization due to its comprehensive nature, integration and global business processes. The organizations are investing heavily in ERP systems and the claimed benefits from such financial and human resources are in three major areas such as accurate and timely

information for strategic decision making business, process improvement and client focused (Fitz-gerald & Carroll, 2004).

2.3 Why do we need ERP system?

Several questions raised in our mind such as:

i) Why are organizations investing huge resources for ERP system implementation?

ii) Why do the organizations opt for off-the-shelf ERP solution?

iii) Why do the organizations shift towards the business process design instead of technical analysis and programming?

The literature addressed such questions in the past research (Vineet, 2006; Zhang, 2002; Jiang Yingjie, 2005) The researchers claim that successful implementation of ERP in an organization may lead to user satisfaction, reduction in unit labor costs, overheads, and duplication of resources and maintenance cost (Mezzacca, 2005; Shanks and Light, 2000. There is an increase in consistency, improvement in quality, standardization in business processes and in face to face communication, ease in supply chain management, improvement in operational efficiency and rapid return on investment in terms of reduced operating and maintenance costs, and reduced administrative expenses (Shanks and Light, 2000; Vineet, 2006).

The popularity of ERP systems is also evidenced by its sales exceeding $30 billion in 2002, an increase of 300% since the late 1990s. More than 60% of US companies have implemented or planned to implement ERP systems (Magnusson et al., 2004). ERP systems are growing day by day and becoming the backbone of the organizations. Markus (2000) say that ERP is the heart of the IS and plays an important role due to its extra ordinary features. ERP system consists of a set of standard functional modules and these modules are developed, integrated and implemented according to the needs of the organization. The examples of such modules are human resources, sales finance and production, product planning, purchasing, inventory control, product distributions and product marketing. These modules may improve the performance of the organization, management control and operational control (Zhang, 2002). According to Estevez and Pastor (2003) some of the modules mentioned above provide cross functional integration of data through embedded business processes.

The potential benefits of Enterprise wide systems such as MRP (during 1970's), MRP-II (during 1980's) and ultimately ERP (1990's) may only be achieved, however, after

their successful implementation. The past research showed different stories regarding success or failure of ERP systems in organization. The past research showed different stories regarding success or failure of ERP systems in organizations (Holland and Light, 1999; Magnusson et al., 2004. The successful implementation of ERP systems is questionable.

2.3 ERP System's Implementation Issues/Challenges:

The implementation of ERP systems is different from traditional Information Systems. The reasons may be i) the integrated nature of ERP applications causing changes on work flows, organizational structure and job of people; ii) ERP systems are adopted not built; iii) ERP implementation is not a technical exercise but a socio-technical challenge as it poses a new set of management procedures (Rasmy et al., 2005). The implementation of a new ERP system which always requires changes in business processes is unquestionably a complex undertaking. In order to continue with business as usual the organizations which are implementing ERP systems require redesigning of business processes all at once. The organizations which hardly care to understand that such changes are essential for implementation of ERP systems may face implementation problems. It needs careful planning regardless of the resources that are needed to implement it successfully. Ghosh and Ghosh (2003) mentioned two major issues faced by the executive sponsors about implementation of ERP systems. One is the mapping of organizational business processes with the ERP software best practices. Secondly, the technical architecture and infrastructure need to be in place as per specifications of the packaged software.

Why is implementation of ERP system problematic? The past research addresses various reasons mentioned below.

- Need to change existing business processes during implementation of an ERP systems (Zhang et al., 2002).
- Lack of user involvement, top management support (Vineets, 2006; Zhang et al., 2002).
- Lack of under estimation of education and user training (Bhatti, 2005; Zhang et al, 2002; Donovan, 1999).
- User resistance (Zhang et al., 2002; Bhatti, 2005).
- Poor selection of ERP system and vendors (Bhatti, 2005).

- Lack of data accuracy (Vineets, 2004).
- Lack of interest in managing cultural issues (Motwani, 2005)
- Inaccurate expectations and customization/tailoring challenges (Aiken and Sullivan, 2002).
- Lack of discipline and organizational commitment may slow down the process of implementation (Zhang et al., 2002).
- Implementation is late or over budget which may be due to poor cost and schedule estimation (Holland and Light, 1999; Parr and Shanks, 1999).

ERP systems require complex software and large investment in terms of money, time, and expertise for its implementation in organizations. Despite various benefits that may be achieved from successful ERP implementation, there exist evidences of failure of ERP systems implementation. (Davenport, 1998). The failure of ERP systems to deliver what is expected may be because of lack of interest of management about how to structure the organization to get maximum benefits from ERP (Donovan, 1999). Both technical and non-technical (the social aspects of people and society and technical aspects of software and technology) issues are common that need to be addressed. The culture of an organization has significant effects upon the implementation of ERP systems (Chatfield, 2000 cited in Thavapragasam, 2003). According to Scot and Vessey (2002), the majority of ERP systems implementation failure stems from management issues. Linda (2003) mentioned people and organizational change process as major challenges. Wallace and Keil (2004) mentioned that preparedness of the organization is a challenge in the successful implementation of ERP system. The management should make sure that the organization, the work processes and the staff are amenable to adapt to the ERP system. Parr and Shanks (2003) mentioned that many ERP systems implementation are not completed on time, and within budget. Similarly, Holland and Light (1999) say that 90 percent of ERP implementation is late or over budget which may be due to poor cost and schedule estimation or changes in project scope. Other researchers explored various issues such as lack of support of top management, resistance from employees, poor selection of ERP system and vendors, inadequate end user training (Bhatti,2005), lack of data accuracy and user involvement (Vineets, 2006).

Kyung & Gul, 2000 mentioned that there is uncertainty in acquisition and hidden costs in implementation, resistance from user due to its disruptive change, political

perspective due to cross-functional IS. The ERP vendors have their own interest, who prepares generic solution applicable to a broad market whereas customer organization has interest of unique and specific business solution. So there exits a difference in the interests of vendors and customer organizations. The implementation of ERP systems is driven by business issues so it always requires careful planning. Tarafdar and Roy (2003) indicate that there exists a lack of research about the characteristics of the problems that ERP systems may face. ERP implementation may be considered successful, if it is completed within the scheduled time frame and remains within planned budget and meets the projects goals.

We observed from the researcher views that the problems in ERP implementation are:

- ERP implementation not completed on time within budget.
- Lack of top management
- data accuracy
- and low user involvement
- inadequate user training
- differences in organizational culture
- resistance from user
- government policy
- Less BPR experience

The ERP systems demand major functional investments, so inviting attention of the researchers. Umble (2002) concluded that an average cost of implementing ERP systems is about eleven million United State of America (USA) dollar and an average time about twenty three months may be considered. Despite heavy investment the ERP systems implementations within budget, within time and up to user's satisfaction is questionable (Scott & Vessey, 2000). Fitz-gerald & Carroll (2000) mentioned that a survey of 117 companies involved in ERP implementation lead to the finding that one in four ERP projects is over budget, 20% are terminated before implementation and 40% of the respondents confirmed that ERP projects' fail to achieve business objectives. Scheer & Habermann (2000) mentioned that ERP projects failure rate is more than 50% . Sumner (1999) mentioned various causes of system failures related to technical, organizational and behavioral problems. Implementation failure may be that ERP systems never integrated into business process, cancelled before the completion, and implementation is not within budget and time (Standish, 2001). The past research

shows dissatisfaction with the ERP mentioning that these systems fail to deliver the expected benefits (Vineets, 2006).

The implementation of ERP systems is a challenging task. The failure rate of ERP systems always invites the attention of the researcher. However, it is important to examine the basic reasons which may impede the successful ERP implementation. There is a need to improve ERP implementation leading to its success. The success of ERP system implementation is defined as it is widely evidenced in past research that to improve.

Critical Success Factors (CSF) is defined as "Factors which are frequent contributors to either a success or a failure" (Yogi, 1996). Some other researchers defined CSF as key business activities if achieved, would ensure competitive performance for an organization. Certain factors which are critical to the success of an organization.

