# Perception of the risk factors associated with implementation and post-implementation of Enterprise Resource Planning (ERP) Systems in Jordan

**By**
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## Abstract

The implementation of ERP systems has increased during recent years. These systems bring a great many benefits to organisations but, at the same time, have been problematic for them. A literature review showed that some companies have succeeded in implementing ERP systems while other companies have failed in this regard, illustrating that ERP systems are complex and risky to implement and operate in companies. Perceiving and understanding the risk factors related to the implementation and operation of ERP systems could have a positive impact on the success of these systems. Therefore, it is important for organisations to perceive and understand risk factors in order to make ERPs more successful and reduce the failure of their implementation and operation.

Reviewing the literature helped in evaluating previous research work on the success or failure of ERP implementation and operation. It was found that there is a gap in the literature regarding understanding the risk factors related to ERP implementation and operation, as well as perceptions of those risk factors on the part of managers in the same organisations who have different levels of ERP expertise, come from different professional backgrounds, and have different cultural outlooks. This thesis constitutes an attempt to clarify the relationship between the perceptions of risks factors associated with ERP systems and cultural worldviews, professions and levels of ERP expertise.

Exploratory interviews, based on a pilot study, were carried out in order to identify the main issues and also to test the risk factors proposed in the literature. Twenty seven interviews were conducted with Jordanian managers to gain an understanding of their opinions and perspectives concerning what they considered to be risk factors. The results of the pilot study elicited 20 risk factors that could lead to the failure of ERP systems during their implementation or operation.

A preliminary research model of the impact of these risk factors on the implementation and operation of ERP systems was built, based on the literature and the findings from the exploratory stage of the research. Also, a framework was constructed in order to understand the relationships between different groups of managers and their perceptions of the risk factors related to the implementation and operation of ERP systems. The main groups of managers were information technology managers, financial accounting

managers, auditing managers, and others groups, such as HR or manufacturing operations managers. To develop and test further the research framework, a survey was conducted. Based on the findings from the pilot study and the literature review, a survey instrument was developed. A 21-item scale to assess the four worldviews identified by Cultural Theory, a five-item scale to measure the level of ERP expertise, and a 65-item scale to assess perceptions of 27 risks factors related to ERP systems were developed. The questionnaires were sent to accounting financial managers, IT managers and other managers with at least one year's experience with ERP systems. The major finding of the survey, obtained from a sample of 166 manager respondents, suggested that there were critical differences in perception among participating managers in Jordan according to their differing culture, level of ERP expertise, and profession. Culture, however, had a stronger effect on the perception of risk factors regarding ERP systems than profession or ERP expertise.

The contribution made by this thesis is the theoretical framework which was built on an analysis of the findings of this research. This is the first such framework, derived from a literature review and empirical study, that has explored the risk factors that lead to failure in implementing ERP systems and which are most important in ensuring success, together with their interrelationships with managers' groups. Furthermore, risk factors concerning the operation of ERP systems were also incorporated into the research framework. Since the risk factors concerning ERP operation have not been highlighted in other studies, this thesis adds new theoretical insights to the existing literature. Moreover, this thesis not only confirms some of the factors stated in the literature, it also adds several new ones, such as working with two systems (old and new) in parallel, sharing passwords, incorrect entry data, repetition of errors, flowing of errors, illogical processing, and lack of information quality. In addition, groups of managers (such as accounting and financial managers, IT managers and others, who have at least one year or more ERP expertise) are important considerations and need more attention. The research framework of this thesis shows that the perception of ERP risk factors varied among those managerial groups and highlights the influence of managers' groups regarding their perceptions of these risk factors, as well as identifying which factors were the most important.

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# 1 Chapter One: Introduction

## 1.1 Background

In recent years, Enterprise Resource Planning Systems have been used broadly by large, medium, and now even small companies. What is more, ERP systems are now deployed in many different countries around the world. ERP systems are developing in Germany and in the USA because of the features of these systems and what they can do for companies to improve their business practices. Enterprise Resource Planning (ERP) systems comprise a number of business applications, such as general ledgers, payroll, supply chain management, manufacturing, and business intelligence (Wright and Wright, 2002).

With the implementation of an ERP system, an organization can obtain numerous benefits. These systems help a company to integrate all data, not only across the departments, but also across the whole company. Therefore, using ERP systems requires data to be entered only once at the transaction source. Moreover, ERP systems give companies the ability to access a wide range of data in real time via the use of a single database, as well as generating the information on time and accurately.

Despite the significant benefits that these systems can provide, ERP systems have been problematic for many organisations, especially in terms of their integration and complexity. Wright and Wright (2002, p99) state that the “implementation of an ERP system is not an easy task”. It is quite a complex, costly and risky proposition; poor implementation and operation of ERP systems can have significant impacts on a business. The literature review shows that some companies have succeeded and achieved significant efficiency through ERP systems, while other companies have failed and witnessed declining performance as a result of the implementation of these systems (Davenport, 1998; O'Leary, 2000). It has been estimated from the literature review that at least 90% of ERP implementations end up late or over-budget and about half fail to realize the required results (Umble et al., 2003; Al-Mashari et al., 2003b; Holland and Light, 1999). So, the question needs to be asked: why do so many ERP systems fail? Explanations for this high rate of failure have been given by a number of different sources. Many companies have failed when implementing ERP systems because they are not prepared for integration and simply buy a piece of ERP software (Fahy, 2001). Verville and Bernadas (2005) indicated that the reasons for the failure of ERP systems are not only related to technical issues; more probably, it is related to organisational changes, or because of behavioural, social, and political reasons. Abdinnour-Helm et al. (2003) and Lengnick-Hall et al. (2004) pointed out that failure was due to people problems rather than technical difficulties. Keil et al. (1998) gave another explanation for this high failure rate: this was that managers do not take prudent measures to understand and manage the risks related to these projects.

Because of the high rate of failure and the complexity and riskiness of ERP implementation in companies, together with the huge amounts of investments, in terms of both time and money, required for these systems, it is necessary to identify the risk factors that increase the probability of failure and decrease the likelihood of success in the implementation of these systems. Furthermore, not only is the success of the implementation of ERP systems important, but the success the operation of the ERP system is important as well in order to provide accurate, real-time information which should be reliable and consistent, have integrity, and contain no errors (Park and Kusiak, 2005; Bingi et al., 1999). However, the companies that have implemented or will implement ERP systems should take into consideration the issues related to ERP data quality. The companies should also understand those factors that have an effect on data quality in ERP systems in order to increase the efficiency of operating such systems.

Knowledge of the risk factors that might lead to the failure of ERP systems is believed to be important in order to assist companies in improving their implementation and operation such systems. Some ERP studies have dealt with issues concerning ways of successfully implementing ERP systems and have identified certain critical success factors (CSFs) in this regards (Bradford and Florin, 2003; Ehie and Madsen, 2005; Kim et al., 2005; Soja, 2006; Wu and Wang, 2006; Ramayah et al., 2007; Nah et al., 2001; Hong and Kim, 2002; Enrique et al., 2005). Also, few studies have attempted to identify risk factors in ERP implementation (Sumner, 2000; O'Leary, 2002; Wright and Wright, 2002; Huang et al., 2004; O'Leary, 2000; Hunton et al., 2004; Musaji, 2002). However, it appears that no studies have been carried out to identify operational risk factors regarding ERP systems. Therefore, there is a need for research to identify the risk factors associated with the implementation and operation of ERP systems. Furthermore, since the implementation and operation of ERP systems involves many people with different characteristics such as different cultures (hierarchies, egalitarian, fatalist, individualist) disciplinary backgrounds (including IT, accounting, management, marketing, manufacturing engineering and so on) and levels of ERP expertise (low/ high expertise), it is important to consider the knowledge of these people and their perceptions (which could be different or similar) of the risk factors related to the implementation and operation of ERP systems.

## 1.2 Research problem and research questions

It appears that very little literature exists which discusses ERP implementation risk factors; and no studies have identified ERP operational risk factors. Therefore, there is a need for research to identify the risk factors associated with the implementation and operation of ERP systems. However, it is observed from literature that there are no guidelines, either theoretically or empirically, on what risk factors currently face ERP implementation and operation. Thus, this thesis seeks to address this problem since it attempts to fill this gap in the literature. The gap in the literature is a lack of knowledge of implementation and operation ERP risk factors.

What is more, ERP systems are developing in Europe and in the USA, and most of the existing literature therefore focuses on the USA and Europe, and while some work has been done in Middle East, which concerns Egypt and Saudi Arabia, no studies have addressed Jordan. For this reason, this thesis focuses on Jordon as no previous studies have been conducted there. It is believed that conducting the current study in a developing country, Jordan, might yield significant results and bridge the gap in this area of research.

In order to explore the research problem, this thesis focuses on one main research question which includes three research sub-questions. The main research question in this study is “How do managers perceive risks factors associated with the implementation and operation of ERP systems in Jordan?”

Sub-questions:

**RQ1.** What risk factors affect the failure or success of the implementation and operation of ERP systems in Jordan, and how could these be managed?

**RQ2.** What are the most important risk factors which affect the implementation and operation of ERP systems from the point of view of Jordanian managers?

**RQ3**. Are there any differences in perception between different groups of managers of those risk factors that affect the failure or success of the implementation and operation of ERP systems based on:

1. The different disciplinary backgrounds or functional roles of Jordanian managers in their companies, (e.g. accounting financial managers, auditing managers, IT managers, and others such as CEOs, HR managers, manufacturing managers, etc.).
2. Different levels of ERP expertise (high and low level of expertise).
3. Different cultures (hierarchies, egalitarian, fatalist, individualist).

## 1.3 Research aims and objectives

The aim of this research is to contribute to the growing body of knowledge in the field of the implementation and operation of ERP systems by exploring the theoretical foundations of explanations of success or failure in the implementation and operation of these systems, as well as developing a better understanding of these issues by identifying the risks factors concerning the implementation and operation of ERP systems.

The main objectives in conducting this research are as follows:

1. To explore those risk factors that have an effect on the failure or success of the implementation and operation of ERP systems in Jordan.
2. To identify the most important risk factors affecting the implementation and operation of ERP systems from the point of view of Jordanian managers.
3. To identify the similarities and differences in managers' perceptions of those risks related to the implementation and operation of ERP systems.
4. To investigate whether there are any differences in perception regarding the risk factors associated with the implementation and operation of ERP systems among managers with different job specifications: e.g. IT managers, accounting financial managers, auditing managers, and others.

5. To examine whether differences in the level of ERP expertise among managers have an effect on the perception of risks associated with complex ERP systems.
6. To explore whether there is difference between managers from different types of culture (e.g. Hierarchism, Individualism, Egalitarianism and Fatalism) in their perception of the risk factors related to the implementation and operation of ERP systems.

## 1.4 Justification for this research/ research motivation

There are a number of motives behind undertaking this research in the field of ERP systems in Jordanian companies. Firstly, the use of ERP systems is rapidly increasing around the world, and especially in Jordan; thus, implementing an ERP system potentially offers very substantial advantages but also possibly very considerable risks (Gable et al., 1998).

Secondly, although previous research has addressed critical factors in the successful implementation of ERP systems (Bradford and Florin, 2003; Ehie and Madsen, 2005; Kim et al., 2005; Soja, 2006; Wu and Wang, 2006; Ramayah et al., 2007; Nah et al., 2001; Hong and Kim, 2002; Enrique et al., 2005; Osei-Bryson, Dong et al., 2008), the implementation of ERP systems still needs to be improved as a significant number of ERP projects still continue to fail or do not achieve their potential (Urwin, 2002; Hakim and Hakim, 2010). Therefore, it is essential, not only to identify the risk factors which affect the success of these systems, but also to discover whether those risk factors are perceived by managers when implementing and operating ERP systems. One of the motivations for this research is to understand how the managers perceive risk factors associated with the implementation and operation of ERP systems as this is important for communicating them efficiently which is vital for the task of risk management.
Thirdly, it is known that complex ERP systems have an impact on managers in terms of the way business is done but no prior research studies have attempted to investigate if variations in managers' ERP expertise, profession and culture explain differences in their perceptions or awareness of the risks that are associated with ERP systems in companies in Jordan.

Fourthly, no research has been carried out in the field of ERP systems in Jordan as it has been observed that almost all the previous studies in this area have been undertaken in developed countries; to the best of the author's knowledge, few studies investigated the issues related to implementation of ERP systems in developing countries, and no previous empirical research has examined the risk factors that threaten the success of ERP systems in developing countries, especially Jordan. It is believed that conducting the current study in a developing country, Jordan, might yield significant results and bridge the gap in this area of research.

Finally, the majority of this study in terms of the background research, identifying gaps in the literature, and the design of this study itself, draws from a wide variety of disciplines and sources. Some of the background for the design of this research is taken from work which has already been conducted in perceptions of risk in the areas of health or the environment; this has then been applied to the field of information systems, and ERP systems in particular. What is more, research into perceptions concerning risk factors in ERP systems is important because then researchers can attempt to understand the ways in which managers think about those risks.

## 1.5 Research contribution for theory and practice

As previously stated, this research aims to identify the risks factors associated with the implementation and operation of ERP systems, discover how these risk factors are perceived by different mangers, and identify the factors that could have an effect on their perceptions. The outcomes of this thesis will contribute to the body of the knowledge for both ERP implementation and operation, and the perceptions of risk. This research will play a role in bridging the gap in the existing literature related to the implementation and operation of ERP systems by offering an empirical study of risk factors and managers' perceptions of these factors.

Understanding these risk factors and their effects on the success or failure of the implementation and operation of ERP systems in an organisation could be useful for practitioners in terms of improving their experience. Furthermore, focusing on those risks factors that are more important, especially in Jordan, will lead to improvements in the success rate of these systems, as well as increasing the efficiency and effectiveness of the ERP procedures during their implementation and operation. Specifically, the results of this thesis can help organisations' top management, IT managers, accounting financial managers and other managers by increasing their awareness of the risk factors associated with the implementation and operation of ERP systems.

In addition, since the theory in the area of ERP implementation and operation is still not established, this research can be taken as a step towards the building of such theory. This study will be the first that explores the relationship between the culture, profession and ERP expertise of managers and the perception of risk factors associated with implementing and operating ERP systems.

### 1.6 Research approach and methodology

In order to complete the objectives of this thesis, this study combines qualitative and quantitative methods that are adopted through semi-structured interviews and a questionnaire survey. The research is structured in two stages: building a research model through pilot and exploratory studies, and testing the model using a survey.

The first stage includes the development of the research model showing possible risk factors associated with the implementation and operation of ERP systems. In order to build the research model, prior theories from the relevant literature and exploratory pilot studies were used. By reviewing previous research work into ERP implementation and operation (i.e. success or failure in the implementation and the operation of ERP systems), a list of significant risk factors is proposed. Pilot and exploratory studies were used to test the researcher's ideas by collecting qualitative data using semi-structured interviews. This was done in order to improve the existing theories as there is a little information available in the literature about the risk factors related to ERP systems. In addition, the exploratory stage was designed to explore and obtain a deeper understanding of the risk factors associated with the implementation and operation of ERP systems from the viewpoint of managers with real experience; in other words, from those who had really been through the implementation and operation of ERP processes. Furthermore, this was done to address the key issues of the research and to build themes within the study under investigation, as well as to obtain richer data in order, by interpreting and analysing them, to draw a more comprehensive picture. Moreover, the interview data helped in developing the questionnaire. Thus, the results from one method helped in developing the others (Creswell, 2008; Creswell, 2003).

Maxwell (2005) states that pilot research is one of most important conceptual resources that helps in generating preliminary or tentative theories about the topic.

Twenty seven semi-structured interviews were carried out in Jordan organisations with managers from different professions, such as accounting financial managers, IT managers, auditors and other managers, in order to identify the main issues and test the risk factors that were proposed in the literature. As the processes of implementing and operating ERP systems are performed by different people from various disciplines, the perceptions of risks factors could be different from different managers. The purpose of this study is to look at ERP risks from different viewpoints.

The preliminary research model of risk factors in the implementation and operation of ERP systems was built based on findings from the literature and from the pilot study as an exploratory stage of the research. Also, a framework was built for understanding the relationships between different groups of managers and their perceptions of the risk factors related to the implementation and operation of ERP systems. The main groups of managers were: information technology managers, financial accounting managers, auditing managers, and others groups, such as HR managers and production managers. Figure 1-1 illustrates how different areas of the literature and the pilot study contributed to the building of the model in this research. Producing a set of risk factors concerning the implementation and operation of ERP systems could concentrate the attention of accounting and IT professionals on those factors that need to be addressed in order to reduce the failure of ERP systems.

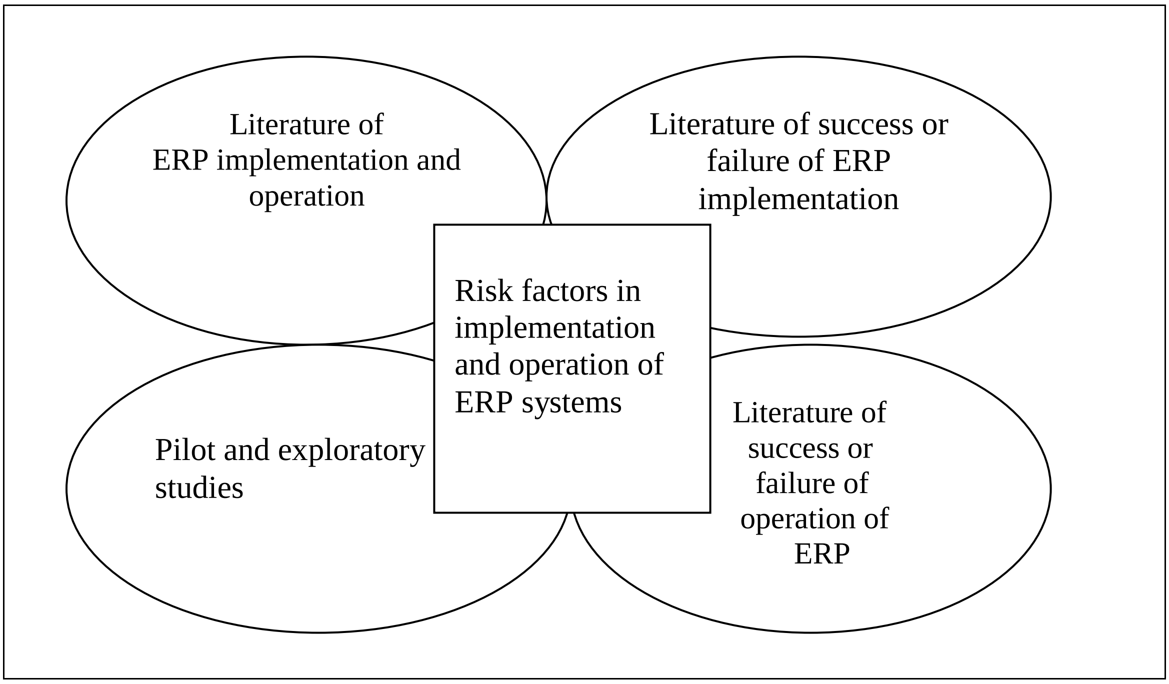


**Figure 1-1: Areas that contributed to the development of the research model**

In the second stage of this thesis, descriptive and explanatory approaches were applied. Descriptive research is suited in this research for investigating the managers' perceptions of risk factors concerning ERP systems and for answering the research question: 'What the most important risk factors are associated with the implementation and operation of ERP systems? How do managers perceive these risk factors?' The risks factors associated with the implementation and operation of ERP systems were identified in the first stage (the literature review and pilot study); these were then tested by employing a structured questionnaire. The purpose of the descriptive study is to understand the similarities and differences in perception concerning the risk factors among the selected managers, based on their profession and their expertise in ERP systems. Moreover, explanatory research was also used in this thesis in order to explain the relationship between managers' perceptions of risk factors and their culture, profession and level of ERP expertise. Quantitative research was carried out by conducting a questionnaire with a large sample for descriptive and explanatory purposes; this helped in testing the themes developed from the initial exploratory findings.

This stage of the study included a survey. The aim of this was further to develop and test the research model. The survey was used for follows purposes:

1. To obtain information about the extent of the agreement or disagreement in terms of those risk factors that were identified from the pilot study and the literature.
2. To rank in order the most important risk factors that had an effect on implementation and operation of ERP systems from the point of view of managers in Jordan.
3. To identify descriptively similarities and differences between managers in their perceptions of those risk factors based on difference in their culture, profession and ERP expertise.
4. To examine analytically whether differences in culture, ERP expertise, and profession affect the perception of risks associated with complex ERP systems.

## 1.7 Structure of the thesis

There are nine chapters in this thesis. **Chapter One** contains the rationale and background of the research and presents the research problem and three sub-research questions for investigation. It also includes the aims and objectives of the research, the research motivation, the contribution made by this study, and a brief overview of the research design (i.e. its approach and method). Finally, in the next section, the layout and content of the chapters are described. This is followed by a literature review in Chapter Two.

**Chapter Two: Overview and Background of ERP systems**

Chapter Two includes a review of the literature concerning ICT in Jordan, definition, history, components and modules, vendors, features, and benefits of ERP systems, together with their problems and difficulties.

**Chapter Three: literature review of risk factors associated with the implementation and operation of ERP systems**

This chapter reviews the relevant and existing body of literature regarding the three research areas: critical success factors for the implementation of ERP; risk factors concerning the implementation of ERP; and risk factors in terms of the operation of ERP systems. Based on a literature review, this chapter identify the important possible risk factors which could impact on the implementation and operation of ERP systems.

**Chapter Four: Theoretical framework and development model of risk perception**

The aim of this chapter is to develop a research model. By reviewing the literature, a preliminary theoretical framework was developed and then refined by conducting pilot study interviews. Besides, three research questions were drawn from the framework for examination.

**Chapter Five: Methodology**

This chapter gives a detailed view of the methodological issues related to this research. This includes a description of the aims and objectives, and how the process of the research was carried out. There is a brief discussion of the epistemological and methodological position adopted, together with a justification for using methods such as the pilot exploratory study and survey. This chapter discusses the processes and procedures used for data collection, the sample of the study, and data sources. This chapter also presents full details concerning the phases of the research, consisting of the pilot study and the survey. The reliability of the questionnaire was confirmed by using Cronbach's Alpha. The chapter concludes by presenting the ethical considerations that were adopted in this thesis.

**Chapter Six: Research findings from the pilot study from manufacturing and non-manufacturing organisations in Jordan**

This chapter describes and analyses the qualitative data, starting by providing a brief background information about the interviewees, and shedding light on the companies where the managers work, the ERP systems which managers use and operate in those companies, the chosen vendor, and reasons for this implementation. Following that, the chapter discusses implementation issues and the problem that were, ERP risk factors, and interactions between IT managers, financial and accounting managers, and internal auditors and their perceptions of risk factors. Finally, this chapter highlights the lessons learned from the semi-structured interviews, the outcomes and a summary of the qualitative data results from the interviews.

**Chapter Seven: Research findings from the survey**

This chapter discusses the results of the survey and provides an analysis of the survey data using SPSS Version 15. This chapter is separated into two mains parts. The first part is a descriptive analysis of the demographic profile of the survey respondents and also offers descriptive statistics concerning all the risk factors in the implementation and operation of ERP systems. The second part includes a statistical analysis using comparative techniques, the Mann Whitney test and the Kruskal-Wallis H test (a non-parametric, independent-sample technique) in order to evaluate the research hypotheses.

**Chapter Eight: Discussion: perceptions of risks factors and factors impacting on these**

Chapter Eight presents a detailed discussion on the main findings. This chapter also develops a framework to demonstrate the relationship between profession, culture and ERP expertise, and perceptions of the risk factors related to the implementation and operation of ERP.

**Chapter Nine: Conclusion and suggestions for further research**

Chapter Eight briefly presents the outcomes of this research. It also shows the contribution made by this research to the body of knowledge and its implications for theory and practice. Finally, it discusses the limitations of this study and directions for future research.

# 2 Chapter Two: Overview and background of ERP systems

## 2.1 Introduction

In the past decade, the world has changed significantly because of the evolving phenomenon of globalisation and a revolution in Information and Communication Technology (ICT). Globalisation has improved the interconnections among diverse societies regarding their economic, political and cultural lives. Information and Communication Technology (ICT), driven by computer hardware and software systems, has penetrated across different societies, whether developed or developing, across private and public sectors within the economy, and across organisational boundaries (Sayed and Westrup 2003). Some experts have asserted that ICT will strengthen the positions of developing countries in the new world economy (Montealegre, 1999) as such technologies provide companies with competitive advantage in the new and complex emerging global economy; they also facilitate communication and organisation across time and space (Walsham, 2002). Indeed, Information and Communication Technology (ICT) has had an effect on all aspects of computing applications across organisations.

In a dramatically changing business environment, with rising competition, growing markets, and increasing customer expectations, organisations are facing the challenge of reducing total costs in all supply chains, shortening throughput times, considerably reducing inventories, increasing product choice and improving quality, providing more reliable information of dates of delivery, and improving customer service (Umble et al., 2003; Hossain, Patrick et al. 2002). In this environment, organisations need to change legacy systems that do not correspond with such rapid changes and any applicable standards, while implementing effective information systems. These information systems could help organisations to improve their competitiveness by reducing costs and improving logistics. They will also provide integrated information to carry out multiple functions, accurately transferring the right information at the right time among different departments both inside and outside the company to different parties such as suppliers, distributors, customers and stockholders (Hossain, Patrick et al. 2002). To achieve all these requirements, organizations are increasingly transferring to Enterprise Resource Planning (ERP) systems (Umble et al., 2003). ERP systems are a solution for business systems; in fact, they are the newest in a number of manufacturing and financial information systems that have been created since 1940 to integrate a complete range of business processes and functions, as well as to streamline the flow of information concerning goods from raw materials to finished products (Norris et al., 2000).

This chapter includes ten sections. After this introduction, Section 2.2 provides an overview of the ICT in Jordan. The definition of ERP systems, evolution of ERP systems, modules, vendors, features, and reasons for adopting ERP systems, are reviewed in Sections 2.3 to 2.8. Following this, Sections 2.9 and 2.10 present a review of ERP systems, together with their benefits and limitations.

## 2.2 Background of Jordan: Jordanian culture

The Kingdom of Jordan is located in the Middle East, its capital is Amman. Jordan is a small country with few natural resources. The total population of Jordan is about six millions and the majority of them (91%) are literate (Halaweh, 2011). Jordan's area is 89.3 thousand square kilometres (Fardous et al., 2004). The official language of Jordan is Arabic, while English is also spoken. Although the income of this country is lower middle, many reforms have recently been undertaken for stabilised prosperity. For example, (Rabaai, 2009) points out that a national strategic modernization has started in the country with the focus on developing infrastructure, education and the private sector.

The first noticeable interest in ICTs in the kingdom appeared when King Abdullah II came to the throne in 1999 where he supported the application of ICTs as an effective means to develop the economy and the social life of the Kingdom (Al-Jaghoub and Westrup, 2003). Since that monarch support, the Jordanian government has worked its best to benefit from ICTs to effectively exploit the resources of the Kingdom and occupy a distinct position in the global and regional competitiveness (Mofleh, Wanous et al., 2008). In this regard, (Rabaai, 2009) argues that the Jordanian governments are highly interested in the application of ICTs to have a place in the global digital economy. To achieve such goals and create an effective ICT sector, Jordan encouraged competiveness and partnership between the public and private sector and developed strong relations with multinational enterprises and international agencies (Al-Jaghoub and Westrup, 2003). The main objective of the Kingdom is to become the regional centre of IT in the Arab world. Therefore, there has been so much interest in developing competitive software and IT services to gain economic and strategic benefits for Jordan. Consequently, Jordan now is developing a strong ICT sector to be a competitive state in this regard (Al-Jaghoub and Westrup, 2003). The Kingdom can play a vital role in ICTs and its applications, especially in technical services and software. Therefore, Jordan has adopted many characteristics of a competition country that is trying to change its economy into a knowledge-based economy that benefits and interacts with the global economy. The entry of Jordan into WTO helps the economy of Jordan to achieve its aims, but it becomes necessary to for the Kingdom to attract international agencies and ICT enterprises (Al-Jaghoub and Westrup, 2003). However, the Kingdom of Jordan should have its own enterprise of competition with other Arab countries to attract investment while paying attention to Jordanian population at the same time (Al-Jaghoub and Westrup, 2003).

Jordan is known for its vital role in the economic and political stability and prosperity of the Middle East states (Naser and Nuseibeh, 2008). The economy of the Kingdom is strengthened by adopting a liberal economic policy that encourages other countries to invest in Jordan (Naser and Nuseibeh, 2008). Such liberal economy is reflected upon technology application and services where Jordan is distinguished in this regard from other Arab countries such as United Arab Emirates and Saudi Arabia. Tubaishat et al. (2006) point out that the use of modern technology in Jordan is more common than other Arab states (e.g., UAE) because of the liberal economy of the country.

Attitudes to technology management and its adoption are influenced by many aspects of the Jordanian society and culture. The national culture is a significant aspect of the organisational culture. Hofstede claimed that organizational cultures could not exist independently of national cultures since organizational culture is nested within a national culture *(*Hofstede, 1980). Moreover, national cultural values of employees directly influence organisational cultures (Twati and Gammack, 2006). Culture in Jordan extremely impact on the behaviour individuals perceived and accepted change. Their national culture derived to a huge extent from religious principles broadly accepted and practiced by employees of the company (Pharaon and Burns, 2010).

Alkailani et al. (2012) used Hofstede cultural model in their study to examine the nation culture of Jordan; and they characterised the Jordan nations collectively as being high in masculinity but low uncertainty avoidance, power distance in individualism. Alkailani et al. (2012, p 77) said that “A high score in Masculinity indicates that the Jordanian Culture places high value on competitiveness and accumulation of wealth; and a very discrete gender role......Jordan culture also appeared to be a collectivist culture. In collectivist societies, people emphasize cooperation and relationship building, trustworthiness, solidarity with others and being conservatives”. By reviewing the history of Arab and Islam religion, it can be found that Arab countries share these features because a direct impact of religion and the Arabs’ history. Jordan is an integral part of the Arab world therefore; their culture is based on Arabic and Islamic aspects with influence of Western culture. Islam is the majority religion of Jordanian people and has an effect on social relations and social organisations. Hill et al. (1998) mentioned that fatalism culture is a main characteristic of the Arab. Also, the family plays a crucial role in the social system and the relationships between the individuals.

Jordanian Culture is low on power distance. Alkailani et al. (2012, p77) argue that “Jordanian culture to represent a “new version” of modern cultures where employees are young, not afraid of disagreeing with their bosses, and are consulted in decisions related to their work”. One reason could explain the Jordanians culture with low power distance is the high rate of education in Jordan. Hofstede (2001) mentioned that education level and occupation has a considerable impact on the level of power distance inside societies. Jordanians are famous with their high desire for getting knowledge and education. The ministry of higher education in Jordan started several reform related to modernizing education and improving the quality of teaching in Jordanian institutions (Khasawneh, 2011).

Although the Jordanian population is highly educated (adult literacy 89.2% and youth literacy 99.4%), the Jordanian people respect the traditional belief that each sex should have distinct roles (Al-Jaghoub and Westrup, 2003). Zubaidi, Al-Sammerai et al., (2011) claims that the Jordanian woman is under-represented in the total work force, especially in administrative (11.6%) and managerial jobs (7.5%). In fact, women’s participation in work in Jordan is still lower than in other countries in the region, and women’s participation is restricted to tourism and agriculture sectors. Such exclusion of woman from important roles, such as ICT workforce, or restricting their participation to minor administration jobs might affect the success of ICT application in Jordan because many organizational and social factors will be neglected in the implementation of information systems (Rabaai, 2009).

Moreover, the environment of business in Jordan will stay to be influenced by changing organizational structures, social traditions and cultural paradigms (Rabaai, 2009). Also, the culture of Jordan is dominated by interpersonal networks (called in Arabic Wasta) that form a possible environment for corruption (Rabaai, 2009). Unfortunately, such type of interpersonal relations in the Arab states affects information sharing and important decisions (Hutchings and Weir, 2006). Cunningham and Sarayrah (1994) explain that this issue is highly sensitive in the Kingdom of Jordan, but many solutions for the problem were applied, such as administrative structural reform and privatisation. Weir and Hutchings (2005) highlight the interconnection between cultural and institutional layers in the Arab organizations which are known for the bad structures with vague authority relationships. Importantly, these organizational structures contradict with the ones imposed by Enterprise Resource Planning systems (ERPs). Because of the social factors that affects business, it might be culturally a wrong decision to take the private/public distinction to distinguish between attitudes towards technology implementation and adoption. In the case where there are no clear lines of authority in organizational structures, then the culture which is imposed by ERPs critically needs important customisation and change of culture because attitudes to this type of culture differ between the public sector and private enterprises (Rabaai, 2009).

Compared to developed countries, EPRs are not widely implemented in developing countries. Although Jordan is one of the developing countries, it is witnessing a fast development in the field of ICT, and it implements ERPS in the private and public sector. However, developing countries in general, and Jordan in particular, face many troubles in the implementation of EPRS at the various levels of organizations (Heeks, 2007 ; Abdelghaffar and Azim, 2010). For example, the geographical location of the country and the regulations of the government, and the technological, economical and industrial status of the country can play a significant role in the limited/broad implementation of EPRs in the developing countries (Huang and Palvia, 2001; Abdelghaffar and Azim, 2010). In this regard, Abdelghaffer and Azim (2010, p.3) say that "ERP adoption is affected by the Information and Communications Technology (ICT) infrastructure of the country. For example, the SCM system that connects the organization with its suppliers might fail due to a weak the ICT infrastructure." In addition, (Dutta and Coury, 2003) argue that the status of education, distribution of income and the status of access to technology are other factors that determine the implementation of ERPs in developing countries. Also, the implementation of ERPs in the developing countries can be affected by cultural factors and awareness or resistance against technology (Huang and Palvia, 2001; Dutta and Coury, 2003; Avison and Malaurent, 2007; Seethamraju and Seethamraju, 2008). A research was conducted by Rabaai (2009) to examine how the public and private sector in Jordan perceive the implementation of ERPs. In the results, he found out that the difference between the two sectors is not important, and the benefits of EPRs implementation in Jordan lag behind those in other cultures. As for levels of satisfaction and ease of use, the study showed that in public and private sectors in Jordan there were low levels of satisfaction with both end-users and customers as well as low ease of use. Importantly, the study also showed that traditional organizational factors, such as communication in the project, support of management, change of management and team structure, do not distinguish the public from the private sector in the implementation of ERPs in Jordan although these factors are traditionally known for their effect on the implementation of ERPs.

## 2.3 Definition of ERP systems

Enterprise resource planning systems have been known by several names such as enterprise systems, integrated standard software packages, integrated vendors software, enterprise wide-systems, enterprise business-systems, and enterprise application systems; moreover, a number of ERP concepts have been viewed from a variety of perspectives by authors and practitioners in the published literature. Although these definitions are different in their orientation from a technical (IT) point of view to a business viewpoint, they are not significantly different (Al-Mudimigh, 2002).

Huang and Palvia (2001) assert that ERP is an industry expression for vast sets of activities supported by multi-module application software that helps a manufacturer or a service business to manage its affairs. Some researchers (e.g. Klaus et al., 2000; O'Leary, 2004; Gable et al., 1998; Shanks and Seddon, 2000) define ERP systems as a comprehensive packaged software solution that integrates the complete range of a business's processes and functions in order to provide a holistic view of the business from a single information and IT architecture. Bingi et al. (1999, p8) points out that "an

ERP system is one database, one application, and a unified interface across the entire enterprise". Watson et al. (1999, p. 3) state that "an ERP system is a generic term for an integrated enterprise computing system, a customized packaged software-based system that handles the majority of an enterprise's information systems requirements". It is brought with recommended best business processes and a software system that supports these processes, integrating all business functions into a single database thus improving control and information flow. Slooten (1999, p.226) describes an ERP software package "as an integrated, multi-dimensional system for all functions which is based on a business model for planning, control and global resource optimisation of the entire supply chain, by using state of the art IS/IT technology that supplies value-added services to all internal and external parties". Davenport (1998) and Kumar and Van Hillegersberg (2000) point out that an ERP consists of a commercial software package that assures to integrate all the information flow based processes within and across functional areas through the company; this could include financial and accounting information, human resources information, supply chain information, and customer information.

O'Leary (2000, p.27) states that "ERP systems are computer-based systems designed to process an organization's transactions and facilitate integrated and real-time planning, production, and customer response." An ERP system is a set of software integrating all departments and functions across a company into a single computer system that is able to assist different departments in sharing information and in communicating knowledge more easily (Fahy, 2001b; Aladwani, 2001).

In brief, from these definitions of ERP systems above from the literature, Enterprise Resource Planning (ERP) software is an integrated, multi-module application software package that includes software for at least: order entry, manufacturing, accounts payable and receivable, general ledger, warehouse, purchasing, and human resources. It combines organisational functions, automates and standardises business processes, shares common databases across all departments (such as accounting, manufacturing, logistics and finance departments), and produces and allows access to information in a real-time environment. ERP systems facilitate the flow of material, information and financial resources among functions within the company through one common database (Kumar et al., 2002).

## 2.4 The evolution and history of ERP systems

Enterprise Resource Planning systems (ERPs) allow companies to replace their old existing systems that are not integrated across departments and that conflict with other, more flexible and integrated systems. Enterprise Resource Planning (ERP) systems, which are computer-based business information systems for enterprise integration, can be traced back to, and were derived from, standard Inventory Control (IC) packages in the 1950s. These were developed into Materials Requirement Planning (MRP) and Manufacturing Resource Planning (MRPII) systems from 1960 to1990, which were designed to assist the manufacturing process. They were finally extended into ERP systems in the 1990s (Chung and Snyder, 2000; Yusuf and Little, 1998; Kumar and Van Hillegersberg, 2000; Chang et al., 2008). According to Deloitte Consulting (Deloitte, 1999), ERP systems are actually the latest generation of a continuing evolution of business systems whose origins date back to the 50s.

The first-generation of ERP systems packages emerged in the manufacturing industry; they have since been used in the finance, retail, insurance, education, manufacturing and telecommunication sectors (Kumar and Van Hillegersberg, 2000). The perspective of these systems is broader than those used in manufacturing (Olhager and Selldin, 2003). ERP systems have developed to include not only manufacturing processes, but now also integrate other business processes or functions in a company, such as sales and order management, marketing, purchasing, warehouse management, financial and managerial accounting, and human resource management (Kumar and Van Hillegersberg, 2000). ERP has developed as the management of information and material has become more and more important (Wah, 2000).

A known perspective on Enterprise Resource Planning is one that focuses on the historical development of business integration concepts (Klaus et al., 2000). The following section summarises the generic history of ERP systems from the 1960s to the 1990s.

In the 1960s, manufacturing systems focused on inventory control and automated warehouse maintenance only. The aim of inventory control systems was to reflect the available stock. Companies could afford to keep a great amount of inventory on hand to satisfy customer demand and still stay competitive (Umble et al., 2003; Ptak, 2000;

Rahman and Kadir, 2007). As a result of this, techniques concentrated on the best and most proficient methods to control huge volumes of inventory (Umble et al., 2003; Ptak, 2000).

However, in the early 1970s, it became obvious that organizations could not continue to maintain a large amount of inventory as manufacturing operations became more complex; thus, there was a need for software that was designed for manufacturing operations in order to enhance productivity and profitability, as well as information flow across the organisation. Therefore, this led manufacturing systems to move to material requirement planning (MRP) systems (Al-Mashari et al., 2003b; Rahman and Kadir, 2007; Umble et al., 2003). Watson and Schneider (1999, p.6) referred to MRP as a "computerized inventory control and production planning system for generating purchase orders and work orders of materials, components, and subassemblies".

MRP systems were developed mainly for planning product or parts requirements according to the master production schedule, allowing the necessary materials to be calculated more efficiently by forecasting from actual customer orders (Hossain et al., 2002; Klaus et al., 2000b. Chung and Snyder (2000) stated that MRPs were introduced as high-level scheduling, priority and capacity management systems for the use of plant managers and their supervisory staff. MRPs represented a huge step forward in the planning process. For the first time, based on a schedule of what was produced, and supported by a specific list of materials needed to produce each finished item, a computer could be used to calculate the total material requirements and compare this to what was already on hand or what was planned to arrive (Umble et al., 2003; Ptak, 2000). This comparison prompted an activity to place orders, cancel orders or modify the timing of existing orders (Umble et al., 2003; Ptak, 2000). In other words, the ability of the planning system to schedule all parts efficiently was a great step forward for productivity and quality control (Umble et al., 2003; Ptak, 2000). MRPs use a master production schedule (MPS) to know what will be made, how many will be made, and when they will be made; a bill of material (BOM) to know what it is needed to make it; and inventory records to know what materials the organisation already has in order to determine future requirements (Wallace and Kremzar, 2001). It combines the marketing information in the MPS with information on current inventory levels and standing manufacturing and purchasing orders; it also offers technological information about the structure of each product and its manufacturing processes. It calculates the required quantity for the order and creates a schedule of planned orders for each item (Shtub, 1999). MRP systems are a good method to use for the order fulfilment process (Wallace and Kremzar, 2001). The outputs of MRP systems are suggestions on how many units of each product, component, parts or raw materials to purchase in order to assemble the product; the system also shows when to issue the production or purchase order (Shtub, 1999).

MRP systems are used, not only to control material, but also to plan and manage capacity (Umble et al., 2003; Ptak, 2000); techniques for capacity planning were also tied in to the MRP system. Besides, tools were developed to support the planning of aggregate sales and production levels (sales and operations planning), the development of the specific build schedule (Master Production Scheduling), forecasting, sales planning and customer-order promises (demand management), and high-level resource analysis (rough-cut capacity planning) (Wallace and Kremzar, 2001).

MRP systems integrate the manufacturing functions relating to purchasing, planning, materials and operations (Chang et al., 2008). They also help managers in manufacturing to improve their productivity and quality, increase customer service, improve cash flow, reduce inventory assets, reduce cost, and reduce waste (Okrent and Vokurka, 2004). All of these features provide companies with great competitive advantages (Ptak, 2000). In addition to these benefits, companies also faced some problems in implementing and using MRP systems. These included a lack of accuracy in inventory records, inaccurate bills of materials, the lack of a master production schedule, out of date data, and poor methodology (O'Grady, 1988).

As a result of certain shortcomings of MRP associated with manufacturing performance, MRP systems have been expanded since 1975 to become Manufacturing Resource Planning (MRPII) (Chung and Snyder, 2000). The emergence of the new generation of MRPII did not means that MRP was not working correctly. Instead, it constituted a significant improvement in terms of the planning tools which used information from the detailed planning and control system to manage demand at an operational level (Ptak, 2000). MRPII was developed to allow the application of information and manufacturing technology, plans and resources in order to enhance the effectiveness of a manufacturing enterprise through integrated efforts, as well as to manage a production facility's orders, production plans and inventories (Chung and

Snyder, 2000; Markus et al., 2000b). In short, MRPII evolved to plan and control all the resources of a manufacturing company; and includes financial and marketing analysis, feedback loops, and an overall business plan (Watson and Schneider, 1999; Chang et al. 2008). MRP was extended to add more functions, such as capacity planning and master production scheduling based on sales forecasting, and accounting activities, such as standard costing (Okrent and Vokurka, 2004; Elbertsen et al., 2006). Al-Mashari et al. (2003b), cited Walters (1990), who defined MRPII as a strategic information system, designed to fulfil the information needs of decision makers. MRPII helps in making fast and effective decisions by accessing useful and accurate information (Ptak, 2000).

In addition, MRPIIs are used for material and production parts, as well as for manufacturing plans and schedules (Wallace and Kremzar, 2001; Hossain et al., 2002). MRPIIs integrate financial accounting systems and financial management systems with manufacturing and material management systems (Ptak, 2000). MRPIIs also include new functionalities such as sales planning, shop floor and distribution management activities, customer orders, capacity management and scheduling, inventory control, and production control (Klaus et al., 2000; Elbertsen et al., 2006; Hossain et al., 2002).

However, the limitations of MRPIIs in managing a production facility's orders, production plans and inventories, as well as the need to integrate these new techniques, led to a demand to extend MRPII systems into more integrated systems solutions (Chung and Snyder, 2000; Klaus et al., 2000b). The concept of a fully integrated system solution is called ERP (Enterprise Resource Planning) and the category of Enterprise Resource Planning (ERP) software was created by the Gartner Group in the early 1990s to link all internal transactions (Ptak, 2000; Umble et al., 2003; Fahy, 2001).

ERP systems evolved to meet the demand for a single management information system to reposit data and to provide valuable information which would help in making fast and reliable decisions (Ptak, 2000). ERP systems are an extension of MRPII systems; they include all the resource planning for an organisation, such as product design, information warehousing, material planning, capacity planning, communication systems, human resources, finance and accounting, and sales management (Ptak, 2000; Gable et al., 1998). These systems play an important role in integrating inventory data with financial, sales and human resources data, allowing organisations to price their products, produce financial statements, and manage their resources of people, materials and money effectively (Markus et al., 2000b).

In the end, knowledge concerning the history and evolution of ERP systems is vital in order to realise the current and future application of these systems (Ptak, 2000). ERP systems are used not only in manufacturing companies, but can be used in any company seeking to increase its competitiveness (Ptak, 2000; Umble et al., 2003).

## 2.5 ERP systems modules

ERP systems are business management systems that integrate all aspects of a business from planning, manufacturing, finance and accounting, to sales and marketing (Yen et al., 2002; Umble et al., 2003; Davenport, 1998). Figure 2-1 shows the integration of information through ERP systems. The ERP system includes multi-modules application software that assists an organisation to manage its business functions (Yen et al., 2002; Musaji, 2002). These modules can communicate with each other directly or by updating a central database. ERP modules can work as stand-alone units or many modules can be combined together to make an integrated system (Hossain et al., 2002).

Many software companies provide an ERP system with different modules and different functionality configurations (Kapp et al., 2001). ERP software packages are not similar, and some of them do not contain a human resource module. However, ERP modules are almost the same for different ERP vendors but with some degree of specialism (Hossain et al., 2002). The Computer Technology Corporation (1999) indicated that an ERP package could have several different modules including 40 to 50 applications. However, some of these modules are more advanced and powerful than others (Chang et al., 2008).

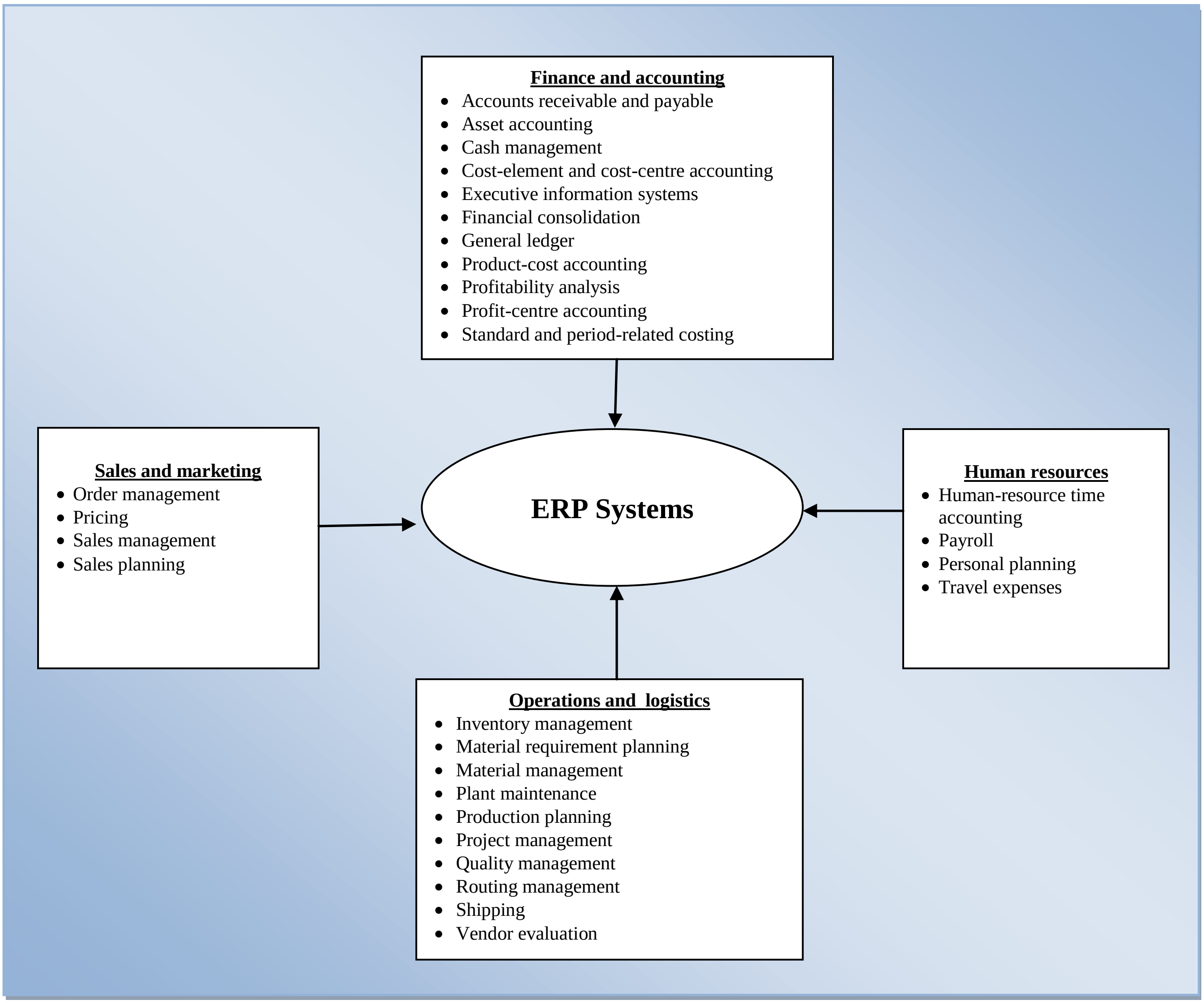


Figure 2-1**: Functions of ERP systems (adapted from Davenport, 1998)**

Companies have a number of choices to make to obtain the best ERP system to suit their needs. For example, they can choose and install only the modules they need from one or more ERP vendors, they can combine their existing legacy programs and new ERP modules, or they can create a system founded on a vendor's specialist strengths. For instance, PeopleSoft is strong for its human resource applications and SAP for its manufacturing applications (Gupta and Kohli, 2006). In addition, companies can broaden or modify the functionality offered by an ERP vendor with other modules from another supplier. The point here is that while ERP systems are standardised systems, each implementation is different.

Generally, ERP systems include many business applications, such as general ledger, payroll, supply chain management, manufacturing and business intelligence (Wright and Wright, 2002). These systems consist of a variety of types of application module, such as accounting, materials management, sales and distribution, etc., with the purpose of optimising business functions by connecting business processes and technology (Helms, 1999). Hossain et al. (2002), Yen et al. (2002), Buck-Emden (2000), Brady et al. (2001), and Chang et al. (2008) all point out that the typical ERP system is made up of core modules which are: (1) accounting and financial module, (2) manufacturing management module, (3) human resource management (HR) module, (4) sales and distribution management, and (5) supply chain management (SCM).

1. Financial and accounting applications: include all relevant information that stems from the interaction of the company with its environment and from the internal processes of consumption and production (Buck-Emden, 2000). These modules are designed to record transactions in the general ledger accounts and to produce financial statements with the purpose of producing an external report (Brady et al., 2001). The financial accounting system aims to provide management with financial information for making a decision. ERP systems provide up-to-the minute financial information which helps in making a financial decision based on the up-to-date data that represent each segment of the company's activities. Finance functioning is tightly integrated across all business areas and all geographic areas. It integrates with material management, human resources, and logistics. Most of this information can be obtained from financial data. The ERP financial accounting module has the ability to track financial accounting data centrally within an international framework of multiple companies, languages, currencies, and chart accounts.
2. Human resource (HR) applications: these modules are designed to manage and control the records of employees, payroll, travel expenses, etc. (Brady et al., 2001).
3. Manufacturing and logistics applications: these are modules for planning production, taking orders, and delivering products to the customer. They manage the purchasing of raw materials from suppliers and manage the movement of raw materials in the company, processing these through multiple points until

they become finished goods; they also manage the movement of finished goods out of the company for consumption (Brady et al., 2001).

In addition to these modules, ERP systems have been extended to include other newer modules; these are customer relationship management (CRM), supply chain management (SCM), and World Wide Web capability (Okrent and Vokurka, 2004; Shanks and Seddon, 2000). A CRM module is designed to improve the business processes associated with sales and marketing, and with customer services; this permits businesses to gain the highest revenue and profitability, and to win the loyalty of customers. CRM provides the company with all the information about its customers such as their purchasing, their inquiries, the highest volume of customer purchases, and dissatisfied customers, all of which can help in improving marketing, product development and production planning (Okrent and Vokurka, 2004). The main aim of the CRM is not only to provide the company with a holistic view of the customer, but also to contribute in giving customers the best value by tightly integrating sales and marketing. CRM allows customers to interact with the business.

## 2.6 ERP vendors

ERP systems are largely offered by several vendors. Gupta et al. (2004) stated that the top ten vendors were: SAP, Baan, Oracle, PeopleSoft, JD Edwards, McKesson, Misys, GEAC, JBA, and System software associates. ERP vendors have been classified into two tiers. The five leading or dominating players and first tier vendors in the ERP markets, which account for approximately 61%of the total ERP market revenue, are SAP, Baan, Oracle, PeopleSoft, and JD Edwards (Bingi et al., 1999; Brown, 1997; Yen et al., 2002; Hossain et al., 2002; Klaus et al., 2000), while the second tier vendors are Great Plains, Lawson, QAD, platinum, Ross and Solomon (Bingi et al., 1999; O'Leary, 2000). These first tier ERP vendors are taking the leading role in shaping the landscape of new target markets, continually updating their technology features and adding new functionalities (Hossain et al., 2002); they also particularly aim to attract large companies which consist of at least 1000 staff (Van Everdingen et al., 2000). ERP vendors have expanded to include services such as ERP outsourcing, Internet portals and electronic commerce, Supply Chain Management (SCM), and Customer Relationship Management (CRM) applications and this expansion has boosted the vendors’ revenues.

ERP systems represent different things to different organisations and different vendors (Kapp et al., 2001). Each vendor has specialised in one particular module area and has developed from different backgrounds such as Baan in manufacturing, PeopleSoft in human resources management, SAP in logistics and manufacturing, and Oracle in financials (Hossain et al., 2002; Wright and Wright, 2002). Thus, a number of choices are available to companies in selecting the best system: for example, one vendor could provide all ERP modules, or existing legacy programs could be integrated with new ERP modules, or an ERP system based on the vendors' specialised strengths could be implemented (Gupta and Kohli, 2006). The following section provides a brief background for each of the five major ERP vendors.

### 2.6.1 ***SAP***

SAP AG was founded by five former IBM engineers in 1972 in Germany (Brown, 1997; Hossain et al., 2002; O'Leary, 2000). SAP refers to its roots in accounting (Gable et al., 1998) and SAP's ERP has three versions. The first version was a financial accounting system (SAP R/1) where R/1 stands for Real-time systems. In 1979, the second version was launched as a mainframe version (SAP R/2); this was then redesigned in 1992 as the client/server software version (SAP R/3) (Gupta et al., 2004; Hossain et al., 2002; Buck-Emden, 2000). The three versions of SAP are designed to help organise manufacturing processes and accounting (Brown, 1997; Yen et al., 2002). In addition, SAP R/3 has advanced functionality in terms of handling all areas of business globally in multiple companies, with multiple languages and multiple currencies. SAP was used in more than 17,000 companies in over 100 countries and in 24 languages (Gupta et al., 2004; Bingi et al., 1999; Hossain et al., 2002). This system is built of many modules such as financial accounting (FI), project system (PS), human resources (HR), production planning, (PP), investment management (IM), controlling (CO), plant maintenance (PM), materials management (MM), asset management (AM), quality management (QM), sales & distribution (SD), customer relationship management (CRM), and supply chain management (SCM) (Hossain et al., 2002; Brown, 1997; Yen et al., 2002; O'Leary, 2000; Wright and Wright, 2002; Kumar and Van Hillegersberg, 2000).

All of these features listed above contribute to making SAP dominate in the ERP software market. In 1999, SAP AG was the third largest and leading software vendor in the world (Russo, 1999), and its sales significantly increased from under than $500 million in 1992 to nearly $3.3 billion in 1997 (Hossain et al., 2002; Davenport, 1998; Bingi et al., 1999). SAP has the largest market share for ERP systems, having one-third of the total market share (Bingi et al., 1999; Hossain et al., 2002; Brown, 1997).

### 2.6.2 *Oracle*

Oracle was founded as a database company in 1977 in the USA by Lawrence J. Ellison (Hossain et al., 2002; O'Leary, 2000; Gupta et al., 2004). The Oracle Company began to develop its own computing applications in the late 1980s and had then established itself as the largest database vendor before 1989 (Gable et al., 1998). In reality, these applications were developed for the USA market in 1989 and then for the international market in 1993 (O'Leary, 2000). Oracle is considered as the number one manufacturer of database software; it is the second largest software company in world behind Microsoft, and the second to SAP in terms of ERP systems (Hossain et al., 2002; Gupta and Kohli, 2006; O'Leary, 2000; Yen et al., 2002; Russo, 1999). Oracle applications comprise more than 50 software modules that are classified into six categories: Oracle financials; Oracle human resources; Oracle projects; Oracle manufacturing; Oracle supply chain and Oracle front office (Hossain et al., 2002; Gupta et al., 2004). Oracle applications are used in more than 5,000 companies over 140 countries (Hossain et al., 2002) and in 29 languages (Gupta et al., 2004).

