CHAPTER (3)

RESEARCH METHODOLOGY

3.0. Introduction

This chapter consists of eight sections which discuss and present the research methodology of the current study. The first section points to the research design including the purpose of the study, study setting, population of interest, unit of analysis, sampling frame and the sampling method selected for this study. In the second section, an ERP implementation success model is developed based on an analysis of previous research and the objective of this study. The third section discusses the operational definitions and measurement of variables. Research hypotheses are developed in next section. In section five, a survey questionnaire is designed based on the principals of the wording and appearance of the questionnaire. Section six assesses the validity and reliability of the questionnaire through expert judgment and a pilot test. In section seven, the way in which the questionnaire was distributed among the target population is explained. Finally, the data analysis techniques used including structural equation modeling (SEM) methodology, measurement model assessment, discriminant validity, convergent validity, confirmatory factor analysis (CFA), and structural model assessment are discussed in the last section.

3.1. Research Design

To undertake research and to handle information, researchers are expected to carefully select an appropriate underlying assumption of conducting research or paradigm, a research methodology, and a set of methods for collecting and analysing their data. A number of authors suggest procedures for selecting a research design. Sarantakos (1998), for example, proposes three related steps i.e. select an appropriate paradigm, select a methodology, and then select a set of methods. Guided by the procedures referred to above, this study has been designed in three steps including selection of a research paradigm, selection of an approach (quantitative or qualitative), and selection of a methodology.

3.1.1. Research Paradigm

Prior to choosing the research approach, it is necessary to consider some underlying assumptions about how to perceive knowledge and how to acquire it. Iivari et al. (1998) have developed a now widely accepted paradigmatic framework, which proposes four major paradigmatic assumptions:

- Ontology refers to the structure and properties of what is assumed to exist.
- Epistemology is concerned with the nature of knowledge and how knowledge can be obtained.
- Research methodology refers to the procedures or research methods that are used to acquire knowledge.
- Ethics refers to assumptions about the responsibility of a researcher for the consequences of his or her research approach and its results.

Based on epistemological assumptions or in other words underlying assumptions about how knowledge can be obtained, Myers (1997) proposed three categories: positivist,

interpretivist and critical. It is arguable that these three paradigms can be adopted independently or in combination. On the other hand, Iivari et al. (1998) distinguish between positivism and anti-positivism.

This research attempts to test universal laws about social phenomena, i.e. organizational factors affecting ERP implementation success. So, this study is considered as a positivist study. The positivist researcher views the social world as the world of natural phenomena. In other words, it is assume that social reality, such as attitudes, satisfaction, beliefs and behaviours can be objectively measured through the use of traditional scientific methods by independent observers (outsiders). As a result, this study typically uses quantitative measurement and statistical analysis. According to Orlikowski and Baroudi (1991), for IS research to be considered as positivist, there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population.

3.1.2. Research Approach

Research approaches are generally categorized as either quantitative or qualitative (Neuman, 1997). These two approaches are known as the scientific empirical tradition and the naturalistic phenomenological approaches, respectively (Burns, 1997). The appropriateness of using quantitative or qualitative approaches depends on a particular research paradigm (Sale et al., 2002; Yauch & Steudel, 2003), or a set of assumptions. A positivist paradigm typically uses a quantitative approach, whereas an interpretive paradigm traditionally uses a qualitative approach. Crotty (1998) insists that the distinction between quantitative and qualitative approaches occurs at the level of methods, or type of data employed. It does not occur at the level of epistemology, or theoretical perspectives. He also contends that method is a technique or procedure used to gather and analyse data.

Similarly, in view of the data presentation, as Yauch and Steudel (2003) discuss, quantitative methods such as surveys or other measurements produce data in the form of numbers, whereas qualitative methods such as interviews, focus groups or participant observation collect individual words. The quantitative approach is based on a scientific method for data collection and analysis in numerical form, a perspective based on positivism or objectivism. The quantitative approach typically tends to learn 'what' and 'how', and determines the frequency and percentage, or proportion, of responses. In other words, quantitative approach involves collecting objective or numerical data that can be charted, graphed, tabulated, and analysed using statistical methods. A quantitative approach is inclined to be deductive. Deductive work begins with a general theory and ends with specific observations. This is in contrast to inductive reasoning, in which a researcher is not influenced by prior theories but aims to generate new ones based on available evidence. In other words, in deductive methodologies, a researcher determines in advance what theories could explain the data. The traditional quantitative technique is the questionnaire survey, administered by mail, face-to-face, or more recently by the Internet to a stratified or random sample of the population. The other common techniques are laboratory experiments, formal methods (e.g., econometrics) and numerical methods (e.g., mathematical modelling) (Myers, 1997).

This study cannot employ qualitative methods for several reasons. First of all, qualitative methods tend to be more appropriate in the early stages of research (exploratory research) and for building theory, whereas this is a confirmatory research which some relevant theories were established already. Second, the research does not want to transform what has been observed, reported or registered into written words. Third, qualitative research tends to rely on detailed and through descriptions of events, people or organization and they are often associated with small-scale studies. Instead, this research should utilize quantitative

methods for a number of reasons. First of all, in this study the theory is well developed and it aims to test the existing theory. Second, this research seeks to quantify relationships between variables of interest, in order to formulate and test hypotheses derived from theories that may therefore be either accepted or rejected on the basis of statistical analyses.

3.1.3. Research Methodology

The purpose of this study is to test a number of hypotheses and examine the hypothetical relationships among some of the critical success factors and ERP implementation success. In hypotheses testing research, the hypothetical relationships are tested to obtain an answer to the hypothesis. Sekaran and Bougie (2010) stated that rigor of methodology enhances when scholars shift from an exploratory study to a hypothesis-testing study. In this study, the researcher is interested in delineating the main critical factors that are associated with ERP implementation success, so the type of current investigation is correlational in nature. A correlational relationship specifies that two variables or concepts move at the same time. A correlational study is employed when the researcher's concern turns to the relationship between the variables or concepts.

After reaching a conclusion on the purpose of this research and the type of investigation, the next step is to make a decision on the research method to be employed. Where the research framework demonstrates a broad understanding of the constructs, the research objective is expected to be framed as research hypotheses. Therefore, the researcher is more concerned with the association among the constructs and will utilize the hypothesis-testing methods like field research and structured surveys. The current research is carried out to predict success factors of the ERP implementation projects. As a result, the hypotheses testing research method has been chosen for this study.

Business research can be undertaken in the natural setting where work goes on normally, i.e. in a non-contrived environment. Studies carried out to set up correlational relationships usually employ the natural setting in which people are generally working. So, the present research is conducted in the non-contrived settings of the ERP adopting organizations. Although there is some interruption to the usual flow of work due to distributing questionnaires in the ERP adopting companies, the researcher's interference in these organizations is negligible.

Research can be conducted in which data are collected just once maybe over a period of months, weeks or days, in order to meet a research objective. These kinds of studies are named cross-sectional or one-shot research. This research is a cross-sectional study in which the data have been gathered over a two-month period from June to July 2009.

3.1.4. Population of Interest and Unit of Analysis

Target population or population of interest refers to the group of people of interest whom the researcher desires to investigate. In the present research, critical success factors for ERP implementation are investigated in those companies in Iran which employed ERP systems. Therefore, ERP adopting companies in Iran are the target population of this study. An element is a single member of the population. In this research, element refers to each ERP adopting company in Iran. An ERP adopting company was defined as one that has implemented at least two ERP system modules. These modules could be Manufacturing and Logistics, Finance, Human Resources Management, Sales and Distribution. In addition, the ERP systems implemented should not have gone live more than three years because of personnel change and difficulty of remembering past implementation processes.

Sekaran and Bougie (2010) stated that the objective of the study determines the unit of analysis. The current study examines ERP implementation projects in the Iranian firms and

critical factors affecting their success. ERP implementation success was discussed and defined in the previous chapter as the user satisfaction and also the user's perception about the ERP project outcomes in their organizations. So, the unit of analysis will be ERP users within the target companies. This is in line with prior relevant research in the literature (Bagchi et al., 2003; Gable et al., 2008; Kanungo & Bagchi, 2000; Kwahk & Lee, 2008; Larsen, 2009; Park, Suh, & Yang, 2007; Shanks et al., 2000). In addition, it is essential to determine not only the unit of analysis, but also the respondents representing the unit of analysis (Hair et al., 2006). As a result, key organizational informants including operational/ functional/ unit managers were chosen as respondents. These groups of respondents are among the most knowledgeable informants regarding ERP implementation in organizations (Ifinedo, 2008; Gable et al., 2003). Besides, operational/ functional/ unit managers are commonly involved in the ERP implementation project and they are well positioned to be aware of important enterprise variables, such as organizational objectives and the degree of reengineering practices within their units (Bradford & Florin, 2003).

This study employed a subjective questionnaire to collect data. Thus, if just one ERP user in each ERP adopting organization was examined, there could be a single respondent bias (Hong & Kim, 2002). Ifinedo (2008) asserted that personal bias cannot be avoided when only one informant provides an examination for his particular organization. Furthermore, relying on the self-report of a single informant might lead to perceptual and common method biases (Wang et al., 2006). Somers et al. (2003) also confirmed that using more than one respondent decreases the degree of common method variance bias and enhances the evaluation of convergent or discriminant validity. Consequently, it was decided that multiple respondents (operational/ functional/ unit managers) from each ERP user company would maximize the validity of the research.