CHAPTER 3
CRTICAL SUCCESS FACTORS (CSFs)

3.1 Defining a Critical Success Factor

Critical Success Factor is a business term for an element which is necessary for an organization or project to achieve its mission (Ralf Knoll, 2006). Pointo and Slevin (1987) mentioned project success as a function of critical factors. Finney and Corpett (2007) defined critical success factors as "reference to any condition or element that was deemed necessary in order for the ERP implementation to occur successfully". Some other researchers described CSF as key business activities, that, if achieved would ensure competitive performance for an organization and consequently its success (Ramayah, 2007). Critical factors may be limited in number (Rockart, 1979), however, these factors are frequent contributors to either a success or a failure of a system (Yogi, 1996). Critical Success Factors may be considered as the conditions that need to be met for assurance of success of a system (Poon and Wagner, 2001).

The difficulties and high failure rate in implementing ERP systems have been widely cited in the literature (Ramayah, 2007 & Davenport, 1998), but research on critical success factors (CSFs) in ERP implementation efficiency is still fragmented. Therefore, the study of ERP implementation success is one of the major research issues in ERP systems. There is a need to explore CSF that may consequently help to avoid costly mistakes, and speeds up the way change is managed (Aggestam and Söderström, 2005). Critical Success Factors approach is commonly used to define and measures ERP implementation (Jose Estevez-Souza, 2000).

3.2 Critical Success Factors and ERP Success

The implementation of ERP system is a complex and costly activity (Magnusson et al, 2004; Markus, 2000). ERP success is evaluated in terms of technical, economic, financial or strategic business and smooth running of business operations, adoption by

managers and customer's organizations (Markus, 2000). Success is viewed in technical, economic, financial or strategic business terms of smooth running of business operation and by the ERP adopting organization stakeholders. Zhang et al. (2002) mentioned business process re-engineering and organizational culture as the most important factors in ERP implementation. ERP implementation is considered successful, if the project is completed within the budget allocated, scheduled time frame and meets the organizational objectives.

The top management support, organizational fit of ERP system, company wide support, effective project management may contribute towards ERP success (Rasmy et al., 2005). Various factors critical towards ERP implementation success are reported in several studies carried out in developed and developing countries. We searched the literature to find out Critical Success Factors concerning ERP implementation. The detail of journals searched is as under:

- Journal of Enterprise Information Management
- Communications of the ACM
- The Database for Advances in Information Systems
- Information & Management
- Information System Research
- Software Engineering Institute Journal
- Business Process Management Journal
- Information Resources Management
- Journal of Information Technology
- International Journal of Production Economics
- Journal of Management Information Systems
- European Journal of Operational Research.
- Journal of Manufacturing Technology Management
- Journal of Managerial Finance
- The Journal of American Academy of Business, Cambridge

The details of the CSF found in the past research are mentioned in the following Table 3.2. This is one of the major contributions of our research work. The contents of the table are derived from the above forty researcher work.

Authors	Top Management Support	Business Process Reengineering	Organizational Culture	User Training	User Involvement	Effective Communication	Change Management	Vendor Support	Project Scope and definition	Leadership	Data Accuracy	Professional Main Power	Legacy system	Schedule of deliverable	Minimal customization	Experience Consultants	Monitoring & feedback	Risk Management	User Acceptances	ERP Implementation Strategy	Software Configuration	Suitable IT Infrastructure	Selection of ERP	Firm IT Maturity
Keil et al. (1998)	√			√	√		√		√			√									√	√		
Web (1998)		√		√			√					√											√	
Holland and light (1999)			√	√									√	√					√	√	√			
Parr and shank (2000)	√						√		√	√		√		√										
Shank et al. (2000)	√			√			√		√	√		√			√						√			
Saker and Lee (2000)						√				√		√												
Hong and Kim (2001)												√												
Esteues-souza-jon (2001)	√	√		√		√	√		√			√	√								√		√	
Huang and Palvia (2001)	√	√	√	√																				
Zhang et al. (2002)	√	√	√	√	√			√			√											√		
E-Scott and Vessey (2002)	√						√	√														√		
Allen et al. (2002)	√	√	√			√	√					√	√	√			√		√	√				
Ghosh et al (2003)								√														√		
Thavapragasam (2003)			√																√		√			
Esteves and Paster (2003)	√				√																			
Magnusson et al (2004)	√		√	√	√	√	√	√		√	√	√								√		√		
Yingjie(2005)	√	√		√	√		√															√		
Bhatti (2005)		√		√	√	√	√		√			√				√		√	√					√
Rasmy et al. (2005)	√		√	√	√																		√	
Motwani (2005)		√	√	√		√													√					
Vineets (2006)	√	√		√	√																			
Law and Ngai (2007)	√	√		√	√		√	√		√		√		√		√		√		√			√	

Hartwick and Barki (2001)					√														√					
Rainer et al. (1995)	√							√								√						√		
Alvarez and Urla (2002)	√				√			√																
Finney and Corbett (2007)	√	√		√		√	√	√	√	√	√	√		√						√	√	√	√	
Lindley et al. (2008)								√					√										√	
Woo (2007)	√			√		√	√				√													
Kim et al. (2005)	√						√	√											√		√			
Baray et al. (2008)	√			√							√											√	√	
Willcocks and Sykes (2000)	√						√		√		√				√									
Kawalek and Harper (2002)					√																			
Basu and Lederer (2004)								√					√			√							√	
Sumner (1999)	√	√		√		√		√	√						√									
Brown (2004)						√	√												√			√		
Biehl (2007)	√	√	√	√	√	√	√		√		√	√											√	
Nah et al. (2001)	√		√	√		√	√	√		√		√	√		√	√	√							
Skok and Legge (2001)	√	√	√	√		√				√						√								
Wierda (2003)	√	√		√	√	√	√		√	√		√	√			√				√	√	√		
Basu et al. (2001)	√				√														√				√	
Svensson and Aurum (2006)	√				√	√			√	√				√				√						
Motwani et al. (2005)	√	√	√	√		√	√		√										√					
Meissonier et al. (2006)	√				√		√					√						√				√	√	√

Table 3.2: Critical Success Factors for ERP Implementation

Twenty four factors those have been found in past research concerns to user, Management and ERP software .The frequency of each CSF cited in the literature is mentioned below in Table 3.3.

Critical Success Factor (CSF)	No. of instances cited in literature
Top Management Support	30
Business Process Reengineering	16
Organizational Culture	12
User Training	23
User Involvement	17
Effective Communication	16
Change Management	20
Vendor Support	10
Project Scope and definition	14
Leadership	13
Data Accuracy	04
Professional Main Power	19
Legacy system	06
Schedule of deliverable	07
Minimal customization	03
Experience Consultants	08
Monitoring & feedback	03
Risk Management	04
User Acceptances	10
ERP Implementation Strategy	06
Software Configuration	10
Suitable IT Infrastructure	10
Selection of ERP	11
Firm IT Maturity	02

Table 3.3

Next section explains the CSF mentioned in table 3.3 in detail.

3.2.1 Top Management Support:

The Management support means support in ethics, moral, finance and resources allocation to achieve the project/organizational objectives in time. Different roles of top management towards ERP implementation may include developing an understanding of the capabilities and limitations of ERP system, establishing reasonable goals and exhibiting strong commitment to the successful introduction of ERP system, and also

communicating the ERP strategy to all employees in the organization (Mockeries and Walton 2002).

ERP systems always require changes in work flows which need organizational alignment that may be accomplished on the part of top management. The commitment and support from top management is critical success factor for ERP implementation (Duchessi, et al. 1999; Shanks and light, 1999). The top management support has a positive impact on the success of ERP implementation (Rasmy et al., 2005). Martin et al. (1999) mentioned project sponsor and project champion roles of top management support may be associated with ERP systems implementation. The strong leadership at top level management has been empirically proved as an essential factor for the successful implementation for ERP implementation (Sarker and Lee, 2000). Finney and Corbett (2007) mentioned that top management support has the 1st most commonly cited critical success factors in his research. Andrew (1989) stated that the managers should understand their roles in ERP implementation as their support is critical to overall success of the system. The lack of top management support in ERP implementation may lead to ERP implementation failure (Bhatti, 2005).