### 2.6.3 *Baan*

Baan is a Dutch company which was founded in 1978 by Jan Baan to provide financial and administrative consulting services (Hossain et al., 2002; O'Leary, 2000). In 1998, the Baan IV product was launched, offering a scalable architecture which is suitable for large, mid-sized or small-scale businesses (Gupta, 2004). Baan ERP was developed as a successor to Baan IV and includes manufacturing, finance, project and distribution modules (Gupta, 2004). Nearly 3,000 companies use Baan in 5,000 sites worldwide (O'Leary, 2000). However, Baan competes with larger ERP vendors (SAP and Oracle) by developing enterprise applications and focusing on areas in which SAP and Oracle are less competitive, such as customisability (Yen et al., 2002; Gupta and Kohli, 2006). One of the most innovative products from Baan is the ‘Orgware tool’ uses customised business processes to configure its enterprise software automatically to fit with the company’s way of doing its business (Hossain et al., 2002; Gupta and Kohli, 2006).

This allows the companies to improve a competitive advantage through the implementation of more flexible systems (Gupta et al., 2004). Besides, it is claimed that Orgware can cut implementation costs significantly and also cut implementation times by up to 50% (Hossain et al., 2002; Gupta and Kohli, 2006). One reason that Orgware is so successful is because Baan’s business processes are separated from the software product; other vendors, such as SAP, are also working on extracting business processes from their software to make the systems more flexible (Gupta and Kohli, 2006).

### 2.6.4 *PeopleSoft*

PeopleSoft, the newest ERP software vendor, was founded in 1987 in Pleasanton, California, USA (O'Leary, 2000; Hossain et al., 2002).The origin of Peoplesoft was derived from human resource management (HRM) systems and payroll; later, it was developed to include modules in manufacturing, human resource management, financials, distribution and SCM (Hossain et al., 2002; Gupta et al., 2004; Gable et al., 1998; Wright and Wright, 2002). Now the company offers a complete commercial solution, targeting the service sector with products designed to assist companies handle their intangible costs (Yen et al., 2002; Gupta et al., 2004; Brown, 1997). Furthermore, PeopleSoft is successfully targeting small- to medium-sized companies by providing them with the product PeopleSoft Select, a complete packaged solution that includes software, hardware and services and that simplifies the implementation process (Gupta et al., 2004).

Many PeopleSoft customers have recognised that PeopleSoft’s strengths are flexibility and collaboration (Hossain et al., 2002). Besides, PeopleSoft is able to manage multiple currencies, languages and business processes for over 4,400 companies in 109 countries (Hossain et al., 2002). PeopleSoft is the third largest vendor in the ERP market after SAP and Oracle, with a 10% market share (O'Leary, 2000; Gupta and Kohli, 2006; Hossain et al., 2002).

### 2.6.5 *JD Edwards*

J.D. Edwards was established in March 1977 in Denver, Colorado, as a software developer supplying software for the AS/400 market (Hossain et al., 2002; Gupta et al., 2004). In 1996, J.D. Edwards launched a client-server version of its software under a new name called OneWorld that has the ability to run on multiple platforms and multiple databases (Hossain et al., 2002). The modules available from JD Edwards are: finance, manufacturing, distribution/logistics, human resources, and customer service management (Hossain et al., 2002; Gupta et al., 2004; Yen et al., 2002). JD Edwards' revenues have increased from $120 million in 1992 to $944 million in 1999, with over 5,000 customers in 100 countries (Hossain et al., 2002).

## 2.7 Why companies are implementing ERP systems

ERPs are becoming the largest and fastest growing systems in the software industry (Yen et al., 2002; Willis and Willis-Brown, 2002; Al-Mashari, 2003c). Year by year, it has been noticed that the number of organisations using ERP systems is increasing around the world. Martin (1998) noted that, in 1997, $10 billion was spent on installing ERP systems by more than 20,000 organisations around the world and this growth is continuing into the future (Hossain et al., 2002). Bingi et al. (1999) stated that ERP growth was predicted to rise from $15 billion to $50 billion in the coming five years. Furthermore, according to AMR Research Inc., a leading industry and market analysis firm, the ERP market is more likely to increase at a compound annual growth rate (CAGR) of 11% in the next five years and will reach $47688 million by 2011 (Jacobson et al., 2007) as businesses become more interested in implementing ERP systems for technological and operational reasons.

**Table 2-1: Total ERP revenue (actual and forecast)**

| 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 5 Year (CAGR) |
|---|---|---|---|---|---|---|
| $28820 m | $32278 m | $35829 m | $39412 m | $43353 m | $47688 m | 11% |

Source: (AMR Research, 2007)

Umble et al. (2003), Yen et al. (2002), Davenport (1998), Bingi et al. (1999), Elbertsen et al. (2006), and Russo (1999) suggested the main reasons for companies implementing ERP systems. For example, for technological reasons, many companies wanted to reengineer their business processes and solve problems concerning year 2000, some wished to replace older systems, and some wished to integrate business processes and systems. Some companies wanted to use one single organisational information system for all their separate organisational functions in combination with a common database. In addition, some companies, especially large ones needed to solve the problem of the

fragmentation of information in their large business, while improving of the quality and visibility of information. Every large company has huge quantities of data which are kept in many repositories. Thus, the information may be spread across many separate computer systems rather than just in one. Also, some companies wanted to reduce redundancy and variation in data during transferring, rekeying and reformatting the form of data from one system to another. Therefore, such companies needed to implement ERP systems that could help them to integrate different business units through the creation and maintenance of a central database of corporate information.
By using ERP systems, information is entered in just one place; entry of any new information leads to the automatic updating of any related information.

For operational reasons, on the other hand, ERP systems give companies an opportunity to increase sales and revenue, face tough competition in the market, improve insufficient business performance, reduce high-cost structures, improve responsiveness to customers, simplify ineffective and complex business processes, support new business strategies, expand business globally, and standardise business processes throughout the company.

## 2.8 ERP features

ERP systems have evolved to manage an organisation‘s mission and critical business data (Yen et al., 2002). An Enterprise Resource Planning system (ERP) is an information technology that was widely implemented by large companies with different corporate and national cultures around the world during the late 1990s. ERP systems are one of the most effective tools to achieve high standards of efficiency (Rizzi and Zamboni, 1999). Some of the main features of ERP and what ERP can do for business systems, as classified by Markus and Tanis (2000a) are: (1) integration, (2) packages, and (3) best practices. The following section provides a brief description of each of those features.

### 2.8.1 *Integration*

ERP system integrate all business processes and data into a comprehensive structure (Bernroider, 2008; O'Leary, 2000). One important feature is that ERP automates core corporate activities and departments, such as manufacturing, human resources, finance, and supply chain management, by incorporating best practices to facilitate greater managerial control, fast decision-making and cost reductions (Holland and Light, 1999; Umble et al., 2003). ERP systems automate all the company’s processes from finance to the shop floor with the aim of integrating information through the company (Leon, 2008). They allow the setup of complex pricing and promotion programs automatically tied to invoicing and billing, which are ultimately tied to accounts receivable and to the general ledger (Willis and Willis-Brown, 2002). These systems help to control all the information associated with a company’s customers, products, employees and financial data (Fahy, 2001). ERP systems work under one centralised database, and a single and standard interface, where a large majority of business transactions and data are entered, recorded, processed, monitored and reported in a consistent way and with controlled redundancy (Umble et al., 2003; O'Leary, 2000; Klaus et al., 2000; Hossain et al., 2002). By using ERP systems, a company can have access to a single set of standardised data in real time (O'Leary, 2000; Yen et al., 2002; Klaus et al., 2000; Okrent and Vokurka, 2004; Hossain et al., 2002). This integration gives companies the ability to be more flexible with product configuration (Hossain et al., 2002; Yen et al., 2002; Bingi et al., 1999).

### 2.8.2 *Packages*

ERP software is not developed in-house but it ready-made packages. They are commercial packages that are purchased or leased from software vendors such as SAP, Baan, Oracle, PeopleSoft, JD Edwards (Markus and Tanis, 2000a). ERP packages can be customised without much programming effort (O'Leary, 2000; Bernroider, 2008).

### 2.8.3 *Best practices*

ERP systems are built based on ‘best practices’ and standardised business processes (Markus and Tanis, 2000a; Hossain et al., 2002; Okrent and Vokurka, 2004). In this regard, ERP vendors searched in academic theory and talked to many companies about the best ways of carrying out accounting or of managing a production floor to craft the “best practice” (Markus and Tanis, 2000a). Best practices are a powerful motive for adopting ERP systems without changing them (Markus and Tanis, 2000a).

Another feature is that ERP systems support companies that operate them in many countries so they handle the specific needs of different regions, offering such features as preconfigured country-specific chart-of-accounts, preformatted document types (quotes, delivery notes or invoices), or HR-related rules like payroll (Klaus et al., 2000). In addition, ERP systems have the ability to support multiple currencies and languages for multinational companies (O'Leary, 2000; Klaus et al., 2000; Bingi et al., 1999).

## 2.9 ERP systems: benefits and limitations

### 2.9.1 *Benefits of ERPs*

ERP systems offer numerous benefits to the companies that implement them. One of the primary benefits that companies can enjoy, if such a system is successfully implemented, is the promotion of integration (Yen et al., 2002). ERP encompasses all functions and departments, facilitating information flow and intra and inter-organisational communication and collaboration; it is responsive to all stakeholders because ERP updates data automatically among different business components and functions (Umble et al., 2003; Yen et al., 2002; O'Leary, 2000; Amoako-Gyampah, 2007). Because ERP systems use a single database, all data are entered only once at a transaction's source (Yen et al., 2002; Umble et al., 2003). This helps the company to eliminate multiple data sources and allows the same data to be accessed from the central database, thus avoiding multiple inputs, redundancy of data and operations (Hossain et al., 2002; Amoako-Gyampah, 2007). Therefore, it can be argued that these systems provide complete, authorised, accurate, reliable, consistent and timely information (Musaji, 2002; Hossain et al., 2002; Poston and Grabski, 2001; Amoako-Gyampah, 2007). Also, ERP systems improve reports, deliver them on time, and produce accurate demand forecasts (Hossain et al., 2002). What is more, ERP systems can help managers and employees to obtain the newest information on any aspect of the product, customer or supplier relationship (Okrent and Vokurka, 2004). Every company that has implemented an ERP system is supposed to be able to make an appropriate and fast business decision (Gibson et al., 1999; Yen et al., 2002; Okrent and Vokurka, 2004; Poston and Grabski, 2001).

All these benefits above can result in considerable reductions in inventory cost, operating costs, raw material costs, errors and business problems (e.g. material shortages), together with reducing the pressure and workload of managers. ERPs can also improve efficiency, quality and cash flow management, while increasing productivity, revenue and profits, and speed production cycles (Muscatello et al., 2003;

Rao, 2000; Gibson et al., 1999; Yen et al., 2002; Okrent and Vokurka, 2004; Bingi et al., 1999; Hossain et al., 2002; Poston and Grabski, 2001; Aladwani, 2001; Russo, 1999). ERP systems can help a company to save a million dollars annually. Umble et al. (2003) stated that implementing an ERP system in the Toro Company helped it to save $10 million due to inventory reduction, while Owens Corning saved $50 millions in logistics, material management and sourcing.

Moreover, a critical benefit of using ERP systems is in improving customer satisfaction by processing customers' orders more quickly and on time, following the order's steps, improving invoicing and reducing customer-service response times (Muscatello et al., 2003; Rao, 2000; Yen et al., 2002; Amoako-Gyampah, 2007; Wah, 2000; Wright and Wright, 2002; Brown, 1997). This helps the company to achieve competitive advantage (Bingi et al., 1999). ERP systems are also useful in integrating companies globally (Bingi et al., 1999; Wah, 2000). They enhance adaptation to multinational business environments by being flexible in terms of language, currency, and accounting standards; they also offer managers control over their distributed business operations globally and improve communication (Gibson et al., 1999; Yen et al., 2002).

### 2.9.2 *Limitations of ERPs*

Despite the significant benefits that can be realised from a successful ERP system, there are some problems that face companies when implementing ERPs; these are listed below.

Firstly, ERPs are very expensive which prevents small companies from implementing them (Yen et al., 2002). This cost can vary from thousands to millions of dollars (Hossain et al., 2002; Al-Mashari et al., 2003b). Companies may need to spend additional money on implementation, business process reengineering and configuration, training for system users, licenses, and hiring consultants to overcome difficulties with the software implementation (Nah et al., 2001; Al-Mashari et al., 2003b; Fahy, 2001; Burns, 2011 ). Davenport (1998) pointed out that it was estimated, in terms of the expenditure of companies on Enterprise Resource Planning (ERP) systems around the world, that costs reached $10 billion per year; this amount could be doubled if consultation costs were added. Moreover, companies also spend a good deal the software licensing costs on the services related to the implementation and maintenance of the software (Burns, 2011). Burns (2011) said that the averages of the licence fees per user is about $3000. So if the company has 50 concurrent users, the software licence cost will be $150,000. Licence and maintenance costs were estimated at $21.5 billions in 2000 (Hossain et al., 2002). Besides, a company might need to install new hardware for running ERP software and a new database for ERP data storing (Al-Mashari et al., 2003b).

Secondly, another limitation is the complexity of ERP systems (Volkoff, 1999; Poston and Grabski, 2001). Companies have faced many difficulties in integrating the ERP software with the hardware, operating systems, database management systems, and telecommunications which are suitable to their organisational needs (Markus and Tanis, 2000a). ERP implementation is more complex due to cross-module integration and data standardisation. Thus, these systems a considerable investment in terms of money, time and expertise to implement them (Davenport, 1998). However, as ERP systems include numerous features and modules, users need to consider carefully and implement only those features they need (Hossain et al., 2002).

Thirdly, in addition to the complexity and high costs of implementing ERP systems, such systems force companies to change their ways of doing business since they impose their own logic on a company’s strategy, culture and organisation (Davenport, 1998). Therefore, there should be conformity between the components and modules of the ERP system and the organisation’s business processes, culture and strategic goals (Hossain et al., 2002).

In the end, to enjoy the benefits of ERP systems, companies must overcome the definite problems and disadvantages listed above and rethink their plans for selecting and implementing such systems.

## 2.10 Conclusion

To sum up, this chapter offers a brief overview of ERP systems, starting by shedding the light on the definition of ERP, then discussing the history of ERP systems. Following this, a discussion is presented on the modules of ERP, which includes SAP, Oracle, Baan, PeopleSoft and JD Edwards.

This chapter ends with a discussion of the reasons for implementing ERP systems and the features of such systems, including integration, packages and best practices; the benefits and limitations of these systems are also reviewed.

# 3 Chapter Three Literature Review (2): risk factors associated with the implementation and operation of ERP systems

## 3.1 Introduction

ERP systems have become an important information technology in many companies around the world. These systems are the backbone of the company as they play a significant role in the integration of all the company’s resources. ERP systems have been likened to the human nervous system because of their effect on many parts of the company (Shanks and Seddon, 2000). Moreover, ERP systems bring the largest possibly benefits to companies, as well as being more likely to entail the largest potential risks for them (Davenport, 1998; Shanks and Seddon, 2000; Cliffe et al., 1999). Thus, some companies are satisfied with the results of ERP implementation, while other companies are not satisfied and consider their ERP implementation a failure (Muscatello et al., 2003; Davenport, 1998; O'Leary, 2000; Stratman and Roth, 1999; Bradford and Florin, 2003). It is clear that not all ERP implementations and operations have been successful and a review of the literature shows that the results of a failed ERP implementation or performance are often disappointing and sometimes disastrous (Trimi et al., 2005; Chin-fu et al., 2004). For example, some companies have faced problems such as bankruptcy, or have abandoned their business and have had to start again, destroying their competitive advantage (Bingi et al., 1999). FoxMeyer Drug Company, for example, claimed that these systems led them to bankruptcy (Scott and Vessey, 2002; Davenport, 1998). The problem was that the ERP system made excess shipments because of incorrect orders. Additionally, Dell Computers claimed that its ERP system was not sufficiently flexible to deal with its expanding global operations (Muscatello et al., 2003).

It has been estimated from the literature that at least 90% of implementations of ERP end up late or over-budget, while around half fail to achieve the desired results (Umble et al., 2003; Al-Mashari et al., 2003b; Holland and Light, 1999). Cliffe et al. (1999) cited Austin and Nolan who reported that 65% of executives thought that ERP systems have at least a moderate chance of damaging their businesses due to the potential for implementation problems. It has also been reported by companies that implement ERP systems that three-quarters of ERP systems were unsuccessful (Griffith et al., 1999). So, the question needs to be asked: why do so many ERP systems fail? Explanations for this high rate of failure have been given by a number of different sources. Many companies have failed when implementing ERP systems because they are not prepared for integration and simply buy a piece of ERP software (Fahy, 2001). Verville and Bernadas (2005) indicated that the reasons for the failure of ERP systems are not only related to technical issues; more probably, it is related to organisational changes, or because of behavioural, social, and political reasons. Abdinnour-Helm et al. (2003) and Lengnick-Hall et al. (2004) pointed out that failure was due to people problems rather than technical difficulties. Keil et al. (1998) gave another explanation for this high failure rate: this was that managers do not take prudent measures to understand and manage the risks related to these projects. Such conflicting ideas have lead this researcher to explore the perception among managers of those risk factors that might cause an ERP implementation and/or operation to fail. Although the perception of ERP risk factors is believed to be significant for a successful implementation and operation of an ERP, no previous research has examined empirically perceptions regarding the risk issues.

There is a wide-ranging body of research on ERP implementation. Most studies have dealt with the topic of implementing an ERP system successfully, and such studies may identify critical success factors (CSFs) for ERP implementation in developed and developing countries ( Umble et al., 2003; Al-Mashari et al., 2003b; Holland and Light, 1999; Bradford and Florin, 2003; Ehie and Madsen, 2005; Kim et al., 2005; Soja, 2006; Wu and Wang, 2006; Nah et al., 2001; Hong and Kim, 2002; Enrique et al., 2005; Rabaai 2009; Dezdar and Ainin 2011; Maditinos, Chatzoudes et al. 2011; Abdelghaffar and Azim 2010). However, to the best of this researcher's knowledge, few studies have paid attention to identifying the risks of ERP implementation (Sumner, 2000; O'Leary, 2002; Wright and Wright, 2002; Huang et al., 2004; Hakim and Hakim 2010); and no prior studies have been carried out to identify the risks of ERP operation (post-implementation). In addition, ERP risk factors are not well defined and there is a clear absence of some ERP risk factors in the literature. Furthermore, a weakness seen in previous studies is the poor level of information available on perceptions regarding those risk factors could make an ERP system fail during its implementation or operation stages. Therefore, there is a need for research in order to understand the risk factors associated with the implementation and operation of ERP systems. Understanding risk factors requires the identification, as Huang et al. (2004) mentioned, of: (1) what are the risk factors; and (2) which of these risks do managers perceive to be more important from their viewpoint. Thus, this thesis undertakes to identify the risk factors that might lead to the failure of an ERP. Also, in this thesis, it is suggested that perceptions of those risk factors associated with ERP implementation and operation are crucial. Thus, this thesis examines and builds a framework of perceptions regarding the risk factors associated with the implementation and operation of ERP systems.

This chapter attempts to present a critical review of the relevant and existing body of literature from several areas in order to identify the scope of the research, highlighting gaps and weak areas which require further consideration while developing a conceptual model as a research guide. The following sections 3.2 and 3.3 provide a brief review and discusses, based on a, literature review the important possible risk factors which could impact on the implementation and operation of ERP systems.

### 3.2 Possible risk factors that could impact on the implementation of ERP

Several issues regarding ERP implementation have been introduced by many researchers and practitioners. Implementing an ERP system is “not an easy task”; it is also very expensive and is a risky process for organisations (Wright and Wright, 2002; Muscatello et al., 2003; Davenport, 1998; Umble et al., 2003; O'Leary, 2000). These systems are: (1) complex and difficult and (2) need a large investment of money, time and expertise to implement them (Davenport, 1998). They also represent a unique and ongoing risk due the presence of tightly-linked automated interdependencies among business processes and a reliance on relational databases and process reengineering (Wright and Wright, 2002; Hunton et al., 2004; Sumner, 2000). In addition to the technical challenges, business problems and managerial issues in the implementation process constitute major barriers to adopting ERP systems effectively (Muscatello et al., 2003; Davenport, 1998). ERP systems force companies to change their way of doing business; they impose their own logic on a company’s strategy, culture and organisation. The logic of the ERP system may conflict with the logic of business and might make the implementation of an ERP system fail (Davenport, 1998, p123).

Thus, the growth of ERP systems could carry great risks which could drive companies into failure in terms of their implementation or they may have potentially damaging results that could produce losses (Musaji, 2002; Davenport, 1998). Some of these risk factors that may influence ERP systems have been studied and are similar to those that could occur with any other large and complex information systems project (Shanks and Seddon, 2000; Willcocks and Sykes, 2000). Assessing a project’s risk factors is important to the success of software projects (McFarlan, 1981). Boehm (1991, p.34) stated that: “Risk identification produces lists of project-specific risk items that are likely to compromise a project's success”. Risk identification is considered as the first step to managing risk.

Reviewing the literature on risks associated with the implementation and operation of ERP systems reveals that few studies are available in this particular area of research. One reason is that the risks associated with ERP systems are a relatively new research area. However, researchers have devoted their efforts to identifying risk factors that might contribute to a failed ERP implementation (Sumner, 2000; O'Leary, 2002; Wright and Wright, 2002; Huang et al., 2004). The main purposes of the previous studies in this category have been to list the implementation risks that might threaten the success of an ERP system in a company. These studies have taken the form of case studies, Delphi methods with ERP experts, and interviews with IT auditors, professionals and financial auditors, all of which have provided rich accounts of the ERP implementation process.

These studies have written about the relative importance of risk factors associated with ERP systems. There are four particularly important studies which have been carried out by researchers in the area of risks in the implementation of Enterprise Resource Planning (ERP). Firstly, Huang et al. (2004) conducted research to identify the major risk factors associated with the implementation of ERP systems. They used a Delphi method to identify the risk factors and then used the Analytic Hierarchy Process (AHP) to analyse and prioritise the risk factors. They found that the top ten risk factors which were the major causes of the failure of an ERP project, were as follows:

1. Lack of top management support,
2. Lack communications with users,
3. Inadequate training of end-users,
4. Failure to obtain the support of users,
5. Lack of an efficient project management methodology,
6. Attempting to build bridges to legacy applications,
7. Conflicts between user departments,
8. The composition of the project team,
9. Failure to redesign the business processes,

10. Unclear/misunderstood and changing requirements

Secondly, Wright and Wright (2002) conducted an exploratory study which attempted to gain an understanding of the unique risks related to the implementation and operation of Enterprise Resource Planning (ERP) systems. They used a semi-structured interview approach with thirty experienced information systems auditors who were ERP specialists to examine risks for ERP systems. The results of the interviews indicated that the most significant risk factors related with ERP implementation were: (1) insufficient training and involvement of users in implementing these systems; (2) failure to redesign business processes; (3) major customisation; (4) inadequate internal expertise; (5) lack of analysts with sufficient knowledge of business and technology; (6) failure to mix internal and external expertise effectively; (7) inability to comply with the standard which ERP software supports; and (8) a lack of adequate controls. Furthermore, the results indicated that the potential for financial statement errors and business risks were intensified as a result of a lack of proper user training. Finally, the finding showed that ongoing risks differed across ERP applications and across vendor packages.

Thirdly, Sumner (2000) conducted a study to identify the major unique risk factors associated with the implementation of ERP systems. She used seven case studies to depict the experiences of companies which had implemented ERP systems using SAP, Peoplesoft and Oracle. In her findings, she highlighted the unique risk factors associated with ERP systems. These included: (1) the danger of customisation; (2) the challenge of re-engineering business processes to fit the processes which the ERP software supported; (3) investment in recruiting and re-skilling technology professionals; (4) the challenge of using external consultants and integrating their application-specific knowledge and technical expertise with existing teams; (5) the challenge of recruiting and retaining business analysts who have both business knowledge and technology knowledge; (6) a lack of top management support; (7) the lack of a champion; (8) ineffective communication; and (9) lack of training.

Finally, Russo, (1999) conducted an exploratory study to look at issues related to the implementation of ERP systems such as SAP. He found that the factors that were most likely to lead to ERP failure were: 1) resistance to change, along with (2) time and (3) the cost of ERP implementation, (4) the complexity of these systems, and (5) a lack of leadership.

Based on the literature review and the pilot study, many risk factors could lead to failure in the implementation of ERP systems. It was noticed that researchers perceived different risk factors as being critical in different ways. The importance of these risk factors has been seen differently in previous studies. The following sections discuss each risk factor that could occur during the implementation of an ERP system.

### 3.2.1 *Difficulties in understanding and using ERP systems*

A common issue is the complexity of ERP systems (Brown, 1997; Soh et al., 2000; O'Leary, 2000; Bingi et al., 1999). Rogers (1995, p242) defines complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use". Understanding the ERP system on the part of employees and managers in the organisation is important for ERP implementation success (Kapp et al., 2001).

### 3.2.2 *Failure to redesign business processes and major customisation of ERP*

ERP systems are built around best practices in specific industries (O'Leary, 2000). In spite of ERP systems being designed to fit the requirements of several companies, they are built to support generic business processes which could be quite different from a company's usual way of doing business (Markus and Tanis, 2000a). Thus, ERP packages may not necessarily suit the operating practices of the company. Therefore, some companies have purchased ERP systems with the idea of reengineering their business processes to conform to best practices, while others have purchased an ERP system with the idea of modifying the package to suit their own idiosyncratic needs (Markus and Tanis, 2000a). According to Gibson et al. (1999, p.1), " from a software perspective an ERP system is complete, but from a business perspective, the software and the business processes need to be aligned which involves a mixture of business process redesign and software configuration". However, implementing an ERP system is a difficult process as they require business processes to be redesigned to align the ERP software's requirements with the business processes (Fahy, 2001; Gibson et al., 1999; Davenport, 1998; Holland and Light, 1999). Companies should change their ways of doing their business and must make changes to the roles and responsibilities of employees.

Business Process Reengineering (BPR) and system customisation are critical factors that might have an effect on the success or failure of ERP systems (Holland and Light, 1999; Sumner, 2000; Jarrar et al., 2000). Therefore, companies should be willing to reengineer their business processes to conform to the package without modifying the ERP packages very much (Markus and Tanis, 2000a; Scheer and Habermann, 2000; Holland and Light, 1999). ERP packages should be kept as they are and, as far as possible, should not be modified (Sumner, 2000). A number of studies have shown that customisation may have an enormously negative effect (Van Everdingen et al., 2000; Bingi et al., 1999; Davenport, 1998; Yen et al., 2002). Yen et al. (2002) pointed out that most experts agree that customising an ERP system can be costly and time-consuming. Furthermore, customising ERP packages could delay the period of time taken to implement these systems.

Bingi et al.(1999) and Markus and Tanis (2000a) noted that modification and vendors' continued development of the packages may lead to reduced benefits. Markus and Tanis (2000a) mentioned that customisation of the systems may make companies more dependent on outside contractors who specialise in ERP customisations. Moreover, when companies decide to customise ERP systems, it will difficult for them to upgrade their ERP systems to any new version in the future. Wright and Wright (2002) indicated that extensive customisation and the redesign of business processes may introduce errors in the ERP systems, resulting in significant risks owing to the potential insufficient knowledge of the implementers. For example, they could not understand the functionality of an ERP package sufficiently to appreciate the implications of customisation or may not understand the reengineered business processes adequately to maintain the ERP system's reliability. As a result, companies that redesign processes to conform to ERP best practices should be more successful and realise the maximum benefits of these systems (Markus and Tanis, 2000a; Scheer and Habermann, 2000).

### 3.2.3 *Lack of top management support*

Top management support is crucial for the success of ERP implementations (Davenport, 1998; Sumner, 2000; Gable and Stewart, 1999; Stratman and Roth, 1999; Somers and Nelson, 2001; Rao, 2000; Aladwani, 2001; Fitz-Gerald, 2003; Dezdar and Ainin, 2011). Slevin and Pinto (1987, p.34) defined the top management support as "the willingness of top management to provide the necessary resources and authority or power for project success". Top management should allocate valuable resources by providing people with the time and money they need to complete the implementation (Holland and

Light, 1999; Roberts and Barrar, 1992). In addition, they need to monitor the project's progress and give direction to the implementation teams (Bingi et al., 1999; Al-Mashari et al., 2003b; Maditinos, Chatzoudes et al. 2011). also they should communicate with users about the importance of ERP and its benefits to raise awareness of the ERP system (Al-Mashari et al., 2003b; Aladwani, 2001). Managers should give the necessary priority to ERP implementation. It is important to get the full support of senior management during the ERP implementation process (O'Leary, 2000) to achieve the project's goals and objectives; these goals should be aligned to the strategic business goals (Sumner, 2000). If top management does not concern itself with the ERP implementation, chaos occurs. Umble and Umble (2002) said that where top management that does not actively participate in ERP implementation and does not effectively commit to the system, the implementation could be at a high risk of failure. Somers and Nelson (2001) and Kweku Ewusi-Mensan (1997) agreed that the failure of ERP systems is more likely when top management does not focus on the implementation process and allows technical staff to make critical decisions instead of them.

To avoid this, top management should legitimise new goals and objectives, establish new organisational structures, roles and responsibilities, and set policies (Nah et al., 2001, Umble and Umble, 2002; Roberts and Barrar, 1992; Brown and Vessey, 1999). As an ERP implementation requires a great many changes, conflicts may arise among different departments. Without the intervention of high management, no one will compromise on the rearrangement of ERP (Huang et al., 2004). In particular, a project without top management support is more likely to fail.

### 3.2.4 ***Insufficient resources***

Sufficient resources, such as time and expenditure, are a key and significant point in a project's success (Somers and Nelson, 2001; Somers and Nelson, 2004). The implementation of an ERP system can take from six months to two years (Okrent and Vokurka, 2004; Wah, 2000) and the cost of an ERP system could vary from thousands to millions of dollars (Hossain et al., 2002; Al-Mashari et al., 2003b; Burns 2011). Start up costs and costs of annual maintenance are high which could decrease the propensity to adopt the technology (Elbertsen et al., 2006). In fact, Okrent and Vokurka (2004) mentioned that the selection of an ERP software package, and the number and availability of resources, will eventually determine the time and the costs needed to implement it.

In previous researches, it has been documented that ERP systems are difficult systems to implement within an expected budget and time (Al-Mudimigh et al., 2001; Bingi et al., 1999; Yen et al.,2002; Volkoff, 1999; Poston and Grabski, 2001; Mabert et al., 2003; Scott and Vessey, 2000). Many implementations of ERP systems have not been completed on time or within budget, and have not succeeded (Shanks and Seddon, 2000). Such companies lose the money they devoted to ERP software and millions that have been paid to external consultants; they may also have lost a portion of their business (Bingi et al., 1999).

Delay in implementing these systems will result in the company facing a major problem because this will require substantial extra resources (Welti, 1999; Burns 2011). Bingi et al. (1999) and Xu et al. (2002) mentioned that companies might make a major investment and spend many years implementing ERP systems. However, a lack of resources and/or an over-spend could seriously endanger the company (Welti, 1999; Grover et al., 1995; Maxwell, 1999). The probability of risk could become high when the implementation of an ERP system takes longer than expected (Welti, 1999).

### 3.2.5 *Lack of change management*

Change management is a main concern for several companies that have implemented in ERP (Somers and Nelson, 2001; Somers and Nelson, 2004); this is an important factor throughout the entire life-cycle of an ERP project implementation (Nah et al., 2001; Bhatti, 2005). Implementing an ERP systems has a significant effect on the organisation, particularly on their users (Welti, 1999) while resistance to change is one of the major problems facing such an implementation (Aladwani, 2001; Gupta, 2000; Bhatti, 2005; Jarrar et al., 2000; Welti, 1999). (For more information, see Section 3.3.10.). These systems bring in major change that may result in resistance, confusion, redundancies and errors (Somers and Nelson, 2001) and many ERP implementations have failed due to the lack of focus on change management (Sumner, 2000). It was estimated by Bhatti (2005) that nearly half of ERP implementations fail to realize their anticipated results since managers significantly underestimate the works required in managing the change.

In essence, change management is necessary in order to prepare an organisation for the introduction of an ERP system and its successful implementation (Jarrar et al., 2000). To implement an ERP system successfully, two things should to change: (1) the way the organisation does business and, (2) the ways people do their jobs (Davenport, 1998). Appropriate change management is key factor for successful implementation (Bhatti, 2005; Grover et al., 1995). However, with ineffective change management processes, a company will not be able to adapt to the ERP system and enjoy the full benefit of it (Kim et al., 2005).

### 3.2.6 *Unclear/misunderstanding of users' requirements*

Unclear or misunderstanding users' requirements is another major risk that could lead to the failure of ERP systems. In many companies that have implemented such systems, the communication between users and the implementation team has failed because users face difficulties in expressing their requirements as they do not have sufficient technical IT skills and the technical IT team does not clearly understand their requirements (Musaji, 2002). Therefore, it is argued that ERP vendors should spend more time clarifying the embedded data requirements and processes of the company; in addition, users in the company require to get additional skills to ask for and probe such details (Soh et al., 2000). Clearly, an ERP system must be matched to the needs of users as a mismatch might lead to additional costs (Musaji, 2002). Communication failures between users and the implementation team could cause the ERP project to fail (Musaji, 2002).

### 3.2.7 *Lack of a champion*

Successful ERP systems are often associated with the presence of a champion who will execute the fundamental functions in the implementation of such a system (Beath, 1991; Nah et al., 2001; Willcocks and Sykes, 2000; Jarrar et al., 2000). Without a leader, serious duplication of effort frequently occurs (Sumner, 2000) and the chance of the project succeeding lessens (Nah et al., 2001). Thus, someone must be placed in charge and the project leader should "champion" the project throughout the company (Sumner, 2000). Project leaders are managers who have the authority to define objectives and legitimise change (Falkowski et al., 1998). These should be high-level leaders who actively and strongly promote their personal vision for using the ERP system; they should keep abreast of the progress of the implementation, monitor the project, and manage people, sorting out conflicts whenever necessary (Kim et al., 2005, Somers and Nelson, 2001). In addition, a project champion has to be involved in each step of the project and understand the technology as well as the business and organisational context (Somers and Nelson, 2001).

### 3.2.8 *Lack of agreement on project goals*

The first step of any project should be a conceptualisation of the goals and potential methods to achieve these objectives (Slevin and Pinto, 1987). Somers and Nelson (2004) pointed out that the goals of the project should be defined even before seeking top management support. Identifying goals and objectives is necessary to guide the direction of the ERP project implementation (Bhatti, 2005; Loh and Koh, 2004; Buck-Emden, 2000; Buckhout et al., 1999; Somers and Nelson, 2004). Moreover, it is critical that project management identifies three competing and interrelated goals concerning scope, time and cost (Bhatti, 2005; Somers and Nelson, 2001**.** If ERP implementations are to be successful they require clear and agreed goals and objectives (Umble et al., 2003, Bhatti, 2005). Many ERP implementations have been delayed, over budget or failed because of the absence of a clear plan (Laughlin, 1999, Somers and Nelson, 2004). However, well-defined objectives help to keep the project team focused on the aim of the project (Somers and Nelson, 2001)**.**

### 3.2.9 *Insufficient training of end-users*

Training is another important driver in terms of the success of an ERP implementation (Russo, 1999; Stratman and Roth, 1999; Jarrar et al., 2000; Dezdar and Ainin, 2011 ). An ERP system is very complex and requires thorough training and proper preparation for users (Bingi et al., 1999; Yen et al., 2002). Training should highlight all aspects of the ERP system (Davenport, 1998). Users should learn those functions of the ERP system that is associated with their work and they need to obtain a adequate theoretical background in order to be familiar with the new processes and procedures (Welti, 1999; Nah et al., 2001). They also need training on how the system works and how it relates to the business process early on in the implementation process (Davenport, 1998). Bingi et al., (1999, p13) pointed out that “Companies should provide opportunities to enhance the skills of the employees by providing training on a continuous basis to meet the changing needs of the business and the employees". ERP training provides experience for the users and helps to build positive attitudes toward the system (Aladwani, 2001).

Regarding the cost of training, Sumner (2000) stated that investment in training could be higher than is usual. Users are one of the hidden costs of implementing an ERP system (Bingi et al., 1999) and they require a significant amount of resources in learning to use it (Musaji, 2002). Thus, due to the high cost associated with the implementation of ERP systems, some companies cut the time allocated to train users (Fahy, 2001). However, implementing an ERP package without sufficient training for end-users so that they understand how to use the system, is likely to make the ERP system ineffective (Jarrar et al., 2000). Somers and Nelson (2001), Gupta (2000), Markus and Tanis (2000a), Bradford and Florin (2003), and Welti (1999) all pointed out that a lack of user training and failure to understand the system completely could be a major cause of the failure of many ERP systems. However, if the training is adequate, the probability of risks occurring is low (Welti, 1999).

### 3.2.10 *Resistance of users*

Many companies have experienced a certain level of user resistance to ERP systems (Laughlin, 1999) and such resistance to change of users is one of the difficulties that face any implementation of an ERP system (Aladwani, 2001; Gupta, 2000; Bhatti, 2005; Jarrar et al., 2000; Welti, 1999) and such resistance may cause the ERP system to fail (Wah, 2000). Resistance to change may derive from changes to the content of a job and/or uncertainty concerning the system itself (Jiang et al., 2000). Aladwani (2001) added that users are afraid of ERP systems because some believe that the system will threaten their jobs; others have no idea how to work with these systems.

To overcome users' resistance to change, management should understand the structure and needs of the users and the reasons for their resistance; they should deal with this by applying effective strategies and techniques to make ERP successful (Aladwani, 2001). Furthermore, people must be involved in the implementation of business processes and the ERP system; they should also be provided with formal education and training (Bingi et al., 1999; Holland and Light, 1999; Martin, 1998). Moreover, management should explain to users how the ERP system will work, clarifying the general inputs and outputs of the system, defining departments that will provide the data, and identifying the computer knowledge needed to operate the system, etc. (Aladwani, 2001).

### 3.2.11 *Lack of involvement of users in the ERP system*

User involvement is one of the key aspects to a successful ERP system implementation (Parr and Shanks, 2000; Al-Fawaz et al., 2008). User involvement is defined as the participation of users in the implementation process (Bhatti, 2005). It was also pointed out by Fitz-Gerald (2003) that the process of an ERP system implementation should be focused greatly on people, particularly users. Bhatti (2005) and Zhang et al. (2002) both indicated that users should be involved in two areas when the company makes a decision to implement an ERP system: first, users should be involved in the stage when the company's needs regarding the ERP system are defined and, secondly, users should participate in the implementation of the ERP system. Thus, the involvement of users is crucial because operating the system after it goes live will rely on the users (Bhatti, 2005). So, insufficient user involvement in the implementation of an ERP system could expose the company to the major risk of making errors unintentionally (Wright and Wright, 2002). Moreover, a lack of user involvement increases user resistance to and lack of acceptance for ERP systems (Esteves and Pastor, 2001). Thus, a lack of user participation is another factor that may contribute to the failure of an ERP implementation (Ghosh, 2002).

### 3.2.12 *Ineffective communications between users*

Effective communication is a essential factor for success ERP implementation (Welti, 1999; Falkowski et al., 1998; Esteves and Pastor, 2001). Slevin and Pinto (1986) showed communication as a main factor across all factors of project implementation. It is essential to have communication within the project team, and between the project team and the whole organisation concerning the goals and results of each implementation stage (Bhatti, 2005)**.** ERP implementations need to communicate across different functional areas as well as with external project members (Parr and Shanks, 2000; Sumner, 2000). The communication should start at an early stage in the ERP implementation and should offer an overview of the system including the scope, objectives and activities of the ERP implementation (Sumner, 2000), together with the reasons for implementing it (Bhatti, 2005)**.** Communication is essential to pass on details about the rationale for the ERP implementation, to organise briefings for the business processes for change management, to display applicable software modules, to give information concerning change management strategies and tactics, and to establish contact points (Bancroft et al., 1998). Through effective communication, everything will work properly (Somers and Nelson, 2001). Kumar and Van Hillegersberg (2000) indicated that poor communication is considered to be a leading factor in the failure of ERP implementations.

### 3.2.13 ***Skill mix***

One of the challenges related to the implementation of ERP systems is having the necessary skills (Sumner, 2000). Lack of knowledge is a risk factor that could lead to the failure of ERP implementation (Willis and Willis-Brown, 2002). Thus, lack of expertise, including lack of user experience, insufficient ‘internal’ expertise, failure to mix internal and external expertise effectively, and a lack of ‘business’ analysts are all risks associated with the recruitment and retention of IT professionals; these all contribute to project risk (Sumner, 2000; Barki et al., 1993).

As implementing ERP systems is complex, many companies use consultants, who are either internal or external experts, to ease the implementation process (Somers and Nelson, 2001; Bhatti, 2005; Al-Mudimigh et al., 2001; Maditinos, Chatzoudes et al., 2011). However, if in-house expertise is not available, a company should to look for outside consultants (Piturro, 1999). Typically, most companies prefer to bring in external consultants rather than use internal expertise to help them select an ERP, configure and reengineer business processes, carry out end-user training, perform requirements analysis, manage the ERP implementation, maintain and support the ERP, and recommend suitable solutions (Al-Mudimigh et al., 2001; Jarrar et al., 2000; Bhatti, 2005); external consultants are also often used to overcome technical and procedural challenges in the design and implementation of these systems, particularly when the internal expertise is insufficient (Sumner, 2000). It is important to bring in consultants with knowledge about certain modules, installation and software (Sumner, 2000; Piturro, 1999; Bhatti, 2005) and they should be involved in the different stages of the ERP implementation (Somers and Nelson, 2004; Thong and Yap, 1994). Sumner (2000), Bhatti (2005), and Barki et al. (1993) all pointed out that building a team which consists of a mix of external consultants and internal staff is significant to provide appropriate expertise in areas where team members lack knowledge; this enables internal staff members to develop the necessary technical skills for the design and implementation of the ERP system.

However, this challenge will be exacerbated when there is a lack of ERP-trained systems developers and a high market demand for their skills (Sumner, 2000) and many companies suffer from difficulties in terms of recruiting and retaining good ERP specialists (Sumner, 2000). Also, Welti (1999) and Al-Mashari et al. (2003b) indicated that there is a deficiency of ERP consultants with sufficient expertise in the market. This is another risk that could occur during the implementation of ERP systems. The probability of failing to recruit expert ERP consultants is considered to be a medium risk but, if those consultants are inefficient or inadequate, this could increase the risk of the implementation failing (Welti, 1999). The ability to obtain analysts with both business and technology knowledge is one of the most critical requirements for the success of ERP systems (Jarrar et al., 2000). Therefore, companies should not rely heavily on limited in –house expertise; instead, they should hire and retain external expertise to ensure the success of these systems (Willis and Willis-Brown, 2002). Welti (1999) and Mendel (1999) considered that the success or failure of an ERP implementation largely depends on the knowledge, skills, capabilities and experience of the consultants because they have in-depth knowledge of ERP software. In addition to the technological capabilities that such a team should possess, it should also understand the company and its business requirements (Remus, 2007). For an ERP to succeed, both business and technical knowledge are essential (Bingi et al., 1999; Sumner, 2000; Nah et al., 2001; Maditinos, Chatzoudes et al., 2011).

### 3.3 Possible risk factors that could impact on the operation of an ERP

Not only is the success of the implementation of ERP systems important, but the success the operation of the ERP system is important as well in order to provide accurate, real-time information which should be reliable and consistent, have integrity, and contain no errors (Park and Kusiak, 2005; Bingi et al., 1999). Chian-Son (2005) mentioned that several implementation risks could lead to operational risks that might have the potential to be damaging and result in losses. For example, inadequately trained users and lack of involvement on their part, exposes the company to the major risk of unintentional errors being made. Reengineering the business processes and customising the ERP during its implementation will enhance the possibility of controlling weaknesses (Wright and Wright, 2002; O'Leary, 2000). Furthermore, inadequate controls, which enable unauthorised access to be gained to data, could increase the possibility of unintentional or intentional errors occurring (Wright and Wright, 2002; O'Leary, 2000; Hunton et al., 2004;, Musaji, 2002).

Moreover, as business processes are integrated in ERP systems, if any errors occur when data are entered, because many applications rely on these data, the greater the impact of the error (Musaji, 2002). Also, in real time and database systems, errors can increase because the time is reduced for checking transactions before they are entered into the automated system's records (Musaji, 2002). This could make organisations more concerned about the input data and the outcomes of the systems; in short, organisations may be very concerned about the quality of ERP data and information and so the process of integration includes operational issues that must be managed carefully (Park and Kusiak, 2005).

There are also serious risks related to the operation of ERP systems such as "inappropriate access, incorrectly inputted data, missing validation procedures or data-checking routines, missing or inappropriate operational steps, inappropriate output formats, and inadequate internal controls (Soh et al., 2000). a number of of these risks, might have a direct financial impact: for example, inaccurate information, invalid transactions, misclassifications, financial misstatements, improper revenue recognition, misstated payroll liabilities, incorrect inventory valuation, duplicate payments to vendors, reduced data integrity, inefficiencies associated with accounts, defalcation, or significant financial losses, especially in the periods immediately following the implementation of an ERP system (Wright and Wright, 2002; O'Leary, 2000; Hunton et al., 2004).

Despite extensive coverage of the risk factors that might make the implementation of an ERP system fail, operational factors are not well covered in ERP literature and yet they can often be the cause of ERP failure. These factors were flagged up as important during the pilot study and the literature review. Operational risk factors include: incorrect entry data, repetition of errors, illogical processes (Musaji, 2002), flowing errors or process interdependency (Musaji, 2002; Wright and Wright, 2002; O'Leary, 2000; Hunton et al., 2004), security risks (Musaji, 2002; Abu-Musa, 2006; Loch et al., 1992; Ryan and Bordoloi, 1997; Wright and Wright, 2002), sharing passwords (Fahy, 2001a; Abu-Musa, 2006), working with two systems in parallel (interview data), and information quality (Wang , 2006). However, these risk factors have not previously been studied in the context of ERP systems.

As a result, knowledge of the risk factors that could impact on the quality of data in ERP systems is crucial to increase the efficiency of operating such systems. In the following section, each of these risks is discussed individually.

### 3.3.1 ***ERP software suitability***

The company's perception of the new product's characteristics plays an important role in the decision to buy and use a product (Van Everdingen et al., 2000). The characteristics of ERP software should fit the company's criteria. Van Everdingen et al. (2000) and Soh et al. (2000) point out that there are two important criteria that should be used in selecting an ERP system. First, is the compatibility of the ERP system with the business processes and, the second, concerns the characteristics of the ERP vendors, such as international orientation, market leadership, the functionality of the product, the product's quality, the speed of implementation, interfaces with other systems, price and corporate image.

As ERP systems are western software, some countries in Asia or in the Middle East may not have the capabilities to use them. This problem is related to mismatches between ERP features and organisational requirements (Markus and Tanis, 2000a; Soh et al., 2000).The "misfit" issue could be worse in Asia or in the Middle East since the most business processes of ERP systems are influenced by European or U.S. industry business practices (Soh et al., 2000; Molla and Loukis, 2005). Molla and Loukis (2005) stated that the transfer of an information system such as an ERP, which was created in an industrialised country, to a developing country is often marred by problems of mismatch with local cultural, economic and regulatory requirements. Business processes and local requirements in Asian or Middle Eastern organisations will most probably be different as these have evolved through different national and local contexts (Soh et al., 2000). Cultural misfit may be a risk for implementing and operating of ERP systems in different countries in the world because of their different economies, different policies, and different levels of knowledge.

Achieving compatibility between the standard ERP processes and a company's business processes is one of the most significant factors in the process of implementing an ERP system (Botta-Genoulaz and Millet, 2006). Compatibility between ERP systems packages and company requirements are clustered into categories in terms of their data format (such as the name of items), the processing procedures they require (e.g. access, control and operations), the presentation format and the information content of the output (Soh et al., 2000; Van Everdingen et al., 2000). Hong (2002) considered the suitability of fit of ERP constructions in terms of the data, processes and user interface before or during the initial implementation period.

Thus, an ERP system that is not designed to meet the specific business needs of the company can be source of great problems and widespread chaos (Umble and Umble, 2002). Incompatibilities or mismatches between organisational requirements and ERP systems could lead to significant difficulties or even failure in the implementation and/or operation of an ERP system (Kumar and Van Hillegersberg, 2000; Umble and Umble, 2002). These problems could include, for example, missing validation procedures or data-checking routines, improper output formats, and incorrect information content of input (Soh et al. 2000); these could lead to the potential risk of financial misstatement (Wright and Wright, 2002).

Hong (2002) conducted a study to explore the cause of the high failure rate of ERP from an "organizational suitability" perspective. They examined the relationship between the organisational suitability of the ERP and the success of the implementation. Hong (2002) found, from a survey of 34 organisations, that implementation success significantly depended on the organisational suitability of the ERP.

### 3.3.2 ***Security risk***

Reviewing the literature related to security risks revealed that ERP security is one of the most important issues facing organisations. Security risk relates to unauthorised access to equipment, software or the database by employees or hackers, actions which carry the likelihood of a variety of potential undesirable results (Hunton et al., 2004; Wright and Wright, 2002). Through unauthorised access to ERP data or systems, the original data can be destroyed or copied quickly without leaving any visible trail (Musaji, 2002). Thus, there are significant risks related to security and the integrity of computerised accounting information systems (CAIS) (Abu-Musa, 2006). Hunton (2004) pointed out that weaknesses in the access controls of ERP systems could make the security risk greater and increase the opportunity for unauthorised access to be gained to the enterprise-wide database. Insufficient controls in ERP systems could make a company suffer losses and reduce the chance of finding errors or fraud before they have an impact on operations (Musaji, 2002).

In a recent study, Abu-Musa (2006) conducted an empirical survey to study the perception of threats in computerised accounting information systems (CAIS) in Saudi organisations by using a proposed checklist of security threats. He carried out a self-administered questionnaire and received one hundred and sixty valid responses. His survey results indicated that almost half of the responding Saudi organisations suffered financial losses due to internal and external CAIS security. The results also revealed that the most significant perceived security threats to CAIS in Saudi organisations were: accidental or intentional entry of bad data; accidental destruction of data by employees; employees' sharing of passwords; introduction of computer viruses to the CAIS; suppression and/or destruction of output; unauthorised document visibility; and directing prints and distributed information to people who were not entitled to receive them. He offered some recommendations to strengthen security controls and to enhance wareness of CAIS security issues among Saudi organisations in order to manage security risks and to better protect their CAIS.

Loch et al. (1992) studied the perception of management information systems executives regarding security threats. Twelve security threats were developed and empirically examined by these executives. The results showed that accidental entry of bad data, destruction of data and unauthorised access to CAIS by hackers were the top security threats. Their results also indicated that the greatest threats came from inside the organisations themselves.

Ryan and Bordoloi (1997) explored how companies that moved from a mainframe environment to a client/server technology evaluated and took security measures to protect against potential information security threats. The results of their study revealed that the most significant security threats were accidental or intentional entry of erroneous data by employees, unauthorised access to the data or systems by hackers or employees, and sharing passwords. So they suggested that organisations must be aware of these significant areas and must ensure that proper security measures are implemented to reduce the likelihood of loss.

Finally, it was illustrated from previous studies that security is a very important factor to consider during the implementation of ERP systems; not only application security but also the security surrounding the servers, the network and databases (Wright and Wright, 2002). Unauthorised access to data and/or systems by both outsiders (hackers) and insiders (employees) were perceived as the main threats (Abu-Musa, 2006). Therefore, organisations should have a secure ERP environment to protect its information systems and data from accidental or intentional unauthorised access (Loch et al., 1992) and should also improve the financial and operational integrity of transactions in production data and processes (Musaji, 2002). Controls and safeguards should be installed to prevent, detect, correct and reduce these risks; awareness of potential security threats should also be raised (Musaji, 2002; Abu-Musa, 2006). So, in cases where there are strong controls for monitoring user passwords and authorisations on the three security aspects of ERP systems (i.e. networks, databases and applications), security risks to the ERP systems will be reduced (O'Leary, 2000; Hunton et al., 2004)

### 3.3.3 *Incorrect entry of data*

In ERP systems, the accidental or intentional entry of bad data is considered to be a serious threat to the success of such systems (Abu-Musa, 2006; Wood and Banks, 1993). Any simple mistakes made by an employee could lead to a serious problem which could have an effect on financial modules and financial statements (Wright and Wright, 2002; Umble and Umble, 2002; Musaji, 2002). For example, where an error is made at the receiving dock, there could be serious implications for inventory accounting, capacity planning, and other areas of the organisation (Kapp et al., 2001). Incorrect data entry could also occur because of human error in keying in data (Musaji, 2002) which could be result of their lack of training or because they were not involved in the implementation of the ERP system (Wright and Wright, 2002). During the keying in process, errors can occur because data can be created and entered at the same time. For example, order entry clerks receive orders by telephone and key them directly into the computer's memory and errors can easily occur during this process (Musaji, 2002).

The nature of ERPs as integrated systems necessitates that users understand the ramifications of their actions; they must also know how to eliminate errors that could occur during the implementation, operation and daily functioning of an integrated ERP system (Kapp et al., 2001). There are two steps for eliminating data errors (Kapp et al., 2001): (1) An ERP system's users need to understand the components of the system and know how these integrate with each other; and (2) they need to learn about the most common kind errors. Knowledge of the types of error that might occur will make users more careful and will encourage them to pay more attention about the treatment of data, thus helping them to reduce the frequency of mistakes (Kapp et al., 2001).

### 3.3.4 ***Repetition of errors***

Testing ERP applications and programs is the final and a very significant step in the implementation of an ERP system in order to reduce the possibility of risks, such as a repetition of errors, that could occur during the operation of the system. Repetitive errors could have an effect on financial misstatements and could occur because of inaccurate customisation or an application programming or hardware failure, or a failure with vendor-supplied software (Musaji, 2002). Therefore, rules should be applied consistently and correctly. Also, the program should be effectively tested and entries of master information should be adequately checked; otherwise, if something is wrong, the processing will also be wrong (Musaji, 2002).

### 3.3.5 ***Flowing of errors***

In integrated system such as ERP systems, flowing errors are more likely to occur than with manual systems. These errors could be insignificant but may lead to major errors if they are not discovered. An error in one part of the program or application may lead to a second error in another part of the application or system, the second error may lead to a third and so on. For example, an insignificant error in the order-entry program can flow through a series of applications making serious errors in the inventory refilling program (Musaji, 2002; Umble and Umble, 2002). Equally, an error made through the sales ordering process (e.g. the quantity ordered of a special product is erroneously doubled) could result in a major error in the production function (process interdependency risk) (Hunton et al., 2004). However, the risk of flowing of errors can be the result of making changes to application systems or entering incorrect data with or without sufficiently testing the applications or with only limited testing of program changes (Musaji, 2002).

### 3.3.6 *Illogical processing*

Illogical processing is more likely to occur in an automated system such as an ERP, than in a manual system due to programming or customisation or hardware errors (Musaji, 2002). Testing the performance of an ERP system (Nah et al., 2001), scanning the output documents, and checking for unusually large amounts has the potential to reduce financial misstatements (Musaji, 2002); these are essential points at the implementation stage of the ERP software before going live. What is more, Musaji(2002) indicated that not many people can understand the processing logic of ERP applications.

### 3.3.7 *Information quality*

One of issue regarding ERP systems is the quality of information in such systems. Park and Kusiak (2005) indicated that ERP systems suffer more than other information systems from poor data quality. Poor data quality can cause major disasters and increase the operational costs due to the time that has to be spent finding and correcting data errors (Hassan, 2003). Thus, ERP systems can cause problems for an organisation if the issue of data quality is not properly addressed (Xu et al., 2002). It is therefore important to understand the data quality issue to make the operation of an ERP system success.

## 3.4 Conclusion

Finally, the question is how to reduce those risks involved in the implementation and operation of ERP systems in order to obtain the benefits of such systems. This has become a challenge for top management. Previous research has proposed that increasing the likelihood of success for ERP systems requires understanding and reducing, or at least managing, the risks associated with the business task or application (Barki et al., 1993; Jiang et al., 2000). Thus, acquiring knowledge concerning perceptions of those risk factors might assist companies in improving the implementation and operation of their ERP systems. To date, no empirical research is available regarding perceptions of risks factors associated with ERP systems. In this thesis, it is proposed that identifying

ERP risk factors is not enough; rather, managers must perceive these as risk factors leading to ERP failure if the implementation and operation of these systems is to be more successful.