3.1.5. Sampling Frame and Sampling Method

The sampling frame is a list of every element in the target population from which the sample is drawn. Unfortunately, there was no single source (sampling frame) which could show all the ERP adopting companies in Iran. Indeed, there was no register in any Iranian private or public institute regarding the organizations that have implemented or are in the process of implementing an ERP system. Consequently, the target population of ERP adopting companies in Iran was unknown. The same problem goes for the identity of international ERP vendors in Iran's market. Therefore, a variety of subsequent sources were utilized to make a complete list of ERP adopting companies and ERP vendors in Iran. The procedure was as follows:

- Searching the 'World Wide Web' using the general keywords of Iran, ERP implementation, and so on.
- Investigating the 'websites of the top 10 international ERP vendor companies' to determine their potential Iranian ERP customers and their likely local representatives.
- Exploring the 'websites of the top 30 local IS vendor companies' to determine whether they are representatives of foreign ERP vendors, if they provide any ERP solutions and finally their possible Iranian ERP customers.
- Reviewing the 'websites of governmental organizations in charge of IT' like the Ministry of ICT, the Ministry of Industries and Mines, the Higher Council of Informatics, to identify possible ERP implementation projects in governmental organizations and companies.
- Reviewing the 'websites of non-governmental organizations in charge of IT' such as the Iranian IT Companies Association, the Iranian Association for Informatics, to identify likely ERP adopting projects.

- Reviewing the 'published reports and articles related to ERP implementation' in Iranian IT/management journals and seminars.
- Searching among 'annual reports of public listed companies' published by the Tehran Stock Exchange (TSE) website, to discover probable ERP implementation projects.
- Asking 12 ERP experts from the local companies and Iranian agents of international ERP vendors via the telephone.

According to the aforementioned steps, a primary list of 68 ERP adopting companies was determined. All 68 companies were telephoned and their CIOs were asked about the ERP systems and the status of their projects. 22 companies replied that their systems were not an ERP, but an MIS, Integrated Finance System, CRM, and so on. Moreover, 15 companies replied that their projects were at the beginning or in the middle of ERP implementation. Finally, 31 enterprises stated that they were in the go-live phase. The target companies included enterprises in a diverse range of industries such as manufacturing (petrochemical, home appliances, automotive, consumer products, agricultural machinery, basic iron and steel, basic precious and non-ferrous metals, detergents and cleaning, and glass products), the service sector (telecommunications, engineering and construction, distribution) and also the mining sector (iron ores and coal).

It should be noted that two kinds of ERP vendors exist in the Iranian market. The first kind is international ERP vendors. A number of them have their exclusive distributor and supporter in Iran and others are operating under other authorization. The second kind of ERP vendor is some of the Iranian IS companies which have developed their own ERP software in the Persian language. However, care should be taken when talking about Iranian developed ERP systems. Although most of them have more consistency with the existing Iranian organizations' businesses and processes, there are some reasons why they

cannot be labeled as ERP systems. Generally speaking, Iranian developed ERP systems have been designed based on the current status of organizations and are not based on best practices in the industry or improved processes. Moreover, the majority of them do not support operations and production management processes in manufacturing companies. In addition, most of the Iranian ERP systems just cover the inter-organizational processes and cannot support intra-organizational interactions with customers and suppliers. In fact, they do not present modules such as supply chain management and customer relationship management. Furthermore, they have a number of limitations like the inability to support multiple languages and multiple currencies which are critical for the multinational and international companies in Iran. Table (3.1) summarizes the two types of ERP systems in Iran and also list of international and Iranian ERP vendors.

Table (3.1) ERP Vendors in Iran

ERP System	ERP Vendors
Developed by International Companies	Epicore Software Corporation, IFS Applications, Logo Business Solutions, Mincom, Netsis Software, Oracle, SAGE, SAP, and 3i Infotech.
Developed by Iranian Companies	Radsamaneh, IRISA, Arico, Pars Royal, Shomaran System, Karaneh, Koroush Rayaneh, Pars System, Dadeh Pardazan Douran, Rayvarz.

Sampling is the procedure of choosing an adequate quantity of elements from the target population so that by studying and understanding the sample characteristics, it would be likely to generalize the sample characteristics to the elements of the target population (Sekaran & Bougie, 2010). Since there are 31 ERP adopting companies in Iran and also the representativeness and generalizability are important for the researcher, all 31 ERP

adopting companies will be investigated. In fact, this study is a population study and all operational managers who use ERP in the 31 companies will be given a questionnaire.

3.2. Measurement of Variables

The measurement of the research variables is an essential feature of the research design and an important part of the study. To find answers to research concerns and to test the hypotheses, the researcher needs to measure the variables in some way. Nevertheless, the measurement of these variables becomes complicated when they are involved with the subjective perceptions, attitudes, and feelings of individuals. In spite of the lack of objective tools to measure the subjective variables, there are techniques for tapping the subjective perceptions and feelings of people. One method is to reduce the intangible ideas or impressions like success to recognizable characteristic performances. The reduction of conceptual notions so that they can be measured in a concrete technique is termed operationalizing the concepts. According to Hair et al. (2006), "operationally defining a concept to render it measurable is achieved by looking at the behavioral dimensions, facets or properties denoted by the concept. These are then translated into observable and measurable elements so as to form an index of measurement of the concept" (p. 361).

The research framework of this study (Figure 3.4) demonstrates that all dependent, moderator and independent variables have a subjective nature. So, attempts are made to measure the variables by shrinking their abstract concept to observable characteristic behaviours. This is conducted by gathering the subjective perceptions and feelings of the respondents. Since a well-developed tool which has been carefully defined by a researcher will be accepted and frequently used by other researchers, measures for all variables of this study were adopted from previous research. Operational definitions of the variables are presented in following paragraphs.

3.2.1. Enterprise-Wide Communication

Enterprise-wide communication refers to providing a suitable network and crucial data to all key factors in the ERP project implementation. Communication is a critical success factor that uses tools such as monthly or weekly meetings, bulletins, frequent e-mail updates, and newsletters. Nah and Delgado (2006) advised that the communication has to be two-way to prevent gaps that can take place if the accurate business requirements and approval are overlooked. Previous scholars believed that there should be an effective communication between ERP project team members and users and also between functional units and departments as well to have a smooth ERP implementation (Chien et al., 2007; Kim et al., 2005, Somers & Nelson, 2004). Besides, the goals and objectives of ERP implementation projects should be explained for users via adequate communication channels such as presentations, demonstrations, newsletters (Amoako-Gyampah & Salam, 2004; Jones et al., 2008). Furthermore, the users' expectation, comments and their approval should be obtained at every level of the project (Muscatello & Chen, 2008; Sedera & Dey, 2006). Lastly, the progress report of the ERP project should be informed to all stakeholders as the implementation takes place (Nah & Delgado, 2006; Nah et al., 2007).

This study adopted the enterprise-wide communication definition from Nah and Delgado (2006) as an efficient way to explain and share the goals, benefits, progress report, user input, feedback and changes between all stakeholders of the ERP implementation project. Table (3.2) provides 6 items employed in the operationalization of the construct which were adopted from relevant previous research.

Table (3.2) Items Used for Measuring Enterprise-Wide Communication

Item	Source
There was an effective communication between project team members and users (functional units) at every level of project.	Chien et al., 2007; Kim et al., 2005; Nah & Delgado, 2006; Nah et al., 2007; Sedera & Dey, 2006
There was an effective communication to get the users' expectations, requirements, comments, and approval at every level of the project.	Kim et al., 2005; Muscatello & Chen, 2008; Nah & Delgado, 2006; Nah et al., 2007; Sedera & Dey, 2006
There was an effective communication among functional departments and units.	Kim et al., 2005; King & Burgess, 2006; Somers & Nelson, 2004
There were enough communication channels to inform the users of goals/objectives/purposes of the implementation (through the newsletters, presentations, demonstrations or road shows).	Amoako-Gyampah & Salam, 2004; Jones et al., 2008; Muscatello & Chen, 2008; Nah et al., 2007;
The project's progress communicated among stakeholders as the implementation took place.	Nah & Delgado, 2006; Nah et al., 2007; Nah et al., 2003
All stakeholders and team members willingly kept each other informed at all times.	Chien et al., 2007; Nah et al., 2003; Ranzhe & Xun, 2007; Sarker & Lee, 2003

3.2.2. Business Process Reengineering

Business Process Reengineering (BPR) was defined by Hammer and Champy (2001) as the deep rethinking and fundamental redesign of a company's procedures to attain remarkable improvement in important measures of performance, such as quality, cost, speed, and service. BPR evaluates the business processes of an enterprise in order to identify the best method of performing business. Hammer and Champy (2001) recommended that business process activities focus the firm on identifying and improving the efficiency of critical operations, on restructuring important non-value-adding operations, and on eliminating inefficient processes. Muscatello and Chen (2008) believed that using reengineering methods to develop a uniform vision of the firm's processes enables the company to reduce uncertainty and achieve ERP implementation success. BPR commonly starts by identifying and clearly documenting the present business processes

(Ehie & Madsen, 2005; Huang et al., 2004). Then the existing redundant and inconsistent activities are analyzed against performance goals and ERP requirements (Hong & Kim, 2002; Law & Ngai, 2007). Based on the outcomes of this analysis, a number of new business processes that properly align with ERP functions are developed (Kim et al., 2005; Muscatello & Chen, 2008). Then the company's procedures need to be decomposed to diverse levels of detail. It is also usual that company organizational structures have to be changed to conform to the reengineered business processes (Wang, Xu, Liu, & Qin, 2005).

In the context of ERP system implementation, this research adopted the definition of business process reengineering from Nah et al. (2003), as redesigning the current business processes to be aligned with the ERP software. Table (3.3) presents 6 items used in the operationalization of the construct which were tailored from related prior studies.