3.2.2 Business Process Reengineering (BPR)

The implementation of ERP systems demand that the existing business processes may be changed to adopt best practices incorporated in the ERP software. ERP systems are usually built keeping in view the best practices that are usually followed for improvement in the organizational effectiveness and efficiency. Hammer and Champy (2001) defined Business Process Re-engineering (BPR) as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed". They further added that business processes of an organization may be analyzed by BPR in order to identify the best practices of doing things.

Olson (2004) mentioned two types of business processes such as operational and infrastructure. The operational processes may help to accomplish business functions whereas infrastructure processes are more administrative. The organization should be willing to adopt the changes in its business processes to fit the ERP systems. Consequently, it may minimize the degree of customization needed on the part of ERP software. The existing business processes in an organization should be aligned in accordance with ERP software to be implemented, and it is considered critical (Nah et

al., 2001). Sutcliffe (1999) stated various difficulties such as resistance to change, inappropriate staffing and inadequate developer and user tools related to Business Process Reengineering.

3.2.3 Organizational Culture

The implementation of ERP systems always demand change in business process and organization culture. The culture of an organization is defined as "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein, 1992 cited in Zhang et al., 2002). The culture of an organization concerns organization workflows, employees personal values, skills, attitude and decision making processes. The people of an organization need to change their mindset to accept the potential changes in business processes that might occur due to ERP Implementation.

Organizational culture plays an important role during implementation of ERP systems and consequently its success (Nah et al., 2001; Thavapragasam, 2003). Vessey (2003) urges that organizational context (organizational culture) is more important than the technical aspects. Most of the ERP software is developed in technically advanced countries so standards area often too high for the under developed or developing countries. The organizations which are going to implement ERP system, should carefully consider cultural issues in this regard (Rasmy et al., 2005). The researchers claimed that clashes between the culture embedded in the ERP packages and the culture of the organization may affect the implementation of ERP system (Krumbholz and Maiden, 2001 cited in Zhang et al., 2002). If the firms rush to finish the ERP project within a certain time period, and have no time to completely change the organization's culture then they face problems (Mabert, et al. 2001).

3.2.4 User Training

The purpose of the training is to provide basic concepts and features of ERP system to the users and how its use may benefit the organization through automation of business processes. The user training might be helpful in increasing their expertise/skills and knowledge. Consequently the user may feel comfortable with the systems. In ERP

implementation context, the users may learn why ERP system needs to be implemented and why are changes in ERP systems needed? New users may find ERP implementation easier rather than those who have many years of experience and may need more time to change their habits. The main objective of ERP training is that the users should understand the various business processes behind the ERP application (Majed Al-Mashari, et al 2003, Zhang et al., 2002). ERP implementation may fail due to lack of proper user training (Bhatti, 2005). Hung et al. (2004) found that lack of user training led to difficulties in MRP systems implementation.

Three aspects related to contents of training are: 1) Logic and concept of ERP; 2) Feature of the ERP systems software; and 3) hand on training (Rasmy et al., 2005; Zhang, 2002) Training the users has some difficulties, including the diversity of the users, the complexity of the new systems, and the variety of training methods available. The training of the user helps them how to work with the system and how ERP systems may affect business processes. Duchessi et al. (1999) mentioned that adequate user training is a critical success factor for implementation of ERP systems.

3.2.5 User Involvement

Hartwick and Barki (1994) defined user involvement as "A psychological state of the individual, and as the importance and personal relevance of a system to a user". Users play an important role in the ERP System implementation (Zhang, et al., 2002). User involvement in defining ERP systems needs and user involvement in the implementation of ERP systems are important aspects (Rasmy et al., 2005). The involvement of the user during the phase of defining organizational information needs may decrease the resistance of user to the ERP systems implementation. Users feel ownership of the system. The user involvement in ERP systems will be helpful to get user requirements, better quality of the system and increase system usage (Jose Estevez et al., 2004). The success of ERP system depends on the use of the system after its successful implementation. Zhang et al. (2002) reported that user involvement at initial stage of ERP system implementation is helpful for the user to understand the system and to provide a valuable feedback.

3.2.6 Effective Communication

The past research findings show that communication among stakeholders is a critical success factor for implementing ERP systems (Estevez et al., 2004). The

communication should start early in the ERP system implementation. It is essential for creating an understanding, getting an overview of the system, an approval of the implementation and sharing information between the project team. It helps in understanding the purpose and reason for implementing the system. Effective communication is critical for ERP implementation (Falkowski et al., 1998). The effective communication may help in acquiring accurate requirements. It may contribute towards managing expectations at every level. (Wee, 2000). Communication includes the formal promotion of project teams and the advertisement of project progress to the rest of the organization (Holland et al., 1999). Middle managers need to communicate its importance (wee, 2000).

3.2.7 Change Management

Change management is critical for successful ERP system implementation (Kuang, 2001; Finney & Corbett, 2007). Some researchers considered it main obstacles for successful ERP implementation (Estevez et al., 2001). For effective change management, training of the users is essential (wee, 2000). This factor is a primary concern of organizations involved in ERP system implementation (Somers et al., 2003). Organizations which underestimate change management, fail in ERP system implementation. For successful ERP system implementation, the organizations manage two types of changes. One, the way organizations do business, will need to change and the other, people do their jobs, will need to change (Nah et al., 2001). The organizations are facing resistance to change as a major issue during implementation of ERP system which creates conflicts among stakeholders (Gupta, 2000). Carefully managing the changes to business processes is required to over come the resistance (Shanks et al., 2000).

3.2.8 Vendor Support

The implementation process may be supported by some factors external to the organization such as vendors' support. Vendor support represents an important factor with any packaged software including extended technical assistance, emergency maintenance, updates, and special user training. Organizations should optimize the vendor support that best serves the implementation process (Rasmy et al., 2005). In choosing the package, vendor support and the number of previous implementers should be taken into account (Roberts and Barrar, 1992). Sumner (1999) identified that the

risks of ERP project failures may be contained by acquiring external expertise through vendors and consultants. User satisfaction is a critical factor for the successful ERP system implementation. ERP system success is measured in terms of user satisfaction (Thavapragasam, 2003).

3.2.9 Project Scope and Definition

The organization must carefully define why the ERP system is being implemented and what critical business needs the system will address. It is important to set the objectives and goals prior to ERP systems implementation. There must also be clear definitions of goals and expectations. Clear goals and objectives are essential to guide an ongoing organizational effort for ERP implementation. Pointo and Slevin (1996) graded clear goals and objectives as the third most critical success factor in his research study. For the successful ERP implementation, project scope and definition is a critical success factor.

3.2.10 Championship/Leadership/Team lead

The past research findings support that the role of a champion (Shanks and Parr et al., 1999) and team lead (Koh et al. 2000; Bingi et al., 1999) are most critical for successful ERP implementation. For any project, there should be a project leader to manage and properly utilize the resources available to run the project successfully. According to Beath (1991), the IT champions are managers who actively promote their vision for using information technology to overcome implementation hurdles. A business leader should be in charge of the project and the project leader should "champion" the project throughout the organization (Sumner, 1999). ERP teamwork and champion have been found critical among different factors studied (Nah et al., 2001). Committed leadership is reported to be critical towards ERP implementation success (Sarker and Lee, 2000). Mousseau (1998) mentioned that "team lead is the most critical resource" who has "credibility" possesses "technical knowledge" as well as "business knowledge," and is able to motivate team members and resolve conflicts among stakeholders.

3.2.11 Data Accuracy

Enterprise Resource Planning (ERP) systems automate core enterprise activities such as human resources, manufacturing finance and supply chain management. All the

modules of the ERP system are integrated, so imprecise data input into one module will negatively affect the functioning of other modules; ERP systems will show erroneous or ambiguous results (Sum, 1995). The need of data consistency and data accuracy is stressed in ERP systems. Data accuracy is a major determinant of ERP success (Markus et al., 2000).