All of the above mentioned risk factors associated with the implementation and operation of ERP systems are important and need to be recognised by managers to reduce the failure of ERP systems. These risk factors are considered here, but not in depth, because in this research the focus is on the managers' perceptions of risk factors associated with: (1) the implementation and (2) the operation of ERP systems, together with those factors that might affect their perceptions. This leads to the primary purpose of this research which is: to examine managers' perceptions of risk factors concerning the implementation and operation of ERPs, and to carry out a preliminary investigation by examining differences among managers with respect to their perception of these risks. The importance of these risk factors could vary depending on the characteristics of the managers, such as their culture, profession, and level of their ERP expertise. These issues are discussed in the next chapter.

# 4 Chapter Four: Theoretical framework, model of perception of risk

## 4.1 Introduction

Risk perception has been studied in various fields, but to our knowledge, not in the ERP context. Thus, this thesis studies the perceptions of risk factors associated with the implementation and operation of ERP systems for two reasons. First of all, it is claimed that the success or failure of ERP systems is based on effective risk management actions, which are dependent on the way managers perceive risks factors related to ERP systems. Secondly, previous researchers in ERP have overlooked managers' perceptions of risk. So, no proposal has been made to study, understand and manage the perception of ERP risk on the part of managers.

As mentioned in the third chapter, the focus and contribution of this thesis is to examine managers' perceptions of those risk factors; it also aims to investigate whether there is any variation between different management groups regarding those factors. Furthermore, this research aims to study the interactions and relationships between the perceptions of risk factors related to the implementation and operation of ERP systems, and the culture, profession, and level of ERP expertise of managers. In order to understand these interactions, it is necessary to start with an examination of the backgrounds and theories which depict how such interactions are constructed. This chapter introduces how the model has been arranged.

The previous chapter reviewed and identified the risk factors related to the implementation and operation of ERP systems; this is shown in Sections 3.2 and 3.3. These risk factors are important to both researchers and practitioners. In turn, the aim of this chapter is to develop the theoretical or conceptual framework and the model of this research. The theoretical framework contains a theory that has been developed from the field of anthropology: cultural theory.

This chapter has seven sections. After this introduction, the first section begins by providing a review of the concept of risk in general and the concept of ERP risk; it also sheds light on the perception of risk as a social construct and in terms of cultural theory in Sections 4.2 to 4.4. In the main body of the review, a critical consideration of the perception of risk is offered while Sections 4.5 outline the culture theory of risk.

Finally, Section 4.6 discusses the research model that shows interactions between perceptions of risk and culture, profession, and level of ERP expertise. The outcome of the review is a development of the preliminary research models for this study; this helps to guide the research in the way described in the methodology chapter.

## 4.2 What is risk?

Risk is a complex and significant concept in a number of fields and a large number of research studies, both experimental and theoretical, have been carried out on the subject of risk. These studies reveal diverse definitions of risk, based on viewpoints across different disciplines ranging from mathematics to psychology, and from financial, economic and technological standpoints. Each definition offers an understanding of ways of constructing, perceiving and managing risk. The mathematical definition of risk is commonly known as "the statistical probability of an outcome, in combination with the severity of the effect" (Boholm, 2003, p160). A general definition of risk was offered by Adams (1995, p. 69) as "the probability of an adverse future event multiplied by its magnitude" while according to Douglas (1992, p.40), risk can be defined as "the probability of an event combined with the magnitude of the losses and gains that it will entail.". Willcocks (1994, p.2) views risk as a "negative outcome that has a known or estimated probability of occurrence, based on experience or some theory". In other words, risk refers to "the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge" (Royal Society, 1983, p. 2).

An etymological analysis of risk illustrate that risks are results of human actions and that they are danger that might be avoided (Stahl et al., 2003). In sociological literature about risk, it has broadly agreed this concept. Kemshall, (2000, p143) states that "the word 'risk' is pervasive in contemporary life and has come to encompass a wide-range of future events and behaviours that are often complex and far from uniform". However, it is difficult to pinpoint a definition of risk as this word has many different meanings. Garland (2002, p. 49) gives the following overview of risk: "Today's accounts of risk are remarkable for their multiplicity and for the variety of senses they give to the term. Risk is a calculation. Risk is a commodity. Risk is a capital. Risk is a technique of government. Risk is objective and scientifically knowable. Risk is subjective and socially constructed. Risk is a problem, a threat, a source of insecurity".

Moreover, Millburn and Billings (1976, p116) defined risk as "a perceptual or subjective response to an environmental event that involves uncertain danger or the possibility of suffering harm or loss". This concept contains the notion of a human response or perception to the risk as the author views risk from a subjective perspective. Boholm (2003) pointed out that subjective risk is the beliefs and opinions of people that often diverge from scientific assessments. A personal or subjective estimation of risk is different from an objective estimation (Boholm, 1996). By comparing subjective and objective risk, it has been found that objective risk indicates a risk that has been scientifically established by using the best available data and knowledge; this is different from perceived risk which is based only upon subjective impressions (Garland, 2002). Boholm (2003, p. 161) stated that: "Objective risk refers to phenomena and causality in the natural world that can have harmful effects. It is the task of science to disclose and assess sources of potential harm, identify measurable correlations and assess the probabilities of harm". The nature of objective risk is quantitative; that is, it depends on the past occurrences of an event and incorporates these into a numerical assessment in order to estimate risk (Ricciardi, 2003). Objective risk is calculated from statistics and probability distributions (Oltedal et al., 2004). However, objective risk is measured depending on the a number of observations or calculations (Ricciardi, 2003) while subjective risk is based on what an individual perceives to be a risk. Boholm (2003) and Beck (1992) stated that, when risks are based on perception, they become subjective. Perception is recognised as the subjective view of a risk and not an objective evaluation of that risk (Starr et al., 1976). In reality, social science supports the concept of subjective risk rather than the notion of objective risk (Ricciardi, 2003). Ciancanelli et al. (2001) pointed out that the definition of risk has begun to be considered as something associated with the way individuals view the world, and how these views come to be constructed. It has been agreed that the difference between objective and subjective or perceived risk could not be continual (Ciancanelli et al., 2001). Risk has been seen as a function of individual perception.

Understanding the perceptions of risk and how individuals perceive these risks has been attempted by many studies in different fields of social science, anthropology, psychology, psychometrics and technology studies (Ricciardi, 2003). These studies have been carried out to examine the way people perceive, manage, and live with risk; and how personal feelings, attitudes, expertise, and social and cultural aspects have an effect on people's interaction with the risk. Sjöberg et al. (2004, p. 13) described risk perception as “the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences”. Perception of risk is a personal opinion concerning the possibility of incurring the risk associated with a particular activity (Ricciardi, 2003). Perception of risk is about people’s views, thoughts, beliefs, attitudes, judgements and feelings (Sjöberg, 1979). Moreover, an individual’s perception of risk is related to his/her personal experience (Chiu, 2002). Identifying a risk requires a particular knowledge about undesirable outcomes, and what situations lead to danger of experiencing those outcomes. People may perceive and worry about different risks due to their background and knowledge. So when people have no kind of knowledge, they could not really have a concept of risk. Douglas (1982b, p. 1) mentioned that “Can we know the risks we face, now or in the future? No, we cannot; but yes, we must act as if we do. Some dangers are unknown; others are known, but not by us because no one person can know everything. Most people cannot be aware of most dangers at most times. Hence, no one can calculate precisely the total risk to be faced. How, then, do people decide which risks to take and which to ignore?”. Risk should be seen as product of knowledge (Douglas, 1982b). Slovic et al (1987) states that ‘experts’ and ‘novices’ sometimes have diverging perceptions of risks. One of the fundamental discordances between ‘expert’ and ‘lay’ conceptions of risk is that the “lay person looks at risk more broadly than the expert whose expertise is narrow and therefore likely to “miss something” of importance to the broader community” (Margolis, 1996, p35 cited in Boterill and Mazur, 2005, p6). Fear of risk has something to do with knowledge and something to do with people. People must be willing to accept the risks, and must be willing to believe in. People use interpretive frame to make sense of things. Experts risk perceptions are influenced by the norms of their associates. Lay risk perception is more broadly which is influenced by personal experiences and circumstances, and is greatly affected by context like social networks.

Perception of risk is “the wider social or cultural values and dispositions that people adopt towards risk” (Pidgeon, 1998, p5). An individual’s perception of risk is often not an isolated matter but is influenced by the way he/she lives and works within a network of social relationships since people are a part of a society and a culture (Ciancanelli et al., 2001; Palmer, 1996). Individuals are rooted in a social environment that has particular values, thoughts and characters; so an individual’s perception of risk is shaped by the values and worldviews of his/her social or cultural contexts (Rippl, 2002;

Douglas and Wildavsky, 1982b; Wildavsky and Dake, 1990). Moreover, the risk perception of people is influenced by the risk communication among people. Flint and Luloff (2005) claims that risks are social interactions which are experienced and shared with others. The collective experiences are the key player that influence on perception of risk. Therefore, researchers in the social sciences have interested in the ways which risk is socially constructed.

The most important studies about the social construction of risk are Mary Douglas, Aaron Wildavsky, and Ulrich Beck. They support the idea that the risk is a social construct and an individual's perception of risk is a reflection of the ways of the society itself (Brenot et al., 1998). Sjöberg et al. (2004) and Douglas and Wildavsky (1982b) claim that perception of risk is socially and culturally framed. Within this view, it is thought that risk is clearly not an objectively given entity, but a social construction (Stahl et al., 2003). Beck (1992) is famous with his assertion on the effect of new risks on the constitution of society. He views the risk as both real and socially constructed at the same time. Social construction is defined in the Collins Dictionary of Sociology as "a formulation employed within some areas of sociology to emphasise the way in which social institutions and social life generally is socially produced rather than naturally given or determined" (Jary and Jary, 1995). Social and cultural perspectives have become increasingly significant in the area of risk research (Rippl, 2002). However, this concept is appropriate to information systems such as ERP systems for the reason that the implementation and operation of ERP systems within organisations are obviously created and used by and through social interaction. Thus, managers' perceptions of risk factors associated with the implementation and operation of ERP systems also have to be fundamentally social constructions.

## 4.3 Definition of risk regarding ERP systems

In ERP systems, risk can be viewed from variety perspectives as something going wrong. O'Leary (2000, p.232) defined risk as "an exposure that can be a success factor if properly handled and a failure factor otherwise", while Wiegers (1998. p. 78) defined risk as "a problem that has not yet happened but which could cause some loss or threaten the success of your project if it did". Using this conception, some research studies have attempted to explore the relative importance of a range of risks in ERP systems and have tried to categorize and reduce these risks (Huang et al., 2004). ERP risk factors can be seen as negative indicators which will warn of the potential failure of an ERP system implementation (Fitz-Gerald, 2003). These risk factors can be viewed as "a negative re-statement of a critical success factor. For example, a well documented CSF is top management support while a well-recognised risk is a lack of top management support" (Fitz-Gerald, 2003, p.3). Consistent with the researchers' definition of ERP risk noted above in this thesis, ERP risk can be said to be an event that could occur and which could make the implementation or operation of an ERP system less successful or even fail.

## 4.4 Risk perception theories

Risk management includes many human activities that are dependent on the way managers' perceptions of risk are associated with information systems (IS) (Tsohou et al., 2006). The recognition and assessment of risk are also human and social activities (Tsohou et al., 2006). However, the implementation and operation of ERP systems will involve many people in different departments in the company. Therefore, the success or failure of such systems depend on the way various managers (e.g. IT managers, accounting financial managers, internal auditors, etc.) perceive risk factors associated with the implementation and operation of ERP systems.

It has been reported in several empirical studies that perceptions of risk are different from individual to individual; each one is worried about a different risk (Nelson, 2004; Garland, 2002; Beck, 1992; Boholm, 1998; Bontempo et al., 1997; Renn et al., 2000; Douglas and Wildavsky, 1982b; Tsohou et al., 2006; Slovic et al., 1982; Brenot et al., 1998). Thus, a subjective assessment of risk would "result in risk being estimated differently, depending upon the differing perspectives of the individual" (Nelson, 2004,p.187) since some risks could be recognised by one person as major risks while they could be recognised by another as minor (Ricciardi, 2003). Also, Bontempo et al. (1997) and Weber (1998) indicated that there are systematic individual, group and cultural differences in perceptions of risk. A number of these points are reflected in the recent IS risk management literature. Perceptions of risk concerning a complex IS system, such as an ERP system, could be more difficult when the ERP system is expanding to be integrated among departments with different backgrounds and with different ways of viewing the risks associated with the  system. When discussing perceptions of those risk factors associated with a particular information system, people perceive risks differently (Tsohou et al., 2006). Also, people are more likely to have different estimations in terms of rating the same risks (Tsohou et al., 2006).

Consequently, many factors could have an effect on people's perception of risk; their perception may be different or vary among them. Culture is one factor that influences the way people perceive risk (Belton, 2001). What is more, personal expertise and information acquired from outside an environment; seeing and hearing opinions from the mass-media such as TV, radio and newspapers; familiarity with the source of the risk; and background and professional experience; are other factors that cause differences in the perceptions of risk among people (Ricciardi, 2003; Belton, 2001; Renn et al., 2000; Tsohou et al., 2006). People often do not perceive risk related to a particular activity due to their lack of certain information. So, without accurate and adequate information, people could make an incorrect judgment or decision (Ricciardi, 2003).

However, two different approaches concentrate on the field of risk perception. The first approach concerns the 'psychometric paradigm' which is derived from the field the of psychology and the decision sciences (Marris et al., 1998). The psychometric paradigm attempts to explain differences in an individual's perceptions of risk by focusing mainly on cognitive factors (Wilkinson, 2001; Rippl, 2002). The significant assumption within the psychometric approach is that risk is inherently subjective (Sjöberg et al., 2004). Slovic (1987), Slovic (1992), and Slovic et al. (1982) used the psychometric model of risk perception and found that the 'dread risk factor' and the 'unknown risk factor' are the core cognitive factors that govern an individual's perception of risk. However, one criticism of the psychometric paradigm was that this theory did not consider the impact of social and cultural perspectives on perceptions of risk (Rippl, 2002)

The second approach is 'cultural theory' that was developed by sociologists and anthropologists (Marris et al., 1998) who were concerned to study the effects of values and cultural settings on the perception of risks. Cultural theory declares that perceptions of risk within social groups and structures are predictable according to the group and individual worldviews. Cultural theory has been used to examine differences in the perception of risk among different types of social solidarity. This thesis then is devoted to an investigation of variation in perceptions of risk in terms of the culture theory. This thesis seeks to bring the Douglas culture of risk perceptions into the literature domain of ERP systems and Douglas' work has been drawn upon to explore the failure of the implementation and operation of ERP systems. Also, different perceptions of ERP risk are examined in this by using a conceptual framework developed from cultural Theory.

While there is another culture theory such Hofstede's Cultural theory which has been used in many IS studies, this research applied Douglas culture theory of risk for some reasons. Firstly, Hofstede's cultural approach provides a useful model in defining national culture which includes five dimensions: individualism–collectivism, power distance, uncertainty avoidance, masculinity, and long-term orientation (Hofstede 1980). In spite of Hofstede's cultural dimensions may provide broader aspects of culture; it is not linked with the perception of risk issue. In reality, researches that are concerned with the impacts of culture on risk perception have been applied Douglas culture theory since the Grid-Group culture dimension covered individualism therefore indicate "deeper" and more general structure of culture.

Secondly, Hofstede's theory assesses and differentiates culture on the national and organizational level, not at the individual level. Ford et al. (2003, p9) pointed out that "Hofstede's dimensions allow national-level analysis and are standardized to allow multiple country comparisons". Thus IS researchers usually applied Hofstede's culture when they want to discuss issues of international or national culture within IS field. *Hofstede's cultural dimensions allow users to differentiate countries but are not about disparity between members of societies.* Hofstede said that "If the questionnaire is used to compare responses from individuals, from occupations, from employers or from other categories other than nations or regions, the answers should be studied question by question and not combined into the five dimensions. There is no reason to assume that in this case the present questionnaire is the most suitable instrument! The questions and dimensions in this questionnaire have been chosen for comparing countries and the questionnaire is meant for use at the country level. It should also apply for the comparison of geographical regions other than countries (within a country or across countries)" (Hofstede, 1994, p. 3). However, choosing countries as the analysis and compare unit level is considered as the major criticism faced Hofstede theory. Culture is assumed to be homogenous; he ignore the importance of subcultures which have important variances with each other (Khastar et al., 2011). As it is known that the mean value of culture in a country generally overlooks the difference within the society. As a result, in a large society with several ethnicities and regions, such as the United States and China, it is important to understand the culture difference within the societies. However, as Douglas cultural theory provide more detailed information on individual level, it helps to understand the culture variance.

Besides to the above criticisms relating to Hofstede's theory, Ford et al. (2003) provide another critique of the Hofstede's work. They highlighted that the Hofstede's culture dimensions is outdate. It is based on data for long time ago. With fast changing global environments, increasing international travelling, and interconnections among diverse societies regarding their cultural lives,  Hofstede's outcomes become too old to be of any modern value (Jones and Alony, 2007).

To overcome all above difficulties, this thesis adopted the Douglas cultural theory. The Douglas cultural theory provides four different types of culture (Individualism, Fatalism, Hierarchy and Egalitarianism). Therefore, researchers can categorize the countries into the four types of cultures.  Besides, this research thesis investigates managers' perceptions of risk factors associated with the implementation and operation of ERP systems; these could be different based on social and culture aspects. Rippl (2002) pointed out that cultural theory, which was developed by Mary Douglas, is the most significant approach for research concerned with examining the impact of social and cultural factors on risk perception. Moreover, culture theory has been widely used in research studies on perceptions of risk in many fields, yet the theory is rarely used in the field of risk perception that is related to IT and IS and not at all in the use of ERP systems so it is the intention of this research to fill this gap. Thus, this thesis examines the implications of cultural theory on managers' perceptions of risk factors associated with the implementation and operation of ERP systems. This thesis therefore aims to contribute to the development of ERP systems research in the field of the risk.

### 4.5 Culture theory

The concept of risk within contemporary social theory is largely studied and considered by Ulrich Beck and Mary Douglas who presented a comprehensive theoretical description for the social development of culture and the politics of risk (Beck, 1992; Douglas, 1992; Douglas and Wildavsky, 1982b; Douglas and Wildavsky, 1982a; Wilkinson, 2001). These researchers  are concerned with the exploration of the cultural meaning of risk. The culture theory was developed over the past thirty years in the fields of anthropology and political science by Mary Douglas, Michael Thompson, and Wildavsky (Douglas and Wildavsky, 1982b; Mamadouh, 1999; Thompson et al., 1990; Wildavsky and Dake, 1990). The general assumption of cultural theory is that the ways people socially interact have an effect on the symbol systems they draw on to view the world (Douglas, 1996a, p. xxxv). Douglas postulates that the "more value people set on social constraints, the more the value they set on symbols of bodily control". Consequently, the central idea of cultural theory is that the concepts people use to understand the world are associated with the social constraints or social structures they face (Ney and Molenaars, 1999).

Cultural theory plays an important role in explaining how and why people construct their perception of risk (Dake, 1992; Dake, 1991; Wildavsky and Dake, 1990; Douglas, 1992; Douglas and Wildavsky, 1982b; Douglas and Wildavsky, 1982a; Thompson et al., 1990; Rayner and Cantor, 1987; Tansey and O'Riordan, 1999; Tsohou et al., 2006). They assert that this comes, not from the thoughts and beliefs of individuals, but from the notion of different types of social solidarity; this confirms the continuity between the present culture and that of any other period of human history (Boholm, 2003; Wilkinson, 2001; Wildavsky and Dake, 1990). However, perceptions of risk are formulated depending on the social context (Tansey and O'Riordan, 1999) and the thoughts of people are always influenced by culture (Boholm, 2003; Douglas and Wildavsky,1982b; Boholm,1998; Boholm,2003), and Wilkinson, 2001). Thompson (1980) also mentioned that an individual's perceptions of risk are guided by his/her world views and culture. Thus, Thompson presumes that risk is a cultural construct, and that the language of risks will have an impact on a person's risk perception. However, individuals select different risks which reflect their way of life and the culture they belong to. Boholm (1998) and Oltedal et al. (2004) also pointed out that culture theory declares that the perception of risk is greatly related to culture and social aspects.

On the whole, the purpose of cultural theory is to show how different people and social groups view or perceive risks differently. Also, Wildavsky and Dake (1990, p. 42) strongly support the view that the cultural theory of risk has the ability to "predict and explain what kind of people will perceive which potential hazards to be how dangerous". However, Douglas clarified her theory of the cultural theory of risk perception by introducing the grid-group theory of society (Douglas and Wildavsky, 1982b). Mamadouh (1999) and Wildavsky and Dake (1990). indicated that the grid-group approach is considered to be a tool for dealing with different cultures. The grid-group theory, however, divided people's culture into four different cultures with different "ways of life"; these are hierarchy, individualism, egalitarianism and fatalism (Douglas and Wildavsky, 1982b). Each form of these groups views risk differently based on the ways in which their social commitments towards a preferred 'way of life' predispose them to adopt a particular view of society, the world and of nature (Wilkinson, 2001). Douglas and Wildavsky (1982b, p.8) claim that ''each form of social life has its own typical risk portfolio'' and the different cultural types socially construct meaning (Ney and Molenaars, 1999).

The two concepts, grid and group, are used to describe the human activities and social life in a society. The grid-group typology uses two central dimensions of sociality in order to classify and compare cultures ((Douglas and Wildavsky, 1982b; Mamadouh, 1999). These dimensions are placed on a system of vertical and horizontal axes, namely the grid and group dimensions. The horizontal axis in the grid-group theory refers to the group which is: "the extent to which an individual is incorporated into bounded units. The greater the incorporation, the more the individual's choice is subject to group determination" (Thompson et al., 1990, p. 5). Douglas and Wildavsky (1982b, p. 138) defined the group as: ''the outside boundary that people have erected between themselves and the outside world''. Furthermore, Oltedal et al.(2004, p. 18) claim that: "group refers to whether an individual is a member of bonded social units and how absorbing the group's activities are on the individual". To summarise, the group dimension is characterised by the degree of social incorporation into bounded social groups.

The vertical axis of the grid-group theory is the grid. This is explained by Thompson et al.(1990, p. 5) as follows: "grid denotes the degree to which an individual's life is circumscribed by externally exposed prescriptions. The more binding and extensive the scope of these prescriptions, the less life is open to individual negotiation". Douglas and Wildavsky (1982b, p. 138) defined the grid as: "all the other social distinctions and delegations of authority that they use to limit how people behave to one another". Oltedal et al.(2004, p. 23) claim that: "grid refers to what degree a social context is regulated and restrictive in regard to the individuals' behaviour". In short, the grid dimension is characterised by the degree of restriction of the regulations or instructions.

Thus, the main foundation of the grid-group theory is that one of the social units, such as a group, organisation or society, can be thought of in terms of two types of social control: grid and group (Thompson et al., 1990). The grid and group dimensions make up a two-axis system, from low to high; these produce four different kinds of culture, worldviews or "ways of life": hierarchism, individualism, egalitarianism and fatalism (Oltedal et al., 2004; Thompson et al., 1990; Douglas, 1992), as represented in Figure 4-1. These four grid-group types have different perceptions and understanding of risk (Oltedal et al., 2004). The characteristics of each type are described below.

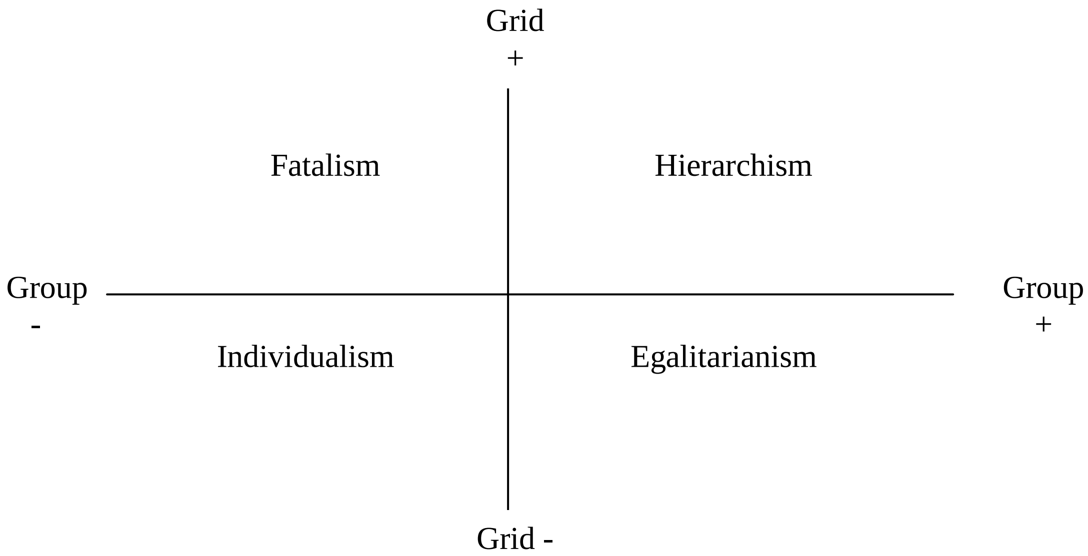


**Figure 4-1: Douglas' grid - group model (source: Oltedal et al., 2004; Thompson et al., 1990; Douglas, 1992)**

### 4.5.1 ***Hierarchism***

Hierarchists are characterised by high group and high grid. This type of culture, which is known as bureaucratic, is bound by strong group incorporation and strong regulations or rules (Tsohou et al., 2006; Mamadouh, 1999; Mars, 1996; Langford et al., 2000; Tansey and O'Riordan, 1999). In a hierarchical culture, roles are well-prescribed for each member and hierarchical organisations are structured according to the principle that each person should know his/her place, although that place could vary with time (Altman and Baruch, 1998). Besides, more regulations and prescriptions will be imposed upon group members (Linsley and Shrives, 2009). These regulations and instructions give precedence to the importance of the whole over the parts, and the collective over the individual (Mamadouh, 1999; Mars, 1996). Hierarchists rely on

formal rules; thus, the relationship between employer and employee is basically moral, as with family links (Rajapakse and Seddon, 2005). Douglas (1996a, p. 83) defined the hierarchical life-style as "formal, adhering to established traditions and established institutions; maintaining a defined network of family and old friends". Thus, established procedures are controlled and run in a well structured way (Mars, 1996).
Hierarchy, however, is less well adapted to accommodate change and there is an over-dependence on standard methods of doing things, including the processing of information and the propensity to occupy managerial privileges (Mars, 1996). Another obvious feature of an hierarchic culture is that this type of culture involves compulsion and inequality (Ney and Molenaars, 1999; Patel, 2007; Wildavsky and Dake, 1990); this culture has unequal roles for unequal members (Patel, 2007).

Hierarchists fear risks that threaten their rules and orders and Tsohou et al.(2006) and Wildavsky and Dake (1990) point out that hierarchists are mainly concerned about things that disrupt this social order and disrupt their rules. Their risk perceptions have a propensity to be satisfied: "As long as you follow the rules, you are safe" (Mars, 1996, p.10). Hierarchists are concerned about the risks that develop from adapting to change (Mars, 1996).

### 4.5.2 *Egalitarianism*

Egalitarians are characterised by high group and low grid. Altman and Baruch (1998, p.772) defined egalitarianism as: "a social context in which the external group boundary is typically the dominant consideration and the social experience of the individual is shaped by the 'we' versus 'them' ethos". Egalitarians place extreme emphasis on the collective (Grendstad, 1999; Mamadouh, 1999; Langford et al., 2000). Tsohou et al.(2006) characterised egalitarian members as having strong group boundaries and a strong or intensive social patterning of self expression; they have few or no regulations and rules, or prescribed roles. Egalitarians refuse instructions related to hierarchy and therefore show much less concern about social deviance (Wildavsky and Dake, 1990). However, without the existence of clear rules and regulations for succession, leadership tends to be charismatic (Ney and Molenaars, 1999; Altman and Baruch, 1998). Egalitarians like social relations that are open to negotiation (Rippl, 2002; Altman and Baruch, 1998) but they dislike social relations that are formed by hierarchical structures (Rippl, 2002). Egalitarians anticipate that individuals will share their ideas and negotiate their relationship with others; individuals are not granted authority by virtue of their position (Langford et al., 2000).

The goal of the egalitarian culture is to achieve intense social equality, justice and freedom (Tsohou et al., 2006; Oltedal et al., 2004; Mamadouh, 1999; Linsley and Shrives, 2009; Douglas, 1992; Tansey and O'Riordan, 1999), such as imposing high taxes on rich people (Oltedal et al., 2004). In an egalitarian culture, decision making should be based on group thinking (Rajapakse and Seddon, 2005; Patel, 2007) while employees perform best in in-groups and group level training is more effective (Rajapakse and Seddon, 2005).

Egalitarians' view of risk is different from the individualists' view; risk is perceived by egalitarians as inequality and injustice (Wildavsky and Dake, 1990; Linsley and Shrives, 2009) and they are afraid of developments that could lead to inequalities amongst people (Oltedal et al., 2004; Tsohou et al., 2006). The egalitarian culture could perceive any risk related to technology to be great and the concomitant benefits of such technology to be small (Wildavsky and Dake, 1990). Thus, risks are perceived as emerging from untrustworthy outsiders (Linsley and Shrives, 2009).

### 4.5.3 ***Individualism***

Individualists are characterised by low group and low grid. This type of culture is confined or bound by weak or no group incorporation, and weak or no regulations or rules or prescribed roles (Wildavsky et al., 1990; Langford et al., 2000; Mamadouh, 1999). Individualists have a few constraints in terms of rules and social interconnections (Tansey and O'Riordan, 1999). Mars (1996) stated that individualists are averse to agreed rules or to following defined instructions or procedures that seem to abolish their present independence. Thus, they are quite free of control by others (Mamadouh, 1999). They feel more responsible for themselves (Ney and Molenaars, 1999; Patel, 2007; Altman and Baruch, 1998) and less responsible towards other members of society (Langford et al., 2000). Also, they consider the allocation of power and resources lie within their own responsibility, not by position (Douglas and Wildavsky, 1982b).

In this type of culture, all the boundaries are provisional, which allows the maximum options for negotiating (Wildavsky et al., 1990; Altman and Baruch, 1998; Mamadouh, 1999; Patel, 2007). The individualist culture supports self-regulation (Wildavsky and Dake, 1990; Grendstad, 1999; Ney and Molenaars, 1999; Patel, 2007) and members are free to enter transactions with any other individuals as they wish (Mamadouh, 1999; Linsley and Shrives, 2009). They will desire to participate with other individuals in cases when earnings and profits can be made from such coalition (Linsley and Shrives, 2009). They also have the freedom to bid and bargain (Wildavsky et al., 1990), choosing any arrangements they prefer within any alliance and associations in order to maintain their interests and realise their requirements or goals (Grendstad, 1999). Wilkinson (2001,p. 5) mentioned that an “individual culture supports social institutions which enshrine the goal of personal acquisition as their supreme value”. Individualists tend to do their own thing and do not normally relate with long-term loyalty to a specific employer (Mars, 1996).

The individualist culture is considered to be competitive and a market culture (Douglas, 1996b); Mamadouh (1999) stated that it is a competitive culture struggling for personal rewards. He also pointed out that fairness consists of equality of opportunity and blame is put on personal failure or lack of competition (Mamadouh, 1999). In business, individuals prefer tasks and the company to prevail over personal relationships (Rajapakse and Seddon, 2005). Moreover, in individualistic cultures, employees perform best as individuals and training at an individual level is more effective (Rajapakse and Seddon, 2005).

The meaning of risk to individualists includes things that might jeopardize their own way of life and their freedom (Oltedal et al., 2004). Individualists view risk as a threat that limits their freedom or obstructs market relationships (Wildavsky and Dake, 1990). They worry about market threats but are described in particular as seeing risk as an opportunity (Oltedal et al., 2004; Thompson et al., 1990). They also mainly focus on economic risks deriving from the entrepreneurial free market perspective that describes this culture (Linsley and Shrives, 2009). Individualists are mostly afraid of the lack of freedom to continue business as usual (Lima and Castro, 2005); however, individualists have a high propensity for risk taking (Mars, 1996).

#### 4.5.4 *Fatalism*

The final cultural type is the fatalistic worldview which is characterised by low group and high grid. This type of culture, which is also known as the culture of isolates, is confined or bound by weak or no group incorporation, high constraint, and strong regulations or rules or prescribed roles (Mars, 1996; Mamadouh, 1999). Fatalists are like hierarchists in the sense that they are constrained with respect to social roles (Linsley and Shrives, 2009) but, unlike the hierarchists, they are deterred for forming groups and remain outside of membership in those organisations responsible for imposing regulations and prescriptions (Tansey and O'Riordan, 1999; Langford et al., 2000; Thompson et al., 1990; Douglas and Wildavsky, 1982b). Fatalists work under a high level of routine (Mars, 1996) and believe that there is no fairness on this earth (Mamadouh, 1999). Fatalists feel that life seems very much like a lottery (Oltedal et al., 2004).

Fatalists view risk as fate or bad luck (Mamadouh, 1999); they are unaware of risks but neither are they concerned about them as they assume that risks are unavoidable anyway and out of their control (Oltedal et al., 2004). Generally, fatalists are unwilling to know or worry about things they believe they cannot do anything about (Oltedal et al., 2004). In terms of risk perception, fatalists think that "There's nothing much you can do so why try? If it is going to happen– it will" (Mars, 1996).

In summary, grid and group theory shows differences in types of culture by illustrating them as diagonally opposed (for example, hierarchy is opposite to individualism, egalitarianism opposite to fatalism, etc.), whereas neighbouring cultures show similarities on one dimension but differences on the other. For example, egalitarianism is in the neighbouring category to hierarchy and individualism and egalitarians are similar to hierarchists they have strong group incorporation but a different relation to the grid dimension: they refuse the instructions and rules related with hierarchy.

Finally, the grid and group dimensions of cultural theory, according to some researchers, constitute an important explanatory method which is very useful for understanding risk perception. It also provides a framework for describing four different cultural types that look at risk in different ways. Therefore, in this thesis, this theory will be used to see how each cultural group in Jordanian society perceives the risks related to the implementation and operation of ERP systems.

## 4.6 Research model

The focus of this research is to identify perceptions of risk factors related to the implementation and operation of ERP systems. Furthermore, this study aims to investigate whether there are any variations among different managers in terms of their perceptions of those risk factors in order to examine the relationship between the managers' culture, profession and ERP expertise, and their perception of those risk factors.

The themes emerged from conducting exploratory pilot studies, and by reviewing the relevant literature on differences in risk perception research; thus, the study's preliminary research model and hypotheses were developed. It was obvious that managers would differ in the way they viewed the risks involved in ERP but it was necessary to ask if such differences could be described or explained by differences in their profession, expertise and culture. Thus, the research hypotheses explore the relationship between their perceptions of ERP risk factors and their culture, profession and ERP expertise. In a review of prior studies, a commonly accepted model was not found to investigate the relationship between culture, profession and ERP expertise and perceptions of ERP risk factors. Consequently, a model for possible factors that affected perceptions of risk was developed; this was based upon ERP, perceptions of risk, the literature on culture theory, and the pilot studies. The research model is illustrated in Figure 4-2 and is discussed below.

Differences in risk perception among managers are assumed to reflect underlying differences in their culture, ERP expertise and profession. Some managers might perceive some ERP risk factors have a very great likelihood of causing an implementation of an ERP system to fail, while other managers might feel that the possibility of these risk factors to leading to failure is quite small.

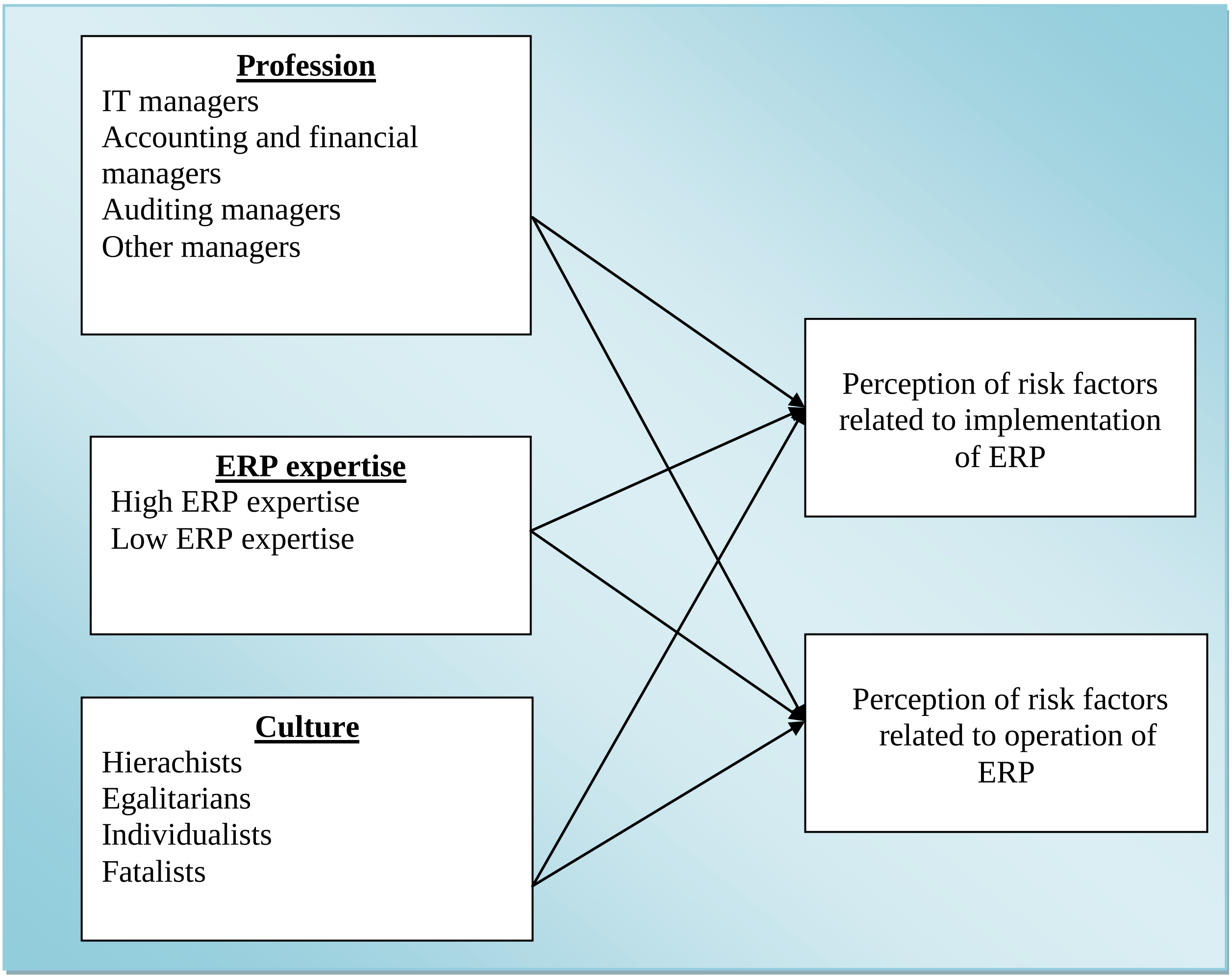


**Figure 4-2 Research model**

### 4.6.1 *Profession of managers and their perception of ERP risk factors*

Recognising risks that threaten the success or failure of ERP systems is a serious issue in companies. These risks can be drawn from a number of disciplines, including information systems and information technology, accounting and finance, auditing, and project management. Each manager should be aware of potential ERP risks (Welti, 1999). The question here is whether IT managers, financial accounting managers and auditing managers have different perceptions of ERP risks. The occupation or profession of managers is assumed to give them different levels of knowledge and awareness about risks related to ERP implementation and operation. For example, the chief financial officer (CFO), on the one hand, could be more concerned about the risk related to insufficient return on investments and the cost structure from implementing an ERP system while, on the other, the project manager's perspective of ERP risk might involve concern about the ERP project being delivered above budget and over a longer time period than expected (Quigley, 2006). ERP risk means different things in different academic fields. Different professions have different educational backgrounds this factor may have an effect on their perception of risk. It is also reasonable to assume that the profession of managers constitute another factor that has an effect on their perception of risks. However, perceptions of risk factors concerning ERP systems in terms of different types of profession (such as IT, accounting and finance, and auditing) are not explicit in the literature. This is also leads the researcher to posit that perceptions of those risk factors associated with the implementation and operation of ERP systems are significantly different among managers. Thus, the first hypothesis is:

H1a: There is a significant difference between managers with different jobs or professions regarding their perceptions of risk factors associated with ERP implementation.

H1b: There is a significant difference between managers with different jobs or professions regarding their perceptions of risk factors associated with ERP operation.

### 4.6.2 ***ERP expertise and perception of risk***

Expertise is another factor that may have an effect on perceptions of risk (Chiu, 2002). The literature reviewed in this section suggests that perceptions of risk factors are different among managers. For example, Bedard and Biggs (1991) revealed that auditors with greater experience were better at identifying a seeded error than auditors with less experience while Johnson et al.(1991) pointed out that there is a positive relationship between industry experience and fraud detection. Du et al.(2007) found that individuals with greater expertise perceived significantly higher levels of risk compared to those with more limited expertise. Auditors with a high level of expertise in accounting information systems (AIS) assessed risks as being greater than auditors with low AIS expertise (Brazel, 2005).

Moreover, Hunton et al.(2004) conducted a quasi-experimental study to understand, assess and examine the extent to which financial auditors and information systems (IS) audit specialists recognised differences in the nature of the unique business and audit risks associated with ERP systems, as compared to traditional computerised (non-ERP) systems. A total of 83 financial auditors and 82 IS audit specialists participated in the experiment. The research results showed that IS audit specialists were significantly more aware of, and concerned with the following risks of the ERP systems than financial auditors: business interruption, network security, database security, application security, process interdependency, and overall control risk. Moreover, financial auditors did not recognise the heightened risks of a seeded control weakness; they were also reluctant to seek consultations with IS audit specialists. However, IS audit specialists were less confident in the abilities of financial auditors to recognise the unique risks posed by ERP systems. However, from the literature review, it is probable that higher expertise with ERP systems might make managers perceive more ERP risks than managers with lower levels of ERP expertise. Accordingly, the second hypotheses are as follows:

H2a: There is a significant difference between managers who have low or high ERP expertise in their perceptions of risk factors associated with the implementation ERP systems.

H2b: There is a significant difference between managers who have low or high ERP expertise in their perceptions of risk factors associated with the operation of ERP systems.

### 4.6.3 *Culture and perception of ERP risk factors*

Cultural theory (as mentioned above) has been used to explain perceptions of risk (Douglas, 1982a; Douglas and Wildavsky, 1982b; Thompson et al., 1990) and individuals' perceptions of ERP risk factors are related to their culture. Cultural theory postulates that modes of perceived risk are different within different types of culture. Hierarchists may be concerned about a risk which is ignored by egalitarians since it is assumed that hierarchists will have high levels of anxiety about risks that threaten the social order (Marris et al., 1998; Langford et al., 2000); they are also assumed to trust risks that are justified by experts (Rippl, 2002). Egalitarians are supposed to have a tendency to be most concerned about risks related to inequality (Langford et al., 2000) so they are assumed not to accept risks that have been high-lighted by experts (Rippl, 2002). Individualists will perceive risks as opportunities and will tend to be more concerned about risks that threaten their economy and their freedom (Wildavsky and Dake, 1990; Rippl, 2002); however, they may view technology as less risky (Thompson et al., 1990). However, fatalists perceive risks as fate (Langford et al., 2000); thus, "they

try not to know and not to worry about things that they believe they can do nothing about" (Rippl, 2002, p.150).
Culture theory suggests that individualists and hierarchists will perceive the risk of technology to be minimal because they have confidence that their organisation will have the ability to control and compensate for an untoward event, while egalitarians will perceive a greater risk from technology (Wildavsky and Dake, 1990). Chiu (2002) argued that the stronger the grid and group characteristic of the society, the higher the computer risk perception would be. However, this thesis is not concerned with the level of risk perception but about the type of risk perception. Thus, with regard to what is mentioned above, the third hypotheses are:

H3a: There is a significant difference between the different types of cultures of managers and their perceptions of risk factors associated with an ERP implementation.
H3b: There is a significant difference between the different types of culture of managers and their perceptions of risk factors associated with an ERP operation.

## 4.7 Conclusion

This research illustrates contemporary research on the social construction of risk perception that can be found across a broad range of disciplines such as sociology and culture studies. These bodies of research provide a rich resource and a powerful alternative discourse on risk to those found in ERP systems. This thesis therefore aims to contribute to the development of ERP systems research in the field of the risk.

Little is known about how individuals perceive risks in ERP systems and how different conditions impact on these perceptions. Based on the ERP literature and with reference to other disciplines, this study therefore aims to investigate empirically how specific conditions impact on ERP risk perception. Specifically, it focuses on three conditions that have attracted particular attention in the IT literature and that have not been examined in prior research: culture, profession and the degree of ERP expertise.

A theoretical or conceptual framework for perceptions of risk associated with the implementation and operation of ERP systems was developed in this chapter. Based on a review of the literature and exploratory pilot study, a preliminary research model was developed. This model was tested using the research methodologies described in the next chapter. In this chapter, the research approaches and strategies are presented and the most appropriate research methods for answering the research questions are identified.

# 5 Chapter Five: Methodology

## 5.1 Introduction

The purpose of this chapter is to describe and explain the research design process; this includes those procedures that are important in gaining the information that is relevant to addressing the specific research problem. Also, this chapter justifies the research ontology, the epistemological paradigm, and the methodology that were adopted for this research. The chapter also describes the steps that were followed and explains the methods and data collection procedures that were used by the researcher.

As pointed out in Chapter One, this thesis aims to identify the risk factors associated with the implementation and operation of ERP systems in organisations in Jordan; it also aims to investigate the effects of culture, profession and level of ERP expertise on perceptions of those risk factors. To achieve these objectives, a variety of methodologies and approaches were adopted and both qualitative and quantitative data collection methods were used in the two stages. The first stage, a pilot and exploratory study, was conducted using semi-structured interviews as there is little information available in the literature on risks related to the implementation and operation of ERP systems. This stage also aimed to identify the risk factors that could occur during the implementation and operation of ERP systems from the viewpoint of managers in Jordan. In a second stage, a survey approach was used to describe similarities and differences in perceptions of ERP risk factors, and to examine the relationship between the perceptions of risk factors related to ERP implementation and operation, and culture, profession and level of ERP expertise.

The structure of this chapter is as follows: After this introduction, the chapter describes, in detail, the design of the research framework is described, starting with a discussion and justification of the research's philosophy, ontology and epistemology, research paradigm, and methodology. Following this, the chapter discusses the research methods that were selected and deployed in this research for data collection, and a justification is offered of these chosen methods in terms of their appropriateness and usefulness in addressing and answering the research objectives mentioned earlier. Then, the processes used for collecting data are described, starting with the pilot study interviews, the number of interviewees, the procedures undertaken relating to the pilot study interviews, the design of the interview questions, and the data preparation, coding and analysis of the interviews. Following this, the data collection procedures used for the survey method are discussed and presented, including the questionnaire design, a justification of the selection of the research population and sample, the pilot work, types and format of questions, the covering letter, content of the final version of the questionnaire, administering the questionnaire, the respondents, checking for non-response bias, and an evaluation of the reliability and validity of the data. The chapter also provides details of the quantitative data analysis, as well as justifying the statistical methods and techniques deployed in this research to analyse data in order to answer the research questions and address the research objectives of this thesis. Finally, the chapter concludes with a discussion of the ethical considerations that were deployed.

## 5.2 Research framework design

The research design provides a framework of data collection and analysis (Bryman and Bell, 2003). A research design is a general plan concerning the way the research questions will be answered; this is influenced by the research philosophy, strategy and methods (Saunders et al., 2007). The choice of the research design should be conceived as effective in terms of the overall strategy for obtaining the information that is needed (Ghauri and Gronhaug, 2002). This choice will have an effect on research activities such as the type of data that will be collected and the ways or methods of collecting them (Ghauri and Gronhaug, 2002). Design errors occur too often so the choice of research design is considered as very important. Making a wrong decision, such as examining a structured problem using a qualitative design, in terms of the research design will make it difficult to answer the research question and research problems, (Ghauri and Gronhaug, 2002).

Research designs vary among the different disciplines due to the different types of research, different paradigms, different theories, different methods used for data collection, and different analytical techniques (Hockey, 2000; Bechhofer and Paterson, 2000). In all social science research, it is fundamental to adopt a research framework design which will discuss all aspects of the study including the philosophical assumptions or perspectives about the creation or production of knowledge, general procedures for research (the strategy of inquiry), specific methods, and procedures for data collection and analysis (Creswell, 2003; Bryman and Bell, 2003; Creswell, 2008).

Crotty (1998) produced a framework which includes four critical elements for any of research process: epistemology, theoretical perspective, methodology, and methods. Figure 5-1 shows how these elements are interrelated with each other in a hierarchical structure to design the research. Each of these elements is usually framed differently in qualitative quantitative or mixed methods approaches (Creswell, 2003).

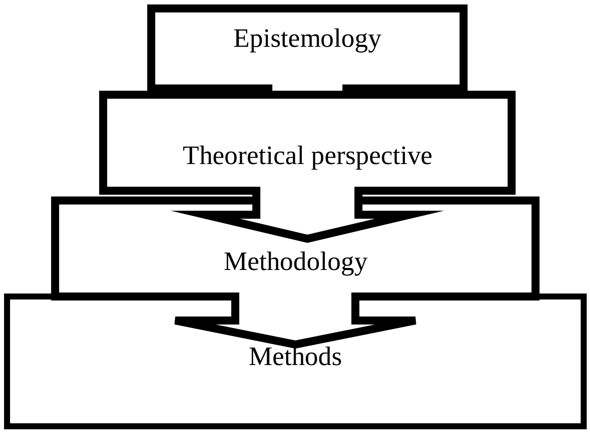


**Figure 5-1**: Four elements of social research (Crotty, 1998)

### 5.3 Research philosophy

The starting point in designing a research study is to assess certain philosophical assumptions that are brought to the study, then to consider the methodology and identify the methods (Crotty, 1998; Creswell, 2003). It is critical for researchers to discuss and understand the fundamentals of research philosophies, methodologies, and methods as this is at the core of the notion of research (Grix, 2002). Easterby-Smith et al. (2002, p. 27) stated that: “There are at least three reasons why an understanding of philosophical issues is very useful. First, because it can help to clarify research designs. Second, knowledge of philosophy can help the researcher to recognise which designs will work and which will not. It should enable a researcher to avoid going up too many blind alleys and should indicate the limitations of particular approaches. Third, knowledge of philosophy can help the researcher identify, and even create, designs, that may be outside his or her past experience. And it may also suggest how to adapt research designs according to the constraints of different subject of knowledge structures”.

The research philosophy includes assumptions (e.g. ontology, epistemology) of how the researchers view the world (Saunders et al., 2007) and these assumptions underpin the research strategy and methods (Saunders et al., 2007). However, researchers should have a clear understanding of these assumptions as this provides a guide for designing all stages of the research (Creswell, 2003).

### 5.4 Ontology and Epistemology

Blaikie (2000, p. 8) explained ontology as "claims and assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units make it up and how these units interact with each other. In short, ontological assumptions are concerned with what we believe constitutes social reality". Ontological assumptions are concerned with the nature of reality and human beings (Saunders et al., 2007; Collis and Hussey, 2009; Crotty, 1998; Brand, 2009; Guba and Lincoln, 1994) and are "assumptions which concern the very essence of the phenomena under investigation" (Burrell and Morgan, 1979, p. 1). The researchers should ask themselves 'what is the nature of reality or the phenomena that research wish to investigate or discover' (Mason, 2002; Guba and Lincoln, 1994).

Epistemology, on the other hand, is "the possible ways of gaining knowledge of social reality, whatever it is understood to be. In short, claims about how what is assumed to exist can be known"(Blaikie, 2000, p. 8). Epistemology is the way of understanding and explaining 'how we know what we know' (Crotty, 1998, p. 8) and constitutes the nature of the relationship between the knower (the researcher) and the known or knowable (Guba and Lincoln, 1994). It is the relationship between that reality and the researcher (Healy and Perry, 2000).

As ontological and epistemological issues tend to merge together, Crotty conceptually combined them in his framework design (Crotty, 1998) while Silverman (2005) differentiated between ontology and epistemology through the understanding of knowledge. Ontology tells about what the reality is like and the basic elements that are contained in the knowledge, while epistemology tells about the nature and status of the knowledge (Silverman, 2005).

There are three types of epistemology: objectivism, subjectivism and constructionism. "Objectivism portrays the position that social entities exist in reality external to social actors" (Saunders et al., 2007). Objectivist epistemology believes that there is objective truth to be discovered by researchers (Crotty, 1998). Burrell and Morgan(1979, p. 71) mentioned that the objectivist position "is to apply models and methods derived from the natural sciences to the study of human affairs. The objectivist treats the social world as if it were the natural world". Objectivism is considered in the context of positivism and post-positivism (Crotty, 1998, p. 16).

In contrast, subjectivism holds that social phenomena are created from the perceptions and consequent actions of those social actors (Saunders et al., 2007). The subjectivist position refutes the suitability of natural science methods for studying the social world and attempts to understand the basis of human life by getting into the depths of the subjective experience of individuals (Hirschheim and Klein, 1989). "The principal concern is with an understanding of the way in which the individual creates, modifies, and interprets the world in which he or she finds himself or herself" (Burrell and Morgan, 1979, p. 3).

On the other hand, constructionists believe that meaning or reality is constructed out of interactions between social actors and their world (Crotty, 1998, p. 8). Constructionism rejects the objectivists' view of human knowledge and believes that there is no objective truth to be discovered by researchers; meaning or truth is not discovered but construed (Crotty, 1998). Thus, researchers should concentrate on people's feelings, thinking and their ways of communicating with each other (Easterby-Smith et al., 2002). Researchers can construct the meaning of the same phenomenon in different ways (Crotty, 1998). Constructionism is considered in the context of interpretivism and underlies most qualitative approaches (Crotty, 1998; Tashakkori and Teddlie, 2003). Often, constructionism and subjectivism are treated the same epistemologically in social research paradigms (Burrell and Morgan, 1979).

## 5.5 Theoretical perspective or research paradigm

Theoretical perspective is the second level in Crotty's framework (Crotty, 1998). The theoretical perspective is the "philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria" (Crotty, 1998,

p. 3) and this perspective is referred to as a research paradigm (Blaikie, 2007). Maxwell(2005) defined a paradigm as “a set of philosophical assumptions about the nature of the world ‘ontology’ and how we can understand it ‘epistemology’, assumptions that tend to be shared by researchers working in the specific field or tradition”. “Paradigm consists of assumptions about knowledge and how to acquire it, and about the physical and social world” (Hirschheim and Klein, 1989, p.1200). However, it is important to investigate ontological and epistemological types in the context of the research in order to find out the most suitable scientific paradigm. What is more, a research paradigm is the broad world view which informs an approach and methods for research (Oliver, 2008, p. 27); it includes the particular methodology strategies connected to these assumptions (Maxwell, 2005). A paradigm is a philosophical framework that provides researchers with a direction for conducting scientific research (Collis and Hussey, 2009).

Determining a scientific paradigm is one of the most important decisions in designing any research as using an appropriate paradigm will help a researcher to build on a coherent and well-developed approach to research (Maxwell, 2005). Therefore, researchers should choose paradigms that are appropriate to their study and to justify *why* and *how* the research is conducted. These paradigms selected by researchers should be the best fit with their own assumptions and methodological preferences (Maxwell, 2005). Lack of fit could appear while developing the conceptual framework, research questions, and methods (Maxwell, 2005).

There are many different types of paradigm which have different ideas about the way knowledge is developed and research is conducted in the social sciences generally and in information systems in particular. Each author classified these types of paradigm differently. Creswell (2003) suggested three underlying paradigms: positivist, interpretivist and pragmatist while Maxwell, (2005) classified paradigms as positivist, constructivist, realist and pragmatist. Crotty (1998) suggested four paradigms: positivism, post-positivism, interpretivism, and critical theory. Guba and Lincoln (1994) discussed five of the most commonly used paradigms as: positivism, post-positivism, scientific realism, critical theory, and constructivism. For information systems research, Orlikowski and Baroudi (1991) classified paradigms as positivist, interpretive and critical while specifically, paradigms underlying qualitative research include interpretivism, critical theory, realism and phenomenology (Maxwell, 2005). Paradigms underlying quantitative research are positivist and post-positivist. A more detailed discussion of these scientific paradigms is presented next. Collis and Hussey (2009), Easterby-Smith et al.(2002), Guba and Lincoln(1994), Healy and Perry(2000) and Creswell(2003) summarised each paradigm in more detail as shown in **Error! eference source not found.**.