Table (3.3) Items Used for Measuring Business Process Reengineering

Item	Source
Our firm tried to rely heavily on reengineering its business processes to fit ERP systems with a minimum ERP customization.	Bradford & Florin, 2003; Ehie & Madsen, 2005; Kamhawi, 2007; Muscatello & Chen, 2008; Nah et al., 2003; Sedera & Dey, 2006; Zhang et al., 2003
Our firm initially mapped out (identified and documented) existing business processes.	Ehie & Madsen, 2005; Huang et al., 2004; Muscatello & Chen, 2008
Our firm standardized the business processes to the extent possible to align with the ERP.	Ehie & Madsen, 2005; Hong & Kim, 2002; Law & Ngai, 2007; Muscatello & Chen, 2008
Our firm analyzed and integrated redundant and inconsistent organizational processes to align with the ERP.	Hong & Kim, 2002; Muscatello & Chen, 2008
Our firm developed new organizational processes to align with the ERP.	Hong & Kim, 2002; Kim et al., 2005
Our firm tried to customize the ERP systems to our business processes with a minimal amount of BPR (reverse coded).	Bradford & Florin, 2003; Huang et al., 2004; Kamhawi, 2007; Nah et al., 2003; Sedera & Dey, 2006

3.2.3. Project Management

Management of ERP implementation projects usually comprises five main parts including preparing an official implementation plan, providing a reasonable time frame, setting up periodic meetings for monitoring project status, having an effective project leader who is also a champion, and participating project team members who are stakeholders (Zhang et al., 2005). Several researchers pointed out that the scope of the ERP implementation project, in terms of the BPR required, the amount of implementation, and participation of business units, should be obviously created and controlled (Muscatello & Chen, 2008; Sedera & Dey, 2006). Shanks et al. (2000) suggested that any proposed modifications should be assessed against potential business benefits and, if possible, implemented at a later time. In addition, the ERP project milestones should be formally defined with obvious delivery dates (Ehie & Madsen, 2005; Nah & Delgado, 2006). Moreover, the tasks of all people involved in the ERP implementation project should be defined and assigned (Nah & Delgado, 2006; Nah et al., 2007; Sedera & Dey, 2006). Furthermore, the progress of an ERP implementation project is supposed to be evaluated and reviewed on a periodic basis (Zhang et al., 2003). Finally, all activities of the vendor/consultant should be followed and checked via an official procedure (Nah et al., 2003; Stratman & Roth, 2002). This study adopted the project management definition from Nah et al. (2007), as a set of critical activities consisting of establishing the project scope and implementation plan, defining milestones, allocating responsibilities to various players, coordinating all tasks, tracking vendor activities, and finally evaluating project progress. Table (3.4) provides 7 items utilized in the operationalization of the construct which were adopted from pertinent prior research.

Table (3.4) Items Used for Measuring Project Management

Item	Source
The project scope was clearly established and controlled.	Muscatello & Chen, 2008; Nah & Delgado, 2006; Sedera & Dey, 2006
A detailed project plan (i.e., what activities to cover at what stage) was provided and established.	Ehie & Madsen, 2005; Kamhawi, 2007; Muscatello & Chen, 2008; Nah et al., 2007
Realistic project milestones and end dates were defined and set with measurable results.	Ehie & Madsen, 2005; Nah & Delgado, 2006; Nah et al., 2007; Sedera & Dey, 2006
The responsibility for all parts of the implementation project was defined and assigned.	Muscatello & Chen, 2008; Nah & Delgado, 2006; Nah et al., 2007; Sedera & Dey, 2006
The project activities across all affected parties were coordinated and organized properly.	Nah & Delgado, 2006; Nah et al., 2003; Sedera & Dey, 2006
There was a formal management process to track and monitor the vendor activities.	Muscatello & Chen, 2008; Nah et al., 2003; Stratman & Roth, 2002
The project progress was reviewed and assessed on a periodic basis.	Muscatello & Chen, 2008; ; Nah et al., 2003; Stratman & Roth, 2002; Zhang et al., 2003

3.3.4. ERP Team Composition and Competence

An ERP implementation project engages all of the departments in an organization. It demands the collaboration of technical and business professionals as well as ERP users. Thus, team composition and teamwork among the ERP implementer and ERP vendor are highlighted in the ERP literature (Nah & Delgado, 2006). Companies implementing an ERP system must be willing to dedicate some of their best employees to the project for successful implementation. These individuals should have a proven reputation and there should be a commitment to release these individuals to the project on a full-time basis. In addition, team members should focus solely on the ERP project and it should be their main concern (Bradley, 2008; Nah & Delgado, 2006; Nah et al., 2003). Furthermore, the members of the ERP project team have to be authorized to make quick decisions regarding

the project (Nah et al., 2003; Sedera & Dey, 2006; Shanks et al., 2000). This research adopted the definition of ERP team composition and competence from the Sedera and Dey (2006), as ERP team members who are technologically competent, understand the company and its business, fully involved, highly rewarded and committed and come from departments affected by the new ERP system. Table (3.5) offers 6 items used in the operationalization of the construct which were adopted from relevant earlier studies.

Table (3.5) Items Used for Measuring ERP Team Composition and Competence

Item	Source
The project had a well experienced and reputed project champion/manager who was committed to the ERP project.	Bradley, 2008; Nah & Delgado, 2006; Sedera & Dey, 2006; Stratman & Roth, 2002; Zhang et al., 2003
A variety of balanced or cross-functional team members were selected for the ERP implementation.	Ehie & Madsen, 2005; Kim et al., 2005; Nah & Delgado, 2006; Nah et al., 2007; Nah et al., 2003
The people selected for ERP implementation teams had the best business (domain knowledge) and technical knowledge.	Ehie & Madsen, 2005; Nah et al., 2007; Nah et al., 2003; Sedera & Dey, 2006; Wang et al., 2008; Wu & Wang, 2006
The implementation team was empowered to make decisions relating to the project.	Sedera & Dey, 2006; Nah & Delgado, 2006; Nah et al., 2003
Those selected for the ERP implementation were working on the project full-time as their only priority.	Bradley, 2008; Nah & Delgado, 2006; Nah et al., 2007; Nah et al., 2003; Sedera & Dey, 2006
Sufficient incentives or compensation were given to those selected for the ERP project.	Bradley, 2008; Nah & Delgado, 2006; Nah et al., 2007; Sedera & Dey, 2006

3.2.5. ERP System Quality

ERP system quality was defined as user perception of measuring the ERP system in terms of its accessibility, reliability, and flexibility (Fan & Fang, 2006).). Measures of system quality are linked to the information processing system itself. DeLone and McLean (2003) believed that the quality of the system is at the technical level, where efficiency and accuracy of the system generating information were vital. These were object-based feelings

and revealed perceptions of the end users. DeLone and McLean (1992) combined the earlier research and presented the diverse potential of system quality metrics, with such extensive items as ease of learning and use, data accuracy, system integration and flexibility, and system efficiency and reliability. Moreover, Rai et al. (2002) proposed two scales for measuring system quality i.e. easy to use and user friendly. Furthermore, Iivari (2005) examined the DeLone and McLean (1992) model empirically and structured perceived system quality as comprising integration, convenience, flexibility, language, and response time. Prior researchers emphasized the important characteristics of the ERP system for measuring its quality such as providing accurate and reliable outputs (Bernroider, 2008; Bradley, 2008; Jones et al., 2008), presenting useful functionality for doing a job (Holsapple et al., 2005; Ifinedo, 2007; Wang et al., 2006), offering user friendly features (Chien & Tsaur, 2007; Gable et al., 2008; Uzoka et al., 2008; Wei et al., 2005), and finally, the ability to exchange data with other systems servicing diverse functional departments (Sedera, Tan, & Dey, 2007; Kim et al., 2005; Wu & Wang, 2007). This study adopted the ERP system quality definition from Bernroider (2008), as information processing capabilities of the ERP system including data accuracy, ease of learning and use, system reliability and efficiency, and system flexibility and integration. Table (3.6) provides 6 items applied in the operationalization of the construct which were customized from significant previous studies.

3.2.6. ERP Vendor Support

ERP systems are extremely complex and require extensive training. Installing an ERP system without sufficient preparation of the end user could have drastic results. Insufficient or lack of training was one of the most important reasons for the failure of many ERP systems (Somers & Nelson, 2001). A particular dispute in ERP implementation is to

Table (3.6) Items Used for Measuring ERP System Quality

Item	Source
The ERP system provides accurate output information.	Bradley, 2008; Chien & Tsaur, 2007; Ifinedo, 2007; Jones et al., 2008; Sedera et al., 2007; Wu & Wang, 2007
The output information provided by the ERP system is reliable (consistent and dependent).	Bernroider, 2008; Bradley, 2008; Gable et al., 2008; Ifinedo, 2007; Jones et al., 2008; Uzoka et al., 2008; Wang et al., 2006; Wei et al., 2005; Wu & Wang, 2007
The ERP system has the ability to communicate data with other systems servicing different functional areas (system integrity).	Ifinedo, 2007; Kim et al., 2005; Sedera et al., 2007; Wu & Wang, 2007
The ERP system has enough flexibility to change, to adjust, or to adapt to new conditions, processes, organization structures, or circumstances.	Bernroider, 2008; Ifinedo, 2007; Kim et al., 2005; Sedera et al., 2007; Uzoka et al., 2008; Wei et al., 2005; Wu & Wang, 2006
I found the ERP system has good features and is useful for doing my job (functionality).	Bernroider, 2008; Gable et al., 2008; Holsapple et al., 2005; Ifinedo, 2007; Sedera et al., 2007; Wang et al., 2006; Wei et al., 2005
I found the ERP system easy to learn and use (user friendliness).	Bernroider, 2008; Bradley, 2008; Chien & Tsaur, 2007; Gable et al., 2008; Ifinedo, 2007; Kim et al., 2005; Uzoka et al., 2008; Wei et al., 2005

choose a proper plan for end-user education and training. Users need training in-house to see how the system will change organizational business processes. It is essential that the user training runs through the life cycle, and provides support to organizational requirements. ERP training should deal with all aspects of the system, be continuous and based on the principles of knowledge transfer where consultants or vendors are involved. In addition to developing a training plan at the beginning of the project, Shanks et al. (2000) stated that training is provided at several points during an ERP project in order not to use all the training just before implementation was finished. Previous studies highlighted the essential characteristics of ERP vendor support and services. ERP vendors should establish a good relationship and communicate well with adopting companies (Ifinedo, 2007;

Muscatello & Chen, 2008; Wang & Chen, 2006), provide quality services in an adequate time (Bernroider, 2008; Wang et al., 2006; Zhang et al., 2003), assign employees with the domain knowledge of the industry and enough experience for implementation (Ifinedo, 2008; Wu & Wang, 2007; Zhang et al., 2005), offer adequate training and practice to increase the user's proficiency in ERP usage (Uzoka et al., 2008; Wang et al., 2008; Wu & Wang, 2007) and finally provide suitable user guides, operation guides, manuals, and any formal documents required for using the ERP system (Huang et al., 2004; Uzoka et al., 2008; Wei et al., 2005). This research adopted the definition of ERP vendor support from Ifinedo (2008), as providing technical services and support at a suitable time and of a suitable quality and offering the complete training and supplementary documents required for using ERP systems employing experienced individuals with domain knowledge of the industry. Table (3.7) offers 6 items employed in the operationalization of the construct which were adopted from relevant prior research.