3.2.12 Professional Manpower/ERP Team

ERP implementation team comprises functional personnel and management, IT personnel and management, top management, IT consultants, ERP vendor, parent company employees, management consultants, and hardware vendor (Esteves, 2003). ERP team should consist of the best people for successful implementation of ERP system in the organization (Buckhout et al., 1999, Rosario, 2000; Wee, 2000). The team should be given compensation and incentives for successfully implementing the system on time and within the assigned budget. The business and technical knowledge of the team members is essential for ERP success (Bingi et al., 1999; Sumner, 1999). The sharing of information particularly between the implementation partners and between partnering companies is vital and requires partnership trust (Stefanou, 1999). Shanks and Parr et al. (2000) mentioned that a balanced implementation team is necessary for ERP implementation success. ERP implementation requires a qualified and a balanced multifunctional team composed of members with a variety of skills from different areas (Willcocks and Sykes, 2000; Woo, 2007).Estevez (2003) conducted a survey and found that competent members in the project team are the fourth most important success factor for ERP implementation.

3.2.13 Company Wide Support

Within an organization various work processes dealing with Human Resource Management (HRM), Material Management, Financial Accounting etc are common. ERP solutions cover business process of the whole enterprise. An ERP system covers all such functional areas of the organization and maintains the whole data. So it is necessary to get support from all areas of the organization for ERP systems' successful implementation (Sum, 1995).

3.2.14 Legacy System

Legacy systems are the IS systems that were in use prior to the ERP implementation that encapsulate the existing business processes, organization structure, culture and Information Technology (Holland et al, 1999). They are a good source of information for implementing ERP systems in an organization (Esteves, 2000), however, there is a need to decide which legacy systems will be replaced with an ERP. Holland and Light (1999) found in their study that ERP strategy; Business Process Change, Software Configuration and Legacy Systems have critical influence on the successful ERP system implementation.

3.2.16 Software Configuration:

The configuration of the Software concerns adoption of the generic functionality of a package to the needs of a particular organization (Markus et al., 2000 cited in Esteves-Souza and Pastor-Collado, 2000). Software Configuration plays an important role in the success of ERP system implementation (Holland and Light, 1999). The ERP packages may be configured to closely fit an enterprise's business processes (Chalmers, 1999 cited in Kim et al., 2005). Finney and Corbett (2007) mentioned that BPR and software configuration has the 3rd most commonly cited critical success factors.

3.2.17 ERP Implementation Strategy

ERP strategy is related with how the software should be implemented. There exist different approaches for the implementation of ERP strategy. The "skeleton" implementation is phased whereas the "big-bang" offers full functionality all at once. These two extremes and the strategies in between each have their advantages and disadvantages that must be considered (Esteves-Souza and Pastor-Collado, 2000). An adequate ERP implementation strategy needs to be adopted. ERP implementation strategy has an influence for successful ERP system implementation (Holland and Light, 1999).

3.2.18 Users' Acceptance

User acceptance of a system was a well accepted surrogate measure of IS success in the past research. User acceptance and adoption of Information System is a critical factor for successful EPP system implementation (Aiken and Sullivan, 2002; Kakumanu and Mezzacca, 2005). The success of an ERP system is heavily dependent on its usage and it may only be possible if users accept the system. User acceptance is a key factor of ERP system implementation (Finney & Corbett, 2007) and consequently, its success (Vathanophas, 2007). According to Kumar et al. (2002), the change management may build user acceptance towards an ERP system. Some researchers advocate that user acceptance should involve securing the support of strategic management throughout the organization (Aladwani, 2001 cited in Finney & Corbett, 2007). The organization should adopt an implementation process that may lead to user acceptance (Magnusson et al., 2004). Woo (2005) mentioned that user acceptance depends on an adequate training of the users. The Technology Acceptance Model – TAM (Davis, 1989) has been adopted by researchers to measure the acceptance of ERP using a set of influencing factors such as perceived usefulness, ease of use, network effects and costs (Moller and Remus, 2006). User acceptance of ERP systems may increase when the users perceived to be competent, friendly, and to emphasize service (Bowman et al., 1993). User acceptance seems to be a good indicator for ERP system's success.

3.2.19 Schedule of Deliverable

The past research findings show that majority of the project fail to due to schedule and budget overruns. The projects fail to complete activities within time. There should be a well-defined schedule for all the activities involved in the ERP implementation with an appropriate allocation of budget and resources. Unrealistically short schedule would result in the implementation being carried out in a haphazard manner. Timelines of the project should be managed (Rosario, 2000). An organization should control the implementation process in order to avoid overrun of budget and ensure the implementation within schedule. There is a need to monitor and control the time and costs, plan/schedule review, whenever justified (Esteves, 2000). Others stated that deadline of the project should be met to help stay within schedule and budget (Wee, 2000).

3.2.20 Minimal Customization

Organizations may change the business processes to fit the software with minimal customization (Holland et al., 1999; Roberts and Barrar, 1992). Summer (1999) emphasized that ERP software should not be modified. Modifications should be avoided to reduce errors and to take advantage of newer versions and releases (Rosario, 2000). Process modeling tools help customizing business processes without changing the software code (Holland et al., 1999).

3.2.21 Experience Consultants

The implementation of an ERP system is complex so it requires the use of either internal or external experts who may have knowledge about the installation of software. Many companies prefer to have consultants to perform ERP implementation. Shanks and Light (2000) revealed that ERP consultants may be involved in different stages of the ERP project implementation. It may be a critical success factor that needs to be managed and monitored very carefully (Somers et al., 2003).

3.2.22 Risk Management

The implementation of ERP system is a complex activity and it involves a possibility of occurrence of events. Therefore, risk management is needed to minimize the impact of unplanned/ unexpected incidents by identifying and addressing potential risks before they might occur. The risk of project failure may be reduced if the appropriate risk management strategy is followed (Bhatti, 2005). The uncertainties, liabilities or vulnerabilities that may cause the project to deviate from the defined plan may be considered ERP implementation risks. Risk management may help in handling unexpected crises and deviation from the plan (pinto and Slevin, 1996).

4.2.24 Suitable IT Infrastructure

An adequate IT infrastructure, hardware and networking are crucial for an ERP system's success. The organization should have a clear understanding of the existing legacy environment and the technological aspects involved in the implementation of the ERP system (Al-Mashari et al, 2003; Hong & Kim, 2002; Umble et al, 2003). The ERP implementation involves a complex transition from legacy information systems and business processes to an integrated IT infra-structure. Hardware selection is driven by the firm's choice of an ERP software package. The ERP software vendor generally

CHAPTER 4

RESEARCH METHODOLOGY

4.1 **Choosing a Research Method**

Research is the application of systematic techniques and methods to find the answers to questions. Qualitative and quantitative research paradigms are choices for a research methodology. Quantitative research as viewed as objective while qualitative research is said to take subjective viewpoint. In a broader spectrum, one may say that qualitative research involves analysis of words whereas quantitative research involves analysis of numerical data. At the outset of planning a piece of research work, the most important decision on the part of a researcher is to choose appropriate research method(s) or approaches that best suite the research question or idea that he/she is likely to address. (Flower, 1998; Nachmias & Nachmias, 1992; Yin, 1994).

Different research strategies have different ways to collect and analyze empirical evidence however each strategy has its own limitations. The researchers believe that research strategy, such as case studies is only appropriate for exploratory study of investigation whereas, surveys are more appropriate for the descriptive study (Shaveson & Townes, 2002 cited in Yin, 1994). The researcher should have clear understanding of the problem that needs to be answered. If the phenonomena under study can be measured in some way then a quantitative study seems to be more appropriate (Flower, 1998; Yin, 1994).