### 5.5.1 ***Positivism***

Positivism is underpinned by the belief that reality is objective and independent of the researcher (Collis and Hussey, 2009; Brand, 2009). However, the researcher should be objective and not influenced by non-scientific sources. The main principle of positivism is that the social world exists externally (Easterby-Smith et al., 2002, p. 32), and only observable and measurable phenomena and facts should be accepted for research through objective methods (Perry, 1998; Tsoukas, 1989). The positivist paradigm is based on testing theories to explain, predict and understand social phenomena through empirical research (observation and experiment*)* (Hussey and Hussey, 1997; Collis and Hussey, 2009; Orlikowski and Baroudi, 1991). Hussey and Hussey (1997) and Collis and Hussey (2009) pointed out that the positivistic approach involves a deductive process and explanatory study which investigates the facts or causes of social phenomena. However, the positivist paradigm underlines quantitative methods, or empiricist and survey research, and statistical analysis (Crotty, 1998; Tashakkori and Teddlie, 2003; Hussey and Hussey, 1997; McEvoy and Richards, 2006). In the positivist paradigm, it is assumed that analysis must be expressed in generalised laws (Cohen et al., 2007). Thus, data should be gathered from a large sample in order to be representative and for the findings to be generalised (Saunders et al., 2007).

### 5.5.2 ***Interpretivisim***

Collis and Hussey(2009) argued that interpretivism was developed as a result of the criticism and insufficiency of the positivist paradigm. Interpretivists believe that social reality is not objective; instead, it is extremely subjective as it is formed by people’s perceptions (Collis and Hussey, 2009). The researcher should interact with the research and should not separate his/her thinking and what is in the mind from what exists in the social world (Creswell, 2008; Creswell, 2003). However, researchers can understand and interpret the same phenomenon in different ways (Saunders et al., 2007; Orlikowski and Baroudi, 1991). The interpretivist paradigm underpins the inductive process as it aims to build theory (Collis and Hussey, 2009). The interpretivist paradigm is applied in most qualitative approaches and can be labelled as subjective (Collis and Hussey, 2009; McEvoy and Richards, 2006; Crotty, 1998). Thus, the data should be gathered from a small but intense sample and through deep, unstructured interviews, focus groups, textual analysis and ethnographic case studies (McEvoy and Richards, 2006). Generalisation is not important in this paradigm as the aim is to understand the structure of a phenomenon in depth (Saunders et al., 2007; Orlikowski and Baroudi, 1991).

### 5.5.3 ***Realism***

Ontologically, realism assumes that there is a ``real" world to discover, though it may be only imperfectly apprehensible (Guba and Lincoln, 1994; Healy and Perry, 2000). Realists believe that the world exists independently of being perceived (Saunders et al., 2007). The realism paradigm is mostly applied in qualitative research but also in some quantitative studies. Realist research includes three principles that relate to methodology: Firstly, methodological trustworthiness, which may seem to be the same concept of reliability within the positivism paradigm, and is rather similar to constructivism's consistency or reliability, has been defined as "the extent to which the research can be audited by developing a case study database and by the use of quotations in the written report" (Healy and Perry, 2000, p. 123). Secondly, analytic generalisation (theory-building), realist research, as with constructivist research, is concerned with exploring, building, confirming or disconfirming theory, rather than theory-testing (Healy and Perry, 2000; Yin 1994). The third principle, construct validity, which seems much the same as the construct validity of positivistic research, is "how well information about the constructs in the theory being built are measured in the research" Healy and Perry, 2000, p.123.

Table 5-1 Features of paradigms

| Philosophical assumption | Positivism | Interpretivism | Critical theory | Realism | Pragmatism |
|---|---|---|---|---|---|
| Ontology and epistemology | • Reality is real and apprehensible<br>• Knowledge is absolute and cumulative<br>• Reality is Objective and singular, separate from researcher<br>• researcher is independent of that being researched<br>• findings are true, research is value-free and unbiased<br>• reduce the phenomena to simplest elements<br>• researcher focus on facts , seeking for causality and fundamental laws<br>• Process is deductive<br>• Theory testing | • Reality is constructed<br>• Reality is Subjective and socially constructed, multiple, as seen by the participants<br>• researcher interacts with that being researched (researcher is part of what is researched<br>• finding created, research acknowledges that research is value-laden and biases are present<br>• researcher focuses on meanings, and understands what is happening<br>Process is inductive | • Reality is shaped by social, economic, ethical, cultural, political, gender values crystallised over time<br>• Reality is subjective<br>• Value mediated findings | • Reality is real but only imperfectly and probabilistically apprehensible<br>• The world is exists independently of being perceived<br>• Focus is on studying causal tendencies or generative mechanisms<br>• Modified objective<br>• Findings probably true with awareness of values between them<br>• Focus on exploration, theory building<br>• Process is inductive | • Mixed worldview<br>• Objective and subjective<br>• Mixed assumption positivist or interpretivist paradigms<br>• Process is inductive and deductive |
| Methodology and methods | • Quantitative methods (experiments/ surveys)<br>• Hypothesis formulating and testing<br>• Operationalise concepts to be measured<br>• Use large sample<br>Statistical generalisation | • Qualitative methods<br>• Hermeneutical, dialectical, case study, ethnography, grounded theory, phenomenology<br>• Use small sample investigated in depth<br>• Generating theories | Dialogic, dialectical | • Mostly qualitative and some quantitative<br>• Case study<br>• Convergent interviewing<br>• Triangulation<br>• Structure equation modelling<br>• Multiple measure<br>Analytical generalisation | • Qualitative and quantitative mixed methods ( case study, phenomenology, ethnography, grounded theory, surveys, experiments<br>• Open and closed questions<br>• Integrate data at different stages of the inquiry<br>• Present visual pictures of the procedure in the study<br>Employs the practices of both qualitative and quantitative data analysis |

### 5.5.4 *Critical theory*

In critical research, social reality is assumed to be historically apprehendable over time and to be shaped by congeries of social, political, cultural, economic, ethical and gender factors (Guba and Lincoln, 1994). Knowledge consists of a series of structural or historical insights which are transformed within the long term (Guba and Lincoln, 1994). Epistemologists assume that critical theory is transactional or subjectivist and that, therefore, knowledge is value-dependent (Guba and Lincoln, 1994). Dialogics and dialectical methodology are used in critical theory research (Guba and Lincoln, 1994).

### 5.5.5 *Pragmatism*

Pragmatism is a pluralist paradigm shaped in terms of selecting between the positivism or interpretivism paradigms, and between qualitative and quantitative methods (Saunders et al., 2007). Pragmatism hold that “most important determinant of the research philosophy adopted is the research question” (Saunders et al., 2007, p. 110). Within pragmatism, researchers are free to choose mixed methods from different paradigms that are highly appropriate to answer the research questions (Collis and Hussey, 2009). Creswell (2008, p.11) provides considerations concerning pragmatic knowledge that are listed below:

- The main claim for pragmatism is that it is not committed to any one system of philosophy and reality. This is related to mixed method research from both quantitative and qualitative assumptions.
- Individual researchers have the freedom to select the research methods, techniques and procedures that are most suitable to fulfil their needs and achieve their purposes.
- Pragmatists do not see the world as an absolute unity. Researchers use many approaches to gather and analyse data, rather than use only one method, e.g. quantitative or qualitative.
- Pragmatist researchers look to the ‘what’ and ‘how’ in order to research. Mixed methods researchers need to find a rationale for the reasons why quantitative and qualitative data require to be mixed.

## 5.6 Methodology and methods

In every social science research study, two questions should be answered: which methodologies and methods should be applied and what are the justifications and reasons for selecting them? (Crotty, 1998). Methodology refers to the processes and techniques used in conducting the research to investigate and find out the reality of knowledge (Collis and Hussey, 2009; Saunders et al., 2007; Healy and Perry, 2000). Methodology is "the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes" (Crotty, 1998, p. 3). Research methods are the techniques or tools or procedures used to collect and analyse data related to research question (Crotty, 1998; Saunders et al., 2007). If the method is well thought through, the research's reliability will increase. Oppenheim (2000) mentioned that selecting the best method is a matter of appropriateness. Research method depends on the type of research questions and what the researcher wants to find out.

Undertaking a research study means that the process is carried out within a framework of a set of philosophies by using methods and techniques that have been tested for their validity and reliability, and that have been designed to be 'unbiased and objective' (Kumar, 2005). However, many types of research are classified according to the logic of the research (e.g. deductive, inductive) (Collis and Hussey, 2009); the purpose of the research (i.e. exploratory, descriptive, analytical or explanatory, or predictive) (McNabb, 2002; Collis and Hussey, 2009; Yin, 2002); and the process of the research (qualitative, quantitative or mixed methods) (Collis and Hussey, 2009).

Two of the major approaches for the building and testing of theory are deductivism and inductivism (Blaikie, 2007; Healy and Perry, 2000; Saunders et al., 2007). Inductive method refers to moving from the particular to the general as it begins with individual observations and then moves to statements of general patterns (Collis and Hussey, 2009). It is usually used to answer 'what' questions rather than 'why' questions (Blaikie, 2000). Whereas The deductive method refers to moving from the general to the specific (Collis and Hussey, 2009). The deductive research strategy is useful to answer 'why' questions (Blaikie, 2000) and can be used to find an explanation or theoretical argument for an existing phenomenon. It seeks to test a theory by developing one or more hypothesis from it; this is then tested empirically by collecting data (Blaikie, 2000).

For the purpose of research, there are four different research purpose: exploratory, descriptive, analytical or explanatory, or predictive research. Exploratory research is conducted to clarify problems or identify and explore issues that are ambiguous in nature, or when relevant theory is unclear, or when there are no or very limited previous studies in the subject area to which the researcher can refer or identify information about the research issue or problem (Collis and Hussey, 2009; Saunders et al., 2007; Kumar, 2005). While descriptive research is used to describe the phenomena and problems of a study as they exist; it is also used to describe the characteristics of the variables of interest in a particular phenomenon (Collis and Hussey, 2009; McNabb, 2002; Kumar, 2005). Descriptive research goes beyond that of exploratory research in examining a problem (Collis and Hussey, 2009) and could be used to try and find answers to research questions that begin with 'who', 'what', 'when', 'where' or 'how' (Collis and Hussey, 2009; Zikmund, 1997). The purpose of a descriptive study is provide a description of an event without explaining why (i.e. the cause/effect relationship), or to identify a set of attitudes, opinions or behaviors that are observed or measured at a certain time and in a certain environment (McNabb, 2002).

Analytical or Explanatory research is a continuation of descriptive research (Collis and Hussey, 2009). Explanatory studies aim to understand phenomena by discovering, establishing and measuring causal (cause-effect) relationships between variables and influences between these variables (Saunders et al., 2007; Collis and Hussey, 2009; Zikmund, 1997; Kumar, 2005). Whereas predictive research goes further than explanatory research (Collis and Hussey, 2009). The predictive approach is applied when the researcher is willing to forecast the future development of a phenomenon. Explanatory researches constructs an explanation for what is occurring in a particular situation while predictive research anticipates the possibility of a similar situation happening elsewhere (Collis and Hussey, 2009).

What is more, the research approach is a significant choice that has an impact on the way in which the researcher collects data. There are three possible research strategies: qualitative, quantitative, and combined or mix methods (Creswell, 2008; Creswell, 2003; McNabb, 2002). Qualitative research is an unstructured approach where the research processes, objectives, design, samples and questions are flexible (Kumar, 2005). The underpinning philosophy in qualitative research is empiricism (Kumar, 2005). Qualitative research is conducted to describe, understand and explain the social phenomena, situations, individuals or circumstances surrounding a phenomenon in word form (Bryman and Bell, 2003); it also provides an understanding of the people, and the cultural and social issues surrounding the research. The methodologies usually applied in qualitative research are phenomenology, ground theory, case studies, ethnography, etc.(Creswell, 2008; Creswell, 2003) through using techniques such as personal interviews, questionnaires, participation, observation, and documents. The aim of qualitative research is to obtain in-depth detail rather than statistical generalisations. This type of research is suited to deductive research as its purpose is to generate hypotheses rather than to test them.

Quantitative research is a structured approach where the research processes, objectives, design, samples, and questionnaires are predetermined (Kumar, 2005). Quantitative research is suited to deductive research; and it is generally conducted for explanatory purposes. in quantitative research, the researcher uses numbers to describe things (McNabb, 2002) and two major approaches involved in quantitative research are experiments and surveys (Creswell, 2008; Creswell, 2003) while the techniques that are associated with collecting quantitative data include structured interviews and questionnaires with fixed answers and a statistical analysis of the data (McEvoy and Richards, 2006; Collis and Hussey, 2009). Quantitative data are usually involve a large sample with little information (Collis and Hussey, 2009) which aims to eliminate potential sources of bias and so that generalisations can be made from the sample to a wider population (McEvoy and Richards, 2006).

Some researchers can use either qualitative or quantitative approaches; others can combine the qualitative and quantitative approaches. Saunders et al. (2007) state that there are major benefits to be gained from using a mixed method in one study: firstly, different methods can be applied for different purposes in a study; secondly, triangulation can be used in mixed research. Triangulation refers to using and combining a variety of theoretical perspectives, different methodology and methods, and multiple techniques and sources of data in one study. This helps in reducing or removing bias which often occurs by using a single approach, it allows a better assessment to be made of the generality of the explanation of phenomena, and increases the validity and the reliability of the results (Creswell, 2008; Creswell, 2003; Maxwell, 2005).

Two types of strategy are used in mixed researches: sequential strategy and concurrent strategy (Creswell, 2008; Creswell, 2003). In the concurrent design, quantitative and qualitative data are collected and analysed in the same period (Creswell, 2008; Creswell, 2003). The purpose of this design is to confirm, cross-validate or corroborate findings from one method with those from another (Creswell, 2008; Creswell, 2003). In sequential designs, one of the qualitative or quantitative methods should be used first, followed by using the other (Creswell, 2008; Creswell, 2003). However, if the research's purpose is exploratory, qualitative data collection and analysis should be carried out first, followed by quantitative data collection and analysis; this is called a sequential exploratory design (Creswell, 2008; Creswell, 2003). On the other hand, in sequential explanatory design, the collection and analysis of the quantitative data should come first, followed by the collection and analysis of the qualitative data if the purpose of the study is explanatory. In this design, qualitative results help researcher to explain and interpret statistically significant quantitative results, non-significant quantitative results, distinguishing demographic characteristics, or unexpected results (Creswell, 2008; Creswell, 2003).

## 5.7 Choosing and justifying the research epistemology and paradigm: research methodology and research methods

The researcher needs an adequate process that will provide a logical set of procedures in order to be able to fulfil the research objectives and answer the research questions, particularly 'what', 'how, and 'why' questions (Crotty, 1998; Blaikie, 2000). As mentioned previously, researchers have many choices which will help them in developing and designing their research frameworks according to their research's ontology and epistemology (objectivism, subjectivism and constructionvism); their research paradigm (positivism, post-positivism, realism, interpretive or critical theory, pragmatism); the logic of the research (deductive or inductive); the purpose of the research (exploratory, descriptive, analytical or explanatory, and predictive); and the process of the research (qualitative, quantitative, or mixed methods). Choosing the research paradigm, the research strategy and methodology, and the data collection techniques and analysis procedures, is driven by the types of research questions and research problems, and how to answer these questions in the best possible way (Creswell, 2008; Saunders et al., 2007; Blaikie, 2007; Ghauri and Gronhaug, 2002; Creswell, 2003).

The research philosophy includes assumptions (e.g. ontology, epistemology) of how the researchers view the world and these assumptions underpin the research strategy and methods (Saunders et al., 2007). Every research is based on a particular set of ontological and epistemological assumptions: "what is out there to know about and what and how can we know about it" (Grix, 2002; Cater-steel and Al-Hakim, 2008). However, it is important to have a clear understanding of these assumptions as this provides a guide for designing all stages of the research, and choosing the suitable research methods and the data collection and analysis process (Creswell, 2003). These assumptions are depended on our belief, values, and experiences which affect on what we will investigate and how we going to investigate it, and how the results will be evaluated. Choosing the research philosophy is not only based on the personality of individual, but also on type of research questions, and how you are going to answer them.

Since ERP systems are a new phenomenon within organisations in Jordan, and the management of the implementation and operation of them is still in developing with increases in experience of them, there is no comprehensive and efficient way to implement and operate these systems. Consequently, the number of failures in implementing and operating these systems is extremely high (Umble et al., 2003; Al-Masha ri et al., 2003b; Holland and Light, 1999). Thus, investigating the risk factors that make the implementation and operation of ERP systems fail should be considered. However, little information is available in the literature about such risk factors. Primarily, a critical review of the relevant literature is required in order to evaluate the status of the existing scientific knowledge available on ERP systems and to identify gaps in this knowledge. Fundamentally, the risk factors associated with the implementation and operation of ERP systems are fragmented and not broad; in fact, a considerable amount of literature in the field of information systems has focused on the risk factors concerning such systems. Therefore, this thesis aims to provide a holistic view about the risk factors associated with the implementation and operation of ERP systems based on the facts and figures available in addition to subjective experiences of those involved. The aim of this research is to a build a model and in order to clarify the relationship between perceptions of those risk factors and culture, profession and level of ERP expertise. Developing this model requires complex evidence about 'what', 'how' and 'why' to be gathered. Thus, the Pragmatism paradigm appears to be an appropriate paradigm that suits the nature and background of this research problem. Since the research questions entail the what', 'how' and 'why' questions, the positivism or interpretivism philosophy may not be an appropriate philosophy. In the positivist philosophy, knowledge should be objective facts based on empirical observations and obtain by deductive process. While in the interpretivism philosophy, knowledge should be subjective and social constructed and obtain by inductive process. Pragmatism is a comprehensive paradigm, as it has a different philosophical perspectives, assumptions and methods (Creswell, 2003). Pragmatism places itself between the positivism and interpretivism philosophies. It is a more flexible philosophy based on the assumption that the truth or meaning of an idea is derived from its observable practical consequences rather than metaphysical. Pragmatists think in an external world which is both independent of the mind and close within the mind; they also think that researchers should stop asking questions about reality and the laws of nature (Creswell, 2003). In addition they accept with positivists the existence of an external world independent of people's minds, they choose explanations that best produce desired outcomes. For pragmatists, "'truth' as a normative concept, like 'good' and 'truth is what works'......in particular, that knowledge claims cannot be totally abstracted from contingent beliefs, interests and projections" (Howe, 1988, p 14–15). Pragmatists do not see the world as an absolute unity. The pragmatic perspective taken was that knowledge is a combination of objective or subjective.

In terms of the mode of enquiry, pragmatism, researchers are free to think and choose mixed methods that are highly appropriate to answer the research questions required both qualitative and quantitative data and analysis. Creswell (2003, p12) said that pragmatism "opens the door to multiple methods, different worldviews, and different assumptions as well as different forms of data collection and analysis in the mixed method study". The pragmatism adopted in this study meant that the quantitative method was toward the positivist assumptions, and qualitative method was toward the interpretivism.

Moreover, Pragmatism paradigm is appropriate for use in answering research question. It is preferable for the theory-building stage and for building the research model. This approach is driven by the willingness to see and explore the risk factors associated with the implementation and operation of ERP systems from the viewpoint of managers with real experience who have actually been through the implementation and operation of ERP processes. The purpose of this research is to identify the generative mechanisms so the qualitative results will be used to develop the theory, a research model that will seek to draw a picture of ERP risk factors. What is more, this paradigm underlies the purpose of testing theory. This paradigm is suitable for the further development and testing of the research model. See Figure 5-2

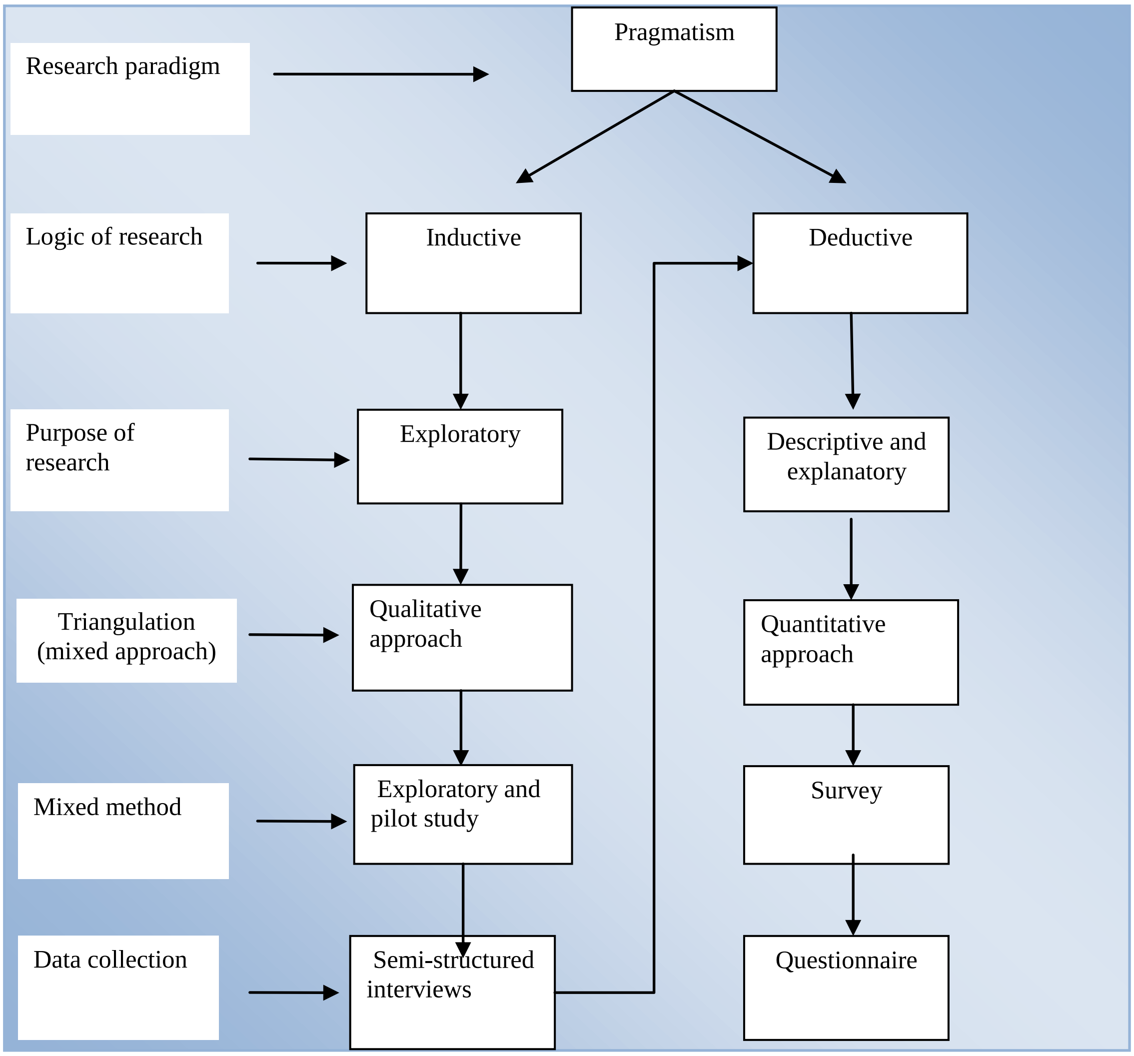


Figure 5-2: Nature of the research

This research uses both inductive and deductive methods. It starts with the inductive method by focusing on a literature review and the observation of a problem; then, qualitative interview data are collected and analysed. The inductive approach helps a researcher to obtain insight into some previous theories and to observe the themes and issues associated with identifying the risk factors from the viewpoint of managers in Jordan. Then, the study can move towards developing the research model and hypotheses. Following that, this thesis applies the deductive method which helps to test empirically the hypotheses which have been generated from theory and empirical research. Figure 5-3 shows the cycle of building and testing theory.

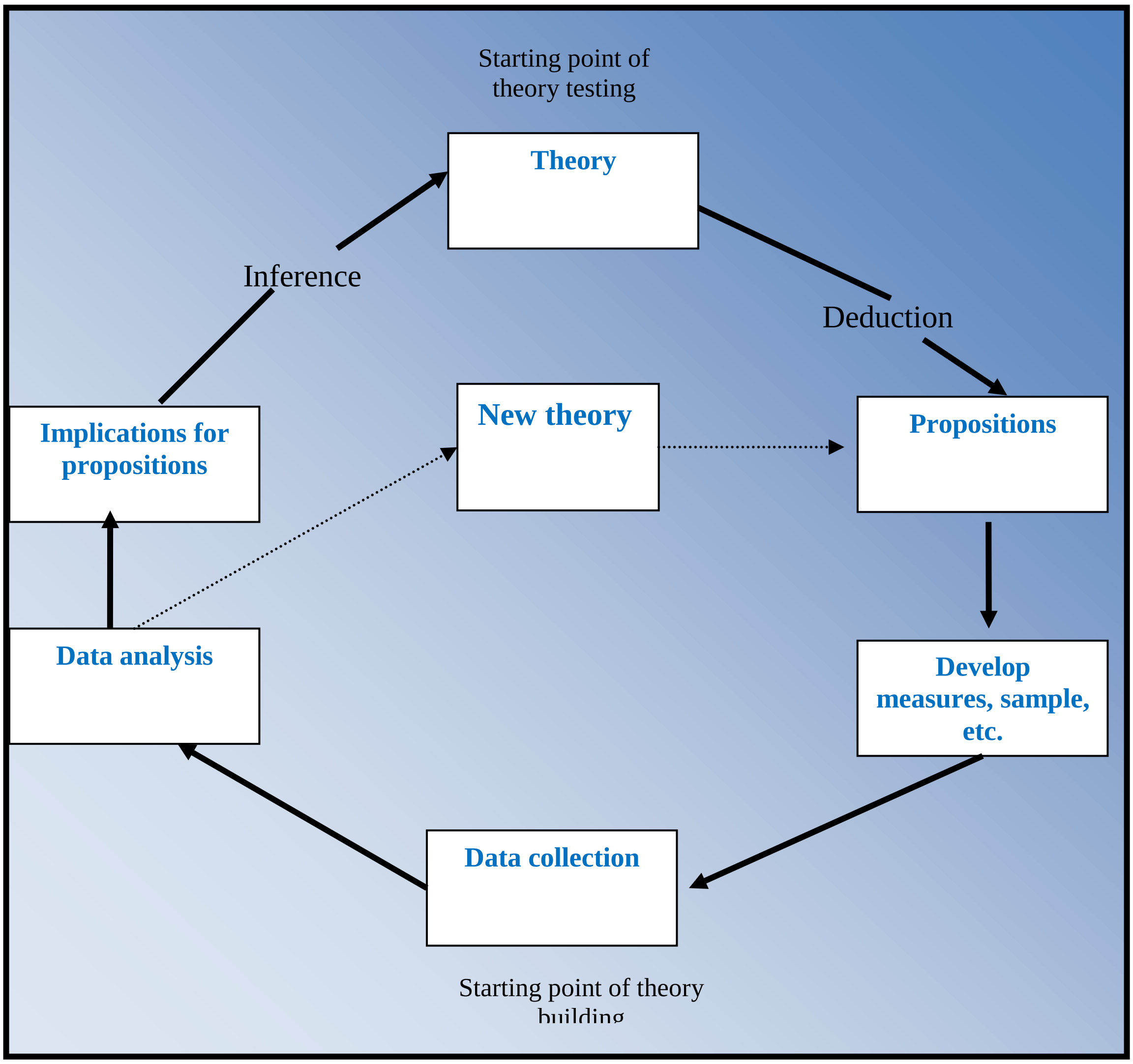


Figure 5-3: Cycle of theory building and testing (adopted from De Vaus, 2001)

In order to understand the perceptions of risks associated with the implementation and operation of ERP systems within organisations in Jordan, and also to build and test theory, this thesis integrates qualitative and quantitative approaches that are adopted through pilot interviews and a survey as these are sufficient and appropriate for this study. For a sequential exploratory design purpose, this research starts by collecting qualitative data (through in-depth interviews), followed by quantitative data (via a questionnaire). The researcher selected three approaches: exploratory, descriptive and explanatory.

Integrating the qualitative and quantitative data helps in untangling different aspects of ERP risks. In the design of this research, the starting point is the pilot and exploratory studies which were used to test the researcher's ideas through collecting qualitative data by using semi-structured interviews. Maxwell (2005) pointed out that pilot studies are usually used in qualitative research as they help to generate an understanding of the concepts and theories held by interviewees. The pilot and exploratory study in this thesis aimed to understand and explore the topic being investigated, as well as to obtain more in-depth information about the risk factors associated with ERP systems, since there is little information available on this topic in the literature. Also, there is a need to address the research issues in Jordanian companies as no ERP systems research has yet been conducted in Jordan; this was also done in order to address the research's key issues, to build themes in the study under investigation, and to obtain richer data in order to be able to draw a comprehensive picture through the interpretation and analysis of the data. Data from the pilot interviews also assisted in improving the existing theories in the area of risk factors related to the implementation and operation of ERP systems from the viewpoint of different managers in Jordan. Furthermore, the interview data helped in developing the questionnaire. In short, the results from one method helped in developing the other (Creswell, 2008; Creswell, 2003). Maxwell (2005) stated that pilot research is one of most important conceptual resources that helps in generating preliminary or tentative theories about the topic.

Secondly, after exploring and identifying the ERP risk factors, this research moved to a descriptive and explanatory study to test the model. Descriptive study helps in obtaining information on the characteristics of a particular issue and descriptive research was suitable for this research to answer the research questions: 'What are the risk factors associated with the implementation and operation of ERP systems and how do managers perceive these risk factors?' Descriptive research helps in ascertaining to what extent there are differences or similarities in Jordanian managers' perceptions of those risk factors. Moreover, explanatory research was also applied in this thesis in order to ascertain the relationship between the managers' perceptions of risk factors, and their culture, profession and level of ERP expertise. Quantitative research was employed by conducting a questionnaire with a large sample for descriptive and explanatory purposes; this helped in testing themes that were developed from the initial exploratory findings.

This study focuses on managers working in different departments, who have different levels of ERP expertise, and who come from different cultures, in order to compare and investigate the similarities and differences between groups, as well as to examine the relationships between managers' perceptions of risk factors and their culture, profession and level of ERP expertise. Thus, a cross-sectional design was suitable for this type of study as the researcher was interested in investigating variations in managers' perceptions of ERP risk factors. Collis and Hussey (2009) stated that cross-sectional studies are designed to obtain research data in different contexts at a single point in time. Cross-sectional research requires quantitative data to be collected from more than one case (Bryman and Bell, 2003). Saunders et al. (2007) and Bryman and Bell (2003) indicated that survey research is generally applied within the context of cross-sectional studies. Adopting a cross-sectional study approach saves time, effort and resources (Collis and Hussey, 2009).

## 5.8 Research design for this thesis

Oppenheim (2000, p.6) referred to the research design as "the basic plan or strategy of the research, and the logic behind it, which will make it possible and valid to draw more general conclusions from it". He stated that the research design will provide the researcher with the method of drawing the sample, the sub-group that should be included, the comparisons that need to be made, and the variables that should be measured. Decisions about the research design are related to the type of study, the place where the study will be conducted, the type of data required, the population from which the data will be collected, and the method of collecting and analysing the data (Kothari, 2009).

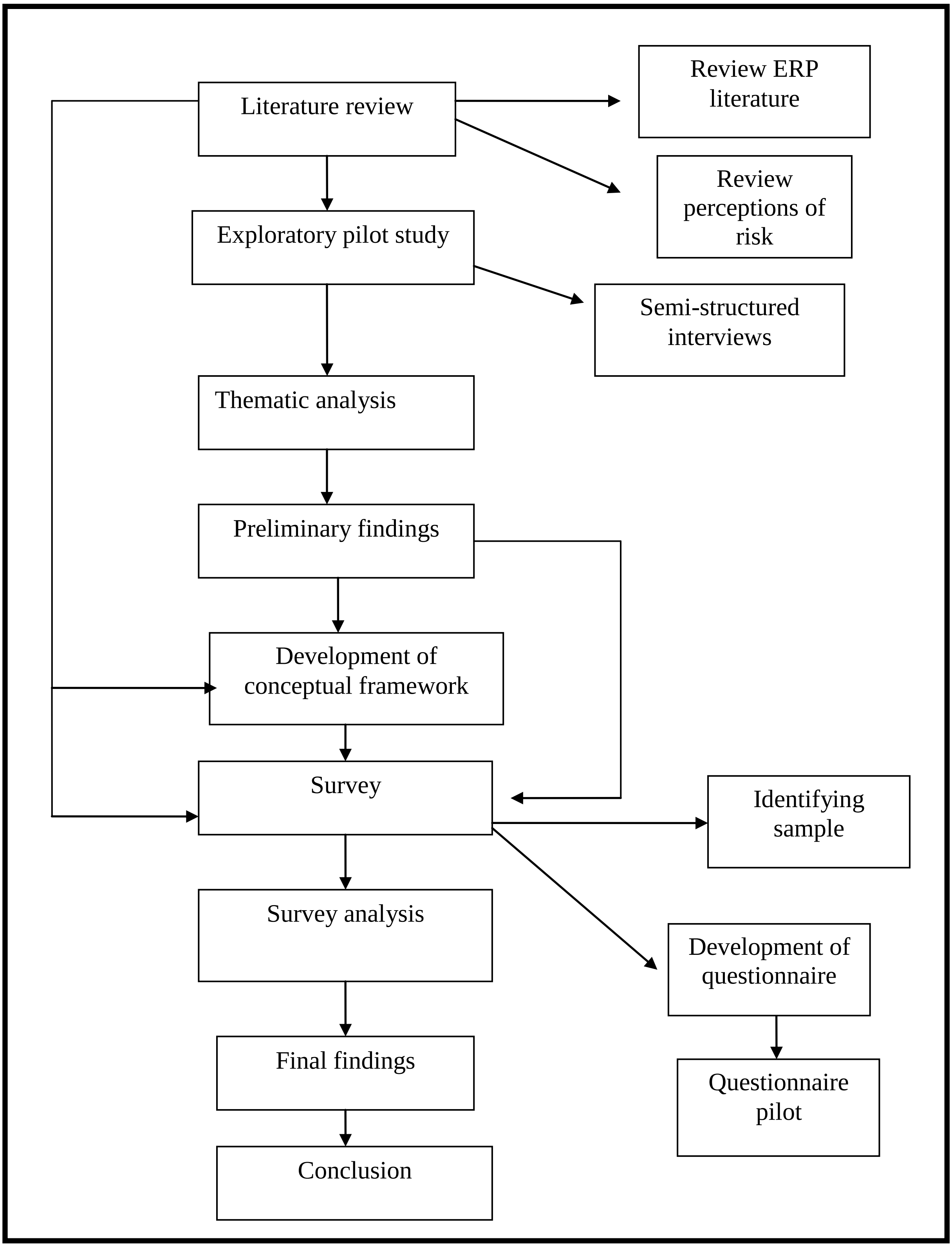


**Figure 5-4: Research design**

The research design should specify a starting point, a series of steps and an end point (Blaikie, 2007). The starting point of this research was the literature review, followed by the exploratory pilot study that was conducted by carrying out semi-structured interviews as a research instrument for collecting qualitative data, and the survey method which was conducted using a questionnaire. These were considered to be the best research instrument for collecting the quantitative data. Figure 5-4 shows the research design adopted in this thesis.

The next section presents the data collection methods and explains how each of them was used. It also provides information about the sample size and how it was selected, as well as examining the instrument used in this study and the data collection procedures. In the last part in this chapter, the ethical issues of the study are discussed.

### 5.8.1 *Literature review*

The starting point for this research was to carry out a detailed and focused literature review that would help to identify the possible risk factors associated with the implementation and operation of ERP systems. Collis and Hussey (2009, p. 100) referred to the literature review as “a critical evaluation of the existing body of knowledge on a topic, which guides the research and demonstrates that relevant literature has been located and analysed”. Researchers should review the literature critically, not only describing what has been done in previous studies (Saunders et al., 2007). Reviewing the literature represents a significant part of a research study as it enhances the researcher’s knowledge about the topic, clarifies the research questions and research problems, and helps to generate and refine the research ideas (Saunders et al., 2007). A literature review not only helps the researcher to understand the research issues and present the theoretical context of the study, but also to identify the methodology used in previous studies (Collis and Hussey, 2009).

In some academic disciplines, it is possible for a researcher to review specific business disciplines (e.g. finance, marketing, or human resource management) and/or other disciplines (such as psychology, sociology and geography) (Saunders et al., 2007). However, this study begins with a review of the literature related to ERP implementation and operation, the success or failure of such ERP implementations, and the success or failure of ERP operations, in order to identify the possible risk factors associated with the implementation and operation of ERP systems. In addition, this research includes reviewing sociological disciplines in order to explain differences in perceptions of risk according to culture theory. Chapters 3 and 4 present a review of the literature in relation to the ERP risk factors and perceptions of risk.

### 5.8.2 *Exploratory pilot study*

The limited information available in the literature on the issues related to factors concerning ERP risks, and the lack of empirical evidence about the implementation of ERP systems and risk factors that could occur in the implementation and operation of these systems in Jordan, made it necessary to conduct preliminary exploratory interviews. Oppenheim (2000) mentioned that exploratory interviews help the researcher to develop ideas and research hypotheses, as well as to produce key differences among interviewee groups. He also stated that exploratory interviews help the researcher to understand how interviewees think and feel about the topics of concern to the research (ibid). In this research, an exploratory pilot study was conducted as a complementary addition to the theoretical part of this research. These interviews were helpful in providing a broad picture and gaining a better understanding of risks related to the implementation and operation of ERP systems from the viewpoint of managers in Jordan (such as IT managers, auditors and financial managers) who have ERP experience and work in companies adopting ERP systems in Jordan. The pilot study also added some risk factors to the research model. Moreover, the researcher was interested in making a comparison of the opinions of managers regarding the risk factors related to ERP systems. Thus, this part of the research presents the processes that were undertaken as part of the qualitative approach by conducting pilot and exploratory interviews.

#### 5.8.2.1 *Interviews*

An interview is an instrument for collecting qualitative data and is a technique for collecting primary data where a sample of interviewees are asked questions to discover their feelings, thinking, perceptions and opinions (Collis and Hussey, 2009). The goal of interview techniques is to gather rich and in-depth data and to obtain reliable and valid data that are related to the research questions and the research objectives (Saunders et al., 2007).

There are three different types of interview questions that are used for different purposes: structured interviews, semi-structured interviews, and unstructured interviews (Saunders et al., 2007; Collis and Hussey, 2009). In unstructured interviews, the questions are open and not prepared before the interviews take place (Bryman and Bell, 2003). Semi-structured interviews are not standardised and the researcher has a pre-set list of questions to guide the interviews (Bryman and Bell, 2003); even these questions might vary from interview to interview (Saunders et al., 2007). Structured interviews are used in questionnaires; they use standardised and predetermined (or closed) questions (Bryman and Bell, 2003; Saunders et al., 2007). Unstructured and semi-structured interviews are usually conducted when the researcher aims to obtain in-depth data from a small numbers of interviewees (usually fewer than thirty) (Oppenheim, 2000). So, the interviewees are free to discuss and describe their thinking and beliefs. The purpose of structured interviews, however, is to obtain a little information with a large sample (which could be more than a hundred) (Oppenheim, 2000). Unstructured and semi-structured interviews are considered to be part of the qualitative method and are usually analysed qualitatively, but structured interviews are part of the quantitative method and survey strategy (Saunders et al., 2007).

Interviews can be conducted by using either a one-to-one interview between the interviewer and one interviewee, or as a focus group between an interviewer and a group or multiple interviewees (Saunders et al., 2007; Hesse-Biber and Leavy, 2006). However, choosing the type of interview to use is based on the purpose of the study and whether it is exploratory, descriptive or explanatory, for example(Saunders et al., 2007). In an exploratory study, the use of unstructured and semi-structured interviews is recommended while in descriptive or explanatory studies, structured interviews are more appropriate (Saunders et al., 2007).

At this stage of the research, face-to-face semi-structured interviews were used as a suitable instrument in conducting the qualitative research in order to obtain an in-depth view and understanding of the dimensions of the research problem, to address in general terms the objectives of the research, and to identify the research issues and themes. Face-to-face interviews give the researcher an opportunity to interact with the interviewees. Face-to-face semi-structured interviews were considered to be the most appropriate technique since the nature of this study is exploratory. Semi-structured interviews allow interviewees to talk freely and openly. In addition, one-to-one interviews are an appropriate method to gain an individual's views. Hesse-Biber and Leavy (2006) and McQueen and Knusson (2005) stated that some principles should be followed when researchers conduct an interview. These are: (1) ensuring that interviewees are comfortable so that they can express their experiences and feelings; (2) being aware of allowing sufficient time to probe; (3) understanding the points of view of interviewees and validating the importance of their opinions.

#### 5.8.2.2 *The interview guide and designing the interview questions*

The interview guide provides a list of questions and topics that need to be covered during the interview (Bernard, 2005; Kvale, 1996; Patton, 2001). Patton (2001, p. 343) mentioned that the "interview guide provides topics or subjects within which the interviewer is free to explore, probe, and ask questions that will elucidate and illuminate that particular subject". Researchers should build and follow an interview guide in each interview in order to obtain reliable and comparable qualitative data which are easy and simply to analyse; this also ensures consistency across the samples (Bernard, 2005). Also, an interview guide helps a researcher to make a careful decision regarding the best way to manage the limited time available in an interview situation in order to gain comprehensive information (Patton, 2001).

This study aims to understand the risk factors associated with the implementation and operation of ERP systems. A semi-structured interview format (using open-ended questions) was followed in each of the interviews. The questions dealt with issues and risk factors that could occur during or after the implementation of an ERP system. Appendix 1A presents the interview questions, which include five sections. The first and second sections concern the demographic details of the interviewees and the organisations in which they work. This general information helped the researcher to contextualise the interviewees' answers (Bryman and Bell, 2003). The third section focuses on general questions about ERP systems and their implementation. This section asks interviewees about the ERP functions that were implemented, their chosen vendor, the cost, the planned and actual time taken for the implementation, reasons for the implementation, implementation issues, and the benefits and problems they faced. These questions guide the interviewees and give them an open choice to describe and explain the most important issues related to the implementation and operation of an ERP system that they faced through their experience in dealing with these programs. Sections Four and Five were specifically intended to identify the ERP risk factors and to look at the similarities and differences in these potential risk factors among managers. Finally, the interview ended with the researcher asking whether there were any comments the respondents might like to add. These general questions were intended to explore the individual experiences of interviewees. The questions were open to give the interviewees an opportunity to express their point of view about the risk factors related to ERP systems. The questions were developed by the researcher herself and reviewed by a supervisor.

#### 5.8.2.3 *Data collection procedures*

Jordan was the likely selection for this study as being a developing Middle East country it embedded the research gaps identified in the ERP systems literature; and therefore it is believed that conducting the current study in a developing country, Jordan, might bring new insights and yield significant results and bridge the gap in this area of research. The researcher is also from Middle East countries and it was also recognize that local knowledge would enhance interviewing and the process questionnaire design.

Considering the nature of the research, the purposive sampling and snowball sampling were used in this study. Most qualitative studies select purposive sampling that aims at selecting a small number of participants that are rich in information facilitate depth in analysis (Patton, 2001). Purposive sampling is used in order to develop theories and concepts and generate hypothesis. The sample sizes used to collect the qualitative data were small because this research aims to get in-depth and richness information of the perception risk factors associated with the implementation and operation of ERP systems in Jordan. For intensive study, Selecting the participants in this research was the first step undertaken in the fieldwork and was based on three dimensions: Managers who had at least one year's experience with ERP systems, working in different departments in the company have implemented ERP systems, and possessing different qualifications. The aim was to employ a heterogeneous groups, to understand the issues from different angles, and to find whether there are any differences in perception regarding the risk factors associated with the implementation and operation of ERP systems among those managers. The second step was to contact the IT Manager in the ERP group's company in Jordan through a colleague's connection who gave a general idea about the companies that had implemented ERP systems in Jordan. This IT manager helped in accessing these companies and selecting participants who had experience with ERP systems. Access and availability are a key consideration in company and interviewees selection. Suitable interviewees for this study were selected according a snowball sampling procedure. Managers who had been interviewed were asked for assistance in finding other managers that they knew that have experience in this area and might be willing to participate in this research. A new names can be mentioned and give rise to other interviews as these referrals were used to get further referrals and so the term snowball. The third step was to contact a number of managers who needed to be interviewed by telephone or by email. Letters of consent had been sent to managers in companies that had implemented ERP systems in Jordan, asking them to be involved in the research. A brief summary of the research and the aims of the study, along with a supporting letter from the researcher, were provided to managers. This letter guaranteed confidentiality and anonymity to the participants. The consent letter was sent before the interview took place in order to give interviewees a chance to read it and resolve any issues which might be raised. At the end of an interview session, managers were asked for their permission to contact them in case something needed to be clarified. However, most of the managers who participated were extremely cooperative and willing to help.

Based on the responses received at this stage, 27 interviews were conducted with managers who had some experience of ERP systems, in eight large companies which had adopted ERP systems. Five of these companies engaged in manufacturing activities and other two were service companies. These companies had implemented Baan systems, JD-Edward systems, Oracle systems, Scala systems, and Ross systems. The response rate was high and many participants were interested in participating in this research and in expressing their views about these systems. The interviews were conducted by the researcher in mid-November 2005 with IT managers, financial and accounting managers, auditors, and other managers who were in charge of ERP systems.

The interview conversation began with the researcher providing general information about herself and the background and aims of the study. After this, the participants were asked to give some brief information about themselves and their background. Then, a discussion took place about the risk factors related to the implementation and operation of ERP systems. In most of the interviews, the researcher followed the questions presented in **Appendix 1A**. However, in some of the interviews, some questions were removed and some new questions were added based on the specific characteristics of the interviewee and the flow of the conversation.

The in-depth interviews took about one to one and half hours to complete. Some interviews were conducted in English and some were in Arabic. At the beginning of the interview, the researcher asked each interviewee for permission to record the interview. Most interviews were recorded on tape, either in Arabic or English; some interviews were just written notes, however, as some managers were not happy to have their interviews recorded. Oppenheim (2000) mentioned that it is very important to record exploratory interviews on tape as this helps the researcher to analyse and interpret them in detail. Bryman and Bell (2003) also stated that recording and transcribing the interviews is essential to achieve the comprehensive and in-depth analysis that is required in qualitative research, as well as to capture the interviewees' answers in their own terms. At a later stage, the interviews were transcribed from tape onto paper and were translated and typed up in English. Each interviewee was given a different code instead of his/her real name in order to maintain confidentiality as far as possible. After this, the process for analysing and interpreting the data began. Different methods can be used to interpret the qualitative data resulting from the interviews in order to explore and understand the risk factors that could occur during the implementation and operation of ERP systems in Jordan from the viewpoint of managers. Thematic analysis was a useful technique for accomplishing this. More information and reasons for applying thematic analysis for the qualitative data are discussed in the next section.

#### 5.8.2.4 *Qualitative data analysis*

When a large amount of qualitative data has been collected, it needs to be analysed and interpreted in order to draw conclusions that make sense. Polonsky and Waller (2010, p. 159) made a distinction between analysis and interpretation saying that: "analysis covers the assembling, cleaning, and examining of the data, whereas interpretation is making sense of the data that you have generated". The process of data analysis is described as an iterative and ongoing process since it is a cycle that is repeated until the results of the study satisfy the researcher.

The purpose of this qualitative research is to explore the risk factors that may have a potential effect on the success or failure of implementing and operating of ERP systems;

it also seeks to investigate the similarities and differences among managers in their perceptions of the risk factors associated with ERP systems. The analysis approach should be well-suited to the research question (Maxwell, 2005). Thematic analysis was used to analyse the qualitative interview data since the goal of this research is to discover and identify the themes that describe the phenomenon and to build an initial model. Thematic analysis is a process of encoding qualitative information into a list of themes (Boyatzis, 1998). The purpose of using thematic analysis is to analyse the qualitative data by looking at the interactions of managers in perceiving the risk factors. Research questions that are concerned with finding similarities and differences can be answered by conducting thematic analysis and so this type of analysis enabled comparisons to be made among the different groups in this study. The basic process of thematic analysis includes coding, categorising and linking data but before starting this process, the researcher must prepare the data for analysis. Each interview was labelled with the interviewee's job title, ERP experience, and company.

In this research a series of steps was followed to analyse the qualitative data from the interviews. The first step in data analysis is the data preparation phase. In this stage, it is necessary to think about what data are required for the analysis and whether these data will allow the research question to be answered (Hesse-Biber and Leavy, 2006). After collecting the interview data, the researcher listened to the recordings on the interview tapes and then transcribed. After that, the researcher began to read and re-read the transcripts a number of times in order to become familiar with the data, and to create a picture so that what the data were telling could be understood. Saunders et al.(2007) mentioned that starting to analyse qualitative data without a picture would challenge a researcher who would have no idea of what picture to create. However, it was noted by reading the transcripts that the manager interviewees had differing perceptions regarding the risk factors that could lead ERP systems to fail. While reading the interview transcripts, the researcher made notes in the margins of the interview transcripts, and underlined and highlighted words, key phrases, and sentences which she thought interesting; she also made memos and developed tentative ideas about the categories and relationships (see appendixes 1B, 1C, and 1D). Writing notes and memo during the data analysis helps in thinking and stimulating analytic insights (Maxwell, 2005).

The qualitative data were analysed by using manual analysis techniques, not computer-assisted qualitative data analysis software such as NVIVO; this was to avoid wasting valuable time (Fielding and Lee, 1998). The researcher found the manual analysis technique more appropriate in generating the themes contained in the data. By reviewing the notes, and the highlighted words, phrases, sentences and paragraphs, different issues and themes started to emerge and attract the researcher's notice. These themes concerned how managers thought about the risk factors. For each theme, the differences and similarities in the opinions of managers were discussed and oriented towards the perceptions of risk factors; these were then highlighted. Labelling and coding the lines from the interviews was also carried out. Coding is an important step in processing and organising data, and in analysing qualitative information (Basit, 2003; Boyatzis, 1998). Categorising the data either by coding them or by conducting thematic analysis facilitates the comparison of data within or between these categories; this helps to generate theoretical concepts (Maxwell, 2005). Coffey and Atkinson (1996, p. 27) mentioned that "coding can be thought about as a way of relating our data to our ideas about those data". Coding in thematic analysis is the process of identifying themes from the data (Ezzy, 2002) and this coding makes the researcher more involved with the data in seeking meaning, connections and insights (Polonsky and Waller, 2010). According to the coding framework, the statements, sentences, phrases or paragraphs were bracketed and assigned specific codes; they were then grouped and placed under similar themes or topics. Each of the respondents' perceptions of risk factors that were similar were grouped together and given a title and a label. Microsoft Word was used during the coding process to help in analysing and managing the text data ( see appendix 1B).

After identifying the themes and completing the coding process, the interpretation of the data began. In this stage, the information and results are described and summarised in a meaningful format; also the step of discussing and interpreting the results is undertaken. Polonsky and Waller (2010) mentioned that the researcher should explain what the results mean and give advice based on these results; a discussion and interpretation is then required to relate the findings to the research question and the literature (Polonsky and Waller, 2010).

As this study was conducted for exploratory purposes, the researcher placed emphasis on explaining particular issues. This research is concerned with how managers perceive the risk factors associated with the implementation and operation of ERP systems. So, the analysis focused on how the managers perceived the risk factors associated with the implementation and operation of ERP systems. More detailed discussion of the findings from the data collected from the qualitative interviews is discussed in the next chapter (Chapter Six) which presents the analysis of the qualitative data.

### 5.8.3 *Development of the conceptual framework and the preliminary research model*

At the end of the exploratory pilot study, a certain set of risk factors concerning the implementation and operation of ERP systems was identified from the viewpoint of business and/or IT professionals. In addition, the exploratory pilot study greatly deepened and broadened this research, allowing new dimensions to be developed and studied, and suggesting new ideas and hypotheses to be investigated. The main findings in the analysis of the pilot study data showed similarities and differences in the perceptions of risk factors among managers in relation to their profession. In Chapter 6, the findings show the themes that were highlighted from the interview data.

However, a further investigation (carried out by conducting a survey) was undertaken in order to understand and examine the relationships between different groups of managers and their perceptions of the risk factors related to the implementation and operation of ERP systems. The main groups of managers were information technology managers, financial accounting managers, and auditing managers; other groups included HR and manufacturing managers. A preliminary research model concerning the perceptions among managers of risk factors in the implementation and operation of ERP systems was built based on findings from the literature review and pilot study data as an exploratory stage of the research. Figure 5-5 shows how different areas of the literature and the pilot study helped in developing the model in this research. In order to test the research model, a survey questionnaire was conducted.

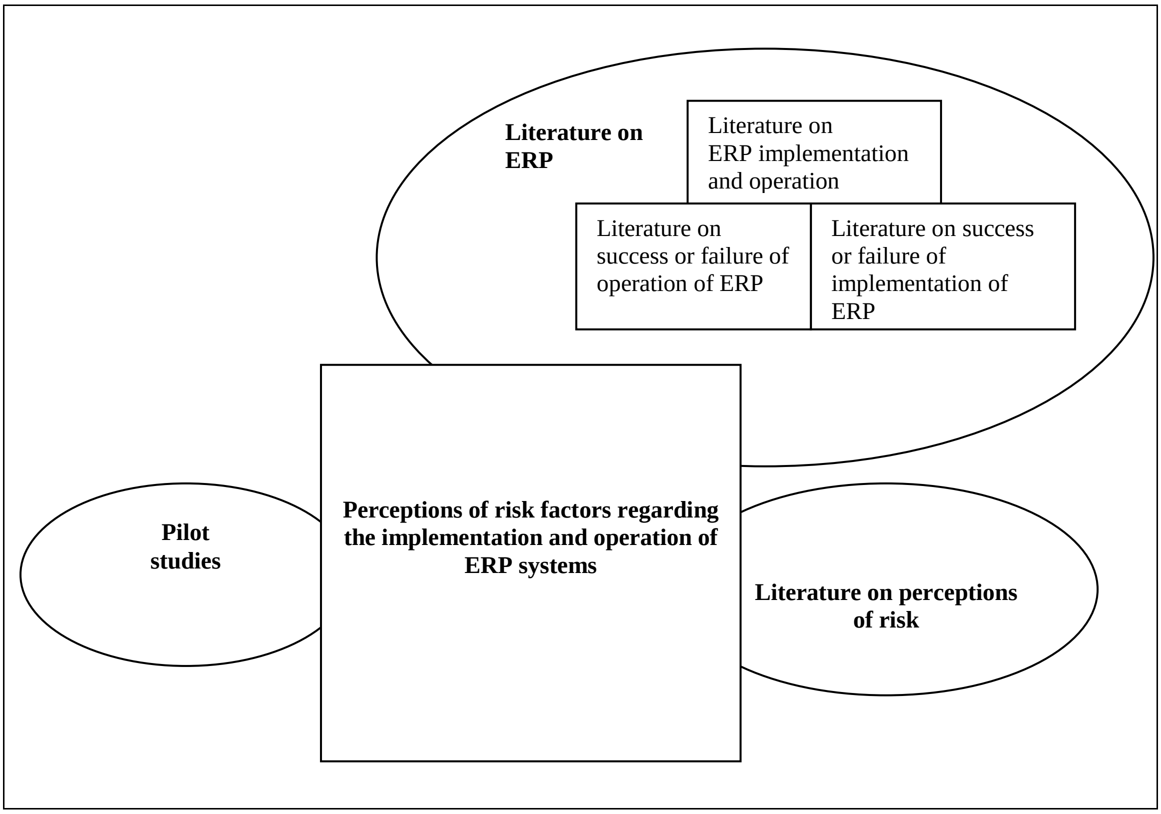


Figure 5-5: Areas that contributed to the development of the research model

### 5.8.4 *Survey*

The survey constituted the second stage of the study; this was considered to be complementary to the first stage of this study. Creswell (2003, p.153) defined a survey as "a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population". Surveys are commonly used for the purpose of exploration and description, explanation, and /or hypothesis (Saunders et al., 2007). They allow a researcher to collect quantitative data to describe variability in different phenomena, or to show the relationship between variables and produce models of these relationships (Saunders et al., 2007). The questionnaire is the most frequently used technique in the survey method; it is also the best research instrument to use for the purpose of descriptive or explanatory research (Saunders et al., 2007). One of the major advantages of the survey questionnaire is its ability to collect data from a large group of people in a highly economical, efficient and accurate way (Saunders et al., 2007; Easterby-Smith et al., 2002) . Questionnaire data are standardised and easy to administrate and compare (Saunders et al., 2007) and questionnaires generally provide data of high validity and reliability. Most of the results from survey questionnaires are representative of the whole population and have the ability to be generalised from the sample to a whole population (Saunders et al., 2007).

There are many ways to collect survey questionnaire data such as by a self-administrated questionnaire which is normally completed by respondents (e.g. an online or internet questionnaire, a postal or mail questionnaire, or a delivered and collected questionnaire). In an interviewer-administrated questionnaire, on the other hand, responses are recorded by an interviewer based on the answers of participants (e.g. telephone questionnaires and structured interviews) (Saunders et al., 2007). Delivered and collected questionnaires were chosen as the most suitable method to collect data in this study. The decision to administer the questionnaire by this method was based on the fact that this research was conducted with managers in Jordan, and the whole of the targeted population was located in the same city: Amman. Also, a delivered and collected questionnaire is able to reach particular respondents more easily. Saunders et al. (2007) summarised the advantages and disadvantages of delivered and collected questionnaires as shown in Table 5-2.