Table (3.7) Items Used for Measuring ERP Vendor Support

Item	Source
The ERP vendor had good relationships and communicated well with my organization.	Ifinedo, 2007; Ifinedo, 2008; Muscatello & Chen, 2008; Wang & Chen, 2006; Wang et al., 2008; Zhang et al., 2005
The ERP vendor had the domain knowledge of the industry and enough experience for implementation.	Ifinedo, 2007; Ifinedo, 2008; Wei et al., 2005; Wu & Wang, 2007; Zhang et al., 2005
The ERP vendor provided quality services.	Ifinedo, 2007; Ifinedo, 2008; Wang et al., 2006; Wang et al., 2008; Wei et al., 2005
The ERP vendor service response was done in an adequate time.	Bernroider, 2008; Wang et al., 2006; Wei et al., 2005; Zhang et al., 2003; Zhang et al., 2005
The amount and quality of training and practice that is afforded to increase the user's proficiency in ERP usage was adequate.	Ifinedo, 2008; Uzoka et al., 2008; Wang et al., 2008; Wei et al., 2005; Wu & Wang, 2007
The ERP vendor provided suitable user guides, operation guides, manuals, and any formal documents required for using the ERP system.	Huang et al., 2004; Uzoka et al., 2008; Wei et al., 2005; Wu & Wang, 2006

3.2.7. Organizational Culture

Previous researchers have developed different concepts, models, and dimensions to study culture and technology adoption or intention to use technology. For example, Karahanna et al. (2006), investigated the impact of subjective culture (regional, national, organizational, etc.) on behavioral intention while Srite and Karahanna (2006) incorporated Hofstede's model to examine the role of espoused national culture in technology acceptance. On the other hand, Gallivan and Srite (2005) reviewed the literature on information technology and culture in order to identify the linkages between IT and culture.

Studies (Krumbholz & Maiden, 2001, Ke & Wei, 2008) have also been conducted to examine the role of organizational culture and ERP implementation. For instance, Nah et al. (2007) examined the role of organizational culture in ERP systems implementation while Ke and Wei (2008) studied the role of organizational culture and leadership on ERP implementation projects.

Organizational culture can be measured using six dimensions: process vs. results orientation, employee vs. job orientation, parochial vs. professional identity, open vs. closed system, loose vs. tight control and normative vs. pragmatic mentality (Hofstede, 2001). This study focused on the three dimensions of 'process vs. result orientation, employee vs. job orientation, and open vs. closed system' in that they are more closely linked with the deployment of IT in general, and ERP implementation in particular than the other three dimensions (Zhang et al., 2005). The 'process vs. result orientation' refers to whether an organization is more concerned about the processes and means to be followed to perform the work or the targets that are tracked with this work. Process orientation is typical of bureaucratic or mechanistic organizations loaded with processes and rules, while the results orientation is typical of risk-taking organizations, in which innovation is valued and mistakes are tolerated. The 'employee vs. job orientation' indicates whether the

organization is more concerned with the execution of work or the well-being of the person. Committees or groups often make important decisions in the employee-focused culture, and an attempt is made to assist new members to adjust. In contrast, job-oriented cultures tend to rely on top-down decisions. An 'open vs. closed system' refers to the climate of communication within the institute. In open system culture information streams through the organization without problems, whereas closed cultures are more secret. However, the employment of an ERP system needs transparent information flow throughout the enterprise. Employees in the closed system think they will be forced by the ERP system, which certainly leads to resistance to the ERP system.

This study adopted the definition of organizational culture from Hofstede (2001), as a set of collective experiences, values, beliefs, and behavioural norms in an organization which facilitates the implementation process of the ERP system. Table (3.8) presents 6 items used in the operationalization of the construct which are based on Hofstede (2001), Ifinedo, 2007; Ke and Wei, 2008; Krumbholz and Maiden, 2001 and Nah et al., 2007.

Table (3.8) Items Used for Measuring Organizational Culture

Item	Source
In my organization, employees are encouraged to analyze mistakes that have been made and learn from them.	Hofstede, 2001; Krumbholz & Maiden, 2001; Nah et al., 2007
In my organization, each day brings new challenges.	Hofstede, 2001; Krumbholz & Maiden, 2001
In my organization, employees are encouraged to express their opinions and ideas regarding work.	Hofstede, 2001; Krumbholz & Maiden, 2001; Nah et al., 2007
In my organization, management freely shares information.	Hofstede, 2001; Ifinedo, 2007; Ke & Wei, 2008; Krumbholz & Maiden, 2001
In my organization, people are supportive and helpful.	Hofstede, 2001; Ifinedo, 2007; Ke & Wei, 2008; Krumbholz & Maiden, 2001; Nah et al., 2007
In my organization, there is willingness to collaborate across organizational units.	Hofstede, 2001; Krumbholz & Maiden, 2001; Nah et al., 2007

3.2.8. ERP Implementation Success

The current study measures ERP implementation success using the two criteria of user satisfaction and organizational impact. This research adopted the definition of ERP user satisfaction from Gable et al. (2008), as the sum of a user's feelings and attitudes towards a variety of factors related to the delivery of information products and services like being up-to-date, precise, comprehensive and so on. Most of the prior ERP research has employed items such as presenting necessary outputs and reports and accurate information (Gable et al., 2008; Law & Ngai, 2007; Somers et al., 2003), providing output information content which is inclusive (Chien & Tsaur, 2007; Jones et al., 2008; Law & Ngai, 2007; Wu & Wang, 2007), offering output and reports in a useful format (Gable et al., 2008; Sedera et al., 2007; Somers et al., 2003), presenting up to date information (Chien & Tsaur, 2007; Jones et al., 2008; Law & Ngai, 2007; Wu & Wang, 2007), improving employee work efficiency (Calisir & Calisir, 2004; Gable et al., 2008; Gattiker & Goodhue, 2005; Ifinedo, 2007; Nah et al., 2007), and overall satisfaction with the ERP system (Bradford & Florin, 2003; Calisir & Calisir, 2004; Gable et al., 2003; Peslak, 2006). Table (3.9) provides 7 items used in operationalization of the ERP user satisfaction which were modified from appropriate past ERP research.

The second dimension of ERP implementation success was organizational impact. ERP organizational impacts concern the effect of ERP system implementation and usage on the performance of an organization. Organizational impact refers to the realization of business goals and improved enterprise operating capabilities as a result of the ERP implementation. The perceived organizational impact variable covers both effectiveness and efficiency-based performance improvements in order to capture the business benefits of the ERP system (Stratman & Roth, 2002). Moreover, implementing an ERP system can lead to improvements in business performance by improving decision performance, being more

Table (3.9) Items Used for Measuring ERP User Satisfaction

Items	Sources
ERP provides output and reports which I need.	Gable et al., 2008; Law & Ngai, 2007; Somers et al., 2003
ERP provides precise and clear information.	Gable et al., 2008; Law & Ngai, 2007; Somers et al., 2003
ERP presents output and reports in a useful format.	Gable et al., 2008; Sedera et al., 2007; Somers et al., 2003
The output information content provided by the ERP system is comprehensive.	Chien & Tsaur, 2007; Jones et al., 2008; Law & Ngai, 2007; Somers et al., 2003; Wu & Wang, 2007
The information provided by the ERP system is up to date.	Chien & Tsaur, 2007; Gable et al., 2008; Jones et al., 2008; Law & Ngai, 2007; Somers et al., 2003; Wu & Wang, 2007
ERP system is beneficial for individual's tasks and improves employee work efficiency.	Calisir & Calisir, 2004; Gable et al., 2008; Gattiker & Goodhue, 2005; Ifinedo, 2007; Jones et al., 2008; Nah et al., 2007
Overall, There is satisfaction with the ERP system.	Bradford & Florin, 2003; Calisir & Calisir, 2004; Gable et al., 2003; Peslak, 2006

responsive to customer requirements, reducing costs, and improving process efficiency (Somers et al., 2003). According to Fan and Fang (2006), ERP systems combine a company's system in managing its logistics, inventory, orders, shipping, customer service, sales, and several other parts. They believed that integrating and standardizing these activities in line with the firm's objective would have a positive impact on the enterprise and staff in enhancing effectiveness and efficiency and inevitably improving competitiveness. For measuring the organizational impact of ERP system implementation, a wide range of measures were employed by previous researchers such as increased customer service and satisfaction (Kamhawi, 2008; Law & Nagi, 2007; Zhang et al., 2005), reduced organizational costs (Jones et al., 2008; Kamhawi, 2007; Sedera et al., 2007), better use of organizational data resources (Bernroider, 2008; Ifinedo, 2008; Jones et al., 2008), organizational-wide communication improvement (Ifinedo, 2008; Nah et al., 2007;

Stratman & Roth, 2002), business processes rationalization (Gable et al., 2008; Law & Nagi, 2007; Sedera et al., 2007), improved overall productivity of the firm (Fan & Fang, 2006; Jones et al., 2008; Sedera et al., 2007), and increased firm's profitability (Fan & Fang, 2006; Gattiker & Goodhue, 2005; Jones et al., 2008).