Each type of empirical research has a research design which is the logical sequence that connects the empirical data to a study's initial research questions and ultimately to its conclusion (Yin, 1994). The research design guides a researcher in the process of collecting, analyzing and interpreting his observations. It allows the researchers to find casual relations among the variables under investigations (Nachmias & Nachmias, 1992). Our research endeavor is to explore critical success factor for successful ERP implementation in various organizations. Keeping in view the research questions mentioned in chapter-1, survey based research has been chosen as a research strategy. It's a way to collect information by asking people questions and their answers constitute the data to be analyzed. Survey method does not restrict to study the phenomena in a

single organization but provides means of collecting information from people in different organizations in order to find answers to questions for a quantitative analysis leading to conclusions.

4.2 Survey as a Research Method

A survey is a method of collecting information directly from people about their ideas and feelings. The survey designed approach is asking questions about some phenomena. A survey can be a self-administered questionnaire that someone fills out alone or with some assistance.

Questionnaire based approach consists of a set of questionnaire which is prepared by the researcher in two phases. In the first phase questionnaire is prepared and distributed for pilot survey through any approachable means of communication. The respondents provide the responses against the questionnaire. The number of the respondents in the pilot phase depends upon the size of the actual survey population which will be taken in future. It is recommended that 20-30 percent of the whole survey population may be considered to conduct pilot study. The pilot survey may help to dig out bugs if any in the questionnaire as well as the responses. It needs to be resolved first before taking the actual survey.

4.3 Preparation and validation of Questionnaire

The researchers recommend that the following considerations should be adopted during the preparation of a questionnaire (Flower, 1998).

- The questions are prepared with the concentration that the respondent can answer them easily.
- Questionnaire is developed in such a manner as every question has the same meaning for all the respondents.
- Closed questions may provide better and clear response (Flower, 1998).

In our research survey method is used to examine the Critical Success Factors for successful ERP system implementation. We developed a questionnaire consisting of 24 potential factors regarding ERP implementation success. However, to ensure that a comprehensive list of factors is included in the questionnaire, the past research findings about the critical success factors were reviewed.

To collect individuals' opinion about their agreement or disagreement with the questionnaire items mentioning critical success factor for ERP systems implementation success, a five-point Likert-type scale ranging from 1 (Definitely Disagree) to 5 (Definitely agree) is used. The advantages of Likert-Type scale are easy to use and interpret, and it gives precise result (Kosecoff, 1998).

Scale Number	Category
5	Definitely agree
4	Mostly agree
3	Neither agree or disagree
2	Mostly disagree
1	Definitely Disagree

4.3.1 FIELD SURVEY

The next phase of testing our survey instrument is a field survey. For this phase, we attempted to approach managers in various organizations in Pakistan who have implemented or in the process of implementing ERP systems. In addition to mail survey, we visited personally (about 75% of the sample survey) in different organizations in order to collect the data through questionnaire.

4.3.1.1 Factor Analysis

Factor Analysis may be used as an expedient way of asserting the minimum hypothetical factors that may account for the observed variation and as a source of exploring for possible data reduction. An exploratory factor analysis needs to be carried out to purify the instrument. After performing the Pilot survey, the questionnaire was validated using the factor analysis techniques in SPSS software. Factor analysis was used to purify our instrument consisting of 24 items (i.e. questions) initially designed. The data from 40 responses were included in doing factor analysis. After extraction 10 items were deleted. Cronbach Alpha (defined at Annexure-IV) value was calculated. Detailed discussion is available in the next chapter.

4.3.1.2 Reliability Analysis

A reliable instrument yields the same results every time. It is used to measure the same object assuming that the object itself has not changed. The reliability refers to the

accuracy of the measuring instrument and the extent to which the respondents can answer the same or approximately the same questions the same way each time (Straub, 1989). The internal consistency reliability was also measured by calculating Cronbach's alpha and its value greater or equal to 0.7 is generally is considered acceptable (Kerlinger, 1973 cited in Law and Ngai, 2007). The reliability results are presented in the next chapter.

4.3.1.3 Content Validity

The content validity of a questionnaire is the manner by which items are refined, so questionnaire should be clearly understandable. In order to improve the content validity , reviews were carried out with the practitioners and experts. Kayrooz and Trevitt (2006) mentioned that testing a questionnaire by piloting is rewarding. Their suggestions further refined the questionnaire in terms of the wording and flow of the items. Content validity reflects the items content domain. Content validity means how comprehensive the items were in creating the scale (Hong and Hong, 2001).

4.3.1.4 Construct Validity Analysis

Construct validity is established by explaining, that the instrument measures the construct for which it is developed. Correlation and factor analysis are the ways to examine construct validity. Construct validity is proportional to high correlation. It helps to examine relative strength of the correlation between items mentioned in the instrument designed to measure the construct. The correlation among the items is calculated by using the sample collected from the survey. The detail is available in the next chapter.

CHAPTER 5

DATA COLLECTION AND RESEARCH FINDINGS

5.1 ERP in Organizations

Today, the organizations are endeavoring to have advantage over their competitors by using Information and Communications Technology (ICT) facilities and adopting ERP solutions. The organizations need ERP for managing their work processes, resources and to coordinate its various activities. ERP is one of the solutions that help organizations to reduce costs and manual processing, integrate operations, and streamline the information flow in an enterprise. ERP includes various modules such as supply chain, financials, customer relationship management, human resources management etc. and are useful for people working in specific industries. ERP systems are being implemented in various sectors in Pakistan. The type of industries that have implemented ERP solutions in Pakistan, and are included in our survey is as under:

Industry
Manufacturing
Government
Natural Gas
Utility
Health Care
Communication

Table 5.1

Data Collection

5.1.1 Pilot study and Instrument Validation

A pilot study is carried out to validate the instrument developed for our research. The detail of questionnaire is available at Annexure-I. The questionnaire consisting of twenty four questions related to success factors for ERP implementation was built and sent to 55 managers in different organizations. However, 40 useable questionnaires were returned by the managers. The response rate was 72%. The sample is used in doing Factor Analysis. Statistical Program for Social Scientists (SPSS) is used to conduct factor analysis using principal component method. The results are as under:

Component Matrix [a]

	Component			
	1	2	3	4
TopManagement	.861	-.330	.039	.009
ProfessionalManPower	.895	-.020	.034	-.037
ProjectScopeDefination	.846	-.274	-.213	.074
ChangeManagmenrt	.820	-.253	.004	.011
Training	.733	-.295	.080	.001
KnowledgeOfLegacy	.035	.157	.143	-.102
ProjectSchedual	.009	-.068	.276	.530
UserInvolvement	.806	-.264	-.275	.048
EffectiveCommunication	.842	-.294	.062	.044
ERPImplementation Stretagies	.167	.112	.213	-.215
UserAcceptance	.829	-.262	-.267	.057
SuitableIT	-.053	-.098	.155	.349
SelectionERPPackage	.885	.127	.056	-.044
OrganizationalCulture	.796	.503	.077	.102
RoleofTeamLead	.805	.498	-.027	.040
BussinessProcessRe Engineering	.841	.072	-.039	-.008
DataAccuracy	-.028	-.130	.543	.315
MinimalCustomizationOf SWP	.398	-.070	.390	-.287
VenderSupport	.808	.494	.005	.114
ExpirenceCulsultent	.456	-.356	.321	-.063
MonitoringFeedBack	-.060	.097	.530	.255
ExperienceofFirmIT	.012	.228	-.331	.309
RiskManagement	.230	.096	.254	-.695
SoftwareConfiguration	.843	.477	.048	.053

Extraction Method: Principal Component Analysis.

a. 4 components extracted.

Table 5.1

The value of Cronbach Alpha for 10 items is observed less than 0.70 in table 5.1. These items were removed from the questionnaire leaving 14 items in the questionnaire to be used in our study. The detail is as under:

Communalities

	Initial	Extraction
TopManagement	1.000	.952
ProfessionalManPower	1.000	.936
ProjectScopeDefination	1.000	.926
ChangeManagmenrt	1.000	.795
Training	1.000	.686
UserInvolvement	1.000	.946
EffectiveCommunication	1.000	.945
UserAcceptance	1.000	.972
SelectionERPPackage	1.000	.831
OrganizationalCulture	1.000	.917
RoleofTeamLead	1.000	.926
BussinessProcessRe Engineering	1.000	.912
VenderSupport	1.000	.938
SoftwareConfiguration	1.000	.976

Extraction Method: Principal Component Analysis.