The survey questionnaire was a major component of this research as it allowed further examination to be made of the themes that were highlighted in the previous pilot study data. The large scale of the survey was used to rank, in order, those risk factors which were identified in the exploratory pilot study and the literature review. Also, it allowed the data to be examined further and to provide an overview of the most important risk factors associated with the implementation and operation of ERP systems from the point view of managers according to their culture, profession and level of ERP expertise. Moreover, the survey was carried out to test the research model and to examine the relationship between managers' perceptions of risk factors, and their culture, profession and level of ERP expertise.

Table 5-2: Advantages and disadvantages of delivered and collected questionnaires

| **Advantages of delivered and collected questionnaires** | **Disadvantages of delivered and collected questionnaires** |
|---|---|
| • Ability to collect quite a large amount of data<br>• Avoids respondent bias and allows the | • In a self-administered questionnaire, the respondents' answers may be contaminated as they could discuss their answers with |

| | |
|---|---|
| respondents’ anonymity<br>• Obtains a high response rate | others<br>• It is more likely to very expensive for respondents in terms of travel |

#### 5.8.4.1 *Questionnaire design and development of the survey instrument*

The design of a questionnaire has an effect on the response rate, and the validity and reliability of the data (Saunders et al., 2007). Obtaining a higher response rate and a lower non-response bias is required in constructing and designing an effective and clear questionnaire that looks good and contains clear instructions (Dillman, 2006). However, Saunders et al.(2007), Collis and Hussey(2009), Oppenheim(2000) and Bryman and Bell(2003) indicated that there are nine elements that should be considered in designing a good questionnaire: (1) designing the individual questions carefully; (2) identifying the needed information and the questions’ content; (3) determining the type and format of questions and responses; (4) deciding on the questions’ wording; (5) establishing the questionnaire’s flow and layout clearly; (6) including a covering letter to explain clearly the purpose of the questionnaire; (7) conducting a pilot test; (8) producing a final version of the questionnaire; (9) and finally administering the questionnaire.

##### *5.8.4.1.1 Determining the content of questions and measurement techniques*

Designing questions should be based on the data that need to be collected (Saunders et al., 2007). It is very important to ensure that the gathered data will answer the research questions and achieve its objectives (Oppenheim, 2000). Thus, the researcher defines the research objectives and translates them into a set of practical issues or hypotheses to be investigated. These then become the research variables that are to be measured, subsequently becoming a set of questions, scales and indicators. The main objective of this research is to investigate perceptions of risks factors, together with the factors that influence these perceptions, associated with the implementation and operation of ERP systems from the viewpoint of managers in Jordanian companies. In this study, the literature was reviewed carefully and the following concepts defined: perceptions of risk, the culture of risk, ERP expertise and profession in order to explain the relationship between perceptions of ERP risk factors (as the dependent variable) and culture, profession and ERP expertise (as independent variables).

A questionnaire is a list of questions; it is an important measurement tool and instrument to collect data (Oppenheim, 2000). Researchers have three choices in designing questions: (1) adopt questions used in other questionnaires; (2) adapt questions used in other questionnaires; (3) develop their own questions (Saunders et al., 2007). Regarding a questionnaire borrowed or adapted from other previous studies, researchers should be aware that this questionnaire will work in their population and provide that data they need (Oppenheim, 2000).

In designing the questionnaire in this research, some questions were adopted from other studies, while others were adapted from other questionnaires to fit the nature of this study. Also, some questions were developed by the researcher based on the literature and the results of the exploratory pilot study. The contents of individual questions that measure the variables were identified from the literature review and the interview data results. The following variables were examined by several questions in order to collect the necessary data. A seven-point scale was utilised to measure the variables noted below.

###### *5.8.4.1.1.1 Risk factors associated with the implementation and operation of ERP systems:*

Reviewing the ERP risk literature (O'Leary, 2000; Wright and Wright, 2002; Sumner, 2000; Huang et al., 2004; Hunton et al., 2004; Musaji, 2002; Abu-Musa, 2006; Hong and Kim, 2002; Bradford and Florin, 2003), as well as the findings from the exploratory study, resulted in the identification of eighteen risk factors related to ERP implementation and nine risks factors associated with the operation of ERP systems; these are listed in Table 5-3. Thirty four statements were designed by the researcher to assess perceptions of risk factors associated with the implementation of ERP systems and thirty one statements were also developed by the researcher to assess the perceptions of risk factors associated with ERP system operations. Respondents were asked to indicate their level of agreement or disagreement with the statements by using a seven-point Likert-type scale ranging from l (strongly disagree) to 7 (strongly agree) (see Appendices 2). The aim of this is to assess respondents' perceptions of these risks, and to identify the similarities and differences in managers' perceptions of these risks.

Table 5-3: Risk factors associated with the implementation and operation of ERP systems

| | **ERP Risk factor** |
|---|---|
| **ERP Implementation risk factors** | 1. Difficulties in understanding and using ERP systems |
| | 2. Failure to redesign business processes and major customisation of ERP |
| | 3. Lack of top management support |
| | 4. Insufficiency of resources |
| | 5. Lack of management of change |
| | 6. Insufficient discipline and standardisation |
| | 7. Unclear/misunderstanding concerning users' requirements |
| | 8. Lack of champion |
| | 9. Lack of agreement on project goals |
| | 10. Lack of effective project management methodology |
| | 11. Insufficient training of end-users |
| | 12. Ineffective communication between users |
| | 13. Resistance of users |
| | 14. Lack of involvement of users in the ERP system |
| | 15. Lack of users' experience |
| | 16. Problem with recruiting qualified ERP system developers |
| | 17. Lack of business analysts with business and technology knowledge |
| | 18. Failure to mix internal and external expertise effectively |
| **ERP Operation risk factors** | 1. ERP software suitability |
| | 2. Working with two systems in parallel |
| | 3. Security risks |
| | 4. Sharing passwords |
| | 5. Incorrect entry data |
| | 6. Repetition of errors |
| | 7. Flowing of errors |
| | 8. Illogical processing |
| | 9. Information quality |

### *5.8.4.1.1.2 Culture of risk*

Based on the culture theory of risk, which was developed by Mary Douglas, the culture variable was measured in terms of four types of worldview: hierarchy, egalitarianism, fatalism and individualism. Twenty one questionnaire items (see Appendices 2) were adopted as scales to measure hierarchy, individualism fatalism and egalitarianism worldviews. These items were developed by Rippl(2002), Marris et al.(1998), Oltedal et al.(2004, Brenot et al.(1998) and Rajapakse and Seddon (2005). Items were rated on a seven-point Likert scale of agreement-disagreement.

### *5.8.4.1.1.3 Measuring ERP expertise*

ERP expertise was conceptualised in terms of training, experience, enjoyment in using ERPs, and comfort with ERP use. Five items (see Appendix 2 from Q22 to Q26) were used to measure ERP expertise; these items were adapted from Brazel(2005). One of measure of expertise which was used was the individual's self-reporting of how much he or she enjoyed using ERP systems. Another measurement (also self-reported) concerned their training, while the third was about their experience and the fourth their comfort in using ERP systems; the fifth measure was their level of ERP expertise. A seven-point Likert scale was used to measure the self-assessment of participants' expertise level as self-reporting was the simplest and most efficient way of addressing their expertise.

### *5.8.4.1.2 Designing questions*

The questionnaire was divided into four main sections. The first section concerned the general demographic information about respondents and their companies, as well as general information about Enterprise Resource Planning (ERP) systems. Most of the questions asked the respondents to tick one answer while a few required them to fill in blanks. The second section addressed those risk factors related to the implementation and operation of ERP systems identified by the pilot study and the literature review. This section contained 65 statements, 34 indicating 18 risk factors related to implementation, and 31 statements indicating 9 risk factors associated with the operation of such systems. Respondents were asked to tick one answer out of seven alternatives using a Likert scale where 1 indicated "strongly disagree" and 7 "strongly agree". The third section was concerned with the identification of the most important risk factors associated with the implementation and operation of ERP systems; these were listed in Section 2. Respondents were asked to go through these risk factors and write them in order, starting with the most important and moving to the least important from their viewpoint. The fourth section dealt with culture and expertise. Respondents were asked 26 questions using a seven-point Likert scale of 1 (strongly disagree) to 7 (strongly agree) in order to measure their culture and level of ERP expertise. Titles were included in each section and sub-section to guide respondents through the questionnaire and make the questionnaire appear clear and easy.

Questionnaires are used to collect opinion and attribute types of data. Thus, the questions asked respondents the extent of their agreement or disagreement with the statements. Opinion questions were included to collect data on respondents' opinions about the risk factors associated with the implementation and operation of ERP systems in order to measure their perceptions of ERP risk factors, their feelings about working with ERP systems to measure their ERP expertise, and the ways they preferred to run their daily lives in order to measure their culture. Data regarding attributes included age, gender, education and occupation.

There are two types of question: open-ended and closed-ended questions. The questions included in this questionnaire were closed-ended questions. Ary et al. (2002) mentioned that it is better to use closed-ended questions so that they can be answered and coded quickly and easily. There are six types of closed questions: list[1], category[2], ranking[3], rating or scale[4], quantity[5], and grid[6] (Saunders et al., 2007). Four types of closed questions were employed in the survey questionnaire: list questions, category questions, scale questions, and ranking questions. The responses to list questions were identified in an obvious and meaningful way for the participants while rating questions were used to gather opinion data. Saunders et al.(2007) mentioned that rating questions are often used in terms of a Likert-style rating scale where respondents are required to indicate their agreement or disagreement with a series of statements. Likert scales are usually used on a four-, five-, six- or seven-point rating scale. Seven-point scales were used in

[1] List, where the respondent is offered a list of items, any of which may be selected.
[2] Category, where only one response can be selected from a given set of categories.
[3] Ranking, where the respondent is asked to place something in order.
[4] Rating or scale, in which a rating device is used to record responses.
[5] Quantity, to which the response is a number giving the amount.
[6] Grid, where responses to two or more questions can be recorded using the same matrix.

the rating questions in this study to measure the perceptions of risk, culture and level of ERP expertise. The perceptions of risk, culture and level of ERP expertise were assessed by asking respondents to state their level of agreement or disagreement with the statements.

The questions were written in clear, simple and familiar language; jargon and specialist phrases were avoided in order to assure the validity of the responses. Saunders et al.(2007) stated that clearly wording questions for respondents, using familiar and readily understood terms, will increase the validity of the questionnaire. As the questionnaires were targeted at companies in Jordan, it was necessary to understand the country and culture in order to avoid making mistakes or using the wrong terminology or language when the questionnaire was translated into Arabic. Understanding the Jordanian culture was achieved by conducting the semi-structured interviews in the first stage.

#### *5.8.4.1.3 Pilot test*

In most social science surveys, researchers should undertake a pilot test to test out a detailed method for the drawing of the sample to arriving at the form of the paper (Oppenheim, 2000). It is important to pilot the wording the questions, the questions' sequence, the scales and the answer categories (Oppenheim, 2000). Morgan (2004, p. 15) stated that "Pilot participants should be asked about the clarity of the items and whether they think any items should be added or deleted. Then use the feedback to make modifications in the instrument before beginning data collection". Prior to conducting the survey questionnaire, a pilot questionnaire was undertaken to assure the validity of the items. As Morgan(2004, p. 15) mentioned, "Content validity can also be checked by asking experts to judge whether your items cover all aspects of the domain you intended to measure and whether they are in appropriate proportions relative to that domain" .

The questionnaire was first designed in English and then translated into Arabic, which is the language spoken and written in Jordan. The questionnaire in both languages (English and Arabic) was reviewed and validated by the researcher's supervisor, two PhD researchers in Information Systems at the University of Newcastle, and by three staff in the Accounting and Information Systems Department at the University of

Damascus. The pilot testing was undertaken in this study in order to optimise the design of the questionnaire, and to reduce bias and any mistakes that had been made in the translation. Regarding this, the expert academic staff were asked to judge and give feedback on the clarity of the questions, the questions' sequence, the measurement scales and the answer categories. Following that, the pilot study was conducted with seven IT managers and financial managers from four Jordanian companies in order to ensure that the statements or items that had been used were similar in terms of their language; they were also asked to answer the questions and to comment on them. Some items were revised on the basis of the pilot results. The pilot was carried in order to achieve the following main objectives:

- To identify any problems with the wording of questions, to test the survey's length, to spot any unclear, ambiguous or unnecessary questions, and to uncover difficult vocabulary or poor arrangement of questions.
- To refine the questions and ensure that they were clear and understandable to the respondents, making it easy for them to complete it.
- To identify the extent of the questions' consistency and accuracy, and whether they were applicable and appropriate to managers in Jordan.
- To assess the time needed to answer and complete the questionnaire by the managers.

After piloting the questionnaire, a modified questionnaire was produced, based on the suggestion and feedback obtained from participants in the pilot study. Regarding the order and flow of questions, the questionnaire was designed to flow smoothly, allowing the participants to read and fill it in easily. A questionnaire with a good appearance and flow of questions will encourage respondents to complete it; this helps in obtaining valid and accurate responses.

The final version of the questionnaire, which (see Appendix 2) consisted of seven pages, was produced and made ready to administer. The questionnaire was printed on both sides of the page which made the papers appear concise and more professional; this encouraged participants and gave them the motivation to respond and fill in the questionnaire (Dillman, 2006).The front page of the questionnaire comprised the cover letter which introduced the purpose of the study; this was followed by a confirmation about the confidentiality and anonymity of the responses, and the importance of their contribution in completing the survey questionnaire. The cover letter was printed with a Newcastle University letterhead that consisted of the logo, the name of Newcastle University and the address of the Business School at the top of the page. The cover letter was signed by the researcher and stamped by the Business school. Well- prepared cover letter should help to make the response rate higher (Schutt, 2006).

#### 5.8.4.2 *Research population and sample selection*

Population is defined as people, firms and products or cases that fall into the category of concern (Oppenheim, 2000). A sample usually refers to a smaller group but not always one that is a representative sample within a population (Oppenheim, 2000). Selecting a sample to examine instead of the whole population helps to save time and money (Ghauri and Gronhaug, 2002).

Ghauri and Gronhaug (2002) and Saunders et al. (2007) classified sampling techniques into two types classified sampling techniques into two types. The first is probability or representative sampling which can be categorised into simple random, systematic, stratified random, and cluster sampling. The second type, non-probability or judgemental sampling, is which divided into quota sampling, purposive or judgmental sampling, snowball sampling, self-selection, and convenience sampling. For probability samples, the possibility of selecting each case from the entire population is known and equal for all cases; it is possible to answer the research questions and reach objectives that the researcher needs in order to make statistical inferences from the sample about the population (Saunders et al., 2007). With non-probability samples, however, the possibility of selecting each case from the whole population is unknown and therefore it is impossible to answer the research questions and reach objectives where the researcher needs to consider statistically the characteristics of a population from the sample. However, a researcher could generalise about a population from non-probability samples (Saunders et al., 2007). Probability samples are mostly used in survey and experiment strategies while non-probability samples are more often used in case study strategies (Saunders et al., 2007). There are five steps involved in drawing sampling, as mentioned by Saunders et al.(2007): (1) Defining the target 'population', (2) Identifying the ‘sampling frame’[7], (3) Determining a suitable sample size, (4) Selecting the sampling procedure and techniques to use to choose the sample, (5) Ensuring the sample is representative.

Of the many sample selection options available under probability and non-probability sampling, purposive sampling or Judgement sampling was used in this study. Selecting types of sample is sometimes based on the researcher judgement and nature of the research aims. Since the main goal of this research is completeness rather than generalisability, purposive sampling or Judgement sampling design is useful method to answer the research questions in this thesis as it gives opportunities to obtain the specialised information on the ERP topic from specific target groups. Also, it is the best sampling design choice especially when there is a limited population that have expertise in the ERP area and can provide information required. Sekaran and Bougie (2009, p. 277) mentioned that “Judgment sampling is the viable sampling method for obtaining the type of the information that required from very specific pockets of people who alone possess the needed facts and give the information sought”. The population for this research is managers with ERP experience working in different departments (such as IT managers, auditors, and financial and accounting managers) in companies in Jordan, Amman which have implemented ERP systems. Managers rather than employees were chosen to participate in the survey because it was believed that they would be more knowledgeable and have more information and better understand the risks of ERP than employees.

The most suitable sampling frame was the ERP provider companies in Amman, Jordan, who provided a complete list of companies in Jordan that had implemented ERP systems. The list contained 60 companies with a wide range of names and contact numbers, addresses, and email addresses of managers (such as IT managers, financial and accounting managers, HR managers, and production and manufacturing managers). However, Collis and Hussey (2009) mentioned that, when a population is relatively small, the sample will be the whole population. As only sixty companies had implemented an ERP system in Amman, Jordan in 2007, data were collected from the entire population. The respondents were chosen on the basis of their profession and

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[7] “*Sampling frame is a record list of all the cases in the population from which a sample can be drawn”.* Collis, J. and Hussey, R. (2009). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students* Palgrave Macmillan; New York.

their level of ERP expertise in order to obtain sufficient reliable variations so that comparisons could be made between the groups.

In order to obtain a sample that is representative of the population, it is very important to ensure that the sample frame is complete, accurate and unbiased (Saunders et al., 2007). Also, obtaining a high rate of response ensures that the results from the sample are representative (Saunders et al., 2007; Collis and Hussey, 2009). Researchers should ensure that the sample is representative and that the designed questionnaire and its pilot is good enough to be able to achieve a good response rate (Saunders et al., 2007). Since the aim of this study is to explore variations in the perceptions of risk factors related to ERP systems among managers with regard to their profession, level of ERP expertise, and culture, statistical representativeness was not an important issue. However, in order to encourage and make the respondents willing to participate fully and positively in this study by completing the questionnaire, confidentiality was guaranteed and a summary of the results was offered which could offer more information about the risk factors raised by managers in Jordan.

#### 5.8.4.3 *Data collection*

A self-administered questionnaire method was applied in order to collect the data required to achieve the research's objectives and answer the research questions, as well as to test the research hypotheses. A delivery and collection approach of hard copies of the questionnaire was chosen as the most appropriate method for this study to guarantee a high response rate. The questionnaire was distributed in various private and public organisations located in Amman, Jordan, from July to September 2007. The questionnaire was to be completed by IT managers, financial and accounting managers, auditing managers, and other managers who had experience of ERP systems. A total of 260 questionnaires were distributed within 60 large and medium organisations in Jordan using ERP systems. A total of 173 completed responses were obtained. After searching for incomplete questionnaires, seven responses were omitted due to incomplete data entry. Some missing values were found, some items for ERP risk factors, and other items regarding ERP expertise and culture, were identified and replaced with an average value for the rest of the items. One hundred and sixty six valid and usable questionnaires were collected, representing a 64% response rate. This response rate is considered good for an empirical survey.

5.8.4.4 ***Statistical method used in data analysis***

Once the data had been collected, preparing them began by coding the data into number form; these numbers were then entered into SPSS. Following this, descriptive and analytical tests were used in order to reach the research objectives and answer the research questions. In this thesis, the two statistical methods were employed: (1) Descriptive statistics, such as frequency and crosstab, (2) Mann-Whitney and Kruskal-Wallis tests. The following section provides a brief description of each of these statistical tests and justifies the reason for using it.

***5.8.4.4.1 Descriptive statistics: frequency and crosstab***

The analysis started with general descriptive statistics using frequency distributions and percentages in order to ascertain the numbers of respondents answering each question (Foster, 2001). Frequency distribution showed the main characteristics of the respondents, the company they worked for , the ERP system implemented in their company, and the most important risk factor related to the implementation and operation of ERP systems.

In addition, descriptive statistics and cross-tabulation tests were used since the researcher was interested to count how many IT managers, financial and accounting managers, and other managers perceived or did not perceive certain factors associated with the implementation and operation of ERP systems as risks. Also, the researcher wished to explore the number of managers from hierarchist, egalitarian, fatalist, individualist, and other mixed cultures who perceived or did not perceive the factors as risks associated with the implementation and operation of ERP systems. Moreover, the researcher was interested to find out whether managers with high or low levels of ERP expertise differed in terms of their perceptions of risk factors associated with ERP implementation systems.

***5.8.4.4.2 Assessing normality***

The following analysis was carried out on the data for analytical testing. For such tests, the statistical procedures differ according to the nature and the form of measurement of both the dependent and independent variables (Bryman and Cramer, 2005; Bryman and Bell, 2003). There are three main level of measurement for different types of variable:

nominal, ordinal, and interval. Determining the level of measurement of a variable is important when beginning an analysis in order to select the most appropriate type of statistical analysis. DeVaus (2002, p. 40) pointed out: “Failing to correctly match the statistical method to a variable’s level of measurement lead to either nonsense results or potentially misleading results”. What is more, statistical tests are divided into two categories: parametric and non-parametric tests. Foster (2001), Bryman and Cramer (2005) and Morgan et al. (2004) mentioned that statistical parametric significance tests, such as T test, ANOVA and Pearson correlation, are suitable for data resting upon two assumptions: that the data are measured on equal interval or ratio scales, and that dependent variables scores are normally distributed. However, if the data do not meet these criteria, then non-parametric statistical tests should be applied. Foster (2001), Morgan et al. (2004) and Saunders et al. (2007) pointed out that non-parametric tests are the appropriate tests to use to analyse ordinal or nominal scales, categorical, scale ranked data, and when the assumptions of parametric test are violated and data are not normally distributed.

Some researchers have ignored these assumptions and have used parametric statistical tests in spite of their data being non-parametric. Field (2009) argued that using parametric testing when the data are not parametric could make the results inaccurate. Therefore, choosing the most suitable type of statistical test for performing statistical significance tests to ascertain the differences between two or more groups, plays a key role regarding the nature of the data to be analysed. The choice will depend on whether these are nominal, ordinal, interval, and whether or not the data violate the assumptions regarding the statistical test to be used (Field, 2009). Before starting to analyse data, it is important clearly to understand the data and check the assumptions to decide which is the most appropriate type of analysis to conduct.

Normal distribution can be symmetrical or a normal curve (a bell-shaped curve); the most frequent scores are in the middle, and small numbers of scores for low and high values are situated toward the extremes, whereas median and mode are approximately equal and coincide in the centre (Collis and Hussey, 2009; Morgan et al., 2004; Pallant, 2007). The normality of the distribution of variables can be examined using SPSS in many methods, such as a histogram, skewness and kurtosis values, and the Kolmogorov-Smirnov test (Collis and Hussey, 2009; Morgan et al., 2004; Pallant, 2007;

Foster, 2001). Pallant (2007, p. 57) said that: “A skewness value provides an indication of the symmetry of the distribution. Kurtosis, on the other hand, provides information about the 'peakedness' of the distribution”. The distribution is normal when the skewness and kurtosis value is 0 (Pallant, 2007; Foster, 2001; Field, 2009). Positive values of skewness indicate too many low scores in the distribution, whereas negative values of skewness indicate too many high scores in the distribution (Field, 2009).

Kolmogorov-Smirnov (KS) is another way of testing the normality of the distribution of scores. Field (2009, p. 144) mentioned that: “Kolmogorov-Smirnov (KS) compares the scores in the sample to a normally distributed set of scores with the same mean and standard deviation..........the K-S test can be used to see if a distribution of scores significantly differs from a normal distribution”. A non-significant result ($p>0.05$) means that distribution of the data is not significantly different from the normal distribution, and scores are approximately normally distributed while a significant result ($p\leq 0.05$) means that the distribution of scores is not normal (Pallant, 2007; Foster, 2001; Field, 2009).

In this study, both the dependent variable (perceptions of each risk factors associated with the implementation and operation of ERP systems) and the independent variables (culture, and level of ERP expertise) were measured on seven-point Likert scales. Likert scales are considered by some researchers as ordinal (Saunders et al., 2007; Morgan et al., 2004; Bryman and Cramer, 2005). While other researchers treat the Likert scale as an interval scale and use parametric tests to analyse their data. However, in this research, even if the Likert scale is considered as an interval scale, using parametric testing is still inappropriate because the dependent variables are not normally distributed. In this thesis, skewness and kurtosis have been used to assess the normality distribution of the data. In addition, the Kolmogorov-Smirnow (KS) test was also conducted in this research in order to confirm the normality of distribution of the variables of this study. According to normality distribution tests in this research data, the frequency distribution was not symmetrical and was not normally distributed. However, non-parametric statistical tests are appropriate tests to analyse the data of this research as the perceptions of the ERP risk factors are based on data of an ordinal nature since an ordinal Likert-scale was used.

#### *5.8.4.4.3 Mann-Whitney and Kruskal-Wallis tests*

This research investigates whether the managers with high and low levels of ERP expertise differ significantly regarding their perceptions of the risk factors associated with the implementation and operation of ERP systems. In order to reach this objective, the Mann-Whitney was applied to test the difference between the two groups since the dependent variable was ordinal and non-parametric, and there was one independent variable with two groups. The Kruskal-Wallis test was also used to compare the scores on variables with more than two independent groups when there is a significant difference between those groups. The Kruskal-Wallis test is particularly appropriate to explore if there is a statistically significant difference between the four culture groups of managers (hierarchist, egalitarian, fatalist, individualist, and other mixed cultures) and their perception of ERP risk factors. It was also used to examine whether there was a significant difference between perception of risk scores and different professions (such as IT managers, financial and accounting managers, auditing managers and others).

### 5.8.5 *Validity and reliability evaluation and measurement*

In order to reduce the probability of getting a wrong answer, validity and reliability should be considered (Saunders et al., 2007). Validity and reliability measurements are the two most important criteria to assess the trustworthiness, accuracy and precision of qualitative and quantitative research (Cohen et al., 2007). Validity ensures that the correct procedures are employed in conducting the research in order to answer the research questions; while reliability is the quality of the measurement procedures that have been used that provide repeatability and precision (Kumar, 2005). Thus, to reach a high level of validity and reliability in the study, it is vital to design and conduct the research by identifying and describing the phenomenon accurately. The validity and reliability of data is based on the design of questions, the structure of the questionnaires and the rigour of the pilot testing (Saunders et al., 2007). Researchers should ensure that their questions are understood by participants in the way they intend and they should understand the respondents’ answers in the way respondents intended (Saunders et al., 2007). A valid and reliable questionnaire makes the collected data accurate and consistent (Saunders et al., 2007). What is more, it is important to be aware of the problems and limitations associated with selected research methods in order to reduce errors and improve the quality of the study.

A brief of explanation of the validity and reliability measurements relevant to this research are discussed below.

### 5.8.5.1 ***Validity and reliability in quantitative research***

#### ***5.8.5.1.1 Validity***

Validity is a term that is usually used to judge the quality of research (Gliner and Morgan, 2000). It is "concerned with the integrity of the conclusion that is generated from the research" (Bryman and Bell, 2003, p77). Validity refers to the truth-value of research and to the degree of truthfulness of the results (Seale, 2004). It is concerned with whether the research findings accurately represent what is really happening in the phenomenon under study (Collis and Hussey, 2009). In other words, validity is the extent to which the data collection methods accurately measure what they are aimed to measure (Saunders et al., 2007). Thus, if the research is invalid, it has no value and is worthless (Cohen et al., 2007). For quantitative data, validity can be improved through careful sampling, proper instrumentation and suitable statistical data analysis (Cohen et al., 2007). However, validity may be reduced when there are errors or faults in research procedures (Bryman and Bell, 2003), obtaining a poor sample, and when measurement is inaccurate (Collis and Hussey, 2009). The measurement of validity is a relative criterion, not an absolute (Cohen et al., 2007) and so it is very difficult for any research to reach validity of 100 percent.

Content validity is the most common type which researchers should establish when they develop a new measure (Bryman and Bell, 2003; Collis and Hussey, 2009). It refers to the extent to which the measure used by the researcher appears to be reasonable or logical for what it is supposed to measure (Ghauri and Gronhaug, 2002; Saunders et al., 2007). The measure should reflect the content of the concept in question (Bryman and Bell, 2003). Content validity ensure that the measure includes a sufficient, representative and comprehensive set of items that represent the concept (Sekaran, 2003, p. 206). Sekaran (2003, p. 207) indicated that "the more the scale items represent the domain or universe of the concept being measured, the greater the content validity".

In this thesis, in order to optimise the content validity of the instruments, the researcher comprehensively and broadly reviewed the ERP literature on perceptions of risk and the culture of risk theory before developing the questionnaire; this was done to produce accurate data and answer the research question. Also, the results of interviews helped in developing the questionnaire. The researcher developed a broad range of items carefully, and identified and clarified the scales and measures. Some of the items were adapted and/or adopted from other studies, while others were developed by the researcher based on the literature and the results of the exploratory pilot study. Moreover, the pilot study was conducted in order to increase the face or content validity of the study before starting to distribute the questionnaire. The questionnaire items were examined and piloted with academic researchers and some expert managers with in-depth ERP experience in order to ensure the content validity of the questionnaire. (For more details about the pilot study, see 5.9.4.1.2.)

#### *5.8.5.1.2 Reliability*

Reliability is concerned with the precision of measurement of the research variables which means that similar answers or results would be reached if the study were repeated by another researcher at another time (Bryman and Bell, 2003; Jankowicz, 1997). Thus, when similar results can be achieved, the instrument is consistent or reliable (Collis and Hussey, 2009). Saunders et al. (2007, p.149) defined "reliability as the degree to which data collection techniques or analysis procedures will yield consistent findings". It concerns the consistency of measurements (Oppenheim, 2000). Cronbach's alpha is generally used as a statistical technique for assessing reliability (Bryman and Bell, 2003; Saunders et al., 2007). The alpha coefficient varies between 1 and 0 (Bryman and Bell, 2003) and this is considered to be the minimum accepted alpha in the social science threshold of 0.60.

In this study, the reliability of the questionnaire was confirmed by adopting Cronbach's coefficient alpha (α) to explore and assess its internal consistency for each construct of the study. For this study's questionnaire, the respondents were asked to indicate their agreement or disagreement with each risk factor during the implementation and operation of ERP systems by ticking one of seven available choices (using a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). Table 7-5 in chapter seven provides Cronbach's coefficient alpha (α) for the risk factors associated with the implementation and operation of ERP systems, the four types of culture, and levels of ERP expertise.

#### 5.8.5.2 *Validity and reliability in qualitative research*

Reliability and validity are usually concerned with quantitative research (Bryman and Bell, 2003). In qualitative research, no experiments can be perfectly controlled, no measuring instrument can be identified as perfect and no concept can be fixed or universal (Kirk and Miller, 1986). However, the appropriateness and applicability of validity and reliability in qualitative research is still a controversial issue (Winter, 2000). Kirk and Miller (1986) and LeCompte and Goetz (1982) indicated that, while some authors argue that validity and reliability are inapplicable or improper for qualitative research as they are grounded in quantitative research, they still recognise the need for a type of quality measure for qualitative research. Therefore, validity and reliability concepts have been employed in the practice of qualitative research and redefined with different terms to make them usefuls and relevant to qualitative research (Golafshani, 2003; Lincoln and Guba, 1985). Cohen et al. (2007) indicated that the validity of qualitative data could be assessed through the honesty, depth, richness and scope of the data achieved, the participants approached, the extent of triangulation, and the objectivity of the researcher.

In this study, triangulation (in both the qualitative and quantitative methods) was applied in order to reduce that bias that normally occurs by using a single approach; this increases the validity and reliability of the research or the evaluation of the findings. Easterby-Smith et al. (2002) and Bryman and Bell (2003) indicated that the aim of triangulation is to improve the quality of the study as it provides many sources of data that help researchers to compare results obtained from different sources. Thus, triangulation offers another source of validation.

In order to maximise the validity of this research, methods for data collection and analysis were chosen to fit and answer the research question. The primary method for data collection was the semi-structured interview, and its validity was based on the interviewee, the questions asked by the researcher, and the way the interview was conducted. The researcher selected interviewees with experience and a background in the research issues according to their profession, qualifications and level of ERP expertise. Also, the researcher carefully analysed the research questions and designed the interview questions in order to answer them. Interviews were conducted by the researcher in an effective way by controlling the conversation. The researcher was aware that too much control could increase the bias of the answers, thereby reducing the objectivity, validity and reliability of the results. Therefore, the researcher avoided the bias that could come from her influence on the performance of the interviewees and their answers.

In terms of checking the reliability of this study, it is difficult to judge whether the interviewees expressed their real opinions and answered the interview questions in a truthful way. However, the themes that emerged were checked for their applicability in Jordan and these themes which emerged from the semi-structured interviews helped in designing the questionnaire that was conducted in Jordanian companies in order to check the validity and applicability of these themes. In triangulation methods, quantitative methods are used for the purpose of confirming.

### 5.9 Ethics and Confidentiality

Ghauri and Gronhaug (2002, p.18) defined ethics as “the moral principles and values that influence the way researchers conduct their research activities”. Ethical principles should be taken into consideration when conducting any research to ensure the accuracy and honesty of the data, as well as to find accurate answers to the research questions (Ghauri and Gronhaug, 2002). Burton (2000, p. 299) claims that “ethical concerns are present in all research designs and go beyond data collection to include analysis and publication”. However, the ethical issues were considered by researcher through the research process. Based on the consideration of ethical confidentiality, the individual interview would be more suitable as the method for collecting qualitative data.

The first main ethical issue was concerning with informed consent. Letters of consent had been sent to managers in companies that had implemented ERP systems in Jordan, asking them to be involved in the research and explaining the voluntary nature of the participation (see Appendix 1A and 2A). This letter guaranteed confidentiality and anonymity to the participants. The consent letter was sent before the interview took place in order to give interviewees a chance to read it and resolve any issues which might be raised. Besides, all the participants have been provided a brief summary of the research, and informed about the aims of the conducting study. As well as they have been informed about the process of collecting data, starting by providing them a brief description, followed by interview questions. Respondents have been given a right to refuse to answer any question if they are unwilling to provide it; and to withdraw from the research at any time during the interview without giving reasons. What is more, participants have been given the opportunity to ask questions, at any time during the interview.

Moreover, one of the ethical issue is to avoid coercing people or offering financial or any material reward to make them participate in the research and also in order to avoid biased results (Collis and Hussey, 2009). Another important ethical issue is that of the confidentiality and anonymity of all participants in the research (Collis and Hussey, 2009; Ghauri and Gronhaug, 2002). In this thesis, the researcher assured the participants in the interviews and survey that their names would be kept anonymous in the thesis, not be identified with the information they provided, and that the information would be completely confidential. The guarantee of confidentiality and anonymity helped to increase the response rate and encouraged the respondents to express their opinions freely and openly, and answer the questions truthfully (Collis and Hussey, 2009). Oppenheim (1992, p.83) claimed that "the basic ethical principle governing data collection is that no harm should come to the respondents as a result of their participation in the research". In addition, permission to record the interview was obtained from the interviewee before the interview commenced. However, most participants agreed to let the researcher record the interview on tape. While few of them refused as were not happy to have their interviews recorded, so notes were written during their interviews.

## 5.10 Summary

In order to achieve the research's objective and to answer the research questions, the researcher has discussed in this chapter the research philosophies, and the methodology and methods that were chosen as being most appropriate for this study. The selection of and justification for choosing the pragmatism paradigms for this thesis were also discussed. The chapter also provided explanations of the logic of the research (deductive, inductive), the purpose of the research (exploratory, descriptive, analytical or explanatory, and predictive), and the process of the research (qualitative, quantitative, and mixed methods). Triangulation was considered for combining the qualitative and quantitative methods in collecting data from the exploratory pilot interview and the survey questionnaire. Twenty seven interviews were conducted with managers; these were analysed using thematic analysis. The themes brought together from the findings from the semi-structured interviews helped in the design of the self-administered survey questionnaire. The questionnaire data was analysed using the statistical package for social sciences (SPSS) version 15. The evaluation to ensure the validity and reliability of the findings was also explained in this chapter.

The following chapter (Chapter Six) focuses on the analysis and presentation of the data obtained from the qualitative study by using semi-structured interviews. Chapter Seven discusses this analysis and presents the data obtained from the quantitative methods using SPSS.

# 6 Chapter Six: Research findings from the exploratory pilot study interviews in Jordan

## 6.1 Introduction

This research aims to understand and identify, from the viewpoint of managers in Jordan, the risk factors that could occur and cause the implementation and operation of ERP systems to fail; it also aims to highlight the difference and similarities in the managers' opinions. Particularly, it aims to explore how the professional experience of such managers leads them to perceive some risk factors and ignore others.

By conducting semi-structured interviews, it is possible to show how understanding and recognising ERP risk factors varies for different managers. By focusing on the qualifications and job position of managers in the organisation and linking these with the way managers view the risk factors, it is argued that a greater understanding can be reached of how perceptions and recognition of risk factors concerning ERP systems interact with different professions and different levels of ERP expertise. What risk factors IT managers perceive could make an ERP system fail, and what financial managers and internal auditing managers also perceive as risk factors more likely to cause failure in these systems are discussed in more detail in this chapter.

This chapter describes and analyses the qualitative data. After this introduction, Section 6.2 provides brief background information about the interviewees, and sheds light on the companies where the managers work, the ERP systems which managers use and operate in those companies, the chosen vendor, and reasons for this implementation. Following that, the chapter discusses, in Sections 6.3 and 6.4, implementation issues and the problem that were, ERP risk factors, and interactions between IT managers, financial and accounting managers, and internal auditors and their perceptions of risk factors. Finally, Sections 6.5 and 6.6 highlight the lessons learned from the semi-structured interviews, the outcomes and a summary of the qualitative data results from the interviews.

## 6.2 Background of interviewees, companies and their ERP systems

Twenty seven interviews were conducted in eight companies which had implemented ERP systems. Six of the interviewees were female and twenty one were male. Information concerning the interviewees' work experience indicated that eight of the interviewees were IT managers, eight were financial and accounting managers, six were internal audit managers, and five were other managers (plant or production managers, and an HR manager). All of the interviewees were in charge of ERP systems and had experience of such systems ranging from 2 to 7 years. The following Table 6-1 shows details and the characteristics of each interviewee.

The interviewees' managers worked in a large private or public shareholding companies in Amman, Jordan. The number of staff was range from 327 to 5000 employees in each company. Most respondents were working in the industrial sector which includes manufacturing, pharmaceutical and transportation companies while other managers were working in the service sector, which includes telecommunications and airline. The strategy of those companies is to provide high-quality products or services, achieving customer satisfaction.

From the Table 6-1, it can be seen that companies implemented Baan, JD Edward, Oracle, Scala, and Ross systems between 1997 and 2004. They implemented several modules such as finance modules (including a general ledger (GL), fixed asset accounting, accounts payable (AP), accounts receivable (AR), and cost accounting); manufacturing modules (purchasing, warehouse control, location control and sales control) operations and logistics module, sales and distribution module and an HR module.

| Company number | Number of interviewee | Interviewee's job profession | Interviewee's qualification | Interviewee's ERP experience | Nature of business | Company foundation | Company strategy | Number of employees | ERP vendor | Year of implementation | ERP modules |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | IT manager (1) | BSc in Mathematics and Computers | 7 years experience with Baan | Manufacturing Company | 1993 | Enhancing the quality of products | 570 employees | Baan | 2001 | Finance modules<br>General ledger (GL)<br>Fixed asset accounting<br>Accounts payable (AP)<br>Accounts receivable (AR)<br>Cost accounting<br>Manufacturing modules,<br>Purchasing<br>Warehouse control<br>Sales control<br>HR module. |
| | 2 | Financial manager (1) | BSc in Accounting and Certificate of Public Accountancy (CPA) in Chicago | 3 years with SAP, 4 years with Oracle, and 2 years with Baan | | | | | | | |
| | 3 | Internal Audit manager (1) | BSc in Accounting and Certificate of Public Accountancy (CPA) | 5 years experience with Baan | | | | | | | |
| | 4 | Production manager (1) | BSc in Management and MBA | 3 years experience with Baan | | | | | | | |
| 2 | 5 | IT manager (2) | BSc in Computing Science and MSc in Management Information Systems | 6 years experience with Baan | Manufacturing Company | 1994 | Providing highest quality products and services | 550 employees | Baan | 1999 | Finance module<br>Warehousing module<br>Purchasing module<br>Quality of management module<br>Manufacturing module<br>Sales module |
| | 6 | Financial manager (2) | BSc and MSc in Accounting and CPA | 4 years experience with Baan | | | | | | | |
| | 7 | Internal Audit manager (2) | BSc in Accounting and CPA | 2 years experience with Baan | | | | | | | |
| | 8 | Plant manager (2) | BSc in Management | 4 years experience with Baan | | | | | | | |
| 3 | 9 | IT manager (3) | BSC in Information Technology | 7 years experience with JD. Edward | Manufacturing Company | 1963 | Focusing on quality products and services | 3700 employees | JD. Edward | Decide to implement in 1997 and went live in 2004 | Financial module, HR module<br>Operations and logistics module<br>Sales and distribution module |
| | 10 | Financial manager (3) | BSc in Accounting | 2 years experience with JD. Edward | | | | | | | |
| | 11 | Internal Audit manager (3) | BSc and MSc in accounting and CPA | 2 years experience with JD. Edward | | | | | | | |
| 4 | 12 | IT manager (4) | BSc in Computing Science | 6 years experience with JD. Edward | Manufacturing Company | 1951 | Providing customers with the best in terms of innovative and reliable products and service. | 1600 employees | JD. Edward | 2003 | Financial modules<br>Account receivable (AR)<br>Accounts payable (AP)<br>Inventory module<br>GL module (GL)<br>HR modules<br>Sales module<br>Purchasing module |
| | 13 | Internal Audit manager(4) | BSc in Accounting and CPA | 3 years experience with JD. Edward | | | | | | | |
| | 14 | Financial manager(4) | BSc in Accounting | 3 years experience with JD. Edward | | | | | | | |
| | 15 | HR manager (4) | BSc in Management | 3 years experience with JD. Edward | | | | | | | |
| 5 | 16 | IT manager (5) | BSc and Masters in Information Systems | 7 years experience with Oracle | Service company | 1962 | Providing best quality and good services | 3500 employees | Oracle | 1998 | Financial module<br>Account receivable (AR)<br>Accounts payable (AP)<br>GL module, Fixed assets<br>Cash management<br>HR modules |
| | 17 | Financial manager (5) | BSc and Masters in Accounting | 7 years experience with Oracle | | | | | | | |
| | 18 | Internal Audit manager (5) | BSc and Masters in Accounting and Certificate of Public Accountancy (CPA) in Jordan. | 5 years experience with Oracle | | | | | | | |
| 6 | 19 | Financial manager (6) | BSc in Accounting, and Certificate of Management Accounting (CMA) | 4 years experience with Scala | Manufacturing Company | 1994 | providing the highest standards of quality, and achieving customer satisfaction. | 327 employees | Scala | 2003 | Financial module<br>Fixed assets<br>Purchasing module<br>Sales module<br>HR modules<br>Manufacturing module |
| | 20 | IT manager (6) | BSc in Computing Science | 7 years experience with Scala | | | | | | | |
| | 21 | Plant manager (6) | BSc and MSc in Management | 4 years experience with Scala | | | | | | | |
| 7 | 22 | Financial manager (7) | BSc in Accounting | 3 years experience with Scala | | 1993 | | | | | |
| | 23 | IT manager (7) | BSc in Information Technology | 6 years experience with Scala | | | | | | | |
| 8 | 24 | Financial manager (8) | BSc and MSc in Accounting | 4 years experience with Ross | Service company | 1971 | Providing customers with the highest quality products and cheapest cost. | 5000 | Ross and Oracle | 1997 | Financial modules<br>Account receivable (AR)<br>Accounts payable (AP)<br>Inventory module<br>Fixed assets module<br>GL module, HR module<br>Customer Care and Billing System (CCBS) |
| | 25 | IT manager (8) | BSc in Computing Science | 7 years experience with Ross | | | | | | | |
| | 26 | Internal audit manager (8) | PhD in Accounting | 4 years experience with Ross | | | | | | | |
| | 27 | HR manager (8) | BSc in Accounting | 3 years experience with Ross | | | | | | | |

Table 6-1 Interviewees' backgrounds

The reasons for implementing ERP systems were, first, one of the company stated that they implemented Baan system because it is considered to be a tier one ERP system among four systems which are SAP, Oracle Financials, PeopleSoft, and Baan, as well as the existence of a local vendor and a support centre for Baan in Jordan that helps companies to solve any problems that might occur, such as bugs. The IT manager (1, 7 years) mentioned:

> I do not believe in buying a product if we do not have a local seller and authorized people to support us.

Second, other company implemented Baan systems to obtain a certain license in order to become an international company and work in parallel with international standards. The IT manager (2, 6 years) noted that:

> Having a particular certificate such as a Good Manufacturing Practice (GMP), you must implement ERP systems.

Third, ERP system had useful features and helped the business to operate more efficiently. It enhances the performance of the work, organise the company's work. All people have to work in the same way as the system requires, not as the manager prefers. Furthermore, there was a need to have a system to help manage and control money, people, materials and production, and to manage day-to-day financial, manufacturing, sales and distribution operations. ERP systems help the company to make sound decisions, manage its materials, and to organise and control the warehouse. According to the IT manager (2, 6 years):

> By implementing Baan systems I can control the warehouse through a computer when the materials are on location. So, if I want to know how many raw of materials for paracetamol we have, and how much this costs, I only press one button and then I get the cost and the quantity of paracetamol.

The ERP systems help to manage and control the companies' activities efficiently. In particular, the aim of implementing the ERP system in the manufacturing department was to expand the control of the product cycle. The plant manager (6, 4years) mentioned:

> In the industry, we have 3000 items to enter into store, 3500 finished goods, and 3000 orders per month. so the control process is not easy. We need a high level of control.

Fourth, the company implemented the ERP systems in order to get rid of the old legacy systems which were in place, to obtain an international integrating solution, and to acquire one database since the volume of data was too high in their company. These system minimises duplication, reduce data redundancy, reduce data errors, facilitates data integrity and data sharing. Interviewees commented:

> If we stay with the old system, then we will need more staff, we will have more errors, we will need more time to repeat our data, and we will need more time to make the right decision.
>
> IT manager (1, 7 years)

Fifth, the reasons given to justify the implementation of these ERP systems were to obtain accurate data and information on time and the fact that decisions are best made on the basis of accurate data, to compete effectively with rival companies, and also to produce financial reports they required quickly and easily at any time during the year. The financial accounting manager (5, 7 years) commented:

> Before we implemented this system, preparing a report took 3 or 4 weeks before it was ready, but now it takes only one minute.

> By using ERP systems, we can get financial statements very early; we do our quarterly balance sheet on time, our data are correct; our information and decisions are best as it based on accurate data.
>
> Financial manager (1, 9 years)

> Baan would give only the accurate data on a timely basis, and enable any decision to be made much faster.
>
> Production manager (1, 3 years)

Finally, implementing an ERP system has had a positive impact on some companies. The system has fulfilled all the company's requirements and needs and therefore, the company has achieved a great many benefits from implementing the ERP program. IT manager (2, 6 years) said:

> The ERP system is the best for our needs.

> Really the performance of the JDE system was good, so we are happy with this system.
>
> Financial manager (4, 3 years)

Implementing the ERP system has given more responsibility to the IT team; it has also improved the capabilities and efficiency of the ERP users when using these systems as they have had new experience in a technical field. This has given them added responsibilities because if any of them stops carrying out his/her work, other users also stop so they have, as a result, become more accurate in completing their tasks which has led to increased productivity and reliability.

Finally, the next section discusses and describes the major themes that emerged from the data from the exploratory interviews from the viewpoints of managers, with ERP experience ranging from 2 to 7 years, who were working in different departments in medium and large organizations.

## 6.3 Data findings: Identifying a set of risk factors that could impact on the implementation of ERP systems

A number of themes, derived from the literature and which related to the risk factors associated with the implementation of ERP systems, were raised during the exploratory pilot study. As mentioned previously, the interviews were conducted with IT managers, financial accounting managers, production managers, plant managers, internal auditing managers, and HR managers. Each of them represented the risk factors concerning the failure of ERP systems from his or her own viewpoint and experience in their work and in ERP systems. From an analysis of the interviews, it was revealed that there were differences in the ways managers talked about and described the risk factors; these differences have impacted on the success of the implementation of ERP systems in Jordan

The findings here present those ERP risk factors which were identified by the managers who had different responsibilities within their companies and show the interactions between the IT managers, financial accounting managers and other managers regarding to ERP risk factors. Each of these risk factors is shown below.

### 6.3.1 *Difficulties in understanding and using ERP systems*

One of the risk factors related to ERP systems is the difficulties encountered when using these systems and difficulties in fully understanding and learning how to use them. It is reported in the literature that ERP systems are complex. This was confirmed by participating managers:

> I cannot say the ERP system is easy to use and easy to understand.
>
> Financial manager (4, 3years)

> I would say that the Baan system is difficult, particularly in Jordan.
>
> Plant manager (2, 4 years)

However, implementing and operating ERP systems results in a great many risk factors if these systems are not well understood by people who must know how these systems work and the requirements of these systems. Managers reported:

> Really, the disaster in my opinion is when the users do not understand these systems, do not know what to do, and how they have to do it.
>
> Financial manager (4, 3 years)

It was mentioned that some of the risks that could increase when users find it difficult to use ERP systems and when they do not understand how these systems work. This can result in resistance of users, incorrect entry data and flowing errors which could have an effect finally on the quality of information; it could also lead to financial misstatements.

> The better the understanding of ERP systems, the better the use of these systems; fewer errors could occur.
>
> HR manager (4,3 years)

> Another risk we faced related to end users. This was their inability to understand the integration process of this system. They could not imagine that any process carried out on the JDE had a financial effect and would have an effect on the next user as well.
>
> IT manager (4, 6 years)

Moreover, difficulties in using and understanding ERP systems are based on the users' experience which varies from user to user. However, certain factors can make an ERP system easier to use and understand. These are: effective user training, user involvement, and obtaining effective support from skilled and knowledgeable IT experts or external consultants. All of these lead to better understanding of ERP systems.

> The complexity of an ERP system, which make it difficult for it to be understood by users, is an inherent risk in the system. To reduce this kind of risk, we should have good training for each user on his module in the ERP system to give him a good understanding of his module.
>
> Financial manager (2, 4 years)

### 6.3.2 *Failure to redesign business processes and carry out major customisation of ERP*

Failure to redesign business processes and make major customisation is considered as a major risk that could make ERP systems fail in many Jordanian companies. Most of the IT managers who were interviewed mentioned this issue. They believed that customisation is unnecessary and should be prevented during the implementation of ERP systems. IT managers said:

> As you know, many companies that have implemented an ERP system have not accepted it as it is but have customized it.
>
> IT manager (6, 7 years)

> Really, major customization is a big problem and leads sometimes to failure in the implementation of an ERP system.
>
> IT manager (3, 7 years)

> Even our company has agreed with the supplier to implement an Oracle system as it did not need any changes, but when the supplier started to implement the project, he faced a lot of problems. For example, key users changed their minds and they started demanding modifications according to their requirements. Each end user wants an Oracle system to fit his and his department's requirements, and they do not think how their requirements affect others. So there was a kind of contradiction between the ideas and the requirements. Really, each person sees ERP systems from his own viewpoint and thinks how it will help his department to perform its work. There was no integral viewpoint regarding the ERP systems in general. Finally, there was a disagreement between the supplier and our company. However, in the end, we stopped implementing the Oracle system after we had spent one year implementing it.
>
> IT manager (4, 6 years)

IT managers were sure that customisation caused a lot of problems as regards the performance of ERP systems in a company, and that it cost the company a huge amount of money to implement these systems while it eliminated their benefits. Also, the company could not then benefit from updating their ERP systems. So, if the company required its ERP systems to be up-dated, any customisation that had been made would be removed and then the company would need to re-customise it again. One of the IT managers mentioned:

> In our company, significant modifications have been made to the ERP system to meet our policies and ways of working, which was really a disaster. The company has taken 7 years to implement the ERP but finally this has failed and a large amount of money has been spent.
>
> IT manager (3, 7 years)

IT managers mentioned that ERP systems are designed in a standard way and these systems are designed to suit the business processes of most companies but, in some cases, the ERP systems do not fully correspond with the business processes of the company. Here, the company should change its business processes instead of modifying the ERP systems. The IT managers commented:

> Because an ERP system is a ready-made system, it sometimes does not achieve all the company requires so that the company has to change its business processes to suit the ERP system. The company should not customize or make any changes to the ERP to suit their old ways of working. Really, if they do any customizing of the ERP, they will get a lot of problems. In my opinion, I definitely refuse customization. Really, these people are not aware of the problems and so want to make modifications.
>
> IT manager (2, 6 years)

> In my opinion, if the ERP system does not achieve the aims of the company, and the company wants to customize the ERP system, it is better to design new software to meet what they need, and satisfy their way of working instead of buying an expensive ready-made package then carry out a lot of customization on it. Another point: if the redesign of a business process is not planned well, it can be a real disaster.
>
> IT manager (3, 7 years)

> You could not implement an ERP system if you did not make a full study of your business processes first, then compare these with the system functions to see if you need to change your business processes or not. But, most of the times work flow in the company differs from the ERP system functions because ERP system functions are at an international standard. So, when the business processes in the company are not at the same level as international standards as it is in ERP systems, you have to change your business processes. Some companies refuse to change their business processes so they change the processes in the ERP system to fit their way in working.
>
> IT manager (8, 7 years)

Although ERP vendors and IT managers warn their customers about the risk of customising ERP systems, the managers, such as the financial and accounting managers, and the manufacturing managers, did not see the customisation of ERP packages as a risk that could threaten their ERP implementation with failure. Instead, they thought that customisation would help them to make the work easier; they also thought that the ERP system would not fulfil all their requirements. The opinions of those managers are presented below:

> I think it is better to customise the ERP system; this is better than redesigning the business processes.
>
> Financial manager (3, 4 years)

> You know, redesigning of business processes is a big problem. I believe that an ERP system is not about redesigning or restructuring your work.
>
> Production manager (1,3 years)

> We did not redesign our business processes; we only made simple modifications to ERP business processes.
>
> Financial and accounting manager (6, 4 years)

> There are some kinds of weakness I can see in the system but still you can never get an ERP to be as perfect as you want. So you have to customise the ERP to fit your needs.
>
> Financial and accounting manager (1, 9 years)

This manager continued by saying

> They did not redesign the business processes which was wrong. This why sometimes I say I need the export department's expenses and they are not there. They are using the old account charts, so there is no cost centre pertaining to the export department. So I do not know how much has been spent in terms of export activities, salaries, and travelling expenses. As a result, I have to do this manually and it is my plan to redesign the account chart; this is one of my priorities. I have created a basic thing but still I think the account chart needs redesigning to give you more detail about the cost centre. For example, the IT department does not have a cost centre so all the salaries will be charged to the general and administrative departments, which is wrong.
>
> Financial and accounting manager (1, 9 years)

> Another point I want to talk about is customization. In our company we did do some customization but within specific criteria permitted by the JD. Edward company. We made a minor customization to the sales module because something did not match 100% to our needs. For example, in the sales department, the truck that gets filled with cement is usually registered as empty and is weighed. It is then loaded with10 tons of cement and weighed again. The difference between the truck's weight as full and empty should not exceed 5 with thousand

> increases or decreases. This difference should be identical to what it says on the docket card that goes to the merchant. All these cases are not present in the JD. Edward system. Also, we made sub-modules and linked them to sale modules. One of these modules named authorities which means that the merchant can authorize any person to load the goods instead of him. This facility is not present in the JD. Edward system; it is special only to the Jordan Company.
>
> Financial manager (4, 3 years)

He continued by saying:

> One other thing I would like to mention is that, due to the huge pressure placed on the our Company in terms of the volumes of orders from merchants, we are obliged to distribute the cement among them in a fair way. So we made a small module that allocates to a merchant a specific share in a specific time and according to his annual consumption. The last customization we made was on the reports system because the form and design of the reports as presented in the JD. Edward system were unacceptable. So, we changed all the reports that were unacceptable to users and we made new reports. For example, a user should get a report after entering a sale order. Usually, in the JDE, you have to open another screen after you have finished entering the sale order to print the form for the sale order. For this reason, we made an exit bar and an icon on the same screen as the entry for the sale order, so that, after someone has finished entering the sale order, he can click onto that icon for a direct print. Really, we made this customization to make the work of the user easier.
>
> Financial manager (4, 3 years)

In the end, the IT managers who were interviewed strongly agreed that the company should not do any customisation to the ERP package; otherwise, the risks of the implementation failing were likely to increase significantly. However, before deciding to buy ERP systems, managers should study their requirements and choose the appropriate ERP software which fit the business processes in their company in order to eliminate the redesign their business processes or reduce the customizing of the ERP business processes.

Reengineering business processes and major customization are more probably have an effect on the accuracy of the information produced within these systems which consequently could lead to misstatement in financial statements. One of the problems that should be considered if it has been decided to customise the system is having knowledge of ERP systems and how to carry out the customisation properly.