This study adopted the organizational impact definition from Jones et al. (2008), as user perception of improving in decision making, organizational communication, business processes rationalization, customer satisfaction, cost reduction, the firm's overall productivity and performance. Table (3.10) provides 8 items used in the operationalization of the ERP organizational impact which were adopted from relevant prior ERP research.

Table (3.10) Items Used for Measuring ERP Organizational Impact

Items	Sources
Implementing the ERP system has helped to better use the organizational data resource and enhances higher-quality of decision making.	Bernroider, 2008; Ifinedo, 2008; Jones et al., 2008; Kamhawi, 2008
Implementing the ERP system has helped to improve organizational-wide communication and sharing of information across the enterprise.	Ifinedo, 2008; Nah et al., 2007; Stratman & Roth, 2002
Implementing the ERP system has helped to improve and rationalize business processes and eliminate redundant tasks.	Bernroider, 2008; Gable et al., 2008; Ifinedo, 2008; Kamhawi, 2008; Law & Nagi, 2007; Sedera et al., 2007
Implementing the ERP system has helped to increase customer (internal or external) service/satisfaction.	Bernroider, 2008; Ifinedo, 2008; Jones et al., 2008; Kamhawi, 2008; Law & Nagi, 2007; Zhang et al., 2005
Implementing the ERP system has helped to reduce organizational cost.	Ifinedo, 2008; Jones et al., 2008; Kamhawi, 2007; Sedera et al., 2007; Zhang et al., 2005
Implementing the ERP system has helped to improve the managerial efficiency and effectiveness.	Fan & Fang, 2006; Huang et al., 2004; Ifinedo, 2008; Jones et al., 2008
Implementing the ERP system has helped to improve the firm's overall productivity.	Fan & Fang, 2006; Gable et al., 2008; Ifinedo, 2008; Jones et al., 2008; Kamhawi, 2008; Sedera et al., 2007;
Implementing the ERP system has helped to improve the firm's overall business performance/profitability.	Bernroider, 2008; Fan & Fang, 2006; Gattiker & Goodhue, 2005; Jones et al., 2008

3.3. Hypotheses Development

Based on the research framework and prior discussions, the research hypotheses are presented in the following paragraphs.

Prior researchers have found a strong correlation between the enterprise communication and ERP implementation success (Amoako-Gyampah & Salam, 2004; Bueno & Salmeron, 2008; Chien et al., 2007; Häkkinen & Hilmola, 2008; Kim et al., 2005; Mabert et al., 2003). So, based on the research questions and research framework of this study, the following hypothesis was defined:

H1: Enterprise-wide communication during the ERP implementation is positively related with ERP implementation success.

Researchers have found a strong correlation between the attention paid to business process improvement and ERP success (Bradford & Florin, 2003; Grabski & Leech, 2007; Mabert et al., 2003; Peslak, 2006; Stratman & Roth, 2002; Sun et al., 2005; Umble et al., 2003). Consequently, regarding the research questions and research framework of the current study, the next hypothesis was defined:

H2: Reengineering the business processes to best practices of an ERP system is positively related with ERP implementation success.

Previous scholars have confirmed a positive correlation between the project management efforts and the possibility of ERP implementation success (Al-Mashari et al., 2006; Correa & Cruz, 2005; Grabski & Leech, 2007; Kamhawi, 2007; Kerimoglu et al., 2008; Nah et al., 2007; Reinhard & Bergamaschi, 2001; Sawah et al., 2008; Umble et al., 2003; Zhang et al., 2005) So, based on the research questions and research framework of this study, the following hypothesis was defined:

H3: An effective project management programme is positively related with ERP implementation success.

Previous researchers have proved a positive correlation between the composition and competence of the ERP team and the opportunity of ERP implementation success (Bradley, 2008; Chien et al., 2007; Ferratt et al., 2006; Mabert et al., 2003; Nah et al., 2007; Peslak, 2006; Ramayah et al., 2007; Soja, 2006; Sun et al., 2005; Umble et al., 2003). Accordingly, based on the research questions and research framework of this study, the following hypothesis was defined:

H4: ERP team composition and competence is positively related with ERP implementation success.

Earlier scholars have verified a positive correlation between the quality of an ERP system and ERP implementation success (Amoako-Gyampah & Salam, 2004; Basoglu et al., 2007; Calisir & Calisir, 2004; Chen & Liu, 2008; Fan & Fang, 2006; Kositanurit et al., 2006; Soja, 2006; Uzoka et al., 2008; Zhang et al., 2005). Thus, according to the research questions and framework of this research, the following hypothesis was identified:

H5: Quality of the ERP system is positively related with ERP implementation success.

Prior scholars have validated a positive correlation between the ERP vendor support and the chance of ERP implementation success (Ferratt et al., 2006; Ifinedo, 2008; Mabert et al., 2003; Ramayah et al., 2007; Reinhard & Bergamaschi, 2001; Sawah et al., 2008; Soja, 2006; Uzoka et al., 2008; Wang & Chen, 2006; Zhang et al., 2005). Then, based on the research questions and research framework of this study, the subsequent hypothesis was defined:

H6: ERP vendor support is positively related with ERP implementation success.

There have been supportive findings for the importance of organizational culture in innovation implementation and adoption in the ERP literature (Chien et al., 2007; Hong & Kim, 2002; Ifinedo, 2007; Kamhawi, 2007; Nah et al., 2007; Ramayah et al. 2007; Zhang et al., 2003; Zhang et al., 2005). So, organizational culture was considered as one of the variables in this study. Based on the findings of Hong and Kim (2002), Nah et al. (2007) and Ramayah et al. (2007), organizational culture was put as a moderator variable which moderates the effects of the independent variables on the dependent variable. The moderating effect of organizational culture is shown in the following paragraphs.

An organizational culture that encourages transparency in communication facilitates the organizational learning process, which contributes to the successful implementation of ERP (Nah et al., 2007). An organizational culture that is open to constant challenges and learning can facilitate effective communication across the organization, which is a key to project success in ERP implementation. A supportive and open culture promotes enhanced communication and improved interaction, which facilitate the communication of the complex and new concepts of ERP systems to the end-users. Since the complexity of an ERP system requires almost all staff to learn new methods of working and new tools, organizational culture can assist the learning process that is essential for successful ERP implementation. As a result, the following hypothesis was presented:

H7: Organizational culture moderates the relationship between enterprise-wide communication and the success of ERP implementation.

The majority of ERP implementing companies are unlikely to have structures and processes compatible with the tools, structure, and types of information from ERP systems (Umble et al., 2003). In line with this fact, firms implementing ERP are expected to reengineer, at least their key processes to support the ERP system requirements. Bingi et al.

(1999), Mandal and Gunasekaran (2002), and Yusuf et al. (2004) recommended that reengineering the organizational business processes is vital to capture full advantage of the ERP system. However, many problems that have led to the failure of ERP implementation have occurred when trying to adopt Western-developed IT applications in organizations in developing countries (Al-Mashari & Zairi, 2000; Al-Mashari et al., 2006; Rasmy et al., 2005; Soh et al., 2000; Zhang et al., 2005). Most of the ERP packages impose a Western culture and style of doing business. Such differences are an important factor impacting on ERP success and failure (Al-Mashari et al., 2003; Hong & Kim, 2002; Markus et al., 2000; Motwani et al., 2002; Soh et al., 2000; Zhang et al., 2003). This shows that the organizational culture of the ERP adopting company affects the procedure of changing the existing processes to align with ERP software. According to Sitkin (1992), the proximity of an enterprise to a state of challenging and learning, significantly facilitates the process of change. Consequently, the following hypothesis was offered:

H8: Organizational culture moderates the relationship between business process reengineering and the success of ERP implementation.

Team leaders of ERP implementation meet the challenge of managing a huge project that usually faces firm deadlines and a way almost impossible to distribute all the necessary training to end users. In addition, leaders of the ERP project team must clearly establish and monitor the project scope, evaluate requests for the expansion of the scope, assess any proposed changes, define the responsibilities, define and establish project milestones, enforce the deadlines of the project, and coordinate ERP project activities in all the parties concerned. An organizational culture that promotes these processes increases the likelihood of implementation success (Nah et al., 2007). As a result, the next hypothesis was presented:

H9: Organizational culture moderates the relationship between a project management programme and the success of ERP implementation.

Teams of ERP implementation projects are necessarily cross-functional, as the ERP system integrates and accumulates a variety of functions within a company. To take full advantage of the ERP system, cross-functional teams working on the implementation project should not only be able to work well as a group, but also understand and realize the diverse skills and strengths that every member brings to the ERP team. Closed or non-supportive organizations are more likely to experience difficulties in facilitating coordination and teamwork between members of cross-functional ERP teams (Ramayah et al., 2007). Therefore, the following hypothesis was developed:

H10: Organizational culture moderates the relationship between ERP team composition and competence and the success of ERP implementation.

Cultural diversity among customers and suppliers of ERP systems indicates not only the organizational culture, but also the national culture (Krumbholz, Galliers, Coulianos, & Maiden, 2000). The national culture dissimilarities exist more in values and less in practices, while differences of organizational culture reside more in practices and less in values (Hofstede, 1997). The current problem is that the culture of ERP adopting companies conflicts with the culture of the ERP vendors, implicit in the ERP software (Krumbholz et al., 2000). Indeed, a common problem when adopting an ERP system has been the subject of 'misfits', that is, the differences between the functionality presented by the software and the requirements of the ERP implementing company. To bridge this cultural diversity, the ERP adopting companies have to choose between customizing the software to be aligned with the organization's requirements or changing the corporate culture and business procedures to incorporate the ERP systems. Consequently, ERP

adopting firms must take into account the cultural diversity among ERP suppliers, consultants and themselves before deciding what to buy and implement. Otherwise, they possibly have to reduce their plans and accept minimal benefits, or even abandon the implementation (Markus & Tanis, 2000). Hong and Kim (2002) argued that the organizational culture facilitates filling the cultural diversity between ERP system quality and an ERP implementing company and thus affects the successful implementation of ERP.