Table 5.2

The details of the validated instrument are available at Annexure-II. The questionnaire was sent through mail to 202 managers of different organizations which either are implementing the ERP systems or have implemented ERP systems recently. Only 116 usable questionnaires were received, so included in data analysis. The response rate was 57%. The designations of the respondents were senior project managers, project manager, business process reengineering specialist, master trainers, master scheduler, production and inventory manager, material handling manager, and production manager.

5.1.1.1 Reliability Analysis

The items with Cronbach Alpha value > 0.70 were considered in our instrument. An item that meets the criteria (i.e. Cronbach Alpha > 0.70) is reliable as shown in the table 5.2 that reliability of each factor is above 0.70.

5.1.1.4 Construct Validity Analysis

The correlation matrix mentioned below represents the relationships among various ERP success factors. The relative strength of the correlation between ERP implementation success factors construct is quiet interesting. The entire critical success factor is strongly correlated with each other in the ERP implementation process. The table 5.4 shows the strong correlation of factors. The complete correlation matrix is placed at Annexure-III. This correlation matrix computes the correlation coefficients of the columns of a matrix. That is, row i and column j of the correlation matrix is the correlation between column i and column j of the original matrix. The diagonal elements of the correlation matrix will be 1 since they are the correlation of a column with itself. The correlation matrix is also symmetric since the correlation of column i with column j is the same as the correlation of column j with column i. If take a row with factor "user acceptance" and the column with "user involvement" having correlation coefficient 0.944, which a strong correlation between user acceptance and user involvement.

Factors	Strong Correlation		
	1st	2nd	3rd
Top Management	Effective Communication	Change Management	Project Scope Definition
	(0.947)	(0.784)	(0.771)
Professional Man Power	Business Process Reengineering	Selection of ERP Package	Change Management
	(0.915)	(0.825)	(0.777)
Project Scope Definition	User Acceptance	User Involvement	Top Management
	(0.919)	(0.869)	(0.771)
Change Management	Top Management	Professional Man Power	Project Scope Definition
	(0.784)	(0.777)	(0.751)
Training	Change Management	Top Management	Effective Communication
	(0.686)	(0.684)	(0.644)
User involvement	User Acceptance	Project Scope Definition	Effective Communication
	(0.944)	(0.869)	(0.728)
Effective Communication	Top Management	User Acceptance	User Involvement
	(0.947)	(0.730)	(0.728)
User Acceptance	User Involvement	Project Scope Definition	Top Management
	(0.944)	(0.919)	(0.768)
Selection of ERP Package	Software Configuration	Professional Man Power	Vendor Support
	(0.829)	(0.825)	(0.781)
Vendor Support	Software Configuration	Role of Team Lead	Organizational Culture
	(0.945)	(0.915)	(0.901)
Organizational Culture	Software Configuration	Vendor Support	Role of Team Lead
	(0.944)	(0.901)	(0.891)
Role of Team lead	Software Configuration	Vendor Support	Organizational Culture
	(0.942)	(0.915)	(0.891)
Business Process Reengineering	Professional Man Power	Selection of ERP Package	Project Scope Definition
	(0.915)	(0.772)	(0.684)
Software Configuration	Vendor Support	Organizational Culture	Role of Team Lead
	(0.954)	(0.944)	(0.942)

** **Correlation is significant at the 0.01 level (2-tailed).**

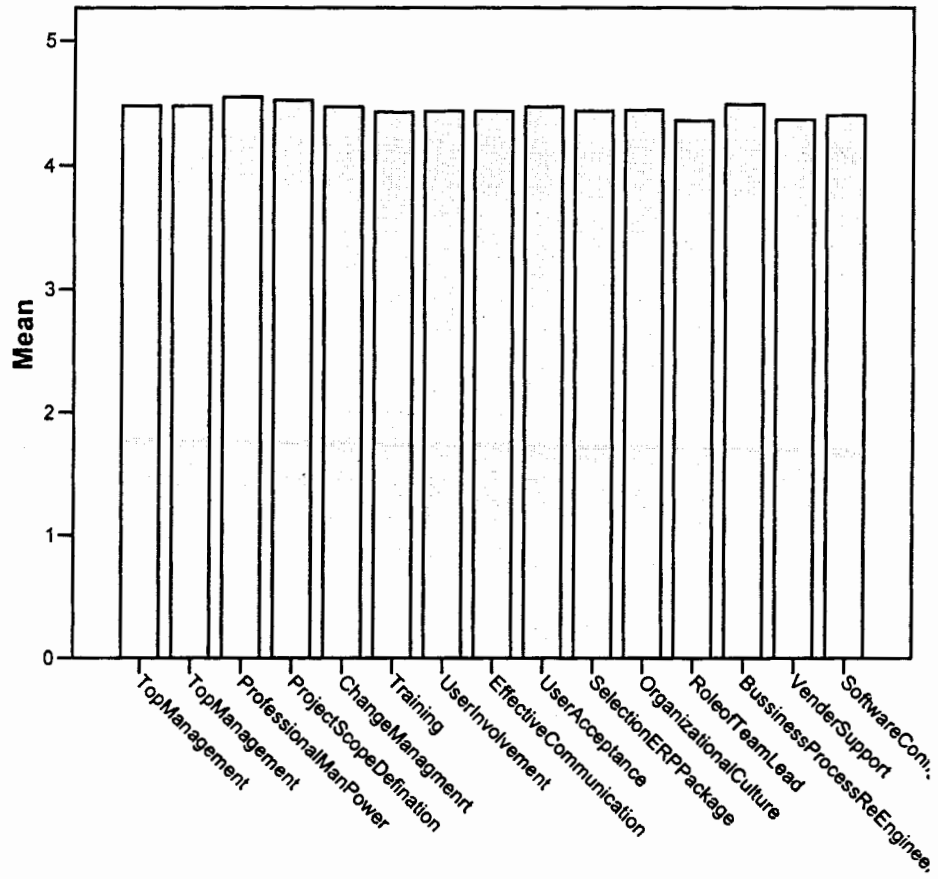
Table 5.4

5.2 Mean Ranking of CSFs

The Critical Success Factors were ranked by calculating means of the responses collected. The findings are as under :

CSF	Mean
Professional Man Power	4.55
Project Scope Definition	4.53
Business Process Re Engineering	4.49
Top Management	4.48
Change Management	4.47
User Acceptance	4.46
Organizational Culture	4.45
User Involvement	4.44
Selection of ERP Package	4.43
Effective Communication	4.42
Training	4.40
Software Configuration	4.38
Vender Support	4.37
Role of Team Lead	4.36

Table 5.5



The top five CSF found in our research are mentioned in the following table 5.6. Among the top 5 factors, the mean value of Professional Man Power is 4.55 (the top most), whereas Change Management was found at 5th position having mean value 4.47 as under:

CSF	Mean
Professional Man Power	4.55
Project Scope Definition	4.53
Business Process Re Engineering	4.49
Top Management Support	4.48
Change Management	4.47

Table 5. 6

5.3 Research Findings & Conclusion

The major objective of this research is to improve the understanding of critical factors affecting ERP implementation success in Pakistan. With this understanding, the

organizations, users, management and system developers may learn a lesson and concentrate on these factors during ERP Implementation in organizations.

A total of twenty four critical success factors related to ERP implementation have been identified based on the review of past research findings. A questionnaire (i.e. an instrument) consisting of 24 questions encompassing all the aspects mentioned in chapter-3 was developed to use in our pilot study. A pilot survey was conducted using this instrument. In our pilot study, forty usable questionnaires were received and used for Factor Analysis. SPSS for windows is used to do factor analysis. Among 24 items mentioned in the instrument, 10 items were discarded on the basis of value of Cronbach alpha < 0.70. The list of items discarded is as under:

Item detail	Cronbach Alpha < 0.70
Data accuracy	.543
Legacy system	.157
Schedule of deliverable	.530
Minimal customization	.398
Experience consultants	.456
Monitoring & feedback	.530
Risk management	.254
Firm IT maturity	.309
ERP Implementation strategy	.213
Suitable IT Infrastructure	.349

Table 5. 7

The detail of the items retained in the instrument after its validation is available at Annex-2. Afterwards, a survey was conducted for our research. Factors affecting ERP implementation are very complex so, a survey may be an ideal method for researchers in the ERP field.