### 6.3.3 *Lack of top management support*

It was indicated by some IT managers that a lack of top management support is one the most important risk factors that could cause the project team to face many difficulties and problems; this could also lead to the failure of the implementation of the ERP system. Top management are not so concerned about the implementation of the system as they often believe that this is the job of the provider and IT experts. One of the IT managers stated:

> In my company, implementing ERP was personal effort, not because the top management did not want to support it, but because they were so busy with their daily work, so they did not have time. The messy thing was they did not give any priority to the ERP system. That's why it was my challenge because if we do not succeed, why am I here?
>
> IT manager (1, 7 years)

> In our company, they implemented the ERP system over 7 years.... one of the reasons for this was that the upper management were not involved in each stage of implementation, and their support was not strong as it should have been.
>
> IT manager (3, 7 years)

> Really, there was no good business team that was supported by high-level management and that was responsible for the success of this project.
>
> IT manager (4, 6 years)

IT managers believed that the upper-level managers had the authority to make decisions about the completion of the implementation of the business processes and that when problem occurred they just made users accept these systems. One IT manager said:

> In June we were delayed by three months in the implementation and our transactions were also late by three months because the system was not implemented. This was a major problem. I did not try to impose the general manager's (GM) decision, I tried to do it by myself, but, in the end, I had to make him interfere and follow up details by himself. This supported me and empowered me to be willing to implement the ERP. He proved to be more interested in this, empowered it, and added some instructions. He was very strict. He supported people and users who were working on the system. However, in the end, everybody wanted to finish his/ her work and so on.
>
> IT manager (1,7 years)

From the above points, it is clear that IT managers feel that top management support and involvement is essential at every step of the implementation, from its beginning until it goes live. On the other hand, financial managers are not so concerned about top management support as it does not have a great effect on the implementation of these systems. Top management should have a regular meeting, either weekly or monthly, in order to know how the project is progressing, ensuring that everything is happening on time, identifying difficulties and problems, and making recommendations. However, lack of top management support are more likely to increase resistance of users to accept these systems, lack of change management, and delay and not completing implementation of ERP system as scheduled.

### 6.3.4 *Insufficiency of Resources*

Another risk factor related to the implementation of ERP systems, which was of concern from the IT point or view, was the failure to allocate realistic sufficient resources. As stated by the IT managers, the implementations of the ERP system particularly in developing countries as Jordan often took longer than they expected and therefore its cost was greater than was allocated by the company.

> In our part of the world, while we don't respect the timing of the project plan and we don't commit to the tasks and their duration, we will never be able to reach that level of professionalism in ERP implementation. There is a need to respect what is written in the documents (deliverables). In our company, we planned to finish implementing the JDE system in one year, but actually we implemented it within 7 years, and it cost more and more money.
>
> IT manager (3, 7 years)

In this respect, the managers noted that the difficulties and problems they faced during the implementation caused project delays and cost more such as lack of top management support, lack of champion, users resistance, customization of systems, and unclear or misunderstanding users requirements; this is illustrated in the following comment:

> The problems are that top management does not provide good support, project leaders are not well qualified, users are resistant, it is difficult to customise systems, and user's requirements are often misunderstood; all of these delay the project and make it the cost more money.
>
> IT manager (3, 7 years)

> In order to reduce the possibility of implementations of the ERP system failing, they took the decision that this system had to be implemented successfully under any circumstances and for any cost.
>
> IT manager (4, 6 years)

### 6.3.5 *Lack of change management*

It was reported by IT managers that change management is a major factor in the success of an ERP implementation. So, when the management does not accept change, it could cause a lot of problems in implementing ERP systems, as well as leading to a failure to recognise the benefits of ERP systems. Change management involves changing the change the upper management, company's policies, procedures, and regulations that they use in carrying out their business. This was pointed out by IT interviewees:

> Really, at that time we made significant changes that led to the successful implementation of the system. The first of these changes was to change the upper management. There was a desire to make any change that the system required. Really, the old upper management was the one of factors that could have lead to failure in implementing the Oracle system because they did not understand the ERP system, and did not want to change of their procedures and work policies. Really, French people from the Lafarge Company helped us to overcome the obstacles and to form a new upper management structure with open-minded mentalities. Changing our top management was a positive point in implementing the JD. Edward system. Also, we changed our procedures, policies and business processes to suit the new system.
>
> IT manager (4, 6 years)

> To manage and reduce risks, the old ways of doing business have to be changed.
>
> IT manager (3, 7 years)

> Implementing the Baan system imposed some new procedures to comply with the ERP system. Actually, we made very big changes in our financial policies and cost accounting policies in order to avoid failure in the implementation.
>
> IT manager (1, 7 years)

In addition, implementing an ERP system changes the ways people do their jobs. After implementing the ERP, the staff in the cost accounting department moved to other departments as the company did not need cost accounting staff to do their work manually; they had nothing to do once the ERP was implemented so the cost accounting department disappeared and became one function of the financial department whose responsibility is only to report at the end of the month. The staff only extract the report from the system; this includes some information concerning purchasing, manufacturing warehouse and sales. That was a major change. Thus, such systems not only impose changes on accounting and manufacturing departments, they also result in change for the IT department. One IT manager stated:

> Implementing an ERP system had a positive impact on my department. It added value to the IT team. It has added more and more to our responsibilities; it has added more to our tasks.
>
> IT manager (7, 6 years)

> When we talked about an ERP, the first thing that came to my mind was the finance because the biggest part of the implementation would take place in the finance department so you would generally expect to see big changes there, as well as in other departments such as the manufacturing department which would use other modules such as bills of material, the order point for the inventory. There was often too much pressure on us to get the ERP system implemented in the finance department.
>
> Financial manager (1, 9 years)

Moreover, change management includes user involvement, training, communication, top management support, and business process reengineering. A lack of top management support, lack of user training, and lack of communication could all lead to a lack of change management and a lack of change management could affect the success of an implementation of an ERP system.

### 6.3.6 *Unclear/ misunderstood users' requirements*

Financial managers mentioned that difficulties in understanding users' requirements during the implementation of ERP systems is another key factor that could have an effect these systems and possibly lead to failure. In addition to the requirement for users to express their needs when implementing an ERP system, when customizing these systems, users' requirements are also needed. In order for users to make clear and correct requirements, they have to have enough skills and experience in information systems. In this respect, a financial manager mentioned:

> Usually, customization depends on the key users' requirements. So, in our department, the users had experience of the financial system as they had worked with it for two years. This helped them to define their requirements to the ERP supplier. Thus, they knew what their requirements were, and what difficulties they faced in getting some information in the old system; they wanted to avoid such problems with the new system.

Financial manager (8, 4 years)

In addition, users should have experience of ERPs or information systems in order to be able to express their needs, while the supplier and IT managers should have business experience in order to understand the users' requirements. So, suppliers need to meet with the purchasing, warehouse and financial managers and with users in order to know their ways of their working and how they will deal with the ERP to meet customers' needs. For example, they should ask the purchasing department about how they purchase materials, how they introduce their suppliers, the types of material they buy nationally and internationally, the times suppliers are paid, and the list of the suppliers' names. In the warehouse department, they should ask the warehouse manager about the number of stores they want to open, the number of locations in the store, how he wants the location to be introduced, and the names of locations etc. Once the consultants understand the nature of the company's work, they should obtain agreement from customers about the way they deal with the ERP program to know if it fulfills the customers' needs. This was discussed by IT managers:

> Top management in our company planned to finish the Baan implementation and to go live with it within 6 months, but actually the implementation took more than 14 months due to the lack of knowledge of both the customers (users) and the supplier (the Baan provider). The internal staff did not understand what was required of the ERP and the supplier did not know the internal culture of the company.

IT manager (1, 7 years)

### 6.3.7 *Lack of a champion*

An important point that could be raised here in relation to the risk of failure of an implementation of an ERP system is the lack of a champion. The project leader has the authority to decide on the completion of business processes.

> To successfully implement an ERP, you should have a good champion, who has the ability to make proper decisions in the implementation.

HR manager (4, 4 years)

There is disagreement about the qualifications needed for project leadership. IT managers believed that the leadership should come from the IT department while financial managers believed that there was a risk of failure of the ERP systems if the company appointed a project leader with just an IT background. So, financial managers thought that the champion should have knowledge in both IT and business. Financial managers talked about problems of leadership in knowledge accounting:

> To make the ERP system a success, the project manager should be from an IT and Accounting department. One of the problems that we faced while implementing our ERP systems was that the ERP project leader was from the IT department and did not have experience in business.
>
> Financial manager (6, 4 years)

> The project leader should work hard, know everything, and be involved in every step.
>
> Plant manager (2, 4 years)

It was pointed out by financial managers and internal auditors that although IT staff and managers who conduct the implementation of ERP systems have better experience with these systems, listening to and following them is still sometimes risky because they do not understand the business area, and they do not have knowledge of financial and accounting standards, or even credit and debits, and payable or receivable. In reality, it is a big risk for such project leaders to support financial systems if they do not have even a basic background in this area. An internal auditor stated:

> One of the biggest risks from my viewpoint is that IT people do not have any knowledge or experience of accounting and financial systems; they are a supporting team to the ERP system. As you know, ERP systems are accounting systems. Really, it is strange for IT people to support an accounting system when they do not even know if this account is a debit or credit. They do not know if this account is payable or receivable.
>
> Internal auditing manager (5, 5 years)

> It's no surprise that there is a lack of IT people with knowledge in the accounting field. They don't know the basic things such as debits or credits. For example, before we went live with the ERP system, we tested it. So while we were testing the balances' system, we found a 700,000JD variance between the debit and credit accounts. As you know, it must be zero. So we complained and asked the supplier to review it again to detect the errors in the system. They came back saying that they had reduced the variance to 3000 JD and the IT leader accepted this variance. This is impossible. The IT people do not have any background in business. They do not know if this account is in credit or debit, or whether an amount is expenditure or revenue.
>
> Financial manager (8, 4 years)

He continued by saying:

> In my opinion, there should be two leaders, one leader from the business department to define

> the needs for each department, and another from the IT department who should implement the business departments' needs. Then the business department should test the system to see if it meets their requirements. After that, the leader should approve it.
>
> Financial manager (8, 4 years)

### 6.3.8 *Lack of training of end-users*

The analysis of the interviews revealed an important issue associated with the implementation and operation of ERP systems in Jordanian companies, was inadequate training. As many of the managers mentioned, when the training is insufficient or unsatisfactory for users, the successful of the ERP implementation could be threatened; this will extend to threaten the operation of the ERP systems as well. Managers commented:

> In my opinion, a company can minimize the risk of failure of its ERP systems, firstly by training its staff and raising awareness among them.
>
> Financial manager (3, 2 years)

> No one on the staff knew what ERP was before the company implemented it. Even after implementing these systems in our company, the information that we got about it was not enough.
>
> HR manager (4, 3years)

> We did not give them enough information about ERP to stop them getting confused.
>
> IT manager (8, 7 years)

Lack of training is one of the major risk factors that not only increases the likelihood of failure in implementing ERP systems, but also increases users' resistance to using these systems, delays in their work. Furthermore, it has a negative effect on the work of ERP systems (the input and output of the systems) as if users are inadequately trained, they will face difficulties in understanding and using ERP systems, as well as the number of data errors that will be made by users will increase. Training is an important issue that should be taken into consideration to make the ERP systems work well. So, when users are properly trained, they will be able to do their job correctly without making any errors. Users should be educated and taught that any mistake they could make will have an effect on the work of other people in their department and in other departments.
One financial manager said:

> As you know training is an important factor because it has an influence on other risks that are associated with failure in the implementation of ERP. If users are not trained well, they could face difficulties in understanding and then they cannot use these systems or they use them but make a lot of errors.
>
> Financial manager (4, 3 years)

> Another type of risk is that users are not trained well, and do not have sufficient knowledge in ERP systems. So we should not let users do any data processing using an ERP system or we should not give them authorization to access the ERP system except after a long period of experimenting and not until we have made sure that the user has a clear understanding of the functions he is utilizing. So, we should not give him authorization until we have made sure that his work on the ERP system will not affect the confidentiality and health of our financial information.
>
> Financial manager (2, 4 years)

Some of managers mentioned that the training which is usually provided for users is basic training; not a lot of detailed information about the systems is provided. The training should teach users, both theoretically and practically, about how they carry out their new role using these new systems. So, what methods can make training effective and useful for users? One of the suggestions made by the interviewees was to train users partially. Users should be trained in stages. Training should start from the beginning and continue during the implementation and should be finished before the system goes live to make sure that users are able to use ERP systems. Also, the training should extend post implementation. HR managers explained this as follows:

> I think it is better to start training with general information on ERP systems, how to use these systems, and problems that could be made for other users if any wrong numbers or letters are entered. Then give them a chance to practise in order that they don't forget what they have been taught. Then, see what their opinion is about these programs, the difficulties and problems they faced using it, and how to sort them out. Then continue training, and so on....
>
> HR manager (4, 3 years)

> But you know the other problem that we faced was that when we had implemented the ERP they called for training which is usually 20 days. Really, they need to get training gradually. They need first primary or basic training for 3 or 4 days which introduces what people can do for with basic functions and then let them go and start working by themselves with supervision to follow them up. Then, after another 30 or 60 days they could have more training as they will have questions and they will know what they are talking about. They need to have training in different phases like phase 1, phase 2, and phase 3; really, I would prefer that.

Financial accounting manager (1, 9 years)

> We start training users. So we plan a time for training each department in the company such as users from the purchasing, warehouse and financial departments. Also, we give the users a chance to work on the Baan system for testing only before we go live. That helps us to break down the fear of using this system and reduces resistance to the Baan system; also users become familiar with the system.
>
> IT manager (2, 6 years)

> When we decided to implement Scala, we had a two-day seminar inside the company for main or key users and we explained to them about the ERP system and the objectives for its implementation in our company. Really, this step helped us to reduce the risk of users being resistant to this system. After that, we put on a one-week training course by the supplier for them which gave them just general ideas about Scala. Then we offered training from a person inside the company who had a great deal of experience with Scala. He gave them more detail about how they could do their work on Scala.
>
> Plant manager (6, 4 years)

What is more, as all the companies that have implemented ERP systems have provided the training, the issue is about the quality and precision of such training. Interviewees shed light on another point that should be considered during the process of training users: the level of the users' knowledge and experience. Management should know the users' requirements and train them according to this and their level of expertise. Some ERP users have no knowledge at all, not only about how to use the ERP systems, but also even in how to use a computer. One of the financial manager said:

> The problem here is not about providing the training but about how to train users....
>
> Financial manager (7, 3 years)

> Before we implemented the ERP system in the Company, we worked on a simple system named "act software". Staff in the company had not worked on an ERP system before as they were working on a manual system using paper, so it was difficult to move the employees from manual working to a complex ERP system. The act software was specialized for a small company. We worked with this system for two years until the employees were used to using computers and doing their work by using a financial system. They got knowledge and experience in using a financial system which helped them to use ERP systems.
>
> Financial manager (8, 4 years)

> So in my company, the end users were provided with good training. The employees had previous

experience and knowledge about how to deal with the systems that we designed in 1995, such as a sales system, inventory system and the accounting system, but these systems were not coherent and unified. They were in Arabic, not English. So we completed for them the information that they needed in order to do their work on the JD.Edward system through training. In addition, we improved their English language skills until they had the ability and skill to deal with the English screens that were presented on this system. A decision was made by the Company that we had to implement the JD.Edward system in English."

Financial manager (4, 3 years)

Another point which was discussed during the interview was that the users with a high level of experience with ERP systems should help to train users who have a low level of expertise or those who have no knowledge or background in ERP systems. Management should trained users to make them able to understand their new roles when using ERP systems. In addition, if users are trained well, this could reduce the need to bring in external consultants, as those trained users could support the company through the knowledge they have gained and train other new users.

Some companies reduce the users' training because it is expensive.

IT manager (2, 6 years)

In our company we always have new training due to staff turnover.

Plant manager (2, 4 years)

In addition to providing users with adequate training, they should have a clear flow chart or clear mapping to help them understand how this system works, how the processing of data occurs from the beginning until outputs or reports are provided. As one financial manager said:

Users who work on the Baan system should have a flow chart or system mapping. They should study and understand this mapping so make sure that the mapping is correct and leads to correct and reliable financial information. If the mapping is wrong, the information that you get from the system will be wrong

Financial manager (2, 4 years)

### 6.3.9 *User Resistance*

Resistance was mentioned many times by the interviewees who noted how this might make the implementation of the project fail. It has been found that the resistance of users was a significant risk that could face companies when they decided to implement ERP systems. Interviewees commented:

> First of all, the main risk that could actually face any company is a kind of resistance to introducing the ERP system; this is normal especially in this part of the world (i.e. the Middle East).
>
> Financial manager (1, 9 years)

> The risk is that when people are not willing to use ERP systems, it is risky to implement such systems.
>
> Plant manager (2, 4 years)

There are many reasons why users might be resistant to using ERP systems, as discussed by the interviewees. To begin with, they may be uncomfortable with ERP systems; they could be unfamiliar with them; have a fear ERP systems and/or computers; lack knowledge, not only of ERP systems but also of the uses of computers; or they might fear that these systems will replace them. The interviewees commented as follows:

> Really, the Oracle system is an excellent package, but there was discomfort about implementing an integrated system on the part of key users. For example, the purchasing department had its own preferred, special and separate purchasing system; in the inventory department, there were two stores and each of them has a motivation which differ from others. Therefore, each department was uncomfortable about implementing an integrated system.
>
> IT manager (4, 6 years)

> Because users are sometimes not familiar even with the PC, imagine the difficulties that we have had in implementing an ERP system. They feel more confident with dealing with books and a pen.
>
> Financial manager (1, 9 years)

> We moved directly from a manual system to a fully integrated automated system. One of the difficulties was that users were against the change because they were afraid of using these systems. They do not have any background in or knowledge of this system.
>
> Financial manager (5, 7 years)

> The staff are unwilling to implement a JD. Edward system because they think this system will replace them. Due to the computer literacy that was available there was a high risk of accepting the system and there was huge resistance to dealing with it.
>
> IT manager (3, 7 years)

Moreover, users often reject change and the use of ERP systems that are going to affect their roles, work, position and responsibilities. If they fear the unknown effect of technology on their work, users will be more resistant to technological change.

> Usually, managers tell them that using ERP will make their workload lower then that means the company will say: "Why do we have 10 people in the finance department or another department? well, let's make them seven".
>
> Financial manager (4, 3 years)

> If they are sure that the result on their job will be positive and it will make their work easier, they will not mind this implementation. I would say it is the uncertainty of whether they will be able to cope with the new changes; they are not sure about that.
>
> Financial manager (3, 2 years)

In reality, Jordanian users, especially long-serving employees, do not like to change their ways of working because some of them are very traditional in their thinking and fight against any changes.

> The people are unwilling to use the ERP system because they are against any change. They are used to controlling a thing in a certain way, so if they want to change they have to create a new method of control and therefore they do not want to do this.
>
> IT manager (1, 7 years)

> Users were unhappy with using the Scala system because the people do not like changing.
>
> Financial and accounting manager (6, 3 years)

In implementing any ERP system, there must be a kind of orientation in the beginning, making the ERP systems clear, as well as the stating clearly reasons for implementing these systems. Interviewees mentioned the importance of finding a method to make users accept working with ERP systems.

> You need to make the ERP very clear to everyone involved in this process; this can help a company to move ahead. Also, the reason why we are having an ERP must be made very clear.
>
> Financial manager (1, 9 years)

To overcome the resistance of users, we should motivate them, know what difficulties and problems they have with the ERP systems and sort them out.

Financial manager (3, 2 years)

We have to convince users to accept these systems. They should explain the reasons for implementing these systems and the benefits of ERP systems. We should give users a chance to express their desires and interests openly.

Financial manager (4, 3 years)

In the beginning of the implementation, we found a lot of resistance to using the Baan. So you have to find ways or methods to overcome this resistance, such as giving rewards, or giving warnings to deter him or her, explaining the features of the ERP system and how the ERP will make their work easier.

IT manager (2, 6 years)

Company should not force users to accept these systems. However, in some companies, and due to the hierarchical culture, top managers could decide to implement ERP systems in the company, even if users do not want it.

We need to clarify that ERP system, we need to think about the employees in a positive way because they served the company for 13 or 14 years, and it is not right to get rid of them because you have an ERP. But if you find problems and find that some people are resisting after starting the implementation, I would not hesitate to get them retired; this happened to me. I have tried my best to explain the benefit that we will get after implementing an ERP, how the company can move ahead, what plans we have, but there are still some people who will have a negative attitude or they are not willing to cooperate and I will not allow them to negatively affect the ERP process. So I will get them removed and it may have to be the end of their service. Sometimes you have to make such decisions and what I will say is that I try to be fair to them.

Financial manager (1, 9 years)

Really, believe me, in most companies in Jordan, there is something wrong here. I will not say it is a bad culture but, as you know, it is not like it is in Britain. Because they do not get people oriented it does not help in trying to make the process helpful or peaceful. It is very important to orient people and make them well aware of the reasons why we need to get the ERP system implemented.

Financial manager (7, 3 years)

So we cancelled the old system and we forced them to use the new system.

Financial and accounting manager (6, 3 years)

Other factors that could help get rid of users' resistance include training users effectively, making users more involved, developing effective communication between users, and getting effective support from skilled and knowledgeable IT people or external consultants. All of these factors help users to gain knowledge and experience with ERP systems and encourage them to accept and start using these systems. One financial manager commented:

> In my opinion, implementing a simple system for a short period before implementing an ERP system is better than implementing it directly. This helps users to get experience in using a financial system which leads to defining clearly the requirements for customization, and to reducing the users' resistance.
>
> Financial manager (8, 4 years)

### 6.3.10 ***Lack of involvement of users in the ERP system***

Choosing qualified and knowledgeable users to be involved and participate in the implementation of an ERP system could make the implementation easier and less failure. Interviewees believed that the user participants should be from the IT staff and include other staff from different business areas. Each manager of a company department should carefully select more than two users from his or her department to represent the needs of their department. One manager's comment was:

> The company could face a lot of problems when there are not enough users involved to work on it. Many staff here were not well involved in the implementation process. They selected one employee, and they focused on this employee, which was really a big mistake. Unfortunately, four months ago he moved to another company so he took 80% percent of the knowledge with him; that is a real problem. When you do not pass on knowledge to all of the employees, that will be risk. Really, now we are suffering because the one who had a detailed knowledge of the ERP is not here. It is very important to get all employees involved in the implementation and, in the end, equal information will be distributed across all the employees, so if one leaves, you will not suffer
>
> Financial manager (4, 3 years)

> A second point that could have lead to failure in implementing the JD. Edward was the formation of a team from the IT and business departments who were not well qualified. In my opinion, it is important to choose good staff to be involved in the implementation stage.
>
> IT manager (4, 6 years)

However, interviewees also argued that the sufficiency and suitability of users' involvement in the implementation of ERP systems will reflect positively on the effectiveness of communication between users. One manager said:

> The point I would say here is, when the users who are involved are unqualified, the communication could be poor.
>
> Financial manager (4, 3 years)

Parr and Shanks (2000), Wright and Wright (2002), Al-Fawaz, Al-Salti et al. (2008) also discussed that insufficient users' involvement in implementation of ERP system could enhance the risk of ERP implementation failure. However, lack of users' involvement could lead to difficulties in understanding and using ERP systems, resistance of users, lack of users experience.

### 6.3.11 *Ineffective communications between users*

Ineffective communication is one crucial aspect that was considered and perceived by managers to be one of the risk factors that might cause the implementation of ERP systems to fail. The difficulty with communication is that users are not only from one department; they are from different ones and therefore have different perspectives. Some users have auditing and financial accounting backgrounds, others have HR, or production, or IT backgrounds. This could make communication between the users problematic. One of the managers commented:

> Poor communication between users causes delays in the implementation of the project which is then not delivered on time.
>
> Plant manager (2, 4 years)

> As users come from different departments and different backgrounds, communication can be ineffective.
>
> Financial manager (4, 3 years)

When communication between users is effective, this adds more value to the success of ERP systems. In terms of this communication, new ideas could be suggested, agreement and disagreement concerning the procedures could be considered, any ideas could be considered, and explanations and clarifications could be made regarding any activities.

So, communication between users is important as it helps them to gain more knowledge about ERP systems.

### 6.3.12 *Skill mix*

To reduce the possibility of failure in the implementation of ERP systems, companies should be more awareness of the importance of choosing an ERP provider with a high level of skills and expertise as this is needed to implement these programs effectively.

> Technical support or consultants are very important because if I face any problems, I do not want to wait many months until they sort this out for me. So, it is very important to choose suppliers who will provide you with a reliable ERP system, who have a large number of client and a good reputation, have many success stories from companies about getting their ERP system implemented, are very knowledgeable about implementing an ERP system, and have had experience of most of the problems that arise from these systems, as well as knowing how to deal with them to sort them out. Therefore, before choosing an ERP system supplier, you should ask them for a list of their clients, then go and meet their financial manager and the IT manager and ask them what problems they faced when they implemented this system. Have they achieved the aims that they planned? Really, this step is very important.
>
> Financial accounting manager (1, 9 years)

> Last year there was Bann conference in the Emirates for all companies which had implemented Baan in the Middle East and we raised a problem with Baan's IT support staff. One company in Egypt moved from Baan to an Oracle system because the Oracle vendor was very active and expert. The problem was not to do with technical risks or technical bugs: the problem related to staff knowledge.
>
> Production manager (1, 3 years)

It was noted that some project leaders had poor skills and expertise or some who did not have knowledge of both the technical and business fields. So when a company does not have sufficient internal expertise and skilled people for implementing ERP systems, they should bring in external consultants to support them in implementing and understanding the ERP systems, and also in training users. Obtaining highly skilled and knowledgeable external consultants who share the same culture and ways of working is important if the implementation of ERP systems is to succeed. Without consultants, the implementation could be difficult or could be delayed, or might not be completed, or users may not understand these systems and then may not be able to use these systems properly. However, bringing in consultants with suitable knowledge of the business area is sometimes difficult or unsatisfactory. The interviewees reported:

> The IT staff and manager do not have proper knowledge about financial applications and this was a big problem we faced. So, if we had any questions, she would say I do not know how to sort it out. Really, this was strange. So now we are doing training for IT employees on Baan which is really too late. You should be able to rely or depend on a consultant to sort out any problems. Sometimes you need a consultant if there is a complicated problem, but if we have a simple problem it should be sorted out by IT employees if they have good qualifications and expertise in Baan.
>
> Financial manager (1, 9 years)

> If we do not get expert consultants, the company could face difficulties in the implementation of the ERP and be unable to implement it.
>
> Financial manager (7, 3 years)

> I got many consultations, but they were unsatisfactory.
>
> HR manager (8, 3 years)

#### 6.3.12.1 *Lack of user experience*

Another risk factor which could negatively affect the implementation or operation of ERP systems, as perceived by financial managers, is lack of users' experience. An IT manager noted:

> I faced a lot of problems as the customer is unconscious to do a good thing and the supplier is optimistic that this customer will do perfectly. And actually I was the only one standing in the middle.
>
> IT manager (1, 7 years)

> Another kind of risk related to ERP systems is that users who are using ERP systems do not have any knowledge or background in IT.
>
> Financial manager (6, 4 years)

Lack of user experience with ERP systems can cause problems during the operation of these systems. Users can make a lot of mistakes during the entry of the data which finally could make the financial information inaccurate. Therefore, users should gain knowledge and experience with ERP systems through either effective training or through communication with other knowledgeable staff who can benefit others from their personal experience.

## 6.4 Identification of a set of risk factors that could impact on the operation of ERP systems

The risk factors that could occur during implementation without proper management could not only lead to the risk of the implementation failing, but could also have an effect on the post-implementation (operation) of the ERP systems. For example, a lack of user training could increase the probability of users entering data incorrectly. Or, a lack of testing the systems before going live could lead to errors being repeated and the risk of illogical processing. Thus, the risk does not stop once the ERP system has been implemented; it also extends to post-implementation. Indeed, a huge number of risk factors could occur during the operation of the ERP systems, as recognised by managers in Jordan. These must be avoided in order to reduce the probability of failure of the ERP system's operation. One financial manager commented:

> Even if the implementation of the ERP systems is completed, this does not mean that everything will be fine and the systems will be working well.
>
> Financial manager (3, 2 years)

IT managers considered that completing the implementation of the ERP and efficiently going live meant that the operation of these systems would be perfect. This section discusses and presents the risk factors associated with the operation of ERP systems that were mentioned by the interviewees.

### 6.4.1 *ERP software suitability*

The suitability of ERP software is one issue that Jordanian companies faced when they implemented ERP systems showing that unsuitable ERP systems could be considered as a big risk leading to the failure of the implementation. Making the transformation to ERP systems is not easy as ERP systems are designed in developed countries and seem to be particularly specialized for developed countries, not developing ones. ERP systems are western systems and so may be more suitable for companies in the western world rather than companies in the Middle East.

> I would say we will take a big risk if we do not have a proper system. Some managers could make a wrong decision in terms of having sometimes a very basic ERP which does not fulfil

what they need, and then they will have a problem. Or, on the contrary, they may have something that is very complicated like having SAP. SAP is a huge software package which we do not need and may perhaps not be utilized by more than 20 people.

Financial manager (1, 9 years)

One of the production managers pointed out that one problem with using standardised systems such as ERPs is the value of the cost of the products. For example, in relation to the cost of products, ERP systems calculate the total cost of goods at the end of the day without showing the detailed cost of each finished item; moreover, IT experts are unable to solve this problem.

We used to calculate costing in a way that an item had more than one cost, according to detailed of raw materials cost needed for each finished item, its place or location in the company. But, when we implemented the Baan, we implemented standard costs for all items, whatever they were. Actually, using the ERP forced us to do it this way.

Production manager (1, 3 years)

One of the problems that some Jordanian managers believed could make ERP systems fail is the gap between the processes built into the ERP and specific organisational requirements. Furthermore, ERP vendors do not assess the extent of the suitability of the ERP's functionality to the needs of the company and the extent of the possibility of the implementation failing because of the ERP's suitability or lack of it.

### 6.4.2 *Security risk*

IT managers and financial accounting managers argued about security risks. IT staff worried about bugs and hackers who could gain access to the server. However, the biggest risk for accountants seemed to be a lack of segregation of duties among users, unlimited access, licenses not secure. Managers' opinions about security risks are presented below:

It seems to me that the biggest risk is the small bug that is not monitored by any of the modules. Then it will be like a virus which affects all the modules and you will not know about it.

IT manager (6, 7 years)

The risk of hacking relates to any system, not only to ERP systems. However, you should have good security to protect your network by having a firewall, a hardware firewall, and a software firewall.

IT manager (1, 7 years)

> If you manage your ERP with limited authorization, you will be safe.
>
> Internal auditing manager (3, 2 years)

> There is no restriction or control on the main store. I mean that any user who has a password to access the Scala system can access the main store and take material or transfer it to a secondary store. In my opinion, this is risky. As we have a main store and a secondary store for raw materials in the company, employees usually take what they need in terms of raw materials from the secondary store. We should not allow employees to enter the main store. This kind of risk occurred in our company. After the secondary store was empty, one of the employees gained access to the main store and took raw materials as he needed to finish the goods. This is absolutely a big risk. We discovered that when we did a monthly inventory of the raw materials. We found that the main store had fewer raw materials than it was supposed to have. So we went back to the Scala system and we found that employee x had withdrawn raw material from the main store.
>
> Plant manager (6, 4 years)

> If we did not segregate the duties between users, there would be a significant risk. So we should separate duties, such as, one user enters data, another user submits it to GL.
>
> Financial manager (5, 7 years)

IT managers in Jordan did not see the sharing of passwords as a risk. They considered the cost of licenses to be expensive and therefore it might be better for two or three employees to share the same password; while financial managers thought that the sharing of passwords and non-separation of duties among employees is a critical security risk which would make defalcation more likely to happen.

> Another type of risk we suffered in our Company which had an effect on control is the problem of licenses. As you know, licensees are expensive. Therefore, the company bought licensees for only 20 users but actually they gave these licenses to 60 users. So every two or 3 users use the same password. For example, the GL accountant and the AP accountant had the same password. This is really a big security risk because we did not segregate duties among users, we did not limit access to data, and so, if any mistake occurs, we will not know who is responsible for it.
>
> Internal auditing manager (5, 5 years)

> In my opinion, the risk comes from end users. Each user has a password to use the Oracle system. Sometimes, the user gives his password to his colleague to do his job tomorrow because he will be late or absent. In this case, the user has caused two kinds of risk: the security risk of not having a secure password and the risk caused by the non-separation of duties among

> employees.
>
> Financial manager (5, 7 years)

Even if the cost of licenses is high, this does not justify buying 20 licenses for 60 users. In reality, it is absolutely wrong to buy a few licenses in order to reduce expenditure because, in this case, they balance the cost of licenses and security or fraud risks. If a license is bought for each user, the cost will be higher but security risks or fraud will be less likely to occur. On the other hand, if companies do not buy a license for each user, the cost will be lower but the risk of breaches of security or fraud will be higher. Furthermore, with the implementation of ERP systems, work should be separated and each user provided with limited authorisation to access the ERP systems via a username and password that will allow him/ her to do his/her work.

> They thought that if they bought fewer licenses and gave them to many users, they would save money.
>
> Internal auditing manager (5, 5 years)

> Control is important to reduce risk. For example, each user using the ERP system should have authorisation depending on his duties. For example, as a financial manager, I do not have authorisation to enter data or do any processing. My role is only to produce reports. This authorisation should be linked to the position of the user. Users should have limited access to the ERP system to be able to perform their work. Also, duties should be segregated among users.
>
> Financial manager (2, 4 years)

> You should buy licenses for each user. You should give authorization to each user depending on his job description. Authorization should be not given without the manager's agreement. You should have firm control over users to prevent them from giving their username and password to their friends or giving any information related to their work or related to the company to another person. Also, you should change passwords three times or more per year. Actually, in our company, the employees change every time so often but the passwords remain the same. Really, this is a big risk.
>
> Internal auditing manager (5, 5 years)

Sharing passwords could permit users to carry out fraud without the company knowing who was responsible. In other words, it is difficult to identify the user who had responsibility and accountability for the fraud.

> In reality, giving one password to three or four users may increase the risk of fraud and defalcation.

Internal auditing manager (5, 5 years)

> Authorization should depend on the description of users' work. We have to give them limited access to the ERP system. Each user has a code. In the case of any error in the entry of data, we can know who entered this data.
>
> Financial manager (8, 4 years)

### 6.4.3 *Working with two systems in parallel*

Another conflict among interviewees was the insistence of users and their managers to work with two systems at the same time. Most of the IT managers considered that working with the old systems in parallel with the new ERP systems was a risk that could have a negative effect on users. Firstly, if users work on two systems at the same time, they need to make more effort and take more time to perform the work on both systems. This could also confuse users and lead them to make a lot of mistakes which, in turn, could make working with the ERP systems ineffective. IT managers believed this to be a significant risk since it would also encourage those users who are resisting the change.

> One point I would like to make is the fact that having two systems or having your old system running with new system encourages the users who are resisting the change. This might also make the change take longer since, because they still use the old system, they might be not too interested in working on a new system. They will focus more on the old system so you have to take a firm decision about working on the new system with no more use of the old systems.
>
> IT manager (5, 7 years)

Financial managers and other managers did not see running two systems together as a risk; they believed that this would help to convince users to use the new systems, as they could then see the benefits of using these new systems. Also, they felt it would make them more confident in terms of the reliability and accuracy of the data and financial information that were produced by the ERP systems. Managers' comments were:

> We were working on the old system alongside the Scala because we were not sure if the Scala provider had implemented the material production control (MPC) module accurately. The suppliers of Scala had a good deal of experience in implementing the financial module in Scala, but they did not have much experience with the MPC module. Really, knowing how to do something is very important. So, their evaluations were wrong because it was the first time they had implemented the MPC and they were not expecting the volume of orders that we have in our company. Also, the crystal report was not built correctly by the suppliers. So after three months

working on the crystal report, we found that the report did not read accurately from the Scala system.

Plant manager (6, 4 years)

We did double work as we were doing work on the old systems and on Scala. We did a monthly inventory for the two systems, then we compared the results that we got from the two systems to see the percentage of accuracy between them.

Financial manager (6, 4 years)

Usually if you have such risks or if you are feeling uncomfortable about the ERP system, you need to have your current system working with the new system for three to six months. So, you need to make sure you are keeping your data on the other system to make sure the new system is working effectively. Once you have your new system tested and once you have your figures correct for six months, then you get rid of the old system. This is the risk that I can see. Work on two systems at the same time for 6 months. This will convince people in the financial department that this is to the benefit of all of us. Again, I am very keen to make employees part of the process instead of imposing things on them. If you introduce a thing in a friendly and convincing way that would help them in doing their tasks more easily

Financial and accounting manager (1, 9 years)

### 6.4.4 *Incorrect entry of data*

An important point that could be raised here in relation to risk factors associated with the operation of ERP systems is incorrect entries of data being made by users. This appears to be an important issue, as discussed by financial managers. Making mistakes while users are carrying out their work on ERP systems was considered to be a major risk, particularly if these mistakes are not discovered at an early stage. This could also have an effect on other users and make the processing of data as well as the output information incorrect. Consequently, this could have an effect on the financial statements and result in incorrect reporting.

The main risk in using ERP systems at the beginning was that users of the system made errors.

Financial and accounting manager (6, 4 years)

In my opinion, the risk is if a user enters wrong data incessantly and does not stop. For example, if a user enters 10,000 pillboxes instead of 1000, this will lead to producing a wrong report which will show that the percentage of the warehouse has increased. So, the user should be more aware when he enters data. Also, we should have another person to check and audit each user’s work.

Plant manager (2, 4 years)

> Usually, after I enter any material or item in the JDE system, we should carry out a search operation on it through a system used by a different person such as a stock keeper, the purchasing department, or the engineer whose turn it is to make sure that the item is present on the system. Also, we found that some users wrote that some items that were entered were new and that it was the first time this kind of item had been entered. In reality, this item was not new and it had been entered before into the system many times. But because the user was too lazy to search to see if this item was new or old, or because he was not qualified to make the right search, he wrote on the form that the item was new. Really, we have to make sure many times that users follow the correct work procedures.
>
> Financial manager (4, 3 years)

The view of IT managers regarding incorrect entry of data was that this was not so risky as such errors could be found and managed by them. IT Managers stated:

> I think it is very easy to see these mistakes, as data pass through many users and manager: at least one of them will find the error.
>
> IT manager (1, 7 years)

> Mistakes will happen, but I will not say these are because of the ERP system; it is not very difficult to get it right.
>
> IT manager (7, 6 years)

> In using an ERP system the level of risk is lower because you can see things much faster and all online, so if you have a problem in sales or in collections, you will see it the same day, not as in the case of manual books or basic systems, where it will take longer to detect the error. It is much faster to detect problems when you use an ERP system.
>
> IT manager (3, 7 years)

But what is more important in terms of the argument about the importance of the risk of incorrect entry of data which developed here between IT managers and financial accounting managers, is the level of impact of these errors. IT managers think that small errors are not so risky while financial managers are worried about all mistakes (whether minor or major, simple or complicated) that have a significant effect on the accuracy of financial information. The comments were as follows:

> Any error occurring in the company will depend on the level of impact that this error makes.
>
> IT manager (7, 6 years)

> In the first years of ERP implementation we faced minor and major errors due to our lack of knowledge; really, I had a big folder full of these errors. But the impact of the errors that we experienced in our company was not acceptable.
>
> Financial manager (3, 2 years)

As is known with ERP systems, there is an interdependency between the processes. Thus, incorrect data entry could lead to the risk of errors flowing. (More details about the risk of the flowing of errors is discussed later.). However, there are many ways to help in detecting errors, such as reviewing the entry of data and transactions regularly, carrying out logical tests, reconciling balances, and using expert systems.

> To avoid the risk of incorrect data entry, we check all the transactions many times to make sure that they are correct and free from any errors. For example, each entry that is made by a user will be checked first by his manager. Usually, the manager does not approve any transaction until he compares the original copy that he has and the data entered by the user. After that, the transaction will also be sent to an internal auditor to be checked and approved.
>
> IT manager (5, 7 years)

> If an error is made by a user, the next user will notice and correct it so that the error does not expand until it becomes a bigger error.
>
> IT manager (6, 7 years)

> So, in my opinion, if we check the entry of data regularly, we will identify mistakes earlier and correct them. In case we do not identify the errors when we review them, we will find them by logical testing. Usually, we identify substantial risks through logical tests that help us to find substantial mistakes which lead to material financial misstatements. For example, a few months ago, one user entered 200,000 JD instead of 20,000JD in the inventory which led to a sharp increase in the inventory. This type of mistake will be found easily by logical testing. But it is difficult to use logical testing to find simple mistakes such as if a user enters 20,100 JD instead of 20,000 JD. Therefore, the logical tests can be used only to find substantial errors not simple ones.
>
> Financial manager (2, 4 years)

He continued by saying:

> Another way help to detect the errors that relate to financial information, such as errors in accounts receivable, is the reconciliation of balances and by sending statements to customers. For example, if there is error in customer accounts, the customers will ask us to correct it. The non-equality of the accounts shows the presence of a mistake. Reconciliation balances are important things to ensure the reliability of the financial information when using an ERP system. We should reconcile the AP and suppliers' accounts on a regular basis to make sure the figures

> that are presented in the financial statement are correct. Also, we should reconcile our account with the bank on a monthly basis.
>
> Financial manager (2, 4 years)

> Usually I use an expert system in auditing to confirm the health of the data. This software assesses the internal control in the company and give us the procedures or audit programs that we have to follow during or at the end of the financial year. Usually we audit around the computer, not through the computer. We define the company’s activities and we take data from the company, then we enter them into our software. So we do data processing to get output; after that, we compare our outputs with the company’s outputs to make sure that both are the same. If there are any differences between the outputs, we go back to transactions and review them to detect the error and correct it. Also, this software gives the errors that it finds, such as if there is no monthly inventory in the company, it asks what is your opinion and if you see this as significant or not. Or, if it found a difference in the volume of the store, such as 10,000 items are missing and the total volume of the store is 10,000,000 items, it asks if this is significant or not. Usually, if the level of risk is less than 5%, it is acceptable.
>
> Internal auditing manager (2, 2 years)

Administration procedures should not be the responsibility of only one user; all users, including the managers who performed the transaction and approved it, should be responsible.

> Every user has another step that follows after. So if one user does not spot the fault, he should be made responsible too. Then the manager should see that the report contains an error. If he does not revise it, then he at fault too.
>
> IT manager (1, 7 years)

However, many procedures should be undertaken in order to reduce, as far as possible, the errors made by users. Firstly, the company should have an effective control system and an effective security program. This is illustrated by some comments made by managers:

> But really we do not face a lot of errors, maybe because we have a good control system in the finance department. Before they post the transaction, they monitor and check the documents they have; they check against the logic tests they have. For example, when sales staff enter the sales order and send it to the delivery department, the finance people then check the whole sales order and they check with the quantities in the warehouse before they execute the cash receipt. So, there are many steps for monitoring.
>
> IT manager (6, 7 years)

> Managers in each department are supposed to check the data entered into the system to approve that they are right and to reduce mistakes if they are found. But, in reality, they do not check users' work because, when two auditors checked, they found a lot of errors in the transactions. And, in spite of there being errors in the transactions, managers signed them off.
>
> Internal auditing manager (5, 5 years)

> To identify errors in the ERP system, we do an audit for each transaction from beginning to end. For example, when we check the purchase payment transaction, we go back to the beginning of the transaction. So, we check the purchase order, who signed the order, and if he is authorized to sign or not. Then we make sure that the purchases are in the store. After that, we verify that the payment process to the supplier have been carried out correctly .
>
> Internal auditing manager (5, 5 years)

Managers explained that order systems are controlled and restricted by the logical quantity of the order, so when the order is above of the restricted amount, a warning message will appear and request a confirmation for the quantity of the order by clicking 'confirm' or 'cancel'. In addition, one internal auditor mentioned that there should be restrictions in the general ledger (GL). Managers' comments were as follows:

> To prevent these errors from occurring, we require the IT people to build in warning messages that define what is the largest quantity possible in each order. So, if a user enters more than that quantity, a warning message will appear for him to make sure of the amount of the order that he just entered.
>
> Financial manager (6, 4 years)

> In my opinion, to reduce this kind of error, as I know all data are sent to the GL, we should put restrictions in the GL to prevent any incorrect data being sent there. Also, we should have special security, a good control system, and thorough training for users.
>
> Internal auditing manager (2, 2 years)

Moreover, users should understand ERP systems in order to use them effectively without making errors. So, there is a need to support users, not only during the implementation of ERP systems, but also after going live. Users could make a lot of errors, particularly when they start use such systems to carry out their work. Consultants should watch users and help them in understanding system so they can do their job perfectly, make corrections and check the processes. As mentioned before, in order to understand ERP systems, users require an effective training programme as the risk of incorrect data entry occurs because of inadequate users training and their lack of involvement.

> Right now we have had a Baan since 2001 yet after 3 or 4 years my staff still do something or certain things incorrectly. So I asked the IT department to arrange more training for us (that is, additional training) in the hope that, when they receive new training, they will realize that 'I am doing this wrong; there is a shorter way that I can take'. Maybe they can also raise or ask deep questions because they know the ERP and are very familiar with it. So again, it is better to make your training gradual, not do it all at once
>
> Financial accounting manager (1, 9 years)

### 6.4.5 *Repetition of errors*

Repetition of errors is a major risk to the operation of ERP systems generally, and particularly to the quality of data which could finally have an impact on the integrity of the financial statement. Controlling and monitoring is very important during the implementation of ERP systems. IT staff have to ensure that everything is running and working perfectly from the point of view of the network, the firewall, hacking and security controls, the server, back-up, and the data. However, some IT managers mentioned the importance of controlling and monitoring ERP systems; at the same time, they believed it is difficult to control everything and that more trust had to placed in the ERP systems. Some managers mentioned:

> So if you want to stop every minute and check and monitor your controls, then you will need a bigger staff for this purpose only, and this is impossible.
>
> IT manager (7, 6 years)

> Usually a big company would conduct a kind of IT audit to make sure all of the processes are working correctly and test all the processes to make sure that the ERP is functioning correctly.
>
> Internal auditing manager (3, 2 years)

> We should increase the controls in those areas that contain more errors. Also, when the number of ERP users increases, you have to raise the control levels.
>
> Financial manager (8, 4 years)

In addition to testing the controls regularly, there should be two levels of control, preventive and detective, as mentioned by an internal auditor manager.

> Any ERP comes with controls. So, in the case of any mistake or error, you should create a

> preventive control which will prevent the error or the fault even sometimes before it happens; and, in cases where it has happened, you need to have your detective control.
>
> Internal auditing manager (1, 5 years)

### 6.4.6 *Flowing of Errors*

In the operation of ERP systems, a number of financial managers stated that transaction processes are dependent on each other, so any mistake that occurs in one step of the transaction will continue in other steps of the transaction; this will not stop unless it is discovered. One financial manager said:

> As you know, in an ERP system, you have to be in the same date system to execute the transactions because it is a circle; it is all linked together. So if any letter is wrongly entered, this error will follow the letter and will affect what is done in other modules. What we are saying is, if you make a mistake in one department, it will be reflected in another.
>
> Financial manager (3, 2 years)

> This mistake could be a small mistake and have no impact on the financial statements, but the issue is, when this mistake is not identified at the beginning, it could turn from being a minor mistake to a major one and have an effect on the financial statements and accounting records.
>
> Financial manager (8, 4 years)

Thus, the feature of integration that is provided in an ERP system is also considered to be one of the risks when ERP users do not have enough experience or knowledge of how to use ERP systems. In addition to lack of user experience, users are used to work with manual systems, not with the ERP systems where its processes are dependent on each other. Thus, any entry they make will automatically affect the work of other users. Users do not think and are not aware of the extent of the problems that can be caused by incorrectly entered data and the difficulties of correcting such errors within these integrated systems. Such users need to be trained well in order to use these systems correctly.

### 6.4.7 *Illogical processing*

Another problem associated with the operation of ERP systems, as mentioned by managers, is that of illogical processing. Incorrect setting up of the system and a lack of testing are two reasons which result in illogical processing. Regarding the testing of ERP systems before the company ‘goes live’, it was noted from the findings on this issue that there is disagreement among managers. IT managers believed that the testing process is not so important; once the ERP systems are implemented, the company could go live and start operating the systems without testing them. These managers are very confident about the ERP systems since they have implemented them many times. An IT manager said:

> We have implemented these systems many times without performing a test, and everything was fine.
>
> IT manager (3, 7 years)

> When IT people become delay in implementing their ERP system and cannot finish every step on time that they put in their agenda, they just want to complete the implementation so they try to delete other steps, such as testing a process step. This, in their opinion, is not a risky or the probability of risk may be 1%, and it is not the first time they have implemented ERP modules.
>
> Financial manager (4, 3 years)

Financial managers, on the other hand, think that testing is essential and should be carried out before going live. They felt that to start using ERP systems without testing would be risky and a lot of errors could occur later; it could also lead to the flowing and repetition of errors. In addition, internal auditing managers are worried about tracking processes as they can follow the process around the computer but not through it. This makes accountants anxious to test the processes before going live. Thus, testing is an important step in order to ensure that ERP systems are working perfectly in the company.

> But for me, as I am internal an auditing manager, it is risky if the supplier does not test the ERP systems because it makes me worry about validation and the reliability of the business processes which, in the end, may have an effect on the financial statement and my future decisions. So I have to stop them and make them carry out the testing to make sure everything working correctly before we go live.
>
> Internal auditing manager (4, 3 years)

> If the ERP system is not tested properly, this will result in a lot of risks.
>
> Internal auditing manager (1, 5 years)

> To reduce the risk, you have to test the process that we customized to know if it works well or not before you go live.
>
> Financial manager (5, 7 years)

To reduce the illogical processing of business transactions, there is a need to ensure and check that the ERP systems are operating properly, particularly if the company has had to customise some of the processes of these systems. Managers mentioned:

> For an assurance of the health of financial information, they should make sure of the set up of the system rather than making sure of the correctness of the information daily through manual checking. I mean, if you have set up your system correctly, have done your mapping correctly, made sure during the implementation process that processing data using a manual system and the ERP system will give the same results in the two systems, all this will confirm that the information that they will get from the ERP system will be reliable. After that, any changes or modifications to the system and set up should have a clear process and clear testing. Also, these changes might or might not affect the level of financial information.
>
> Financial manager (2, 4 years)

> We always check on security and any errors in the system. If we have any problems, we inform the provider and then they contact the mother company to get them fixed.
>
> IT manager (1, 7 years)

The IT managers noted that, in spite of ERP systems having built-in controls, errors may still occur. One example is that ERP systems can be used in various languages. So, in Jordan, some companies used the Arabic version of ERP systems and in this version the screen displays the debit and the credit sides of a transaction the opposite way round.

> Really, it was a positive point in the success of this system to use the JD. Edward modules in English without making any translation into Arabic as another company did. They translated all the system modules into Arabic and worked on them in Arabic. This led them to face a lot of errors. For example, usually each account in the general ledger has credit and debit sections, so when they translated the general ledger into Arabic, the debit part became the credit and vice versa in some accounts.
>
> IT manager (4, 6 years)

### 6.4.8 *Lack of information quality*

It was reported by financial managers that obtaining accurate and timely information is sometimes difficult with ERP systems, especially in the early years of their operation. Financial managers indicated that processing the transactions and getting accurate financial and accounting information on time was the main reason for using these systems.

> The main risk is the unreliability of data, especially financial data. As you know, the outputs of these systems are financial information that express the financial situation. So, it is a big risk that the data may be incorrect or inaccurate.
>
> Internal auditing manager (8, 4 years)

> I want to say that even if the auditor checks the transactions that have been done in the company, that does not mean the report and the information will be 100 percent correct.
>
> Internal auditing manager (5, 5 years)

However, most of the risk factors that have been mentioned above could have an effect on the quality of information produced by ERP systems. Ineffective of training of users, lack of user involvement, lack of communication, lack of user experience: all of these factors could finally make information inaccurate and not timely. As mentioned before, sufficient understanding of how ERP systems work and knowing how to use these systems properly, will lead to the generation of accurate, timely and useful information from ERP systems. What is more, major customisation and a failure to reengineer business process, affect the implementation of ERP systems but they also have an impact on the quality of information.

> Each company that implements ERP systems and wants to get accurate information and accurate financial reports from an ERP system, must have a good control system. The work should be organized and documented to prevent the users or managers working just as they want. You have to follow the procedures and policies set by the ERP supplier. Documentation and approval are very important in organizing the authorization and security on the system. Repeated reviews of the system are needed to ensure it works well and is free from any bugs. All users should be well qualified and properly trained. Accounting staff should have experience in IT as well; their English language skills should also be good to be able to deal with the Oracle system or any other ERP system.
>
> Internal auditing manager (5, 5 years)

## 6.5 Lessons learned

### 6.5.1 *New risk factors*

From analysing the interview data, a large number of risk factors associated with the implementation and operation of ERP systems were derived. Most of the risk factors associated with the implementation of ERP systems are already mentioned in the literature while only a few of the risk factors related to the operation of ERP systems are represented in the current relevant literature, such as the suitability of ERP systems and security risks. Others are new and have not yet been mentioned as important risk factors which could make ERP systems fail. These factors include: working with two systems (old and new) in parallel, sharing passwords, incorrect entry of data, repetition of errors, flowing of errors, illogical processing, lack of testing, and lack of information quality. These concepts of risk factors are not new since they have been addressed in other studies in the area of information systems but they have not previously been mentioned as risk factors related to ERP systems. Two of the risk factors not mentioned by managers in Jordan but which exist in the literature are a lack of agreement on the project's goals and the lack of an effective project management methodology.

### 6.5.2 *Relationship between ERP risk factors*

Table 6.2 show the inter-related nature of the risk factors associated with the implementation and operation of ERP systems.  Some risks generate other risks. For example, difficulties in understanding and using ERP systems could lead to users being resistant, and incorrect entry of data. while difficulties in understanding and using ERP systems could be a result of a lack of top management support, lack of user training, a lack of user involvement, lack of users experience, and lack of obtaining effective support from skilled and knowledgeable IT experts or external consultants.

Furthermore, insufficient training of users could make users face difficulties in understanding and using ERP systems, increase their resistance to change, lack of users experience. In addition, insufficient of training of end-users could threaten implementation of ERP systems, and it also increase the possibility of entering incorrect and inaccurate data into the systems, which may lead to the flowing of errors with or without discovering it. By the end this could produce incorrect information resulting financial statements misstated.

The first thing worth noting is that most risk factors related to the operation of ERP systems are caused by the risk factors associated with their implementation. For example, incorrect data entry could be the cause of difficulties in understanding and using ERP systems, lack of user training, resistance of users, lack of involvement of users, ineffective communication between users, lack of user experience, and working with two systems in parallel. Furthermore, the lack of information quality might be influenced by most the risk factors associated with both the implementation and operation of ERP systems.

Moreover, as illustrated in Table 6-2, each factor leads to other factors. For example, a lack of top management support could impact on the failure to redesign business processes and customise the ERP systems; this, in turn, might affect the sufficiency (or lack) of resources, which could then have a knock-on effect on the lack of user training , in turn, could cause difficulties in terms of understanding and using ERP systems, the resistance of users, ineffective communication between users, a lack of user experience, incorrect entry data, flowing of errors, and a lack of information quality.

### 6.5.3 *Perceptions of risk*

Perceptions of risk factors associated with the implementation and operation of ERP systems is seen as one of the issues related to the failure of ERP systems. As shown from the data, there is a critical difference of opinion among interviewee managers, particularly between the IT managers and other managers, such as financial accounting managers, HR managers, production managers and internal auditing managers. So, when interviewees were asked about the most serious ERP risks from their viewpoint and what types of risk made these systems fail, it was found that opinions regarding risk potential varied greatly in different professions. Financial and accounting managers were more concerned about risks related to users errors as result of users' lack of qualifications and/or abilities to achieve the aims of the company in using ERP systems. The greatest risk lies in any incorrect inputs in the system that could affect the validity of the financial information. Also, the report that is produced by the financial department as an output could not be reliable, which leads to the biggest risk. Financial managers are concerned about what would happen if the ERP implementation did not go very well and ended up without proper accounts, proper orientation, proper and ongoing training, proper technical support, proper internal controls. Moreover, internal auditing managers saw risks in terms of financial misstatements and fraud. Risk is the probability of the presence of any specific event which could affect negatively the achievement of the company's targets or exposes the company to financial loss or to fraud. The risk of failure of ERP systems is related to the extent of these systems'

Table 6-2: Inter-relations between the risk factors associated with the implementation and operation of ERP systems

| Risk factors | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Difficulties in understanding and using ERP systems | | | | | √ | | | √ | | | | | | | | | √ | | √ | | √ |
| 2. Failure to redesign business processes and customise ERP | | | | √ | | | | | | | | | | | | | | | | √ | √ |
| 3. Lack of top management support | | √ | | √ | | | | √ | | | √ | | | | | √ | | | | | |
| 4. Insufficiency of resources | | | | | | | √ | | | | | | | | √ | | | | | | |
| 5. Unclear/ misunderstood users' requirements | | | | | | | | | | | | | | | | | | | | √ | √ |
| 6. Lack of champion | | | | | √ | | | | | | | | | | | | | | | √ | √ |
| 7. Insufficient training of end-users | √ | | | | √ | | | √ | | √ | | | √ | | | | √ | | | | √ |
| 8. Resistance of users | | | | | | | | | | | | | | | | | √ | | | | |
| 9. Lack of involvement of users in the new system | √ | | | | | | | √ | | | | | √ | | | | √ | | | | |
| 10. Ineffective communication between users | | | | | | | | | | | | | √ | | | | √ | | | | |
| 11. Lack of change management | | √ | | | | | | √ | | | | | | | | | | | | | |
| 12. Lack of skills | √ | √ | | √ | √ | √ | √ | | | | | | | | | | | | | √ | √ |
| 13. Lack of user experience | √ | | | | √ | | | √ | | | | | | | | | √ | | | | |
| 14. ERP software unsuitability | | √ | | | | | | | | | √ | | | | | | | | | | |
| 15. Security risks | | | | | | | | | | | | | | | | | | | | | √ |
| 16. Risk of working with two systems in parallel | | | | | | | | √ | | | | | | | | | √ | | | | |
| 17. Incorrect entry of data | | | | | | | | | | | | | | | | | | | √ | | √ |
| 18. Repetition of errors | | | | | | | | | | | | | | | | | | | | | √ |
| 19. Flowing of errors r | | | | | | | | | | | | | | | | | | | | | √ |
| 20. Illogical processing | | | | | | | | | | | | | | | | | | | | | √ |
| 21. Lack of information quality | | | | | | | | | | | | | | | | | | | | | |

efficiency, the extent of the accuracy of the databases, the extent of their ability to allow decisions to be made using correct information. On the other hand, IT managers were more concerned about those risks related to technological issues and the people mentality and attitudes against change. IT managers were more concerned about the risk factors associated with failure to redesign business processes and carry out major customisation of the ERP, lack of top management support, lack of change management, and resistance of users. Additionally, IT managers perceived the following as higher risks associated with the implementation of an ERP system: insufficient resources, inadequate security systems, and working with two systems in parallel risk factors. On the other hand, financial accounting managers and other managers were less recognising these factors as high risk.