H11: Organizational culture moderates the relationship between ERP system quality and the success of ERP implementation.

From another point of view, the culture of an organization is related to how the overall success of an ERP system is seen in the adopting companies (Krumbholz & Maiden, 2001, Soh et al., 2000, Swan et al., 1999). This is because people in an organization are accustomed to doing jobs in a certain way due to shared beliefs and may have to accommodate the changes that ERP system enforces to increase implementation success (Davenport, 2000; Krumbholz & Maiden, 2001). Moreover, cultural attributes such as collaboration, consensus, and cooperation are essential ingredients to successfully achieve through the adoption of an ERP system (Davenport, 2000; Markus & Tanis, 2000; Willcocks & Sykes, 2000). Jones and Price (2004) stated that members of the organization need to share knowledge and collaborate as a team to make the necessary changes in the company to achieve the long-term benefits of ERP. Ramayah et al. (2007) confirmed that the organizational culture that contribute to the relationship between ERP adopting staff and ERP vendor's employees will result in a successful implementation of ERP. Accordingly, subsequent hypotheses were presented:

H12: Organizational culture moderates the relationship between ERP vendor support and the success of ERP implementation.

3.4. Questionnaire Design

A structured questionnaire was designed for data gathering based on several principals recommended by Sekaran and Bougie (2010).

3.4.1. Principals of the Wording of the Questionnaire

The language of the questionnaire was selected based on the understanding level of the respondents. In this research, the Persian language was chosen as the medium language of the respondents. The final English version of the questionnaire was translated into Persian in a back to back translation process. This was done to ensure that the process of translation would be consistent and two Persian and English versions of the questionnaire were as similar as possible. This is very important because some of the respondents might be from multinational companies with an English medium.

Demographic questions are known as classification data or personal information. Such data as age, gender, educational level, and number of years in the organization were included in the questionnaire to describe the characteristics of the respondents later. The policy of this research was not to ask for the name of the respondent. Furthermore, a set of alternatives was given to respondents to choose for gathering the demographic data. For instance:

Please indicate your level of education:

Undergraduate	*Graduate*	*Postgraduate (MS)*	*Postgraduate (PhD)*

The nature of the variable tapped i.e. objective facts or subjective feelings, determines the type of questions that will be asked. In this research, where objective variables such as the demographic data of the respondents are used, a single direct question with an 'ordinal scaled' set of categories has been utilized. For example:

How long have you been using the ERP system?	*About one year*	*2 years*	*3 years*	*More than 3 years*

If the variables are exploited in a subjective form, where respondents' attitudes, perceptions and beliefs should be measured, the questions use the elements and dimensions of the concepts. For instance, 6 items were employed to measure the variable 'organizational culture'.

The form of questions refers to positively and negatively worded questions. A small number of the questions are stated in the negative form, instead of wording them positively. This is done to decrease the propensity of respondents to automatically select one end of the scale and to verify the reliability of responses. For example:

ERP Project Management	*Strongly Disagree*	*Disagree*	*Moderately Disagree*	*Slightly Disagree*	*Neither Agree Nor Disagree*	*Slightly Agree*	*Moderately Agree*	*Strongly Agree*
There was not a formal management process to monitor the ERP vendor activities.								

The type of question refers to whether it is closed or open. In this research, all questions have been organized in the closed question format. There is just one open ended question which will be explained in section 4.5.2. For instance, to measure the dependent, moderator and independent variables, a 7-point Likert scale was utilized.

ERP System Quality	*Strongly Disagree*	*Disagree*	*Moderately Disagree*	*Slightly Disagree*	*Neither Agree Nor Disagree*	*Slightly Agree*	*Moderately Agree*	*Strongly Agree*
The ERP system provides dependable information.								

3.4.2. Principals of Appearance of the questionnaire

It is very important to pay attention to how the questionnaire appears. A neat and attractive questionnaire with an appropriate introduction and a well dressed series of questions and answers will make the task easier for respondents. A good introduction has been provided to clearly reveal the identity of the researcher, in order to communicate the intention of the survey and to ensure the confidentiality of information presented by respondents. This introduction provides less biased responses by respondents. In addition, the introduction has been completed on a courteous note; thanking the respondent for taking the time to respond to the questionnaire.

The questions were organized in a logical and orderly manner in the appropriate section. Instructions were provided on how to respond to the items in each section to help participants answer them without difficulty and with minimal time and effort. The questions were organized efficiently and reasonably in appropriate sections. In addition, instructions were provided on how to respond to the items in each section to help the participants answer them without any trouble and with minimal time and effort. For example:

'*In this section, please indicate the extent to which you agree with the following statements by marking an "X" against the appropriate scale shown.'*

Sometimes, people become irritated by the private nature of the questions. So, in this research, such questions were organized in categories like ordinal scaling format. For example:

Please indicate your age :

Below 30	*31-40*	*41-50*	*Above 50*

The questionnaire concluded with honest thanks for the respondents. Moreover, the survey was completed on a polite note, reminding the participant to verify that all questions have been answered. Finally, the questionnaire ended with an open question, inviting respondents to comment on subjects that may not have been adequately or completely covered.

3.5. Validity and Reliability Assessment of Questionnaire

The validity and reliability of the developed questionnaire were evaluated to make sure that collected data are suitable to test the research hypotheses. These evaluations referred to the scales and scaling methods employed to measure the variables and assess the validity and reliability of the measures used.

3.5.1. Scales and Scaling Techniques

The final outcome of the operationalization process is a variable that can be measured. The following step is to use measurement scales that are appropriate to measure diverse variables. A measurement scale is a device or instrument by which respondents are differentiated on how they vary from one another on the variable of interest to this research. There are four types of measurement scale including nominal, ordinal, interval, and ratio. The level of sophistication to which the scales are fine tuned gradually increases as researchers shift from the nominal to the ratio scale. In other words, information on variables can be achieved with a greater degree of detail when researchers use a ratio or interval scale rather than the other two scales. More sophisticated data analysis can be carried out with more powerful scales, which means that more meaningful answers can be found to the research questions. In this research, the Likert scale was utilized to examine

how strongly respondents agree or disagree with a statement on a seven-point scale with the following anchors:

Strongly Disagree	*Moderately Disagree*	*Slightly Disagree*	*Neither Agree nor Disagree*	*Slightly Agree*	*Moderately Agree*	*Strongly Agree*
1	2	3	4	5	6	7

3.5.2. Assessment of Questionnaire Validity

Cavana et al. (2001) stated that "content validity relates to the representativeness or sampling adequacy of the questionnaire regarding the content or the theoretical construct to be measured" (p. 238). Content validity of the questionnaire was examined through the following three steps as recommended by Cavana et al. (2001). First, the origins or history of each of the items was reported. All questionnaire items were used and verified by prior researchers. But due to using the combination of these items, additional validity assessment was needed which will be described in following paragraphs.

Second, a further test of content validity was conducted by sending the questionnaire to a group of ERP experts. The ERP experts examined all the elements of the questionnaire and made judgments about whether each item measures the theoretical construct proposed. Another name for this method is 'expert judgment validity'. From the literature review, 28 well-known ERP researchers who published frequently in prominent IS journals were chosen. These authors were from diverse countries such as the USA, UK, Australia, Canada, France, Italy, the Netherlands, China, Malaysia, Taiwan, South Korea, Egypt, Saudi Arabia, and Turkey. A set of problem statement, research objectives, research questions, research framework and questionnaire was sent to these 28 ERP researchers via e-mail. Five of the ERP researchers sent back an e-mail and all confirmed the research framework and questionnaire set (Professor Hooshang M. Beheshti, Faculty of Business

and Economics, Radford University, USA; Professor Ike C. Ehie, Faculty of Business Administration, Kansas State University, USA; Professor Jahangir Karimi, School of Business, University of Colorado, USA; Professor John Ward, School of Management, Cranfield University, Bedford, UK; and Professor Valerie Botta-Genoulaz, Faculty of Information Technology, National Institute of Applied Sciences of Lyon, France). Their approval can be seen in Appendix (C).

Third, the English questionnaire was translated into the Persian language which was the medium communication of the respondents. A professor in IT/Management who graduated from the USA was asked to translate the validated English version of the questionnaire into Persian. Then, the Persian questionnaire was given to six experts involved in ERP implementation projects in Iran. These ERP experts were the best of ERP consultants, vendors' representatives and ERP project managers. They were asked to review the questionnaire separately and let the researcher know of any changes needed. Based on the suggestions of the ERP experts, 32 changes were made to the wording and format of the questionnaire. In addition, five items were removed from the questionnaire and one item was added to the demographic data section. Finally, the modified Persian questionnaire was given to a different IT/Management professor who graduated from the USA as well and he was requested to translate it back into English. This was done to ensure that the process of translation was consistent and the Persian and English versions of the questionnaire were as similar as possible. This was very important because some of the respondents were from multinational companies where English was the medium of communication. Table (3.11) summarizes the number of changes made to the questionnaire in the process of content validity assessment.

Table (3.11) Changes Made to Questionnaire in Content Validity Assessment

No.	Subject	Initial Items	Items Dropped	Items Added	Items Edited	Final Items
1	Demographic Data	7	-	1	1	8
2	Enterprise-Wide Communication	6	-	-	3	6
3	Business Processes Reengineering	6	1	-	2	5
4	Project Management	7	1	-	4	6
5	Team Composition and Competence	6	1	-	2	5
6	ERP System Quality	6	1	-	3	5
7	ERP Vendor Support	6	-	-	4	6
8	Organizational Culture	6	-	-	3	6
9	ERP User Satisfaction	7	-	-	5	7
10	ERP Organizational Impact	8	1	-	5	7
Total		65	5	1	32	61

3.5.3. Assessment of Questionnaire Reliability

To examine the reliability of the questionnaire, a pilot study was carried out. Contacts were made with all 31 companies listed, however only one agreed to participate in the pilot study. The finalized version of the questionnaire was distributed to 54 ERP users (operational/ functional/ unit managers). If a considerable number of respondents had been employed in the pilot study, then very few respondents would have been left to collect data from in the main data collection stage. After one month, 37 completed questionnaires were collected. The data were inserted into SPSS software 16.0.