Despite the growing importance of ERP in developing countries, it is perhaps surprising that the literature to date is relatively sparse. However, most of the studies regarding ERP implementation success factors have been conducted in USA and Europe. To be more specific, hardly any research study on Critical success factors in ERP system implementation had addressed this issue in Pakistan. This research will thus add to the growing body of knowledge on ERP implementations in Pakistan.

Professional Man Power, Project Scope Definition, Business Process Re-Engineering Top Management, Change Management, User Acceptance and Organizational Culture have been the most critical success factors for ERP implementation in Pakistan by the empirical data. The data analysis proves the significance of CSF in ERP implementation. These factors have a critical influence on the implementation process and outcome.

Past research findings show the top management support as the most critical success factor (Rasmy et al., 2005; Keil et al, 1998; Wierda, 2003; Woo, 2007). Yingjie (2005) mentioned the top management support and the suitability of software and hardware with an average value of 3.80 as the top most Critical Success Factors among six factors considered in his research. Similarly, however, our research findings showed professional manpower and project scope definition as the top most critical with a mean value of 4.55 and 4.53 respectively among 14 factors found as critical. Moreover, it is also observed that professional manpower and project scope definition are strongly correlated ($r = 0.744$).

Rasmy et al. (2005) concluded that vendor support does not show any effect on the ERP system implementation in Egypt. However, our research findings support that vendor support is one of the top ten most Critical Success Factor for ERP system implementation in Pakistan.

Thavapragasam (2003) also mentioned that organization culture is the most critical success factor influencing at the post-implementation stage of ERP. Our research finding reflects that organization culture is a critical success factor but it falls at 7^{th} position in ranking. Rasmy et al. (2005) findings also support that Organizational culture is a critical success factor in ERP implementation.

Our research findings support that the change management, user involvement, professional man power and top management support are most critical success factor for ERP system implementation in Pakistan. Similar findings have been found in the past research (see Meissonier et al.(2006)).

Our research results show project scope and user involvement as critical success factors in ERP implementation success. Similar findings have been found in a study conducted in Sweden and Australia (see Svensson and Aurum(2006)). Similarly, the factors such as change management, top management support, project scope, professional manpower, role of champion, user involvement, consultant, strong communication, user training which appeared critical in our study were in match with factors that had

been found critical in another study conducted in NewZeeland (see Wierda, 2003; Woo, 2007).

Keil et al (1998) mentioned that top management support, user involvement, change in project scope and training are the most critical success factors for ERP system in their study conducted in Hong Kong, Finland and the USA. The same factors are found critical in our research also.Willcocks and Sykes (2000) concluded that role of champion/CIO is the most critical for successful ERP system implementation. According to our research finding professional manpower is the top most critical and the role of champion/CIO is a critical factor at the bottom of the list consisting of fourteen factors.

Among the fourteen most critical success factors found in our research, the following twelve factors are common in developed countries and developing countries like Pakistan.

Top Management Support
User Training
User Involvement
Effective Communication
Change Management
Vendor Support
Project Scope and definition
Leadership
Professional Main Power
User Acceptances
Software Configuration
Selection of ERP

Table 5. 8

However, two factors such as organizational culture and BPR which were found most critical in developing countries like Pakistan have least importance in the developed countries.

The findings regarding secondary questions mentioned in chapter no. 1 are as under:

The findings of the survey lead to the conclusion that user related factors such as user acceptance; user involvement and training are found critical in implementing ERP systems. Within the 14 most critical factors found, the ranking of user related factors are 6, 8, and 11. The ranking of organizational culture is 7 and selection of ERP software is 9 (see table 5.5).The culture of the organization is highly ranked as compared to user involvement, user training and selection of ERP packages.

The findings of our research reflect that top management support is at higher rank as compared to user involvement and training. Similar findings have been found in the past research (see Yingjie, 2005)

5.4 Future Work

The difficulties and high failure rate in implementing ERP systems have been widely cited in the literature (Ramayah, 2007 & Davenport, 1998), but research on critical success factors (CSFs) in ERP implementation efficiency is still fragmented. Therefore, the study of ERP implementation success is one of the major research issues in ERP systems to avoid costly mistakes, and speeds up the way change is managed (Aggestam and Söderström, 2005).

Future work will consist of how these success factors are critical in ERP Implementation among various Pakistan Industries. This will helpful to determine that these critical success factors vary from one industry to another.

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Annexure-I

Research Questionnaire

Critical Success Factors for ERP Implementation in Pakistan

For each statement below, show the extent of your agreement or disagreement about factors in determining the success of ERP system implementation by ticking (√) one box which reflects your current views.

Criticality is defined by ranking them from 5 to 1 as given below.

5. Definitely Agree **4.** Mostly Agree **3.** Neither Agree or disagree

2. Mostly Disagree **1.** Definitely Disagree

For successful implementation of ERP:

The Statement	Ranking Scale
01. Top Management's Support plays a vital role.	☐5 ☐4 ☐3 ☐2 ☐1
02. Professional/Skilled manpower is necessary.	☐5 ☐4 ☐3 ☐2 ☐1
03. The definition of project scope should be clearly defined.	☐5 ☐4 ☐3 ☐2 ☐1
04. Change management is not necessary because resistance from actors is not a main hurdle.	☐5 ☐4 ☐3 ☐2 ☐1
05. Training to the core team members is essential.	☐5 ☐4 ☐3 ☐2 ☐1
06. The knowledge of legacy system is essential for core team members.	☐5 ☐4 ☐3 ☐2 ☐1
07. The schedule of deliverable should be clearly mentioned.	☐5 ☐4 ☐3 ☐2 ☐1
08. User involvement is necessary.	☐5 ☐4 ☐3 ☐2 ☐1
09. The effective communication among stakeholders is essential.	☐5 ☐4 ☐3 ☐2 ☐1
10. The common ERP implementation strategies (Big bang, Phased etc) should be adopted.	☐5 ☐4 ☐3 ☐2 ☐1
11. The acceptance of the system on the part of user is essential.	☐5 ☐4 ☐3 ☐2 ☐1
12. The suitable information technology (Hardware, Network etc) and tools are needed.	☐5 ☐4 ☐3 ☐2 ☐1
13. Selection of ERP software package (BAN, People Soft, SAP etc) is not necessary.	☐5 ☐4 ☐3 ☐2 ☐1
14. The organizational culture should be supportive.	☐5 ☐4 ☐3 ☐2 ☐1
15. The role of team lead is vital.	☐5 ☐4 ☐3 ☐2 ☐1
16. Business process reengineering is essentially needed.	☐5 ☐4 ☐3 ☐2 ☐1
17 The high quality data is needed when data is loaded from existing legacy system.	☐5 ☐4 ☐3 ☐2 ☐1
18. The Minimal Customization (modification) of software process is needed.	☐5 ☐4 ☐3 ☐2 ☐1
19. The consistent and long term vendor support is not necessary.	☐5 ☐4 ☐3 ☐2 ☐1
20. The experienced consultant's team is necessary.	☐5 ☐4 ☐3 ☐2 ☐1
21. The Monitoring and feedback during the implementation of ERP is needed.	☐5 ☐4 ☐3 ☐2 ☐1
22. The experience of the firm in "IT" contributes nothing.	☐5 ☐4 ☐3 ☐2 ☐1
23. The Risk Management (The ERP implementation project risks are described as uncertainties, liabilities, and vulnerabilities) is not essential.	☐5 ☐4 ☐3 ☐2 ☐1
24. The Software configuration (enabling the required functionality embedded with the ERP system) is not needed.	☐5 ☐4 ☐3 ☐2 ☐1

Please fill in your details in the following table.