Moreover, IT managers were less aware or concerned than financial accounting and other managers with the following risk factors associated with ERP systems: the lack of a champion, difficulties in understanding and using ERP systems, a lack of user training, lack of user involvement, and ineffective communication, lack of user experience, sharing passwords between users, incorrect data entry by users, lack of testing, repetition errors, flowing errors, illogical processing, and lack of information quality. Financial accounting managers and other managers were more concerned of the above unique risk factors associated with ERP implementation and operation systems

As a result, ERP risk factors are identified based on a subjective perception of risk which could differ from one individual to another. Strictly speaking, while some managers accept some ERP risk factors as high-level risks, others do not accept these as risks of the highest level from their point of view. For example, this was illustrated regarding the desire to customise ERP systems to fit the company's business processes. Customisation is a risk factor that could lead to other problems and could make the implementation of ERP systems fail. Reengineering the company's business processes to fit the ERP processes is recommended instead.  The perception of this as a risk factor was viewed differently by different managers. Customisation was recognised and accepted by IT managers as risky, while it was not recognised as a risk factor by financial accounting managers.

On the whole, there was a lack of awareness by different managers of the risks related to the implementation and operation of ERP systems. The findings from the qualitative data showed that IT managers are aware of all the risk factors related to IT while they are less aware of the risk factors associated with other fields, such as the financial and accounting area. IT managers are more likely to perceive those risk factors related to implementation, and are more trusting of and confident in the systems than other managers since the IT participants believed that ERP systems will work perfectly when the implementation is conducted in an effective way.

## 6.6 Summary

This chapter has presented and discussed themes generated through conducting by interviews with managers in companies in Jordan that had implemented ERP systems. By using a thematic analysis of the qualitative data from the interviews, 12 themes emerged for the risk factors associated with the implementation of ERP systems and 8 themes for those risk factors relating to the operation of ERP systems from the viewpoint of managers. It was found that some risk factors already exist in the literature while others are new risk factors that have been generated from the interview pilot studies. All of these risk factors will be tested in the second stage of the data collection by conducting a questionnaire survey. The preliminary exploratory interviews helped in providing a conceptual framework for the design of the questionnaire.

By analysing the semi-structured interviews, two important issues have been arrived at. Firstly, relationships were found within and between the risk factors associated with the implementation and operation of ERP systems. So, some of the risk factors associated with the implementation of ERP systems (mentioned above) could lead to the occurrence of others risk factors related to either the implementation or the operation of these systems. Furthermore, some operational risk factors could have an effect on the occurrence of other operational risk factors, as shown in Section 6.6.2. Secondly, through an analysis of the qualitative data from the interviews, focus was placed on how the managers perceived risk factors associated with the implementation and operation of ERP systems; the similarities and differences among managers in their perceptions were also explained and described. Since this study aims to investigate perceptions of risk factors associated with the implementation and operation of ERP systems, this thesis also focuses on the second issue. So, the first issue concerning the relationships within and between the risk factors associated with the implementation and operation of ERP systems must be left to be investigated by future research.

However, the results of the analysis of the interview data leads the researcher to investigate "why" in terms of perceptions of ERP risk. These differences and similarities could be explained by the three factors addressed in this study which may have an influence on managers' perceptions of ERP risk factors: culture, profession and level of ERP expertise. However, these qualitative findings were considered as a starting point for exploring the differences in perception of risk factors related to ERP systems by using a grid-group typology developed by Mary Douglas' cultural theory of risk (Douglas, 1992; Thompson et al., 1990). Therefore, further data were required to explain the variances in perception of ERP risk and so a questionnaire survey was used for this purpose. More information about the results of the analysis of the quantitative data is given in the next chapter, Chapter 7.

# 7 Chapter Seven: Quantitative data analysis

## 7.1 Introduction

A survey questionnaire was conducted as the main part of this research to allow further examination of the themes that were highlighted in the previous pilot study. The survey was used to rank the risk factors which were identified in the exploratory pilot study and the literature review in order further to examine and provide an overview of the most important risk factors associated with the implementation and operation of ERP systems from the point view of managers in Jordan, and to identify the similarities and differences in their perceptions of those risks according to their culture, profession and level of ERP expertise. Furthermore, the survey enabled the research to examine whether differences in culture, ERP expertise level and profession, affected the managers' perceptions of risks associated with complex ERP systems.

This chapter is based on the survey results collected from 166 respondents in organisations based in Jordan that had already implemented ERP software packages. The questionnaire included 18 risk factors associated with the implementation of ERP systems and 9 risk factors associated with their operation. Respondents were asked to indicate their level of agreement or disagreement with the statements by using seven-point Likert-type scales ranging from l (strongly disagree) to 7 (strongly agree); (see Appendices B). The questionnaire also assessed the level of ERP expertise of respondents, and the type of culture they were associated with. The data were analysed using SPSS (version 15). Frequency description was also executed to show the most important risk factors as perceived by different managers. What is more, analysis of variance, using the Mann-Whitney, and Kruskal Wallis tests, was carried out to explore whether there were any significant differences between the managers' perceptions of risk factors related to the implementation and operation of ERP systems, and their culture, ERP expertise level and profession.

The results of the quantitative data analysis and the research findings are presented in this chapter. After this introduction, Section 7.2 provides information about processing the data while Section 7.3 includes descriptive data concerning demographic information about the survey participants, the companies where the respondents were working, the ERP systems which managers used and operated in the company, ERP functions that were implemented, their chosen vendor, the cost, and both the planned and actual time taken for implementation. Following this, the most important risk factors associated with the implementation and operation of ERP systems are presented in Section 7.4. Section 7.5 presents the results of the normality distribution test which were achieved by using skewness, kurtosis and the Kolmogorov-Smirnov test. According to the respondents' profession, culture and level of ERP expertise, a comparison of their responses regarding the risk factors associated with the implementation and operation of ERP systems was performed through cross-tabulation; this is discussed in Section 7.6. Section 7.6 also shows the results of the Mann-Whitney and Kruskal Wallis tests concerning any significant differences between the managers' perceptions of risk factors related to the implementation and operation of ERP systems, and their culture, ERP expertise level and profession. Finally, Section 7.7 highlights the research's outcomes and offers a summary of the quantitative results from the questionnaire. The implications of the results of both the qualitative and quantitative work is comprehensively discussed in the next chapter, Chapter Eight, the discussion chapter.

## 7.2 Data Processing

### 7.2.1 *Coding of data*

First of all, before entering data into SPSS, they must be cleaned, and be clear, consistent and readable (Morgan et al., 2004). The data were checked after collection to confirm that the participants had filled in their questionnaires appropriately and that there were no double answers to a question. The row data from the questionnaires were coded consistently for all participants to avoid bias; the results were recorded as a seven–point Likert's scale with 1 for strongly disagree to 7 for strongly agree. Based on Morgan et al.(2004), high numbers were used for the "agree" end of a variable because, when results are interpreted, high values are seen as positive.

To reduce coding errors and to increase the accuracy of the coding, DeVaus(2002) and Morgan et al.(2004) pointed out that questionnaires should include codes as responses to fixed–choice questions. Also, the data should be entered directly from the questionnaires into SPSS.

### 7.2.2 *Missing data*

Missing data is a common problem that occurs in most questionnaire surveys. It is very rare to obtain a complete set of data from every respondent when the research method, such as a questionnaire, involves human beings. However, many common approaches can be used to handle missing data, such as Listwise or casewise data deletion[8], Pairwise data deletion[9], and Mean substitution (MS)[10]. Mean substitution (MS**)** is widely used because it is the best method for replacing missing values and avoids the deletion of such cases and the subsequent reduction of the sample size which is the case with other methods. Listwise or casewise data deletion could reduce the size of the sample (Pallant, 2007). However, the Mean substitution (MS**)** method should not be used, particularly if there is a lot of missing values (Pallant, 2007). Thus, if a large number of questions was not answered by a respondent, it is preferable to remove that questionnaire while, if just a few items have been not answered, Mean substitution (MS) could be used to replace the missing value.

A total of 173 completed responses were obtained. After checking for incomplete questionnaires, seven cases were dropped and excluded from the data analysis due to incomplete data since many of the questions were not answered. For example, some participants answered only the demographic questions and a few concerning ERP risk factors but did not answer others. Also, some left out the questions relating to culture and ERP expertise (which totalled more than twenty items). Bryman and Cramer (2005, p. 58) argued that: "if many scores for an individual are missing, it is most probably best to omit this person from the sample". Finally, one hundred and sixty six questionnaires were left with complete responses for the analysis of the data. There were a few missing values in these one hundred and sixty six questionnaires. At the beginning of the questionnaire, respondents were asked to indicate general information about the company they were working in and about the ERP systems implemented in these

[8] This approach will include cases in analysis only if it has full data on all of the variables. A case will be totally excluded and omitted from all the analysis if even one piece of information is missing.
Pallant, J. (2007) *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows.* Allen & Unwin: Australia..

[9] **Pairwise data deletion**: this method excludes cases only if they are missing data which are required for the specific analysis. They will still be included in any of the analysis for which they have the necessary information. Pairwise data deletion is available in SPSS statistical procedures. (Ibid.

[10] **The replace with mean option,** is available in SPSS statistical procedures; it calculates the mean value for a variable and gives every missing case this value. Ibid.

companies. So, in this section, there were very few missing values, ranging from 1 to 5 cases (0.6% to 3%). These missing values were completed by looking at the responses of other respondents who were working in the same company. Other missing values related to items regarding ERP risk factors and other items concerning ERP expertise and culture; in these cases, the researcher replaced the missing values using Mean substitution. This method is suitable for this research as there is little missing data in some items, ranging from 1 to 8 cases (0.6% to 4.8%).

The following sections provide a full description of each part of the survey, starting with respondents' profiles, and information about the organisation and the ERP system.

## 7.3 Descriptive Data for Demographic Information

### 7.3.1 *Profile of respondents*

After excluding the incomplete and invalid responses, the data analysed were based on surveys completed by 166 managers employed by organisations based in Jordan. A total of 260 questionnaires were distributed within 60 organisations. One hundred and sixty six were completed, and were valid and usable, representing a 64 percent response rate. This response rate is considered as a good response rate in an empirical survey. Rubin and Babbie (2009, p. 117) indicated that "a response rate of at least 50 percent is usually considered adequate for analysis and reporting. A response rate of at least 60 percent is good, a response rate of 70 percent is very good".

The demographic data collected included gender, age, education, job responsibility, years in the profession, years of employment in the current organisations and years of experience with ERP systems. Table 7-1 show the frequency distribution for the sample according to gender. Of the 166 managers that comprised this sample, 134 (80.7%) were male and 32 (19.3%) were female. The age of the respondents ranged from those in their twenties to those aged 50 and above, with those in their thirties being the most frequent. The distribution of the age groupings of respondents is shown in Figure 7-1.

Table 7-1: Frequency distribution for the sample according to gender

| Gender | Percent | Frequency |
|---|---|---|
| Male | 80.7 | 134 |
| Female | 19.3 | 32 |
| Total | 100.0 | 166 |

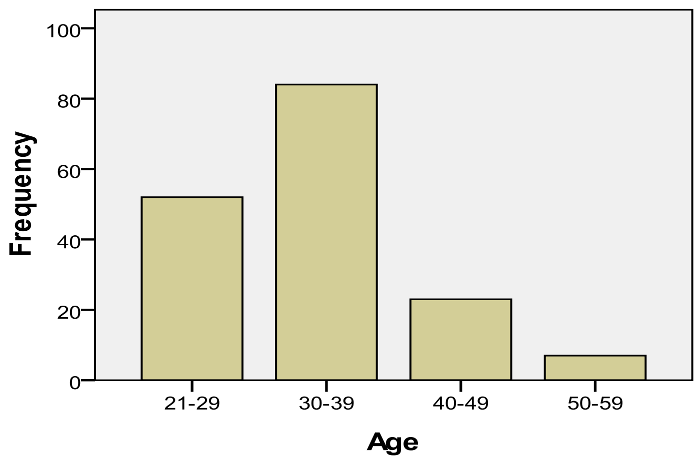


Figure 7-1: Frequency distribution of age groupings of respondents

The highest level of education attained by the respondents ranged from those who gained a diploma qualification 1(0.6%) to those with a postgraduate Masters 35(21.1%) or a PhD 3(1.8%) with those who had a Bachelor's degree the most frequent 127 (76.5%). Most of the managers had management, accounting or auditing degrees 100 (60%), and 63 (40%) of the managers had an IT qualification. Among these, 8 (4.8%) managers had experience in business while just 3 (1.8%) had other qualifications in areas such as manufacturing engineering. Table 7-2 shows a summary of the managers' qualifications.

Table 7-2: Frequency distribution of the sample according to qualification type and level

| Qualification | Frequency | percent |
|---|---|---|
| **Level** | | |
| Diploma | 1 | 0.6 |
| BA | 127 | 76.5 |
| MSc | 35 | 21.1 |
| PhD | 3 | 1.8 |
| **Type** | | |
| Management | 14 | 8.4 |
| Accounting | 60 | 36.1 |
| Auditing | 26 | 15.7 |
| IT | 55 | 33.1 |
| IT and Business Administration | 8 | 4.8 |
| Others | 3 | 1.8 |
| Total | 166 | 100 |

Respondents were requested to report their job responsibility. As Figure 7-2 shows, the majority of respondents were IT managers, representing 36.7% (n=61) of all respondents. And 33.7% (n=56) of respondents were accounting financial managers (CFOs). Whereas smaller proportion, 15.7% (n=26) were auditing managers and 13.9% (n=23) was made up of others, such as manufacturing managers, HR managers, sales managers and purchasing managers.

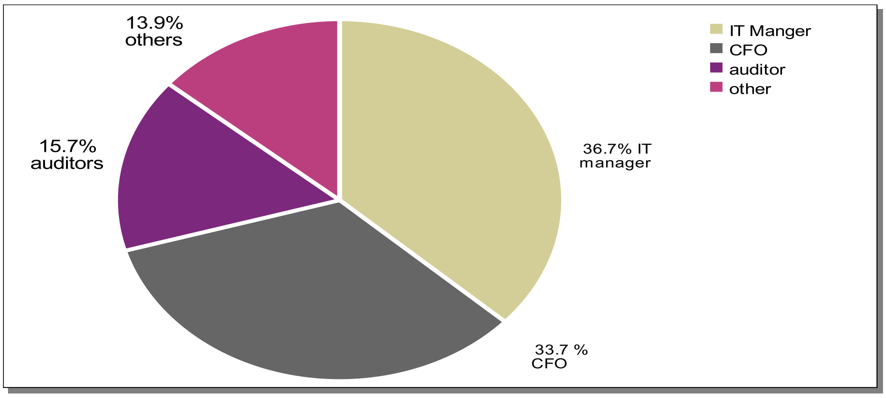


Figure 7-2 Frequency distribution of respondents' job

**Past experience**

This section of the questionnaire investigated the respondents' experience in their profession, in the organisation where they currently worked and the ERP systems they worked with. The majority of the participants reported their work experience, the number of years they had been employed in their current organisation, and their years of ERP experience, as ranging from 3 to 5 years. The summary below in Table 7-3 shows details of the lengths of different experience that were recorded.

Table 7-3: Summary of Jordanian managers' experience

| | Years' experience | | Years' in current organisation | | ERP experience | |
|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| <6 Months | 4 | 2.4 | 7 | 4.2 | 8 | 4.8 |
| 6-12 Months | 9 | 5.4 | 11 | 6.6 | 21 | 12.7 |
| 1-2 Years | 25 | 15.1 | 25 | 15.1 | 49 | 29.5 |
| 3-5 Years | 50 | 30.1 | 53 | 31.9 | 58 | 34.9 |
| 6-10 Years | 40 | 24.1 | 38 | 22.9 | 26 | 15.7 |
| > 10 Years | 38 | 22.9 | 32 | 19.3 | 4 | 2.4 |
| Total | 166 | 100 | 166 | 100 | 166 | 100 |

### 7.3.2 ***Profile of responding organisations***

#### 7.3.2.1 ***Sectors of organisations***

The responding managers worked in organisations from different sectors. As can be seen in Figure 7-3, the majority of respondents (60.2%) were working in the industrial sector which includes manufacturing, pharmaceutical and transportation companies while (18.7%) of managers were working in the service sector, which includes financial, tourism, telecommunications and IT services. Also, the figure below illustrates that (3.6%) were working in retail, while (17.5%) were made up of managers from other types of sector.

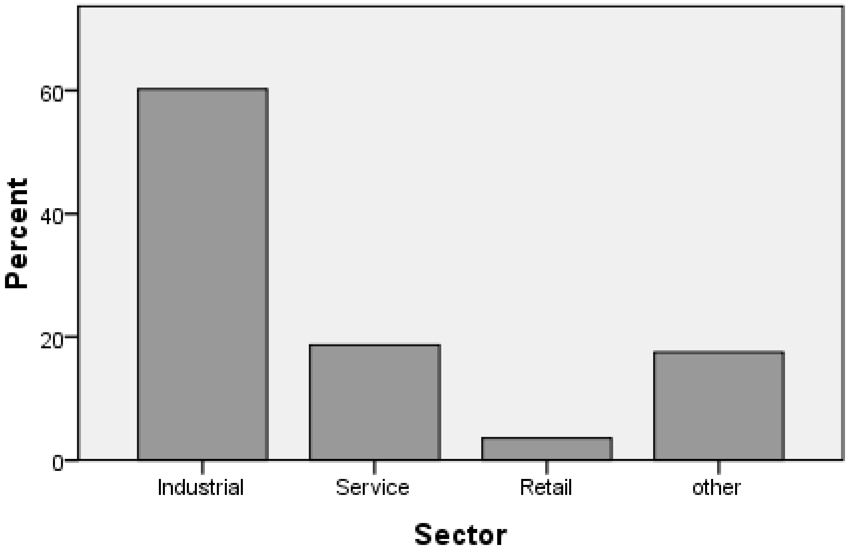


Figure 7-3: Frequency distribution of organisations by sector

#### 7.3.2.2 *size of organisation*

The size of the organisation was measured based on the number of employees. The questionnaire responses received from managers working in a variety of small, medium and large organisations in Jordan, in terms of the number of employees, showed that the organisations ranged from those with 11-50 employees to those with over 500 employees. Figure 7-4 shows that a minority of the respondents worked in small organisations which employed 11-50 employees (3%) whereas the majority of the respondents worked in large organisations which employed over 500 employees (46%).

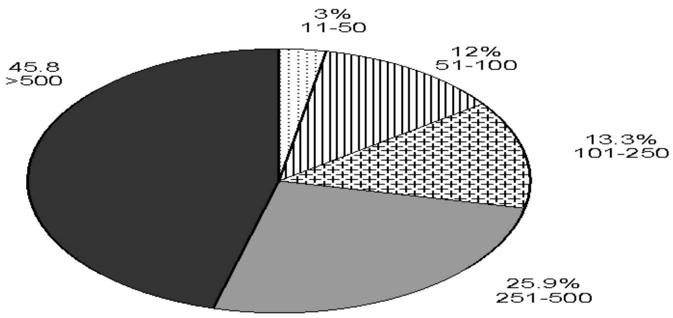


Figure 7-4: Frequency distribution of the number of employees

### 7.3.3 *Profile of ERP systems*

#### 7.3.3.1 *ERP systems providers*

Respondents were asked to indicate the type of ERP systems that were implemented in their companies. From the Figure 7-5, it can be seen that most of the participants were using Scala, with (25.9%), and Oracle with (21.1%). A few of the participants (7.2%) were working with SAP. Regarding Baan and other providers, such as Great Plains, Acc-Pac, Navision, Axapta and Ross, these represented nearly 13.9% of participants working with each of them, whereas about 17.5% of managers were working with JD. Edwards.

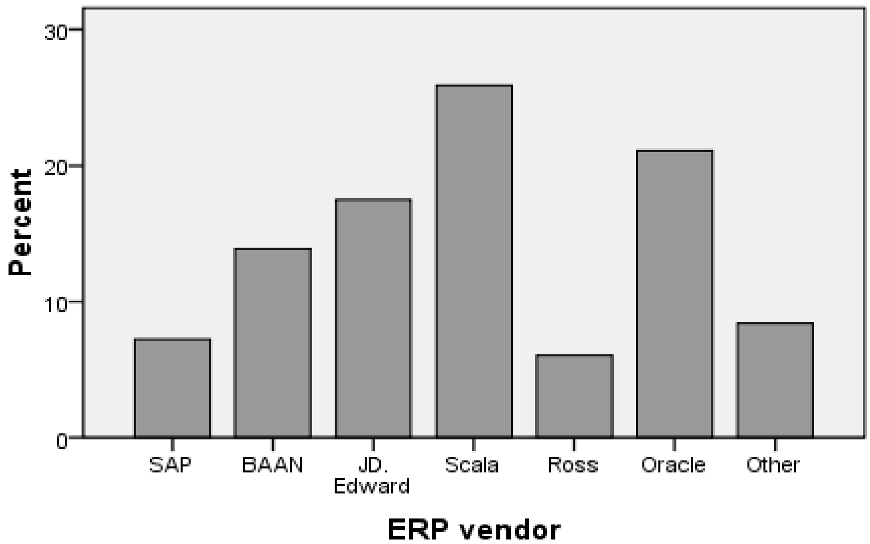


Figure 7-5: Frequency distribution of ERP systems vendors

#### 7.3.3.2 *ERP systems' implementation*

Most of the responding Jordanian organisations had implemented their ERP systems less than 3 to 5 years previously (60.8%). As can be seen in Figure 7-6 below, 13.3% of the responding organisations had implemented their ERP systems between 6 to 10 years ago, while 18.1% had implemented their ERP systems approximately 1 or 2 years ago; only 7.8% of organisations had implemented their ERP systems in the last 6-12 months.

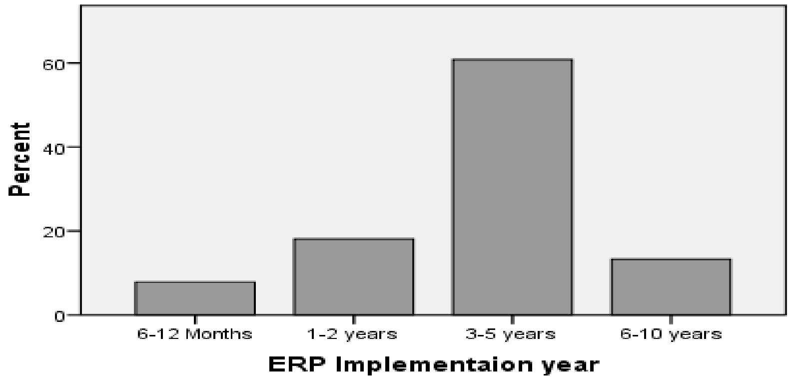


Figure 7-6: Frequency distribution of years since ERP implementation

It is clear from Table 7-4 that most Jordanian organisations experience had delay in the implementation schedule of their ERP system. As can be seen, none of organisations which planned to finish implementing their ERP system within less than six months, implemented it on time. Also, 77.1% of the organisations planned to finish implementing the ERP system during a 6-12 month period but only 11.4% of the organisations finished the implementation during this 6-12 month period. Although none of responding organisations planned implementing their ERP over 3 to 5 years, 23.5% of them did finish implementing their ERP system over this span of time (3-5 years) and 21.1% of them spent between 6 and10 years implementing their system. However, about 60% of Jordanian companies had been working with ERP systems for 3 to 5 years, and 13.3% of them had had these systems for 6 to 10 years while 7.8% said they had used ERP systems for 6-12 months and nearly 18% for 1-2 years.

Table 7-4: Summary of planned months and actual months for ERP implementation, and year of implementation

| | **Planning months for implementing ERP** | | **Actual months for implementing ERP** | | **Years of implementation of ERP** | |
|---|---|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| <6 Months | 12 | 7.2 | - | - | - | - |
| 6-12 Months | 128 | 77.1 | 19 | 11.4 | 13 | 7.8 |
| 1-2 Years | 26 | 15.7 | 73 | 44 | 30 | 18.1 |
| 3-5 Years | - | - | 39 | 23.5 | 101 | 60.8 |
| 6-10 Years | - | - | 35 | 21.1 | 22 | 13.3 |
| Total | 166 | 100 | 166 | 100 | 166 | 100 |

## 7.4 Reliability of the quantitative data

As it can be seen from Table 7-5, the result of the reliability test showed that the questionnaire design was highly reliable as Cronbach's coefficient alpha (α) values of the constructs were above 0.85. The collected data, which related to the risk factors associated with ERP implementation and operation in organizations in Jordan, are highly reliable and consistent since the alpha level for the instrument ranged from 0.87 to 0.98. Also, Cronbach's alpha for each worldview score (hierarchist, individualist, egalitarian and fatalist worldviews) were 0.96, 0.92, 0.93 and 0.91 respectively; for ERP expertise this was 0.85. Moreover, the reliability test using Cronbach's alpha coefficients showed an adequate level of reliability as it reached the generally accepted threshold of 0.70 suggested by Mangan et al.(2004).

**Table 7-5: Cronbach's alpha for reliability results**

| Variable | Item number | Cronbach's alpha |
|---|---|---|
| **1. Difficulties of understanding ERP** | 4 | 0.93 |
| **2. Failure to BPR and major customisation required** | 2 | 0.87 |
| **3. Lack of top management support** | 1 | - |
| **4. Insufficiency of resources** | 2 | 0.89 |
| **5. Lack of management change** | 1 | - |
| **6. Insufficient discipline and standardisation** | 1 | - |
| **7. Unclear/ misunderstanding of users' requirements** | 4 | 0.95 |
| **8. Lack of champion** | 1 | - |
| **9. Lack of agreement on project management** | 2 | 0.96 |
| **10. Lack of effective project management methodology** | 2 | 0.94 |
| **11. Insufficient training of end-users** | 2 | 0.91 |
| **12. Ineffective communication between users** | 2 | 0.94 |
| **13. Resistance of users** | 3 | 0.93 |
| **14. Lack of involvement of users in the ERP system** | 1 | - |

| | | |
|---|---|---|
| **15. Lack of user experience** | 3 | 0.89 |
| **16. Lack of ability to recruit and retain qualified ERP systems developers** | 1 | - |
| **17. Lack of business analysts with business and technology knowledge** | 1 | - |
| **18. Failure to mix internal and external expertise effectively** | 1 | - |
| **19. ERP suitability** | 4 | 0.92 |
| **20. Working with two systems in parallel** | 1 | - |
| **21. Security risk** | 6 | 0.90 |
| **22. Sharing passwords** | 3 | 0.98 |
| **23. Incorrect entry data** | 4 | 0.97 |
| **24. Repetition of errors** | 3 | 0.96 |
| **25. Flowing of errors** | 3 | 0.92 |
| **26. Illogicalprocessing** | 3 | 0.95 |
| **27. Quality of information** | 4 | 0.95 |
| **28. Hierarchism** | 7 | 0.96 |
| **29. Individualism** | 5 | 0.92 |
| **30. Egalitarianism** | 4 | 0.93 |
| **31. Fatalism** | 5 | 0.91 |
| **32. ERP expertise** | 5 | 0.85 |

## 7.5 Descriptive statistics for perceived risk factors with ERP systems during implementation and operation stages

### 7.5.1 *Data file management for research variables:*

#### 7.5.1.1 *Computing and recoding variables*

In order to obtain the data in the form required to answer the research question, the researcher carried out several data transformations, such as computing a new variable using two methods (the sum and the average), and by recoding. From these operations, 27 new variables were produced. One research question in this thesis is: “What percentage of managers agree, are neutral, or disagree with the risks related to the implementation and operation of ERP systems?” The aim of this question was to show

how managers perceived the risks related to ERP systems during their implementation and operation. To answer this question, each risk factor needed to be computed[11] by adding the items for each variable and dividing the sum of the number of items in order to obtain the average score for each variable.

In this thesis, a Likert scale was used to elicit specific information about participants' perceptions of risks factors associated with implementation and operation of ERP systems. It was believed that using Likert scale was the simplest and most efficient way of addressing their perceptions of these risks as Cohen et al. (2007, p.327) note, a Likert scale "combines the opportunity for a flexible response with the ability to determine frequencies, correlations and other forms of quantitative analysis" Likert scales are usually used on a four-, five-, six- seven, or nine-point rating scale. Seven-point scales were used in the rating questions in this study to measure the perceptions of risk. The perceptions of risk were assessed by asking respondents to state their level of agreement or disagreement with a series of statements by using a seven-point Likert-type scale ranging from l (strongly disagree) to 7 (strongly agree) (see Appendices 2). The aim of this is to assess respondents' perceptions of these risks, and to identify the similarities and differences in managers' perceptions of these risks. Kothari (2009, p. 78) argued that "more points scales provide an opportunity for greater sensitivity of measurement". Cummins and Gullone (2000) and Finstad (2010) also said that 7-point scales provides a fast increase in reliability and best accurate measure of a respondent's perception and the easiest to use. Lewis (1993) indicated that seven-point Likert item resulted in stronger correlations with *t*-test results.

De Vaus (2004) mentions that a variable with many categories can make two problems for data analysis: a) difficulties in reading and summarising tables and graphs, and b) some categories could contain very few cases when the sample size is not too large. De Vaus (2004, p. 33-34) also pointed out two key ways of handling variables with a large

[11] **Note:** The method will not compute an average score or score for particular participant if there is missing data for any of the questions. However, the computed score will be missing. So, to avoid that, the researcher chose the ***MEAN function (transform – compute, function box*** highlight ***MEAN )*** which computes an average score for each participant who has a score for any of the variables used ( even if the participant answers one variable and leaves the other blank), or ***SUM*** which computes a score for each participant who has a score for any of the variables used. Morgan, G. A., Leech, N. L., Gloeckner, G. W. and Barrett, K. C. (2004) *SPSS for Introductory Statistics: Use and Interpretation* Lawrence Erlbaum Associates Inc: Mahwah.

number of categories. Firstly, avoid using graphs or tables and simply use a correlation coefficient such as gamma or Spearman to indicate the degree to which these two variables are related. But for a single variable, such as age or income, MEAN age or income could be used to show a summary of the distribution rather than all the detail that a table or graph might present. Secondly, reduce the number of categories in order to present the data in graphical or tabular form by using the substantive approach. This approach combines categories based on the nature of the categories. For presentation and analysis purposes in this thesis, seven frequency categories were re-scaled into three sub-categories. For choices being headed 'Strongly Disagree', 'Disagree', 'Somewhat Disagree', 'Neutral', 'Somewhat agree', 'agree', 'Strongly Agree': a category called 'disagree' was created, combining the three ratings 'Strongly Disagree', 'Disagree', and 'Somewhat Disagree'. 'Neutral' was unchanged, while 'agree' combined the three ratings 'Somewhat agree', 'agree', 'Strongly Agree'. For the purpose, the new variable was recoded in a different variable so that recoding the risk factor variables were given as:

1 to 3.49 = 1 disagree
3.50 to 4.49 = 2 neutral
4.50 to 7 = 3 agree

The statistical findings related to the perceptions of the risks associated with ERP implementation and operation in Jordan are presented and discussed in the following sections.

### 7.5.2 *Statistical findings regarding perceptions of ERP implementation risks*

In this section, the second research question is addressed and a discussion is presented on the extent to which managers perceived the risks factors could have happened during the implementation of ERP systems, as well as the overall mean scores and standard deviations of the data gathered on those risk factors. Respondents were asked to indicate their agreement or disagreement with 34 statements about risks associated with the implementation of ERP systems. Table 7-6 presents a summary of frequency distributions for the mean scores of managers' perceptions of risks related to ERP implementation, as well as the mean and the standard deviations of their distribution. The statistical results revealed that 126 of the respondents, representing 75.9 percent of the total respondents, agreed that the overall implementation of an ERP system is risky.

Two respondents (1.2 percent) disagreed the implementation of an ERP system is risky and just 38 respondents (22.9 percent) were neutral. Table 7-6 also shows that the overall responses towards the risk factors associated with the implementation of ERP systems were towards the positive end of the 7-point scale as the mean scores were (4.79) and the standard deviation was (0.533). However, the descriptive statistical results for each of the perceptions of risk factors associated with the implementation of ERP systems from the highest to the lowest perception of those risks by Jordanian managers is discussed in detail below.

#### 7.5.2.1 ***Insufficient training of end-users***

Table 7-6 shows that majority of managers, representing 91% (n= 151) perceived that insufficient training of end-users is the most critical risk factor which maximises the possibility of ERP implementation failure. They agreed that providing extensive training on the ERP system for end users could minimise the possibility of the implementation failing. Also, they agreed that a company which has dedicated resources to making sure employees are very familiar with the ERP system is less likely to fail. A glance at the mean score shows it is clear that insufficient training of end-users had the highest positive mean score of 5.88 with a standard deviation of 1.119.

#### 7.5.2.2 ***Lack of user experience***

As can be seen from the Table 7-6, a high percentage of the managers in Jordanian organisations, representing 84.9% (N=141), recognised that a lack of user experience is the second highest risk factor that could lead to the failure of an ERP implementation. They agreed that where users of ERP software are familiar with the ERP system, the life cycle stages of its implementation, and data processing as a working tool, the implementation of ERP systems is more likely to succeed. Furthermore, they believed that if users of ERP software are unfamiliar with this type of application, there is a greater risk of the implementation failing. The overall responses for lack of user experience were towards the positive end of the 7-point scale as the mean scores were (5.28) and the standard deviation was (1.056).

#### 7.5.2.3 *Lack of business analysts with business and technology knowledge*

From Table 7-6 it can be seen that 82% (n=136) of the responding managers perceived that a lack of business analysts with business and technology knowledge made the ERP implementation more likely to fail whereas, a few, representing 7.2% (n=12) did not believe this factor would make the ERP implementation more likely to fail. The table also shows that the overall responses to the factor of the lack of business analysts with business and technology knowledge were towards the positive end of the 7-point scale as the mean scores were (5.31) and the standard deviation (1.283).

#### 7.5.2.4 *Failure to mix internal and external expertise effectively*

From Table 7-6, it is noticeable that 78.9% (n=131) of the responding managers perceived the failure to mix internal and external expertise effectively was a major risk to an ERP implementation. On the other hand, a few of them, representing 10.2% (n=17), did not believe failure to mix internal and external expertise effectively was a major risk in the implementation of an ERP system. However, the overall responses of this factor were towards the positive end of the 7-point scale as the mean scores were (5.22) and the standard deviation (1.346).

#### 7.5.2.5 *Unclear/ misunderstood users' requirements*

The statistics show that more than three quarters (77.1%) of managers perceived that unclear or misunderstood user's requirements were one of the risk factors that could have a negative impact on an ERP implementation. They agreed that communication between the implementation team and the users of the ERP system is crucial to the success of an implementation project. However, technical experts are often unable to understand users' business requirements. A majority of managers in the Jordanian companies understood that an ERP implementation failure was less likely if the users of the ERP software actively participated in defining their requirements and if they had the technical IT skills to enable them to express their needs effectively. However, the mean score of the responses regarding this factor was (5.17) with a standard deviation of (1.359).

#### 7.5.2.6 *Resistance of users*

As can be seen in Table 7-6, just less than three quarters (73.5%) of respondents saw the resistance of users as a major risk of an ERP project failing. They believed that users' resistance to change is a barrier to the successful implementation of an ERP system and that, if users persisted in traditional business practices, even though the ERP changed the way they conducted business, the organisation would not see the benefits of the ERP. Respondents agreed that, where there are many people wishing the ERP to fail, it is more likely to fail. However, the mean score of the responses regarding this factor was (5.13) with a standard deviation of (1.356).

#### 7.5.2.7 *Insufficiency of resources*

It is clear in Table 7-6 that one hundred and nineteen participants (71.7%) believed that to implement an ERP system successfully takes a long time, and an implementation failure is often the result of upper management failing to allocate adequate financial resources. Thus, insufficient resources was considered to be a crucial risk factors in causing an ERP implementation to fail. The mean score for this was (4.68) with a standard deviation of (1.454).

#### 7.5.2.8 *Lack of ability to recruit and retain qualified ERP systems developers*

One hundred and sixteen (69.9%) participants perceived that the problem of recruiting and retaining qualified ERP systems developers increased the risk of an ERP implementation failing whereas only a few, representing 9.6% (n= 16), disagreed. The mean score for this was (5.08) with a standard deviation of (1.279).

#### 7.5.2.9 *Failure to redesign business processes and make major customisation of ERP*

More than two thirds of this sample (68.1%) expressed the belief that an ERP implementation is more likely to fail if the company fails to redesign its business processes before configuring the ERP software. They also understood that companies which try to fit the ERP package to their business processes with a minimal amount of business process redesign, are more likely to fail. The overall responses relating to the failure to redesign business processes and make major customisation of the ERP was above the mid-point of the 7-point scale on the agreement scale as the mean score was (4.73) with a standard deviation of (1.446).

#### 7.5.2.10 ***Lack of top management support***

To understand the respondents' opinions regarding the lack of top management support during the implementation of an ERP system, the respondents were asked to indicate the extent of their agreement or disagreement to the following statement: "Lack of top management support hinders effective ERP implementation". It can be observed that less than two thirds (62.7%) of respondents agreed, while more than a quarter (26.5%) disagreed that the failure of an ERP implementation was due to a lack of top management support. However, the overall responses relating to a lack of top management support was above the mid-point of the 7-point scale as the mean score was (4.95) with a standard deviation of (1.863).

#### 7.5.2.11 ***Ineffective communications between users***

The statistical findings revealed that almost 61 percent of participants believed that ineffective communications between users was one of the risk factors that makes the implementation of an ERP system more likely to fail. On the other hand, 28.3 percent of respondents did not believe that an ERP implementation risked failure because of insufficient communication between users. However, the overall of responses relating to ineffective communications between users was above the mid-point of the 7-point scale on the agreement scale as the mean score was (4.70) with a standard deviation of (1.686).

#### 7.5.2.12 ***Lack of agreement on project goals***

The results show that 60.2% (n=100) of managers in organisations recognised that an ERP implementation project goal cannot be achieved with unclear objectives; they felt that reaching agreement on project goals is the key to the project's success. Conversely, merely a quarter of them (24.1%) thought that a lack of agreement on ERP project goals is not a critical risk factor associated with the implementation of an ERP system. However, the overall responses relating to the lack of agreement on project goals was nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.64) with a standard deviation of (1.708).

#### 7.5.2.13 ***Lack of an effective project management methodology***

From the Table 7-6, it can be seen that 59.6% (n= 99) of managers accepted that ineffective ERP project management methodology was a cause of project failure. They believed that when a project's management has used a formal implementation plan, the ERP implementation project is less likely to fail. The overall responses relating to the lack of an effective project management methodology were nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.53) with a standard deviation of (1.579).

#### 7.5.2.14 ***Lack of champion***

As can be seen in Table 7-6, 55.4% (n= 92) of the respondents perceived that ineffective project leadership would lead to an ERP implementation failure whereas less than a third (31.9%) of respondents disagreed that lack of a champion in the implementation of an ERP could lead to failure. However, the overall responses relating to a lack of a champion were nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.26) with a standard deviation of (1.755).

#### 7.5.2.15 ***Insufficient discipline and standardisation***

The findings show that approximately half of the respondents (48.8%) thought that, insufficient discipline and standardisation implementation would make an ERP system implementation more likely to fail. Almost (40%) of respondents did not believe that insufficient discipline and standardisation was a critical risk factor. However, the overall responses relating to insufficient discipline and standardisation were nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.22) with a standard deviation of (1.797).

#### 7.5.2.16 ***Lack of management of change***

It was clearly noticed that 48.2% (n=80) of the participants agreed that an ERP implementation is more likely to succeed if the company allocates effort and resources to managing the change process. Thus, they believed that a lack of management of change as a risk factor related to the implementation of an ERP system could lead to failure. However, the overall responses relating to the lack of management of change was nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.31) with a standard deviation of (1.915).

#### 7.5.2.17 ***Lack of involvement of users in the ERP system***

Of the 166 managers that comprised this sample, 76 (45.8%) of them perceived that the participation of users in the system's implementation processes is critical to the success of the implementation project. Roughly 45.2% (n=75) of respondents disagreed however that a lack of involvement of users in the ERP system was critical risk which could cause the failure of the implementation. However, the overall responses relating to this lack of involvement of users in the ERP system was nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.26) with a standard deviation of (1.761).

Table 7-6: Summary of descriptive statistics for risk factors during the implementation of an ERP

| Risk factors during the implementation of ERP systems | Frequency | | | Mean | SD |
|---|---|---|---|---|---|
| | Agree | Neutral | Disagree | | |
| **1. Insufficient training of end-users** | 151 (91%) | 4 (2.4%) | 11 (6.6%) | 5.88 | 1.119 |
| **2. Lack of user experience** | 141 (84.9%) | 12 (7.2%) | 13 (7.8%) | 5.28 | 1.056 |
| **3. Lack of business analysts with business and technology knowledge** | 136 (82%) | 18 (10.8%) | 12 (7.2%) | 5.31 | 1.283 |
| **4. Failure to mix internal and external expertise effectively** | 131 (78.9%) | 18 (10.8%) | 17 (10.2%) | 5.22 | 1.346 |
| **5. Unclear/misunderstood users' requirements** | 128 (77.1%) | 15 (9%) | 23 (13.9%) | 5.17 | 1.359 |
| **6. Resistance of users** | 122 (73.5%) | 16 (9.6%) | 28 (16.9%) | 5.13 | 1.356 |
| **7. Insufficiency of resources** | 119 (71.7%) | 18 (10.8%) | 29 (17.5%) | 4.68 | 1.454 |
| **8. Lack of ability to recruit and retain qualified ERP systems' developers** | 116 (69.9%) | 34 (20.5%) | 16 (9.6%) | 5.08 | 1.279 |
| **9. Failure to redesign business processes and make major customisation of ERP** | 113 (68.1%) | 16 (9.6%) | 37 (22.3%) | 4.73 | 1.446 |
| **10. Lack of top management support** | 104 (62.7%) | 18 (10.8%) | 44 (26.5%) | 4.95 | 1.863 |
| **11. Ineffective communications between users** | 102 (61.4%) | 17 (10.2%) | 47 (28.3%) | 4.70 | 1.686 |
| **12. Lack of agreement on project goals** | 100 (60.2%) | 26 (15.7%) | 40 (24.1%) | 4.64 | 1.708 |
| **13. Lack of effective project management methodology** | 99 (59.6%) | 27 (16.3%) | 40 (24.1%) | 4.53 | 1.579 |
| **14. Lack of champion** | 92 (55.4%) | 21 (12.7%) | 53 (31.9%) | 4.64 | 1.755 |
| **15. Insufficient discipline and standardisation** | 81 (48.8%) | 19 (11.4%) | 66 (39.8%) | 4.22 | 1.797 |
| **16. Lack of management of change** | 80 (48.2%) | 21 (12.7%) | 65 (39.2%) | 4.31 | 1.915 |
| **17. Lack of involvement of users in the ERP system** | 76 (45.8%) | 15 (9%) | 75 (45.2%) | 4.26 | 1.761 |
| **18. Difficulties in understanding and using ERP systems** | 65 (39.2%) | 16 (9.6%) | 85 (51.2%) | 3.68 | 1.424 |
| **Overall total implementation ERP risks** | 126 (75.9%) | 38 (22.9%) | 2 (1.2%) | 4.79 | .533 |

#### 7.5.2.1 ***Difficulties in understanding and using ERP systems***

The statistical results show that 65 (39.2%) of respondents found ERP systems complex and difficult to understand. They believed that employees find it difficult to get the ERP system to do what they want it to do and said that learning to use the ERP system had been difficult for employees. Overall, respondents agreed that the complexity of ERP systems makes implementation projects more likely to fail. On the other hand, more than half of the respondents (51.2%) did not find difficulties in understanding and using ERP systems. The responses concerning difficulties in understanding and using ERP systems were slightly towards the lower end of the 7-point scale as the mean scores were (3.68) with a standard deviation of (1.424).

### 7.5.3 ***Statistical findings of perceptions of ERP operation risks***

In this section, the second research question is addressed. The extent of the awareness of the risk factors that could occur during the operation of an ERP system from the point of view of managers in Jordan is also discussed, and the overall mean scores and standard deviations of the data gathered on those risk factors are presented. Respondents were asked to indicate their agreement and disagreement with 31 statements about the risks associated with the operation of ERP systems.

Table 7-7 presents a summary of the frequency distributions of the mean scores of managers' perceptions of the risks related to the operation of ERPs, together with the mean and standard deviations. The statistical results revealed that 98 of the respondents, representing 59 percent of the total respondents, agreed that the overall operation of an ERP system is risky. Twenty one respondents (12.7%) disagreed with this and just 47 respondents (28.3 percent) were neutral. Table 7-7 also shows that the overall responses concerning the risk factors associated with the operation of ERP systems were above the mid-end of the 7-point scale as the mean scores were (4.60) and the standard deviation was (0.863). The descriptive statistical results for each of the perceptions of risk factors associated with the operation of ERP systems, from the highest to the lowest perception of those risks from the point of view of managers, is discussed in more detail below.

#### 7.5.3.1 ***Lack of ERP software suitability***

From Table 7-7 it can be seen that 81.9% (n=136) of managers agreed that the likelihood of ERP operations failing is reduced if the processes built into the ERP meet all the needs required by the organisation, if the names and meanings of the ERP data items correspond to those of the documents used in the company (for example, sales order sheet, sales reports, etc.), if the input data items of the ERP correspond to those of the documents used in the company, and if the user interface of the ERP is well aligned with the business needs of the company. Only eight respondents (4.8%) disagreed that ERP software suitability makes the operation of ERP systems more successful. A glance at the mean score shows it is clear that the overall response in terms of the lack of ERP software suitability had the highest positive mean score of 5.27 with a standard deviation of 1.072.

#### 7.5.3.2 ***Security risk***

The majority of respondents 80.7% (n=134) realised that unauthorised access to data or the system by *outsiders* (hackers) is a major risk associated with operating an ERP system; such problems could cause the company major losses and have a direct impact on the company's financial statements. Also, the respondents believed that unauthorised access to data or the system by *employees* is a major risk that could lead to major losses and have a direct impact on the company's financial statement. Just a few respondents 4.8% (n = 8) did not think that security risks could have negative impact on the operation of ERP systems. However, the overall responses relating to security risks within ERP systems was below the mid-point of the 7-point scale on the agreement scale as the mean score was (4.33) with a standard deviation of (1.769).

#### 7.5.3.3 ***Repetition of errors***

Of the study sample, 70.5% (n=117) of the managers in Jordanian organisations believed that insufficient program testing is (was) a major source of problems within ERP operations; furthermore, repetition of errors will occur if there have been inadequate checks on the entry of master information. Thus, repetition of errors is likely to lead to major financial misstatements although less than a quarter 23.5% (n=39) of the managers did not perceive that repetition of errors could make the operation of ERPs system more risky. However, the overall responses for repetition of errors within ERP systems were towards the positive end of the 7-point scale as the mean scores were (4.87) and the standard deviation was (1.545).

#### 7.5.3.4 *Incorrect entry of data*

The statistics revealed that 69.3% (n=115) of participant managers indicated that accidental or intentional entry of incorrect data by employees was a major cause of problems for a company which has implemented ERP; this results in a loss of confidence in the integrity of the company's information and is likely to lead to major financial misstatements. However, less than a quarter (23.5%) of the managers did not perceive that incorrect entry of data could make ERP operations more risky. However, the overall responses for incorrect entry of data within ERP systems were towards the positive end of the 7-point scale as the mean scores were (4.77) and the standard deviation was (1.570).

#### 7.5.3.5 *Flowing of errors*

It was obvious from Table 7-7 that almost two thirds of respondents 110 (66.3 %) who participated in this study thought that the flowing of errors is (was) more likely because ERPs are an integrated system. An error in one part of the program or application leads to a second error in another part of the application, and this second error may lead to a third error, and so on. They believed that a problem in one business process (e.g., an improperly inputted customer sales order) could lead to problems in other processes when an ERP system has been implemented; they also believed that process interdependency is a risk in ERP systems as this could lead to potential misstatements in the company's financial information. However, not many managers 24.7% (n=41) saw the flowing of errors as a risk factor related to ERP operation; instead they felt that this was more likely to happen as a result of process interdependency. However, the overall responses related to the flowing of errors was nearly in the mid-point of the 7-point scale on the agreement scale as the mean score was (4.69) with a standard deviation of (1.418).

#### 7.5.3.6 *Illogical processing*

From Table 7-7, it appeared that 62% (n=103) of participants recognised that illogical processing is likely to occur with ERP if a company fails to check for unusually large values in output documents or unless a company effectively scans output documents. Overall, they believed that illogical processing has a major potential for producing financial misstatements. On the other hand, nearly a quarter of respondents (24.1%) did not think that a failure to check for unusually large amounts on output documents, or to scan output documents, could lead to illogical processing that might affect badly the operation of the ERP system. However, the overall responses relating to illogical processing were nearly at the mid-point of the 7-point scale on the agreement scale as the mean score was (4.59) with a standard deviation of (1.490).

#### 7.5.3.7 *Working with two systems in parallel*

Ninety one (54.8%) of respondents thought that running the old system in parallel with the new one (ERP) after going live could make the operation of the ERP less risky, while sixty five (39.2%) of respondents believed that the operation of ERP systems is more risky if the company runs two systems at the same time (i.e. the old system and the ERP system). However, the overall responses relating to working with two systems in parallel were below the mid-point of the 7-point scale on the agreement scale as the mean score was (4.33) with a standard deviation of (1.769).

#### 7.5.3.8 *Sharing passwords*

By looking at Table 7-7, it can be seen that a third (33.1) of managers in Jordan did not see the sharing of passwords as a risk. They considered the cost of licenses to be expensive and therefore it might be better for two or three employees to share the same password; also, they did not think that the sharing of passwords by employees was a major security risk that could increase the possibility of fraud. However, 53.6% (n=89) of the survey respondents disagreed that using one password by two or three users of the ERP would be acceptable because of the high cost of licences. They took into consideration that sharing passwords is a critical security risk which would make defalcation more likely to happen. However, the overall responses relating to sharing passwords among ERP users were below the mid-point of the 7-point scale on the agreement scale as the mean score was (4.42) with a standard deviation of (1.759).

#### 7.5.3.9 *Information quality*

The results show that few respondents 21 (12.7%) believed that the output information provided by an ERP system is often inaccurate, too late to be useful, inconsistent, and incomplete. In fact, it appeared that around three quarters (n=123) of respondents considered the output information provided by an ERP system to be often accurate, not too late to be useful, consistent and complete. However, the overall responses relating to information quality when using ERP systems were considerably towards the lower end of the 7-point scale as the mean scores were (2.63) with a standard deviation of (1.418).

Table 7-7: Summary of risk factors during the operation of an ERP

| Risk factors during the operation of ERP systems | Agree | Neutral | Disagree | Mean | SD |
|---|---|---|---|---|---|
| **1. ERP software suitability** | 136 (81.9%) | 22 (13.3%) | 8 (4.8%) | 5.27 | 1.072 |
| **2. Security risks** | 134 (80.7%) | 24 (14.5%) | 8 (4.8%) | 4.33 | 1.769 |
| **3. Repetition of errors** | 117 (70.5%) | 10 (6%) | 39 (23.5%) | 4.87 | 1.545 |
| **4. Incorrect entry of data** | 115 (69.3%) | 12 (7.2%) | 39 (23.5%) | 4.77 | 1.570 |
| **5. Flowing of errors** | 110 (66.3%) | 15 (9 %) | 41 (24.7%) | 4.69 | 1.418 |
| **6. Illogical processing** | 103 (62%) | 23 (13.9%) | 40 (24.1%) | 4.59 | 1.490 |
| **7. Working with two systems in parallel** | 91 (54.8%) | 10 (6%) | 65 (39.2%) | 4.33 | 1.769 |
| **8. Sharing passwords** | 89 (53.6%) | 22 (13.3%) | 55 (33.1) | 4.42 | 1.759 |
| **9. Information quality** | 21 (12.7%) | 22 (13.3%) | 123 (74.1%) | 2.63 | 1.418 |
| **Overall total operation ERP risks** | 98 (59%) | 47 (28.3%) | 21 (12.7%) | 4.60 | .863 |

## 7.6 Testing the normality distribution assumption

The normality distribution tests were performed using skewness, kurtosis and the Kolmogorov-Smirnov tests. Appendices 3 (Table C-1, Table C-2 and Table C-3) shows these tests for each of the risk factors associated with implementation and operation of ERP systems, the four types of culture, and the level of ERP expertise. As can be seen from the appendix, the values of the skewness and kurtosis are clearly not zero for all the perceptions of risk factors associated with implementation and operation of ERP systems, the four types of culture, and the level of ERP expertise. This indicates that the data are not normally distributed and are not symmetrical. Table C-1, Table C-2 and Table C-3 show that the Kolmogorov Smirnov (KS) test also shows violations of normality distribution for all of the dependent and independent variables since the significant values are smaller than 0.05 ($p < 0.05$). The variables of this research were not normally distributed and so non-parametric tests were chosen to examine whether the differences in the perceptions of risk factors related to the implementation and operation of ERP systems among managers regarding their profession, culture, or level of ERP expertise were statistically significant. The Mann-Whitney and Kruskal-Wallis tests were used to answer the research questions and address the research hypothesis as shown in the next section.

## 7.7 Statistical findings of differences and similarities in the perceptions of risk factors with regard to ERP implementation and operation

The third research question of this study aimed to discover whether there was any significant difference between managers' perceptions of each risk factor associated with the implementation and operation of ERP systems and their profession, their level of ERP expertise, or their culture. Cross tabulation, and the Mann-Whitney and Kruskal-Wallis tests were used to provide answers to this research question and to test the research hypotheses.

When the questionnaires were conducted to show to what extent the managers perceived the risk factors associated with the implementation and operation of ERP systems, the researcher often favoured multiple-item measures. Multiple-item scales are popular for many reasons. Firstly, a number of items are more likely to capture the totality of a broad concept like perception of risk than a single question. Secondly, these scales draw greater distinctions between people. The security risk measure comprised six questions which were scored from 1 to 7; therefore, respondents' overall scores could vary between 6 and 42. If only one question was asked, the variation would be between 1 and 7 which is a much narrower range of potential variation. The analysis procedure for multiple–item measures is to aggregate each individual's response in relation to each question and to treat the overall measure as a scale in relation to which each unit of analysis has a score (Bryman, 2005, p. 67). In the case of each ERP risk factor, a Likert scaling was used, which is a popular approach to create a multiple-item measure. With Likert scaling, individuals indicate their degree of agreement or disagreement on a seven-point range. The answer to each constituent question or item is scored from 1 (strongly disagree) to 7 (strongly agree). The individual scores are added up to form an overall score for each respondent, with higher scores indicating greater perception and understanding of the risks.

In this section, the hypothesis for this research is examined and the results discussed.

### 7.7.1 *Statistical findings of differences in perception of the risks of ERP implementation risks according to profession (H1a)*

To understand more deeply to what extent the managers, who had different jobs or professions, recognised or perceived the various risk factors related to the implementation of ERPs, and whether such difference were statistically significant, cross-tabulation and the Kruskal-Wallis H test were conducted to compare the perceptions of each group of managers for each risk factor. The following table, Table 7-8, represents a summary of the frequency distributions for the mean scores of the managers' perceptions of risks related to ERP implementation according to their type of job or profession. Table 7-8 shows the results of the Kruskal-Wallis H test which uses non-parametric, independent-sample techniques.