Cronbach's alpha was used to indicate the extent to which a set of questions can be considered for measuring a particular variable. Cronbach's alpha usually increases when the correlations between the questions increase. So, the elements of each variable must be strongly correlated to have higher internal consistency in the test. As can be seen in Table

(3.12), the results confirmed that all variables had high rates of Cronbach's alpha (above the 0.7 level). So, the questionnaire was considered as reliable as suggested by Hair et al. (2006). The complete outcomes of the reliability assessment were shown in Appendix (E).

Based on prior research findings and preceding validity and reliability assessment, a comprehensive questionnaire was designed. The questionnaire set consisted of the following five parts and can be seen in appendix (D):

- A cover letter, which introduces the researcher and research objectives.
- A confirmation letter from the Faculty of Business and Accountancy, University of Malaya, Malaysia.
- Demographic data of respondents.
- Close-ended questions relating to variables measurement items.
- An open question to elicit more comments and suggestions from the respondents.

Table (3.12) Reliability Assessment of Variables

No.	Construct	Cronbach's (α)
1	Enterprise-Wide Communication	0.784
2	Business Processes Reengineering	0.775
3	Project Management	0.878
4	Team Composition and Competence	0.835
5	ERP System Quality	0.803
6	ERP Vendor Support	0.898
7	Organizational Culture	0.807
8	ERP User Satisfaction	0.897
9	ERP Organizational Impact	0.901

3.6. Questionnaire Distribution

After identification of the target population, the researcher held discussions with the ERP project managers or chief information officers (CIO) of ERP user companies. The identity of the researcher was disclosed and the purpose of the survey was clearly described. They were also asked to identify a liaison person. Subsequently, in several companies a meeting with the liaison person was arranged to describe the method of distributing, completing and also collecting the completed questionnaires. For the remaining companies, the liaison person was informed via telephone. The liaison persons were also asked to indicate the number of the operational /functional /unit managers who use ERP systems in their companies. Five hundred and sixty-two were identified.

After confirming the number for each company, the questionnaires were distributed. The Persian version questionnaires were distributed to all but two companies. The liaison persons were informed that they had to collect and send the completed questionnaires to the researcher within one month. During the data collection period, more than 50 calls were received from the liaison persons to seek clarification. On average, three rounds of follow-up were carried out using the telephone and email. After constant reminders, 411 completed questionnaires (73%) were collected between June to July 2009. Table (3.13) indicates the proportions of the distributed and collected questionnaires in 31 target companies.

Table (3.13) Proportion of Distributed and Collected Questionnaires

Company No.	Distributed Questionnaire		Collected Questionnaire	
	Number	Percent	Number	Percent
1	16	2.8	11	2.7
2	19	3.4	15	3.6
3	21	3.7	15	3.6
4	23	4.1	17	4.1
5	18	3.2	14	3.4
6	17	3.0	12	2.9
7	22	3.9	14	3.4
8	19	3.4	14	3.4
9	21	3.7	16	3.9
10	19	3.4	14	3.4
11	16	2.8	13	3.2
12	18	3.2	12	2.9
13	15	2.7	11	2.7
14	15	2.7	10	2.4
15	17	3.0	13	3.2
16	16	2.8	12	2.9
17	19	3.4	13	3.2
18	18	3.2	13	3.2
19	22	3.9	17	4.1
20	17	3.0	12	2.9
21	15	2.7	12	2.9
22	14	2.5	11	2.7
23	21	3.7	16	3.9
24	18	3.2	13	3.2
25	14	2.5	10	2.4
26	22	3.9	15	3.6
27	19	3.4	15	3.6
28	16	2.8	11	2.7
29	18	3.2	15	3.6
30	16	2.8	11	2.7
31	21	3.7	14	3.4
Total	562		411	

3.7. Data Analysis Techniques Used

3.7.1. Overview of Structural Equation Modeling

Structural Equation Modeling (SEM) is commonly accepted as a powerful technique for capturing and explaining multifaceted relationships in social science. SEM is considered as a second generation instrument for data analysis. It is a mixed methodology which consists of confirmatory factor analysis, regression, and path analysis. The majority of the first generation techniques can assess only one level of relationship between dependent and independent variables at once. However, SEM is able to handle a series of interrelated research issues in an inclusive and systematic examination by modeling the relationships among several dependent and independent variables concurrently (Gefen et al., 2000). SEM presents multiple advantages over the more frequently used statistical methods of path analysis and multiple regressions. SEM allows the researcher to examine several relationships in a single analysis. It also offers the possibility of testing overall models rather than coefficients separately. SEM has the capability to test research models with several dependent variables. Lastly, it offers multiple measures to evaluate model fit (Kline, 2005).

There are two main methods for SEM analysis including covariance analysis and partial least squares. LISREL, EQS, and AMOS are statistical software which employ covariance analysis, while PLS is the statistical software which uses partial least squares. These two special kinds of SEM methods differ in their statistical assumptions, their analyses objectives, and the nature of their produced fit statistics. Table (3.14) demonstrates the comparison of covariance analysis, partial least squares, and linear regression.

Table (3.14) Comparison between Statistical Techniques

Issue	Covariance based SEM	PLS	Linear Regression
Objective of Overall Analysis	Show that the null hypothesis of the entire proposed model is plausible, while rejecting path-specific null hypotheses of no effect.	Reject a set of path specific null hypotheses of no effect.	Reject a set of path specific null hypotheses of no effect.
Objective of Variance Analysis	Overall model fit, such as insignificant Chi-square	Variance explanation (high R-square)	Variance explanation (high R-square)
Required Theory Base	Requires sound theory base. Supports confirmatory research.	Does not necessarily require sound theory base. Supports both exploratory and confirmatory research.	Does not necessarily require sound theory base. Supports both exploratory and confirmatory research.
Assumed Distribution	Multivariate normal, if estimation through Maximum Likelihood. Deviations from multivariate normal are supported with other estimation techniques.	Relatively robust to deviations from a multivariate distribution.	Relatively robust to deviations from a multivariate distribution, with established methods of handling non- multivariate distributions.
Required Minimal Sample Size	At least 100-150 cases.	At least 10 times the number of items in the most complex constructs.	Supports smaller sample sizes, although a sample of at least 30 is required.

(Source: Gefen et al., 2000)

The first SEM technique, covariance based analysis, is suitable for confirmatory investigation such as testing theories. Nonetheless, PLS method differs from covariance based analysis and it is more appropriate for building theories. PLS based SEM is considered a limited-information method the parameter estimates of which are not considered to be as efficient as the full-information estimates offered by covariance based SEM. Covariance based SEM provides an overall test for model fit, while PLS has no overall test for model fit (Gefen et al., 2000). For these reasons, this study employed the covariance based SEM techniques. In addition, one kind of covariance based SEM software, AMOS™ 16.0, has been employed in this study because it is compatible with SPSS® software and it has a graphical interface. The most important facet of AMOS™

16.0 is that the researcher can draw a research model and assess it with AMOS Graphics that does not need any particular programming language.

In SEM method, independent and dependent variables are named exogenous and endogenous variables, respectively. Unlike the observed variables which are measured directly by the researcher, the latent variables are not observed directly. The latent variables are inferred by the relationships among measured variables in the SEM model. SEM applies path diagrams which can represent the relationships among latent and observed variables. Circles or ovals represent the latent variables, while squares or rectangles represent observed variables. Since residuals are unobserved forever, they are represented by circles or ovals. Bidirectional arrows symbolize covariances and correlations, which point to relationships with no definite causal direction. To assess and validate the model, SEM technique runs two types of analytical processes at the same time. The first type of analysis is confirmatory factor analysis (CFA). CFA determines the set of observed variables that share common variance characteristics to identify the constructs or latent variables (factors). Regression analysis is the second type of analysis, run simultaneously with CFA. The second type of analysis is regression analysis which confirms the path model consisting of relationships between latent variables (Kline, 2005).

Since there is no single statistical test to illustrate the strength of a model, researchers have developed some goodness-of-fit measures to evaluate the results from three points of view: comparative fit to a base model, model parsimony, and overall fit. The AMOS package offers a number of statistics to assess the hypothesized model and also modify the model. Hair et al. (2006) recommended that using three to four fit indices provides sufficient proof for model fit. They added that a researcher should present at least Chi-square statistic ($\chi 2$) and associated degrees of freedom, one incremental index, and one absolute index.

The model chi-square ($\chi 2$) fit statistic can be used to test the overall significance of the proposed model. In AMOS, the chi-square fit statistic is named CMIN. Small value of the chi-square statistic is better and points to small residuals and, therefore, a reasonably good fit. DF (df) is the number of degrees of freedom to test the model. CMIN/DF is the minimum discrepancy divided by its degrees of freedom. In general, the desired level has been recommended as low as 3 as a satisfactory fit (Hair et al., 2006). The Comparative Fit Index (CFI) is an index of incremental fit. CFI compares the present model fit with a null model which assumes that the latent variables in the model are not correlated. CFI varies from 0 (no good at all) to 1 (perfect fit). A generally suggested value of CFI is 0.90 or greater (Hair et al., 2006). The Root Mean Square Error of Approximation (RMSEA) corrects for the complexity of the model. RMSEA is known as a descriptive measure of overall model fit and lower values indicate better fit. Values below 0.05 show good fit, values as high as 0.08 represent reasonable errors of the population estimate, values which range from 0.08 to 0.10 indicate average fit, and values greater than 0.10 indicate poor fit (Hair et al., 2006).