Name, age, and Designation.	
Company Name and industry type.	
ERP System Name implementing/implemented in your organization.	
No. of employees in your Organization	
Annual revenue of your Organization	
E-Mail Address.	

Annexure-II

Research Questionnaire

Critical Success Factors for ERP Implementation in Pakistan

For each statement below, show the extent of your agreement or disagreement about factors in determining the success of ERP system implementation by ticking (√) one box which reflects your current views.

Criticality is defined by ranking them from 5 to 1 as given below.

5. Definitely Agree **4.** Mostly Agree **3.** Neither Agree or disagree

2. Mostly Disagree **1.** Definitely Disagree

For successful implementation of ERP:

The Statement	Ranking Scale
01. Top Management's Support plays a vital role.	☐5 ☐4 ☐3 ☐2 ☐1
02. Professional/Skilled manpower is necessary.	☐5 ☐4 ☐3 ☐2 ☐1
03. The definition of project scope should be clearly defined.	☐5 ☐4 ☐3 ☐2 ☐1
04. Change management is not necessary because resistance from actors is not a main hurdle.	☐5 ☐4 ☐3 ☐2 ☐1
05. Training to the core team members is essential.	☐5 ☐4 ☐3 ☐2 ☐1
06. User involvement is necessary.	☐5 ☐4 ☐3 ☐2 ☐1
07. The effective communication among stakeholders is essential.	☐5 ☐4 ☐3 ☐2 ☐1
08. The acceptance of the system on the part of user is essential.	☐5 ☐4 ☐3 ☐2 ☐1
09. Selection of ERP software package (BAN, People Soft, SAP etc) is not necessary.	☐5 ☐4 ☐3 ☐2 ☐1
10. The organizational culture should be supportive.	☐5 ☐4 ☐3 ☐2 ☐1
11. The role of team lead is vital.	☐5 ☐4 ☐3 ☐2 ☐1
12. Business process reengineering is essentially needed.	☐5 ☐4 ☐3 ☐2 ☐1
13. The consistent and long term vendor support is not necessary.	☐5 ☐4 ☐3 ☐2 ☐1
14. The Software configuration (enabling the required functionality embedded with the ERP system) is not needed.	☐5 ☐4 ☐3 ☐2 ☐1

Please fill in your details in the following table.

Name, age, and Designation.	
Company Name and industry type.	
ERP System Name implementing/implemented in your organization.	
No. of employees in your Organization	
Annual revenue of your Organization	
E-Mail Address.	

Appendix

Principle Components Analysis

Principal components analysis is a method of method of factor extraction. Others methods are, unweighted least squares, generalized least squares, maximum likelihood, principal axis factoring, alpha factoring, and image factoring. Principal components analysis is a technique that requires a large sample size. Principal components analysis is based on the correlation matrix of the variables involved, and correlations usually need a large sample size before they stabilize. Tabachnick and Fidell (2001, page 588) cite Comrey and Lee's (1992) advise regarding sample size: 50 cases is very poor, 100 is poor, 200 is fair, 300 is good, 500 is very good, and 1000 or more is excellent. As a rule of thumb, a bare minimum of 10 observations per variable is necessary to avoid computational difficulties.

Cron Bach' Alpha Value

This is a model of internal consistency, based on the average inter-item correlation. Cronbach's alpha is an index of reliability associated with the variation accounted for by the true score of the "underlying construct." To check reliability of resulting scales. Construct is the hypothetical variable that is being measured (Hatcher, 1994). Alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e., rating scale: 1 = poor, 5 = excellent). The higher the score, the more reliable the generated scale is. Nunnaly (1978) has indicated 0.7 to be an acceptable reliability coefficient but lower thresholds are known as problem items that should be excluded from the scale sometimes used in the literature.

Correlations

		TopManagement	ProfessionalManPower	ProjectScopeDefination	ChangeManagmenrt	Training	UserInvolvement	Effective Communication	UserAcceptance	SelectionERPPackage	OrganizationalCulture	RoleofTeamLead	Bussiness ProcessReEngineering	VenderSupport	SoftwareConfiguration
TopManagement	Pearson Correlation	1	.746(**)	.771(**)	.784(**)	.684(**)	.720(**)	.947(**)	.768(**)	.681(**)	.523(**)	.531(**)	.656(**)	.541(**)	.560(**)
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
ProfessionalManPower	Pearson Correlation	.746(**)	1	.744(**)	.777(**)	.652(**)	.625(**)	.695(**)	.671(**)	.825(**)	.647(**)	.650(**)	.915(**)	.659(**)	.697(**)
	Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
ProjectScopeDefination	Pearson Correlation	.771(**)	.744(**)	1	.751(**)	.642(**)	.869(**)	.714(**)	.919(**)	.632(**)	.509(**)	.554(**)	.651(**)	.538(**)	.556(**)
	Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
ChangeManagmenrt	Pearson Correlation	.784(**)	.777(**)	.751(**)	1	.686(**)	.618(**)	.727(**)	.670(**)	.634(**)	.522(**)	.528(**)	.684(**)	.515(**)	.559(**)
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Training	Pearson Correlation	.684(**)	.652(**)	.642(**)	.686(**)	1	.627(**)	.644(**)	.605(**)	.594(**)	.460(**)	.430(**)	.625(**)	.442(**)	.491(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
UserInvolvement	Pearson Correlation	.720(**)	.625(**)	.869(**)	.618(**)	.627(**)	1	.728(**)	.944(**)	.618(**)	.524(**)	.547(**)	.570(**)	.533(**)	.560(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
EffectiveCommunication	Pearson Correlation	.947(**)	.695(**)	.714(**)	.727(**)	.644(**)	.728(**)	1	.730(**)	.665(**)	.553(**)	.552(**)	.622(**)	.563(**)	.586(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
UserAcceptance	Pearson Correlation	.768(**)	.671(**)	.919(**)	.670(**)	.605(**)	.944(**)	.730(**)	1	.649(**)	.527(**)	.559(**)	.595(**)	.544(**)	.567(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
SelectionERPPackage	Pearson Correlation	.681(**)	.825(**)	.632(**)	.634(**)	.594(**)	.618(**)	.665(**)	.649(**)	1	.767(**)	.770(**)	.772(**)	.781(**)	.829(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
OrganizationalCulture	Pearson Correlation	.523(**)	.647(**)	.509(**)	.522(**)	.460(**)	.524(**)	.553(**)	.527(**)	.767(**)	1	.891(**)	.648(**)	.901(**)	.944(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
RoleofTeamLead	Pearson Correlation	.531(**)	.650(**)	.554(**)	.528(**)	.430(**)	.547(**)	.552(**)	.559(**)	.770(**)	.891(**)	1	.636(**)	.915(**)	.942(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.000	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
BussinessProcessReEngineering	Pearson Correlation	.656(**)	.915(**)	.651(**)	.684(**)	.625(**)	.570(**)	.622(**)	.595(**)	.772(**)	.648(**)	.636(**)	1	.672(**)	.690(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.000

VenderSupport	Pearson Correlation	.541(**)	.659(**)	.538(**)	.515(**)	.442(**)	.533(**)	.563(**)	.544(**)	.781(**)	.901(**)	.915(**)	.672(**)	1	.954(**)
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.	.000
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116
SoftwareConfiguration	Pearson Correlation	.560(**)	.697(**)	.556(**)	.559(**)	.491(**)	.560(**)	.586(**)	.567(**)	.829(**)	.944(**)	.942(**)	.690(**)	.954(**)	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.
	N	116	116	116	116	116	116	116	116	116	116	116	116	116	116

** Correlation is significant at the 0.01 level (2-tailed).

Eigenvalue

An eigenvalue is a "cutoff point" - any factor should account for at least the variance of a single variable. If not, its eigenvalue is less than 1.0 and it is dropped. The value used in deciding how many components to be retained is called eigenvalue. One handy rule of thumb is to retain only components with eigenvalues of one or more. The components with eigenvalue less than 1 are not retaining.