3.7.2. Structural Equation Modeling Stages

The structural equation modeling was employed in this research using the following two main steps as suggested by Hair et al. (2006):

3.7.2.1. Measurement Model Assessment

In the first stage of the SEM process, every latent variable is modeled like a distinct measurement model in which the measurement model relates the observed variables to their relevant latent variable. Then the measurement model is assessed by finding whether the observed variables are suitable measures of their respective latent variable. For evaluating

the measurement model, the observed variables are submitted to analysis to test model fit indexes for each latent variable. Hair et al. (2006) recommended that reporting the chi-square ($\chi 2$), degrees of freedom, the CFI, and the RMSEA often presents enough information to assess a model. In evaluating the measurement model, several primary indications of model fit may illustrate poor fit. Consequently, additional model adjustment is performed based on modification indices. The modification index (MI) is a symbol of both item correlations (multicolinearity) and measurement error correlations. A high modification index represents error covariance which means that an element can share variance explained by the other element (commonality) and, therefore, they are redundant. Hair et al. (2006) suggested that the corrective action for error covariance is to remove such an element that has high error variance.

Schumacker and Lomax (2004) confirmed that validation of the measurement model addresses both discriminant validity and convergent validity. However, additional analyses are carried out to evaluate the psychometric properties of the scales.

Discriminant validity evaluates the independence of the dimensions or constructs. SEM methodology can be employed for assessing discriminant validity (Schumacker & Lomax, 2004). Confirmation of second-order construct is the main feature of discriminant validity. Target coefficient (T) can be employed to check the existence of the only construct of the second order which takes into account variations in all its dimensions. The T coefficient is determined as follows. Suppose the model (A) (Figure 3.1) represents four correlated first-order factors and the model (B) (Figure 3.2) theorizes the identical four first-order factors and one second-order factor.

The T coefficient is the proportion of the chi-square model (A) to the chi-square model (B) showing the percentage of deviation in the four first-order factors in model (A) explicated by the second-order factor in model (B). The T coefficient of 0.80 to 1.0 points

to the existence of a second-order construct because the largest part of the variation shared by the four first-order factors is clarified by the single second-order factor (Hair et al., 2006).

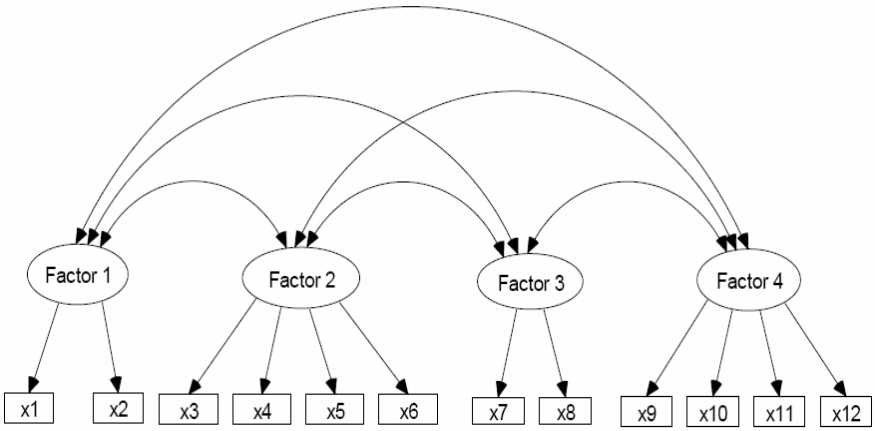

Figure (3.1) Four Correlated First-Order Factors (Model A)

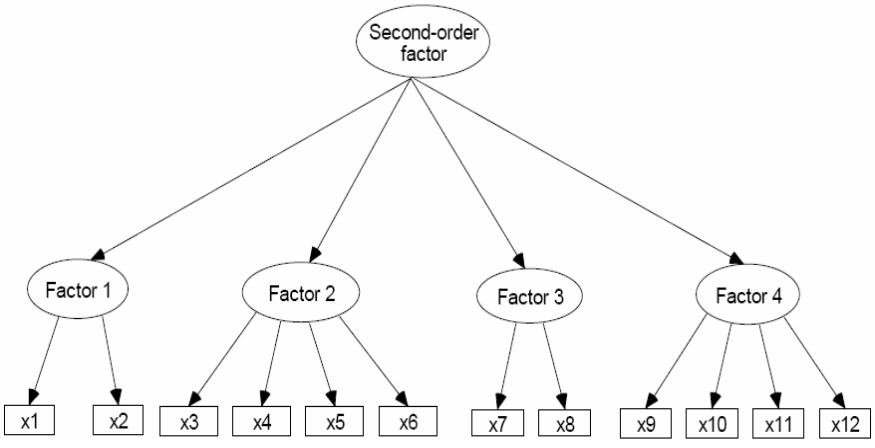

Figure (3.2) Second-Order Factor (Model B)

Convergent validity is described as the degree of converging the measurement items into a theoretical construct. Convergent validity is evaluated with three measures including factor loading, composite construct reliability, and average variance extracted. According to Hair et al. (2006), each item in the measurement model should load significantly ($p < 0.01$) on its original construct and the factor loadings of the items must be greater than 0.70. Then, the composite reliability of the construct must be within the recommended range above 0.70. Finally, the average variances extracted should be greater than the generally accepted level of 0.50.

Confirmatory factor analysis (CFA) classifies the observed variables that have identical variance and covariance characteristics. Consequently, the latent variables, constructs, and factors are defined. To examine the overall effectiveness of the measurement model, several general model fit measures are used i.e. normed $\chi 2$, comparative fit index (CFI), and root mean square error of approximation (RMSEA). The measurement model indicates an acceptable fit if the model fit measures meet the threshold of a normal fitting model (Hair et al., 2006). So, the CFA technique was conducted to test the measurement model for all latent variables with their associated observed variables.

3.7.2.2. Structural Model Assessment

The second stage of the SEM method is to test the structural model. SEM is designed to estimate the strength and direction of each path of the hypothesis that is specified in the model. Provided that the measurement model has both discriminant and convergent validity, the test of the structural model offers an assessment of the structural model in terms of nomological validity (Burnette & Williams, 2005). Nomological validity is the extent to which a construct acts as it should in an associated constructs system. This research examined the proposed structural model employing common measures of model

fit including normed $\chi 2$, comparative fit index (CFI), and root mean square error of approximation (RMSEA). SEM fit indices evaluates the degree of difference between the covariance matrix derived from the sample and the covariance matrix derived from the hypothesized model. The method of maximum likelihood (ML) was used to estimate all fit indices and parameters (Hair et al., 2006).

The hypothesized model of the current research also contained a moderator variable which affects the relation between the independent and dependent variables. Baron and Kenny (1986) described how a moderator variable influences the strength and/or direction of the relation between the dependent and independent variables. Figure (3.3) summarizes the properties of a moderator variable. Chin, Marcolin, and Newsted (1996) presented a guideline for the testing moderation (interaction) effects. In summary, each indicator or variable in the interaction is standardized or normalized by subtracting the average of each indicator and dividing by its standard deviation. Then, by multiplying the value of each of the composed indicators or variables, the interaction construct is created.

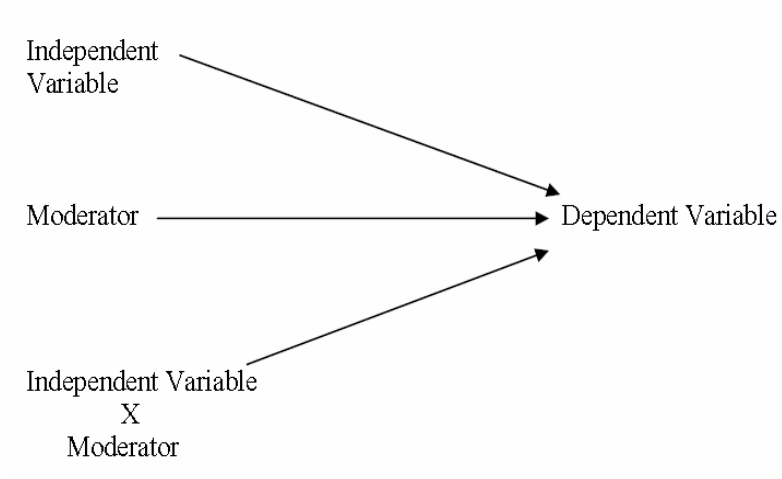

Figure (3.3): Moderator Model

(Source: Baron & Kenny, 1986)

In addition, changes in R-square can be examined to determine the magnitude of the effect resulting from interactions of a model (Cohen, 1988). Change in R-square is computed by subtracting the R-square of the main effect model from the R-square of the interaction model. Cohen (1988) provided a method for calculating the effect size ($f2$) of the interaction, which is shown below. Cohen recommended that the effect size of 0.371 or above is considered significant interaction, the effect size between 0.100 and 0.371 is considered medium interaction, and the effect size of 0.1 or less is considered small interaction.

$$f^2 = \frac{R^2(\text{interacting effect model}) - R^2(\text{main effects})}{1 - R^2(\text{main effects})}.$$

(Source: Cohen, 1988)

3.8. Summary

This chapter presented the research design of the study. The target population and sampling method selected for this study were described. Next, based on the objectives of this study and analysis of prior research, an ERP implementation success model was outlined. Then, operational definitions were provided for measuring the variables. After that, the research hypotheses were developed. Moreover, a survey questionnaire was designed and its validity and reliability was assessed through expert judgment and pilot study. In addition, the questionnaire distribution and data collection was explained. Lastly, the appropriate data analysis techniques were discussed in detail.

The next chapter describes the process of data analysis. First, collected data are prepared for analysis. Then, a range of descriptive statistics including frequency distribution, measures of central tendencies and dispersion of variables is presented. Next, the structural

equation modeling (SEM) technique is employed for data analysis, using two steps: the measurement model and the structural model. A number of goodness-of-fit measures are utilized to assess the results. Furthermore, dicriminant validity, convergent validity and confirmatory factor analysis are discussed. Finally, the hypotheses are tested.