As can been seen in Table 7-8, around half of the accounting financial managers and auditing managers (53.6% and 53.8% respectively) believed that ERP systems are complex and difficult to understand, learn, and use by employees; these difficulties makes an ERP implementation more likely to fail. On the other hand, more than two thirds of IT managers (67.2%) did not see using and understanding ERP systems on the part of employees as difficult, while more than half of the other managers (56.5%) perceived ERPs as an easy system to learn and understand. In addition, (83.6%, 51.8%, 73.1% and 60.9% respectively) of IT managers, financial accounting managers, audit managers and other managers, believed that, if a company failed to redesign its business processes and carry out a major customisation of the ERP system, the implementation of such a system could fail. Moreover, most of the IT managers, financial accounting managers, audit managers and other managers had a high level of perception of risk for both of a lack of business analysts with business and technology knowledge (86.9%, 75%, 88.5% and 69.6% respectively), and the failure to mix internal and external expertise in an ERP implementation (88.5%, 73.2%, 76.9%, and 69.6%).

The analysis indicated that there is a statistically significant difference between managers from different job groups in terms of their perceptions of difficulties in understanding and using ERP systems (P=0.001), a failure to redesign business processes and carry out a major customisation of the ERP (P= 0.009), a lack of business analysts with business and technology knowledge (P=0.028), and a failure to mix internal and external expertise in an ERP implementation (p=0.043); in these cases the p value was less than 0.05. A comparison of the mean ranks of managers' professions suggests that financial accounting managers, audit managers and other managers have higher mean ranks than IT managers in terms of their perceptions of the difficulties in understanding and using ERP systems as a risk factor that could make an ERP implementation fail. However, for the other three risk factors mentioned above, IT managers were more likely to recognise these risk factors (as their mean rank was higher than IT managers) than financial accounting managers, audit managers and other managers.

It was observed from Table 7-8 that IT managers, financial accounting managers, audit managers and other mangers perceived very similarly some risk factors related to ERP systems' implementation. They perceived that a lack of top management support hinders an effective ERP implementation with (63.9%, 62%, 57.7% and 65.2% respectively). Besides, (65.6%, 82.1%, 76.9% and 56.5%) of them respectively considered an insufficiency of resources as a crucial risk factor that could cause an ERP implementation to fail and (52.5%, 64.3%, 42.3% and 56.5% respectively) believed that the lack of a champion would lead to an ERP implementation failure. However, no significant differences were found between the managers with different types of job for the perceptions of a lack of top management support (p=0.990), insufficiency of resources (p=0.287), and the lack of a champion (p=0.147).

Furthermore, it was obvious that there was similarity in terms of agreement among the professions (78.7%, 69.6% and 84.6% respectively) that the resistance of users to the implementation and use of ERP systems is a risk that could lead to failure while just (56.5%) of other managers agreed with this proposition. Concerning to ineffective communications between users from different departments, such as finance and IT, it was clear from Table 7-8 that about half of the IT managers (52.5%) perceived this risk to be a critical threat to the implementation's success while (67.9%, 69.2% and 60.9%

respectively) of accounting financial managers, auditing managers, and other managers believed this. Moreover, IT managers, accounting financial managers, auditing managers, and other managers similarly perceived that a lack of user involvement in ERP systems was a risk factor that could result in the failure of an ERP implementation with (44.3%, 46.4%, 46.2% and 47.8% respectively).

Regarding unclear or misunderstood users' requirements relating to the failure of the implementation of an ERP system, little difference was found between IT and financial accounting managers, audit managers, other managers with (80.3%, 76.8%, 69.2%, and 78.3% respectively) in terms of perceiving this factor as a risk that could have a negative impact on an ERP implementation. However, no significant differences were found between the managers with different types of job for perceptions regarding the resistance of users (p=0.188), ineffective communications (p=0574), a lack of involvement of users (p=0.990), unclear or misunderstood user's requirements (p=0.298).

It was also clear from Table 7-8 that a substantial number of IT managers, financial accounting managers, audit managers and other managers perceived some risks factors related to the implementation of ERP systems. (91.8%, 87.5%, 92.3% and 95.7%) of them respectively felt that insufficient training of end-users with the ERP system is critical and maximised the possibility of the implementation failing while (85.2%, 87.5%, 80.8% and 82.6% respectively) of them considered a lack of ERP user experience as a crucial risk factor in an ERP implementation. The statistical results show that auditing managers (88.5%) were most likely to perceive that a lack of ability to recruit and retain qualified ERP systems developers could lead to ERP failure while financial accounting managers (69.6%) and other managers perceived this factor as a risk equally; (62.3%) of the IT managers perceived this factor as a risk. However, no significant differences were found between managers with different types of job for the perception as a risk of insufficient training of end-users (p=0.937), the lack of ERP user experience (p=0.809) and the lack of ability to recruit and retain qualified ERP systems developers (p=0.649).

Relating to the lack of agreement on project goals and the lack of an effective project management methodology, it was observed that IT managers, auditing managers, and other managers perceived both of these risks at roughly the same level: 59%, 53.8% and 56.5% respectively. However, about two thirds (66.1%) of financial accounting managers saw a lack of agreement on ERP project goals as a critical risk factor associated with the implementation of ERP systems and a little less than two thirds (64.3%) saw an ineffective ERP project management methodology as a major cause of project failure. However, no significant differences were found between the managers with different types of job for perceptions regarding a lack of agreement on project goals (p=0.162) and the lack of an effective project management methodology (p=0.208).

Regarding a lack of management of change, and insufficient discipline and standardisation associated with ERP systems' implementation, it was noticed that IT managers, financial accounting managers, auditing managers and other managers perceived both of these risks at nearly the same level: 52.5%, 46.4%, 38.5% and 52.2% respectively. Thus, the managers recognised that a lack of change management could have a negative impact on an ERP implementation. Furthermore, 54.1%, 44.6%, 42.3% and 52.2% of respondents respectively believed that insufficient discipline and standardisation was a key risk factor which could have a negative impact on an ERP implementation. However, no significant differences were found for the perceptions between the managers with different types of profession that a lack of management of change was a risk (p=0.293) or for insufficient discipline and standardisation as a risk factor associated with the implementation of an ERP system (p=0.428).

Generally speaking, it is clear from Table 7-8 that a large number of managers in Jordan from different professions see the implementation of an ERP system as risky. However, no significant differences were found between the managers with different types of job or profession for the perception of risk factors related to the implementation of ERP systems (p=0.725).

In brief, it was expected that the perceptions of risk factors associated with the implementation of ERP systems would be different among different groups of managers in terms of their job roles. However, the results showed from comparisons between the managers with different jobs (i.e. IT managers, accounting financial managers, auditing managers and others) that there was a significant differentiation in perceptions in only four of the 18 risk factors related to ERP systems implementation; these were:

difficulties in understanding and using ERP systems, failure to redesign business processes and carry out major customisation of the ERP, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise. In these examples, the p-value was less than 0.05.

Regarding the other 14 risk factors, no significant differentiation was found in terms of the perceptions of all the other ERP risk factors among the managers with different jobs or professions. These can be seen in Table 7-8. Therefore, the hypothesis H1a that: "*There is a significant difference between managers with different jobs or professions in their perceptions of patterns of the risk factors associated with ERP implementation*" is supported for only four risk factors (difficulties in understanding and using ERP systems, failure to redesign business processes and carry out major customisation of the ERP, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise ; the hypothesis is not supported for the all other risk factors. In other words, it is clear that the different professions have an influence on managers' perceptions of the four risk factors associated with the implementation of ERP systems but that they do not have an effect on the manager's perceptions of other risk factors; this indicates that their perceptions of those risk factors are similar regardless of their profession.

IT managers were more likely than the accounting, auditing and management professionals to perceive six risk factors associated with the implementation of ERP systems. These were: failure to redesign business processes and carry out major customisation of the ERP, lack of change management, insufficient discipline and standardisation, resistance of users, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise. This finding makes sense as IT managers are more involved in the implementation stage, while financial accounting managers, audit managers and other managers are less likely to be involved in this stage.

Table 7-8: Differences in perceptions of risk factors during ERP implementation according to profession

| Risk factors during implementation of ERP systems | Job/Profession | N | Frequency | | | Mean rank | Asym p. Sig. |
|---|---|---|---|---|---|---|---|
| | | | Disagree | neutral | Agree | | |
| 1. **Difficulties in understanding and using ERP systems** | **IT managers** | 61 | 41(67.2%) | 5 (8.2%) | 15(24.6%) | 65.30 | 0.001 |
| | **CFO** | 56 | 25 (44%) | 1 1.8%) | 30(53.6%) | 95.97 | |
| | **Auditing managers** | 26 | 6 (23.1%) | 6 (23.1%) | 14(53.8%) | 104.13 | |
| | **Others** | 23 | 13 (56.5%) | 4 (17.4%) | 6 (26.1%) | 78.07 | |
| 2. **Failure to redesign business processes and carry out major customisation of ERP** | **IT managers** | *61* | 5 (8.2%) | 5 (8.2%) | 51 (83.6%) | 99.67 | 0.009 |
| | **CFO** | 56 | 21 (37.5%) | 6 (10.7%) | 29(51.8%) | 73.54 | |
| | **Auditing managers** | 26 | 4 (15.4%) | 3 (11.5%) | 19 (73.1%) | 79.38 | |
| | **Others** | 23 | 7 (30.4%) | 2 (8.7%) | 14 (60.9%) | 69.52 | |
| 3.**Lack of top management support** | **IT managers** | 61 | 15 (24.6%) | 7 (11.5%) | 39 (63.9%) | 85.09 | 0.990 |
| | **CFO** | 56 | 17(30.4%) | 4 (7.1%) | 35 (62.5%) | 82.56 | |
| | **Auditing managers** | 26 | 7 (26.9%) | 4(15.4%) | 15 (57.7%) | 82.81 | |
| | **Others** | 23 | 5 (21.7%) | 3 (13%) | 15 (65.2%) | 82.35 | |
| 4.**Insufficiency of resources** | **IT managers** | 61 | 18 (29.5%) | 3 (4.9%) | 40 (65.6%) | 83.18 | 0.287 |
| | **CFO** | 56 | 2 (3.6%) | 8 (14.3%) | 46 (82.1%) | 87.90 | |
| | **Auditing managers** | 26 | 4 (15.4%) | 2 (7.7%) | 20 (76.9%) | 89.65 | |
| | **Others** | 23 | 5 (21.7%) | 5 (21.7%) | 13 (56.5%) | 66.67 | |
| 5. **Lack of management of change** | **IT managers** | 61 | 20 (32.8%) | 9 (14.8 %) | 32 (52.5%) | 91.74 | 0.293 |
| | **CFO** | 56 | 26 (46.4%) | 4 (7.1%) | 26 (46.4%) | 78.28 | |
| | **Auditing managers** | 26 | 11 (42.3%) | 5 (19.2%) | 10(38.5%) | 73.54 | |
| | **Others** | 23 | 8 (34.8%) | 3 (13%) | 12 (52.2%) | 85.63 | |
| 6.**Insufficient discipline and standardisation** | **IT managers** | 61 | 22 (36.1%) | 6 (9.8%) | 33 (54.1%) | 91.48 | 0.428 |
| | **CFO** | 56 | 25 (44.6%) | 6 (10.7%) | 25(44.6%) | 79.23 | |
| | **Auditing managers** | 26 | 9(34.6%) | 6(23.1%) | 11(42.3%) | 78.50 | |
| | **Others** | 23 | 10 (43.5%) | 1(4.3%) | 12 (52.2%) | 78.37 | |
| 7.**Unclear/ misunderstood users'requirements** | **IT managers** | 61 | 9 (14.8%) | 3 (4.9%) | 49 (80.3%) | 83.96 | 0.298 |
| | **CFO** | 56 | 9 (16.1%) | 4(7.1%) | 43 (76.8%) | 88.04 | |
| | **Auditing managers** | 26 | 2 (7.7%) | 6 (23.1%) | 18 (69.2%) | 67.63 | |
| | **Others** | 23 | 3 (13%) | 2(8.7%) | 18 (78.3%) | 89.17 | |
| 8.**Lack of champion** | **IT managers** | 61 | 23 (37.7%) | 6 (9.8%) | 32 (52.5% ) | 78.71 | 0.147 |
| | **CFO** | 56 | 15 (26.8%) | 5(8.9%) | 36 (64.3%) | 90.63 | |
| | **Auditing managers** | 26 | 10 (38.5%) | 5 (19.2%) | 11 (42.3%) | 69.67 | |
| | **Others** | 23 | 5 (21.7%) | 5 (21.7%) | 13 (56.5%) | 94.48 | |
| 9.**Lack of agreement on project goals** | **IT managers** | 61 | 17 (27.9%) | 8 (13.1%) | 36 (59%) | 78.92 | 0.162 |
| | **CFO** | 56 | 10 (17.9%) | 9 (16.1%) | 37(66.1%) | 91.13 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Auditing managers** | 26 | 8 (30.8%) | 4 (15.4%) | 14(53.8%) | 69.46 | |
| | **Others** | 23 | 5 (21.7%) | 5 (21.7%) | 13 (56.5%) | 92.93 | |
| 10. **Lack of effective project management methodology** | **IT managers** | 61 | 15 (24.6%) | 10 (16.4%) | 36 (59%) | 81.93 | 0.208 |
| | **CFO** | 56 | 12 (21.4%) | 8(14.3%) | 36 (64.3%) | 89.32 | |
| | **Auditing managers** | 26 | 9 (34.6%) | 3(11.5%) | 14 (53.8%) | 67.37 | |
| | **Others** | 23 | 4(17.4%) | 6 (26.1%) | 13 (56.5%) | 91.74 | |
| 11. **Insufficient training of end-users** | **IT managers** | 61 | 3 (4.9%) | 2 (3.3%) | 56 (91.8%) | 85.03 | 0.937 |
| | **CFO** | 56 | 5 (8.9%) | 2 (3.6%) | 49 (87.5%) | 84.61 | |
| | **Auditing managers** | 26 | 2 (7.7.%) | - | 24 (92.3%) | 82.15 | |
| | **Others** | 23 | 1 (4.3%) | - | 22 (95.7%) | 78.26 | |
| 12. **Ineffective communications between users** | **IT managers** | 61 | 23 (37.7 %) | 6 (9.8%) | 32 (52.5%) | 77.13 | 0.574 |
| | **CFO** | 56 | 12 (21.4%) | 6 (10.7%) | 38 (67.9%) | 89.45 | |
| | **Auditing managers** | 26 | 5 (19.2%) | 3 (11.5%) | 18 (69.2%) | 85.13 | |
| | **Others** | 23 | 7 (30.4%) | 2 (8.7%) | 14(60.9%) | 84.07 | |
| 13. **Resistance of users** | **IT managers** | 61 | 9 (14.8%) | 4 (6.6%) | 48 (78.7 %) | 93.26 | 0.188 |
| | **CFO** | 56 | 14(25%) | 3 (5.4%) | 39 (69.6%) | 80.08 | |
| | **Auditing managers** | 26 | 2 (7.7%) | 2 (7.7%) | 22 (84.6%) | 79.77 | |
| | **Others** | 23 | 3 (13%) | 7 (30.4%) | 13 (56.5%) | 70.15 | |
| 14. **Lack of involvement of users in the ERP system** | **IT managers** | 61 | 28 (45.9%) | 6 (9.8%) | 27 (44.3 %) | 81.95 | 0.990 |
| | **CFO** | 56 | 25(44.6%) | 5(8.9%) | 26(46.4%) | 84.74 | |
| | **Auditing managers** | 26 | 11 (42.3%) | 3(11.5%) | 12(46.2%) | 83.83 | |
| | **Others** | 23 | 11 (47.8%) | 1 (4.3%) | 11 (47.8%) | 84.22 | |
| 15. **Lack of user experience** | **IT managers** | 61 | 3 (4.9%) | 6 (9.8%) | 52 (85.2 %) | 87.14 | 0.809 |
| | **CFO** | 56 | 4 (7.1%) | 3(5.4%) | 49 (87.5%) | 84.00 | |
| | **Auditing managers** | 26 | 4 (15.4%) | 1(3.8%) | 21(80.8%) | 77.19 | |
| | **Others** | 23 | 2 (8.7%) | 2 (8.7%) | 19 (82.6%) | 79.76 | |
| 16. **Lack of ability to recruit and retain qualified ERP systems developers** | **IT managers** | 61 | 6 (9.8%) | 17 (27.9%) | 38 (62.3%) | 82.02 | 0.649 |
| | **CFO** | 56 | 6 (10.7%) | 11(19.6%) | 39 (69.6%) | 79.13 | |
| | **Auditing managers** | 26 | 2 (7.7%) | 1(3.8%) | 23(88.5%) | 91.42 | |
| | **Others** | 23 | 2 (8.7%) | 5 (21.7%) | 16 (69.6%) | 89.11 | |
| 17. **Lack of business analysts with business and technology knowledge** | **IT managers** | 61 | 3 (4.9%) | 5 (8.2%) | 53 (86.9%) | 97.60 | 0.028 |
| | **CFO** | 56 | 7 (12.5%) | 7 (12.5%) | 42 (75%) | 75.90 | |
| | **Auditing managers** | 26 | 1 (3.8%) | 2 (7.7%) | 23 (88.5%) | 73.23 | |
| | **Others** | 23 | 1 (4.3%) | 4 (17.4%) | 18(78.3%) | 76.22 | |
| 18. **Failure to mix internal and external expertise effectively** | **IT managers** | 61 | 4 (6.6%) | 3 (4.9%) | 54 (88.5 %) | 96.80 | 0.043 |
| | **CFO** | 56 | 9 (16.1%) | 6 (10.7%) | 41 (73.2%) | 76.94 | |
| | **Auditing managers** | 26 | 1 (3.8%) | 5 (19.2%) | 20 (76.9%) | 74.96 | |
| | **Others** | 23 | 3 (13%) | 4 (17.4%) | 16 (69.6%) | 73.85 | |
| **Overall totals for ERP implementation risks** | **IT managers** | **61** | 1 (1.6%) | 14 (23%) | 46 (75.4%) | 82.29 | 0.725 |
| | **CFO** | 56 | - | 11 (19.6%) | 45 (80.4%) | 89.11 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Auditing managers** | 26 | - | 8(30.8%) | 18 (69.2%) | 78.10 | |
| | **Others** | 23 | 1 (4.3%) | 5 (21.7%) | 17 (73.9%) | 79.17 | |

In the accordance with the mean rank of the other 12 risk factors, the mean rank for each profession group of managers regarding the seven risk factors (i.e. lack of top management support, insufficiency of resources, unclear or misunderstood users' requirements, insufficient training of end users, lack of involvement of users in the ERP system, lack of users' experience, lack of ability to recruit and retain qualified ERP systems developers) appear as approximately in the same mean rank. However, it seems that financial accounting managers, audit managers, and other managers have higher mean ranks than IT managers in terms of their perceptions of the difficulties in understanding and using ERP systems, lack of a champion, lack of agreement on project goals, lack of an effective project management methodology, and ineffective communication between users.

### 7.7.2 ***Statistical findings regarding differences in perception of ERP operational risks according to job or profession (H1b)***

This section of findings presents the extent of differentiation in terms of the perceptions of risks associated with the operation of ERP systems among managers from different professions, and whether this difference is statistically significant. Cross-tabulation and Kruskal-Wallis H tests were conducted to compare the perceptions for each risk factor among each group of managers. The following table, Table 7-9, represents a summary of the frequency distributions for the mean scores of the Jordanian managers' perceptions of risks related to ERP operation according to their type of job. Also, Table 7-9 shows the results of the Kruskal- Wallis H test, a non-parametric independent-sample technique.

The comparison of IT managers, financial accounting managers, audit managers and others managers, as seen in Table 7-9, shows that the levels of perception among them concerning some risk factors related to the operation of ERP systems were similar; however, there was a significant differentiation in the levels of perception of others risk factors related to ERP systems among the same managers.

By reviewing Table 7-9 it can be seen that there is considerable differentiation among managers who have different types of job responsibility in their perception levels of the risks that could arise during the operation of an ERP system. The majority of financial accounting managers and audit managers (83.9% and 96.2% respectively), and less than three quarters (69.6%) of other managers felt that running the old system in parallel with the new system (ERP) one after going live could make the operation of the ERP less risky. A very small number (4.9%) of IT managers perceived this as not risky and that it would not have a negative effect on the operation of an ERP system. On the contrary, however, a large proportion of IT managers (90.2%) believed that the operation of an ERP system would be more risky if the company ran two systems at the same time (i.e. the old system and the ERP system). In addition, it was obvious that financial accounting managers, audit managers and other managers were more concerned than IT managers about the risks that could arise by sharing passwords among two or more employees. More than three quarters (80.4% and 80.8% respectively) of financial accounting managers and audit managers, and less than half (47.8%) of other managers considered sharing a password as a critical security risk which would make defalcation more likely to happen. On the other hand, 73.8% of IT managers did not see that employees sharing passwords would be a major security risk that could increase the possibility of fraud. The results in Table 7-9 show that more or less a third of IT managers perceived incorrect entry data, repetition of errors, flowing of errors, and illogical processing, as risk factors that could influence the effectiveness of the operation of an ERP system and could lead to major financial misstatements. Moreover, a large number of financial accounting managers, audit managers and other managers, ranging from 73.9% to 100%, perceived these factors as critical, making the operation of an ERP system more risky and which could ultimately cause a loss of confidence in the integrity of the company's information. However, the Kruskal-Wallis test indicated that there was a statistically significant difference between managers from different profession groups in terms of their perceptions of: the risk of working with two systems in parallel (p=0.000), sharing a password among two or more employees (p=0.000), incorrect entry data (p=0.000), repetition of errors (p=0.000), flowing of errors (p=0.000), and illogical processing (p=0.000) since these had a p value of less than 0.05.

Table 7-9 summarises the risk factors that could occur during the operation of an ERP system that were at nearly the same level in the perceptions of the managers. The majority of IT managers and financial accounting managers (88.5% and 82.1% respectively), and more than three quarters (76.9%) of audit managers thought that the possibility of ERP operation failing would be reduced if the ERP software was suitable for the company and met all its needs; more than two thirds (69.6%) of other managers agreed with this assertions. In relation to ERP security risk, it was observed that a higher number of IT managers and accounting financial managers (83.6% and 87.5%, respectively) perceived that unauthorised access to data or the system by outsiders (hackers) or insiders (employees) was a major risk associated with operating an ERP system and which could cause major losses to company, having a direct impact on the company’s financial statements. More than three quarters (76.9%) of audit managers and 60.9% of other managers believed that security risks could have a negative impact on the operation of ERP systems. Besides this, Table 7-9 shows that a low number of IT managers, accounting financial managers, audit managers and other managers (13.1%, 10.7%, and 11.5%, 17.4% respectively) considered that the output information provided by the ERP system is often inaccurate, too late to be useful, inconsistent and incomplete. The Kruskal-Wallis test result showed that there was no significant difference between IT managers, financial accounting managers, audit managers and others managers in terms of their perceptions of ERP software suitability (p=0.100), ERP security risk (p=0.076), and ERP information quality (p=0.469).

In general, it is clear from Table 7-9 that the managers from different professions perceived the risk factors related to the operation of ERP systems differently. Financial accounting managers and audit managers in organisations in Jordan were the managers most likely (82.1% and 96.2% respectively) to see the operation of ERP systems as risky while the IT managers were least likely (23%) to view the operation of an ERP system as risky. More than half (56.5%) of other managers believed this to be a risky operation. However, the Kruskal- Wallis test showed that there were significant differences between the managers with different types of job in the perceptions of the risk factors related to the operation of ERP systems (p=0.000).

In summary, Table 7-9 shows that six of the 9 risk factors could occur during the operation of ERP systems. These were: working with two systems in parallel, sharing passwords between users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing results. All these showed statistically significant differences between the managers with different job roles (i.e. IT managers, accounting financial managers, auditing managers and other managers) since $p \leq 0.05$. Regarding the other three ERP operation risk factors, namely ERP software suitability, ERP security risks and ERP information quality, no significant differences were found in the perception of those risk factors among the managers with different jobs. Therefore, hypothesis H1b that stated: "*There is a significant difference between managers with different jobs or professions in their perceptions of patterns of risk factors associated with ERP operation*", is supported for six risk factors but not supported for the other three. In other words, it is clear that the different professions have an influence on managers' perceptions of six of the risk factors associated with the operation of ERP systems, while they do not have an effect on their perceptions of the other risk factors, which means that their perceptions of those risk factors are similar for managers irrespective of their profession.

A comparison of the mean ranks of managers' jobs shows that financial accounting managers, audit managers and other managers have higher mean ranks than IT managers regarding six risk factors associated with the operation of ERP systems. These are: working with two systems in parallel, sharing passwords between users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. In all of these six risk factors, financial accounting managers, audit managers and other managers were more likely to view these as risk factors than IT managers (as their mean rank was higher than IT managers). Accounting, auditing and management professionals are more likely than IT managers to perceive of most of the factors associated with the operation of ERP systems as risky since they are more involved than IT managers in working with an ERP system during its operation stage; IT managers are more involved in the implementation of this program.

Regarding the mean rank of the other three risk factors, the mean rank for each professional group regarding the two risk factors (ERP software suitability and ERP security risk) appeared to be similar but IT and financial accounting managers were shown to have a slightly higher mean rank than audit managers and other managers. However, audit managers and other managers had higher mean ranks than IT managers and financial accounting managers in terms of their perceptions that the output information provided by ERP systems is often inaccurate, too late to be useful, inconsistent and incomplete.

Table 7-9: Differences regarding risk factors during the operation of an ERP system according to profession

| Risk factors during operation of ERP systems | Job/Profession | N | Frequency | | | Mean rank | Asymp. Sig. |
|---|---|---|---|---|---|---|---|
| | | | disagree | neutral | agree | | |
| ERP software suitability | IT managers | 61 | 1 (1.6%) | 6 (9.8%) | 54 (88.5%) | 94.23 | 0.100 |
| | CFO | 56 | 4 (7.1%) | 6 (10.7%) | 46 (82.1 %) | 82.34 | |
| | Auditing managers | 26 | 1 (3.8%) | 5 (19.2%) | 20 (76.9%) | 71.27 | |
| | Others | 23 | 2(8.7%) | 5(21.7%) | 16 (69.6%) | 71.70 | |
| 2. Working with two systems in parallel | IT managers | 61 | 55 (90.2%) | 3 (4.9%) | 3 (4.9%) | 37.30 | 0.000 |
| | CFO | 56 | 6(10.7%) | 3 (5.4%) | 47(83.9%) | 110.09 | |
| | Auditing managers | 26 | - | 1 (3.8%) | 25 (96.2%) | 120.73 | |
| | Others | 23 | 4(17.4%) | 3 (13%) | 16 (69.6%) | 99.20 | |
| 3. Security risks | IT managers | 61 | 3 (4.9%) | 7 (11.5%) | 51 (83.6%) | 87.15 | 0.076 |
| | CFO | 56 | 2(3.6%) | 5(8.9%) | 49 (87.5%) | 92.34 | |
| | Auditing managers | 26 | 2 (7.7%) | 4 (15.4%) | 20(76.9%) | 67.58 | |
| | Others | 23 | 1 (4.3%) | 8(34.8%) | 14 (60.9%) | 70.30 | |
| 4. Sharing passwords | IT managers | 61 | 45 (73.8%) | 4 (6.6%) | 12 (19.7%) | 42.49 | 0.000 |
| | CFO | 56 | 5 (8.9%) | 6(10.7%) | 45(80.4%) | 112.23 | |
| | Auditing managers | 26 | - | 5(19.2%) | 21(80.8%) | 111.46 | |
| | Others | 23 | 5(21.7%) | 7(30.4%) | 11(47.8%) | 90.70 | |
| 5. Incorrect entry of data | IT managers | 61 | 34 (55.7%) | 7 (11.5%) | 20 (32.8 %) | 50.45 | 0.000 |
| | CFO | 56 | 3(5.4%) | 3(5.4%) | 50(89.3%) | 106.04 | |
| | Auditing managers | 26 | - | - | 26 (100%) | 103.77 | |
| | Others | 23 | 2(8.7%) | 2(8.7%) | 19(82.6%) | 93.35 | |
| 6. Repetition of errors | IT managers | 61 | 33 (54.1%) | 6 (9.8%) | 22 (36.1%) | 51.94 | 0.000 |
| | CFO | 56 | 4(7.1%) | 1(1.8%) | 51(91.1%) | 102.08 | |
| | Auditing managers | 26 | - | - | 26(100%) | 108.87 | |
| | Others | 23 | 2 (8.7%) | 3 (13%) | 18(78.3%) | 93.28 | |
| 7. Flowing of errors | IT managers | 61 | 36 (59%) | 7(11.5%) | 18(29.5%) | 46.83 | 0.000 |
| | CFO | 56 | 2 (3.6%) | 3(5.4%) | 51(91.1%) | 107.06 | |
| | Auditing managers | 26 | - | 2(7.7%) | 24(92.3%) | 112.90 | |
| | Others | 23 | 3(13%) | 3(13%) | 17(73.9%) | 90.15 | |
| 8. Illogical processing | IT managers | 61 | 35 (57.4%) | 9 (14.8%) | 17 (27.9%) | 50.49 | 0.000 |
| | CFO | 56 | 4(7.1%) | 4(7.1%) | 48 (85.7%) | 102.09 | |
| | Auditing managers | 26 | - | 5(19.2%) | 21(80.8%) | 114.23 | |
| | Others | 23 | 1(4.3%) | 5(21.7%) | 17(73.9%) | 91.04 | |
| 9. Information quality | IT managers | 61 | 47 (77%) | 6 (9.8 %) | 8 (13.1 %) | 78.98 | 0.469 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **CFO** | 56 | 40 (71.4%) | 10(17.9%) | 6(10.7%) | 81.63 | |
| | **Auditing managers** | 26 | 19 (73.1%) | 4(15.4%) | 3 (11.5) | 95.87 | |
| | **Others** | 23 | 17 (73.9%) | 2(8.7%) | 4 (17.4%) | 86.09 | |
| **Overall totals for ERP operation risks** | **IT managers** | 61 | 20 (32.8%) | 27 (44.3%) | 14 (23%) | 46.40 | 0.000 |
| | **CFO** | 56 | 1 (1.8%) | 9(16.1%) | 46(82.1%) | 109.21 | |
| | **Auditing managers** | 26 | - | 1(3.8%) | 25(96.2%) | 108.62 | |
| | **Others** | 23 | - | 10(43.5%) | 13(56.5%) | 90.89 | |

### 7.7.3 *Statistical findings regarding differences in perception of ERP implementation risks according to ERP expertise (H2a)*

The aim of the research question is to compare the perceptions of risk factors related to the implementation of ERP systems between the managers with high and low levels of ERP expertise, and explore whether any differences are statistically significant. Cross-tabulation and the Mann-Whitney test were applied in order to examine this research question and fulfil this research objective. Thus, the questionnaire was distributed to managers with different levels of ERP experience in order to make a valid and adequate comparison.

For the purpose of this research question, the level of ERP expertise was classified into high and low levels. Thus, the sample of respondents was divided in half via a median ERP expertise score as possessing high and low ERP expertise. Respondents were measured in terms of their average response to five items on a seven-point scale (i.e. their average ERP expertise score). The mean and median scores of ERP expertise were 4.76 and 4.80 respectively. Similar to Brazel (2005), the sample was split into two groups, with the respondents scoring below 4.80 being classified as low expertise and those above 4.80as having a high level of ERP expertise. Using this system to categorise individuals, the sample contained eighty five managers with low ERP expertise and eighty one who had high ERP expertise.

Table 7-10 below presents a summary of the frequency distributions for the mean scores of managers' perception of the risks related to ERP implementation according to their ERP expertise. Table 7-10 also shows the results of the Mann–Whitney U test (a non-parametric independent-sample technique). As can be seen in Table 7-10, (69.4 %) of managers with low ERP expertise believed that employees had difficulties in understanding and using ERP systems, and that the complexity of ERP systems made implementation projects more likely to fail. However, not many (7.4%) managers with high ERP expertise perceived ERPs as a difficult system to learn and understand. It can also be noted that managers with a low level of ERP expertise showed statistically significantly different perceptions from the managers with a high level of ERP expertise in terms of difficulties in understanding and using ERP systems, where the p-value (p=0.000) was less than 0.05. Regarding the mean rank scores for managers with low and high levels of ERP expertise (114.6 and 50.79 respectively), the managers with a low level of ERP expertise perceived of this risk factor to be significantly higher than the managers with a high level of ERP expertise.

Also, it can be seen from Table 7-10 that the largest number of managers with high ERP expertise (95.1% and 98.8%) believed that a failure to redesign business processes and carry out major customisation of the ERP, and unclear or misunderstood users' requirements, were major risks related to ERP implementation. However, only 42.4% and 56.5% of managers with low ERP expertise agreed that these risks could cause the failure of an ERP implementation. The results of the Mann-Whitney test indicated that there is a significant difference in the perceptions of the failure to redesign business processes and carry out major customisation of the ERP (p= 0.000), and unclear or misunderstood users' requirements as major risks relating to ERP implementation (p=0.000) between the managers with high levels of ERP expertise and managers with low levels of ERP expertise. Regarding the higher scores of mean rank for managers with low and high levels of ERP expertise for the perception that failure to redesign business processes and carry out major customisation of the ERP, and unclear or misunderstood users' requirements are major risks related to ERP implementation (55.75 and 112.62), (58.16 and 110.09), the perceptions of managers with a high level of ERP expertise is significantly higher than the managers with a low level of ERP expertise.

Regarding lack of management of change, and insufficient discipline and standardisation as risk factors associated with the implementation ERP systems, it is clear from Table 7-10 that over three quarters of managers with high ERP expertise (79%) perceived both of these risks as key threats to the success of an ERP implementation. However, 18.8% and 20% of managers with low ERP expertise believed this. What is more, managers with high levels of ERP expertise (65.4%) were more likely than managers with low ERP expertise (27.1%) to recognise that a lack of involvement of users in the ERP system could have a negative impact on the ERP implementation. Table 7-10 indicates that there is a significant statistical difference between the managers with a high level of ERP expertise and managers with a low level of expertise in terms of their perceptions of the lack of management of change (p=0.000), insufficient discipline and standardisation (p=0.000), and lack of involvement of users in the ERP system (p= 0.000). Regarding on the higher score of mean rank for managers with low and high level of ERP expertise for perception of lack of management of change, insufficient discipline and standardization, and lack of involvement of users in the ERP system (55.68, 112.70), (55.67, 112.70), and (68.78, 98.94) respectively, the managers with high level of ERP expertise is significantly higher perceived of these risk factors than the managers with low level of ERP expertise.

The statistics in Table 7-10 reveal that managers with low and high ERP expertise demonstrated differences in terms of their perceptions that the resistance of users (62.4% and 85.2% respectively); ineffective communication between users (49.4% and 74.1% respectively); lack of business analysts with business and technology knowledge (71.8% and 92.6%); and failure to mix internal and external expertise (69.4% and 88.9%) could make ERP systems implementations fail. From Table 7-10 it can be seen that managers with a high level of ERP expertise and managers with a low level of ERP expertise had statistically significant differences in attitude regarding the resistance of users (p= 0.000), ineffective communication between users (p= 0.000), lack of business analysts with business and technology knowledge (p= 0.000) and failure to mix internal and external expertise (p= 0.006) as risk factors that could make an ERP implementation fail. Regarding on the higher score of mean rank for managers with low and high level of ERP expertise for perception of resistance of user (69.25, 98.45), ineffective communication between users (70.19, 97.46) Lack of business analysts with business and technology knowledge (69.28, 98.43), Failure to mix internal and external expertise (74.00, 93.47), the managers with high level of ERP expertise is significantly higher perceived of these risk factors than the managers with low level of ERP expertise.

The statistics in Table 7-10 reveal that managers who had low and high levels of ERP expertise were only slightly different in their perception that a lack of ability to recruit and retain qualified ERP systems developers was a risk factor in ERP implementation as 76.2% of managers with high ERP expertise and 63.5% of managers with low ERP expertise felt this. On the other hand, managers with high ERP expertise of were less convinced than those with low ERP expertise in terms of their perception of the following being a risk to ERP implementation: lack of top management support (56.8% and 68.2%respectively) and insufficiency of resources (69.1% and 74.1%). However, no significant differences were found between the managers with high level of ERP expertise and managers with low level of ERP expertise concerning the lack of top management support (p=0.373), insufficiency of resources (p=0.586), lack of ability to recruit and retain qualified ERP systems developers (p=0.094).

In relation to the ERP implementation risk factors such as the lack of a champion, the lack of an effective project management methodology, and a lack of agreement on project goals, it can be noticed in Table 7-10 that managers with both high and low ERP expertise had quite equal awareness about these risks and the scope of their effect on the success or failure of the project. However, no significant differences were found between the managers with high levels of ERP expertise and managers with low levels of ERP expertise concerning their perceptions of the lack of a champion (p=0.065), a lack of agreement on project goals (p=0.086), and the lack of an effective project management methodology (p=0.185).

In addition, a substantial number of mangers with both high and low expertise perceived that insufficient training of ERP end-users (91.4% and 90.6% respectively) and lack of users' experience (86.4% and 83.5% respectively) were important risks in ERP implementation. However, no significant differences were found between managers with high levels of ERP expertise and those with low expertise regarding their perceptions of insufficient training of ERP end-users (p=0.903) and a lack of users' experience (p=0.311).

Overall, managers with high ERP expertise were more concerned and had higher perceptions concerning ERP implementation risks than managers with low ERP expertise. Table 7-10 illustrates that 91.4% of managers with high ERP expertise perceived ERP implementations as risky while just 61.2% of managers with low ERP expertise perceived ERP implementations as risky systems. It can also be seen that there is a significant difference in the perception of risk factors associated with implementation of ERP systems between the two groups (p= 0.000). In terms of higher scores of mean rankings for managers with both low and high levels of ERP expertise (64.17and103.78), the managers with a high level of ERP expertise perceived risk factor related to ERP implementation significantly higher than the managers with a low level of ERP expertise.

In summary, Table 7-10 shows that ten out of 18 risk factors were statistically significantly different, at a p value $\leq 0.05$, between the two groups of managers: i.e. those possessing low or high levels of ERP expertise. The ten risk factors were: difficulties in understanding and using ERP systems, failure to redesign business processes and carry out major customisation of the ERP, lack of change management, insufficient discipline and standardisation, unclear or misunderstood users' requirements, ineffective communication between users, resistance of users, lack of involvement of users in the ERP system, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise.

Regarding the other eight risk factors, there was no significant differentiation in the perceptions of all the other ERP risk factors between the two groups of managers. Therefore, hypothesis H2a that said that: *There is a significant difference between managers who have low and high ERP expertise in their perceptions of patterns of risk factors associated with implementation ERP systems* is supported for only ten risk factors but is not supported for the others. In other words, it is clear that the level of ERP expertise does have some influence on managers' perceptions of some of the risk factors associated with the implementation of ERP systems. However, it does not have an effect on their perceptions of other risk factors which means that their perceptions of those risk factors are similar to other managers whatever their level of ERP expertise.

By comparing the mean rank, the managers with a high level of ERP expertise gained higher scores than the managers with a low level of ERP expertise in terms of their perceptions of the following 14 risk factors: failure to redesign business processes and carry out major customisation of the ERP, lack of change management, insufficient discipline and standardisation, unclear or misunderstood users' requirements, lack of a champion, lack of agreement on project goals, lack of an effective project management methodology, ineffective communication between users, resistance of users, lack of involvement of users in the ERP system, lack of users' experience, lack of ability to recruit and retain qualified ERP systems developers, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise.

However, the managers with a low level of ERP expertise were significantly higher than the managers with a high level of ERP expertise in terms of their perceptions of the risk factor of difficulties in understanding and using ERP systems. This is quite a logical result since the managers with high ERP expertise are likely to believe these systems are easy to understand and use. In terms of insufficient training of end users, insufficiency of resources, and lack of top management support, the mean rank for the two groups of managers is nearly the same.

Table 7-10: Differences regarding risk factors during the implementation of an ERP according to level of ERP expertise

| Risk factors during implementation of ERP systems | ERP expertise | N | Frequency | | | Mean rank | Sum of ranks | Mann-Whitney | Wilcoxon | Z | Asymp. Sig. (2-tailed ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Disagree | neutral | agree | | | | | | |
| 1. Difficulties in understanding and using ERP systems | Low | 85 | 15 (17.6%) | 11 (12.9%) | 59 (69.4%) | 114.67 | 9747.00 | 793.000 | 4114.000 | -8.585 | .000 |
| | High | 81 | 70 (86.4%) | 5 (6.2%) | 6 (7.4%) | 50.79 | 4114.00 | | | | |
| 2. Failure to redesign business processes and carry out major customisation of ERP | Low | 85 | 35 (41.2%) | 14 (16.5%) | 36 (42.4%) | 55.75 | 4739.00 | 1084.000 | 4739.000 | -7.688 | .000 |
| | High | 81 | 2 (2.5%) | 2 (2.5%) | 77 (95.1%) | 112.62 | 9122.00 | | | | |
| 3. Lack of top management support | Low | 85 | 18 (21.2%) | 9 (10.6%) | 58 (68.2%) | 86.67 | 7367.00 | 3173.000 | 6494.000 | -.891 | 0.373 |
| | High | 81 | 26 (32.1%) | 9 (11.1%) | 46 (56.8%) | 80.17 | 6494.00 | | | | |
| 4. Insufficiency of resources | Low | 85 | 12 (14.1%) | 10 (11.8%) | 63 (74.1%) | 81.53 | 6930.00 | 3275.000 | 6930.000 | -.545 | .586 |
| | High | 81 | 17 (21%) | 8 (9.9%) | 56 (69.1%) | 85.57 | 6931.00 | | | | |
| 5. Lack of management of change | Low | 85 | 57(67.1%) | 12 (14.1%) | 16 (18.8%) | 55.68 | 4732.50 | 1077.500 | 4732.500 | -7.749 | .000 |
| | High | 81 | 8 (9.9%) | 9 (11.1%) | 64(79%) | 112.70 | 9128.50 | | | | |
| 6. Insufficient discipline and standardisation | Low | 85 | 54 (63.5%) | 14 (16.5%) | 17 (20%) | 55.67 | 4732.00 | 1077.000 | 4732.000 | -7.787 | .000 |
| | High | 81 | 12 (14.8%) | 5 (6.2%) | 64 (79%) | 112.70 | 9129.00 | | | | |
| 7. Unclear/ misunderstood users' requirements | Low | 85 | 23 (27.1%) | 14 (16.5%) | 48 (56.5%) | 58.16 | 4944.00 | 1289.000 | 4944.000 | -6.981 | .000 |
| | High | 81 | - | 1 (1.2%) | 80 (98.8%) | 110.09 | 8917.00 | | | | |
| 8. Lack of champion | Low | 85 | 28 (32.9%) | 10 (11.8%) | 47 (55.3%) | 76.89 | 6536.00 | 2881.000 | 6536.000 | -1.845 | .065 |
| | High | 81 | 25 (30.9%) | 11 (13.6%) | 45 (55.6%) | 90.43 | 7325.00 | | | | |
| 9. Lack of agreement on project goals | Low | 85 | 23 (27.1%) | 10 (11.8%) | 52 (61.2%) | 77.29 | 6570.00 | 2915.000 | 6570.000 | -1.716 | 0.086 |
| | High | 81 | 17 (21%) | 16 (19.8%) | 48 (59.3%) | 90.01 | 7291.00 | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10. **Lack of effective project management methodology** | **Low** | 85 | 23 (27.1%) | 11 (12.9%) | 51 (60%) | 78.70 | 6689.50 | 3034.500 | 6689.500 | -1.326 | 0.185 |
| | **High** | 81 | 17 (21%) | 16 (19.8%) | 48 (59.3%) | 88.54 | 7171.50 | | | | |
| 11. **Insufficient training of end-users** | **Low** | 85 | 7 (8.2%) | 1 (1.2%) | 77(90.6%) | 83.93 | 7134.00 | 3406.000 | 6727.000 | -0.122 | 0.903 |
| | **High** | 81 | 4 (4.9%) | 3 (3.7%) | 74 (91.4%) | 83.05 | 6727.00 | | | | |
| 12. **Ineffective communications between user** | **Low** | 85 | 32 (37.6%) | 11 (12.9%) | 42 (49.4%) | 70.19 | 5966.50 | 2311.500 | 5966.500 | -3.68 | 0.000 |
| | **High** | 81 | 15 (18.5%) | 6 (7.4%) | 60 (74.1%) | 97.46 | 7894.50 | | | | |
| 13. **Resistance of users** | **Low** | 85 | 23 (27.1%) | 9 (10.6%) | 53 (62.4%) | 69.25 | 5886.50 | 2231.500 | 5886.500 | -3.934 | 0.000 |
| | **High** | 81 | 5 (6.2%) | 7 (8.6%) | 69 (85.2%) | 98.45 | 7974.50 | | | | |
| 14. **Lack of involvement of users in the ERP system** | **Low** | 85 | 52 (61.2%) | 10 (11.8%) | 23 (27.1%) | 68.78 | 5846.50 | 2191.500 | 5846.500 | -4.141 | 0.000 |
| | **High** | 81 | 23 (28.4%) | 5 (6.2%) | 53 (65.4%) | 98.94 | 8014.50 | | | | |
| 15. **Lack of user experience** | **Low** | 85 | 8 (9.4%) | 6 (7.1%) | 71 (83.5%) | 79.85 | 6787.50 | 3132.500 | 6787.500 | -1.014 | 0.311 |
| | **High** | 81 | 5 (6.2%) | 6 (7.4%) | 70 (86.4%) | 87.33 | 7073.50 | | | | |
| 16. **Lack of ability to recruit and retain qualified ERP systems developers** | **Low** | 85 | 12 (14.1%) | 19 (22.4%) | 54 (63.5%) | 77.59 | 6595.50 | 2940.500 | 6595.500 | -1.676 | 0.094 |
| | **High** | 81 | 4 (4.9%) | 15 (18.5%) | 62 (76.2%) | 89.70 | 7265.50 | | | | |
| 17. **Lack of business analysts with business an technology knowledge** | **Low** | 85 | 10 (11.8%) | 14 (16.5%) | 61 (71.8%) | 69.28 | 5888.50 | 2233.500 | 5888.500 | -4.071 | 0.000 |
| | **High** | 81 | 2 (2.5%) | 4 (4.9%) | 75(92.6%) | 98.43 | 7972.50 | | | | |
| 18. **Failure to mix internal and external expertise effectively** | **Low** | 85 | 11 12.9%) | 15 (17.6%) | 59(69.4%) | 74.00 | 6290.00 | 2635.000 | 6290.000 | -2.723 | 0.006 |
| | **High** | 81 | 6 (7.4%) | 3 (3.7%) | 72(88.9%) | 93.47 | 7571.00 | | | | |
| **Overall total risks of ERP implementation** | **Low** | 85 | 2 (2.4%) | 31 (36.5%) | 52( 61.2%) | 64.17 | 5454.50 | 1799.500 | 5454.500 | -5.309 | 0.000 |
| | **High** | 81 | - | 7 (8.6%) | 74 (91.4%) | 103.78 | 8406.50 | | | | |

### 7.7.4 *Statistical findings regarding differences in perceptions of ERP operational risks according to ERP expertise (H2b)*

Cross-tabulation and the Mann Whitney test were employed in order to find whether there were statistically significant differences between managers with high and low ERP expertise in terms of their perceptions of risk factors associated with the operation of ERP systems. The following table, Table 7-11, shows that a higher proportion of managers possessing low ERP expertise (74.1%) than managers possessing high ERP expertise (34.6%) felt that working with two systems in parallel (the old system and the ERP system) after going live could make the operation of ERP less risky. Conversely, a higher proportion of managers with low ERP expertise (67.1%) than managers with high ERP expertise (39.5%) believed that the sharing of passwords among ERP users was a major security risk and made fraud more likely. Thus, Table 7-11 indicates that ERP expertise has a statistically significant effect on perceptions regarding the working with two systems in parallel (p= 0.000) and sharing passwords among ERP users as a major security risk (p= 0.000). Regarding the mean rank for managers with low and high levels of ERP expertise regarding their perceptions of working with two systems in parallel (104.43 and 61.54) and the sharing of passwords among ERP users as a major security risk (100.22, 65.95), the managers with a low level of ERP expertise perceived these factors to be a significantly higher risk than the managers with a high level of ERP expertise.

Concerning the risks of illogical processing, incorrect entry of data, repetition of errors, and the flowing of errors, it was observed that a large number of managers with low ERP expertise (77.6%, 85.9%, 87.1% and 82.4 respectively) perceived these to be risks linked to an ERP's operation. Also, 45.7%, 51.9%, 53.1% and 49.4% respectively of managers with low ERP expertise perceived that these risk factors could have the potential to cause errors in the company's financial statements. Furthermore, Table 7-11 indicates that, statistically, there is a significant difference between the managers with high levels of ERP expertise and managers with low levels of ERP expertise concerning their perceptions of the risks from illogical processing (p= 0.000), incorrect entry of data (p= 0.000), repetition of errors (p= 0.000), and the flowing of errors (p= 0.000). In terms of the higher scores of mean rank for managers with low and high levels of ERP expertise regarding their perceptions of the risks of illogical processing (101.78 and 64.31), incorrect entry of data (104.48 and 61.48), repetition of errors (101.31 and

64.81), and the flowing of errors (104.42and 61.54), the managers with a low level of ERP expertise ranked these risk factors significantly higher than the managers with high levels of ERP expertise.

Relating to the operational risk factors such as the suitability of ERP software and the ERP security risks, it can be seen in Table 7-11 that managers with both high and low levels of ERP expertise had quite high and similar perceptions regarding these risks and the range of their effects on the success or failure of an ERP operation. In addition, the lowest number of managers with high or low expertise (11.1% and 14.1% respectively) perceived that the output information provided by an ERP system is often inaccurate, too late to be useful, inconsistent and incomplete. However, no significant differences were found between the managers with high levels of ERP expertise and managers with low levels of expertise in terms of their perceptions of the suitability of ERP software (p=0.108), security risks (p=0.671), and lack of information quality (p=0.068).

On the whole, managers with high ERP expertise were less concerned and had lower perceptions concerning the operational ERP risks than managers with low ERP expertise. Table 7-11 highlights that 42% of managers with high ERP expertise perceived ERP operations as risky systems, whereas about three quarters (75.3%) of managers with low ERP expertise perceived these systems as risky. It can also be seen that there is a significant difference in perceptions of the risk factors associated with the operation of ERP systems (p= 0.000). Regarding the higher scores of mean rank for managers with both low and high levels of ERP expertise (103.58 and 62.43), the managers with a low level of ERP expertise perceived ERP operation risks significantly higher than the managers with a high level of ERP expertise.

To conclude, six out of nine operational risk factors showed statistically significant differences between the two groups of managers (those possessing low or high levels of ERP expertise) where p value $\leq 0.05$. Those six risk factors were: working with two systems in parallel, sharing passwords among ERP users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. Regarding the other three ERP operation risk factors, namely the suitability of ERP software, ERP security risks, and the lack of information quality, there was no significant difference in the perceptions of the managers with low and high levels of ERP expertise concerning those risk factors. Therefore, hypothesis H2b that said: *There is a significant difference between managers who have low or high ERP expertise regarding their perceptions of the patterns of risk factors associated with the operation of ERP systems*, is supported but only for those six risk factors; it is not supported for other risk factors. In other words, it is clear that the level of ERP expertise has some influence on managers' perceptions of some of the risk factors associated with the operation of ERP systems but that it does not have an effect on their perceptions of other risk factors. This means that the perceptions of those risk factors are similar for managers according to their level of ERP expertise.

Comparing the higher scores of mean rank, the managers with low levels of ERP expertise had higher scores than the managers with high levels of ERP expertise in terms of their perception of the following risk factors: working with two systems in parallel, sharing passwords among users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. However, managers with both high and low levels of ERP expertise perceived to a similar extent the risk factor concerning the suitability of ERP software, ERP security risks, and the lack of information quality.

Table 7-11: Differences in risk factors during the operation of an ERP system according to level of ERP expertise

| Risk factors during operation of ERP systems | ERP expertise | N | Frequency disagree | Frequency neutral | Frequency agree | Mean rank | Sum of ranks | Mann-Whitney | Wilcoxon | Z | Asymp. Sig. (2-tailed ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. ERP software suitability | Low | 85 | 7 (8.2%) | 12 (14.1%) | 66 (77.6%) | 77.70 | 6604.50 | 2949.500 | 6604.500 | -1.606 | 0.108 |
| | High | 81 | 1 (1.2%) | 10 (12.3%) | 70 (86.4%) | 89.59 | 7256.50 | | | | |
| 2. Working with two systems in parallel | Low | 85 | 17 (20%) | 5 (5.9%) | 63 (74.1%) | 104.43 | 8876.50 | 1663.500 | 4984.500 | -5.850 | 0.000 |
| | High | 81 | 48 (59.3%) | 5 (6.2%) | 28 (34.6%) | 61.54 | 4984.50 | | | | |
| 3. Security risks | Low | 85 | 4 (4.7%) | 15 (17.6%) | 66 (77.6%) | 81.96 | 6966.50 | 3311.500 | 6966.500 | -0.425 | 0.671 |
| | High | 81 | 4 (4.9%) | 9 (11.1%) | 68 (84%) | 85.12 | 6894.50 | | | | |
| 4. Sharing passwords | Low | 85 | 17 (20%) | 11 (12.9%) | 57 (67.1%) | 100.22 | 8519.00 | 2021.000 | 5342.000 | -4.606 | 0.000 |
| | High | 81 | 38 (46.9%) | 11 (13.6%) | 32 (39.5%) | 65.95 | 5342.00 | | | | |
| 5. Incorrect entry of data | Low | 85 | 5 (5.9%) | 7 (8.2%) | 73 (85.9%) | 104.48 | 8881.00 | 1659.000 | 4980.000 | -5.783 | 0.000 |
| | High | 81 | 34 (42%) | 5 (6.2%) | 42 (51.9%) | 61.48 | 4980.00 | | | | |
| 6. Repetition of errors | Low | 85 | 5 (5.9%) | 6 (7.1%) | 74 (87.1%) | 101.31 | 8611.00 | 1929.000 | 5250.000 | -4.924 | 0.000 |
| | High | 81 | 34 (42%) | 4 (4.9%) | 43 (53.1%) | 64.81 | 5250.00 | | | | |
| 7. Flowing of errors | Low | 85 | 6 (7.1%) | 9 (10.6%) | 70 (82.4%) | 104.42 | 8876.00 | 1664.000 | 4985.000 | -5.771 | 0.000 |
| | High | 81 | 35 (43.2%) | 6 (7.4%) | 40(49.4%) | 61.54 | 4985.00 | | | | |
| 8. Illogical processing | Low | 85 | 9 (10.6%) | 10 (11.8%) | 66 (77.6%) | 101.78 | 8651.50 | 1888.500 | 5209.500 | -5.044 | 0.000 |
| | High | 81 | 31 (38.3%) | 13 (16%) | 37 (45.7%) | 64.31 | 5209.50 | | | | |
| 9. Information quality | Low | 85 | 59(69.4%) | 14 (16.5%) | 12 (14.1%) | 89.98 | 7648.00 | 2892.000 | 6213.000 | -1.823 | 0.068 |
| | High | 81 | 64 (79%) | 8 (9.9%) | 9 (11.1%) | 76.70 | 6213.00 | | | | |
| **Overall total of operational ERP risks** | Low | 85 | 3 (3.5 %) | 18 (21.2%) | 64 (75.3%) | 103.58 | 8804.00 | 1736.000 | 5057.000 | -5.514 | 0.000 |
| | High | 81 | 18 (22.2%) | 29 (35.8 %) | 34 (42%) | 62.43 | 5057.00 | | | | |

### 7.7.5 ***Statistical findings regarding differences in perception of ERP implementation risks according to culture (H3a)***

Twenty one items (see Appendices 2) were used in the questionnaire (developed by Dake, 1992; Dake, 1991; Wildavsky and Dake; Rippl, 2002; Marris et al., 1998; Oltedal et al., 2004; Brenot et al., 1998; Rajapakse and Seddon, 2005) to measure managers' culture. Items were rated on a seven-point Likert scale of agreement-disagreement. Four culture scores were calculated for each respondent. An individual's responses to each of the items attributed to a culture were added up and divided by the number of items used for that culture. This procedure resulted in a score between 1 and 7 for each culture for each respondent. According to the advice of Marris et al. (1998) and Brenot et al.(1998), the sample of respondents was split into a half via a mean score in order to be allocated to a particular culture for respondents who had score above the mean score. It was expected that each respondent would get one score above the mean while the other scores would fall below the mean. The mean scores for Hierarchism, Individualism, Egalitarianism and Fatalism were 4.25, 3.25, 4.71 and 2.93 respectively. Using this system to categorise individuals, the sample consisted of 42 egalitarians, eleven individualists, thirty two hierarchists and four fatalists. Seventy seven respondents were of mixed cultural types as they had more than one score above the mean. These sample results were quite similar to those of Marris et al.(1998).

Cross tabulation and the Kruskal-Wallis test were used in order to investigate whether there were any significant differences in perception among the different culture groups of managers (i.e. hierarchists, individualists, egalitarians, fatalists and mixed cultures) concerning each risk factor related to the implementation of ERP systems. The results of the cross tabulation and the Kruskal-Wallis test are presented in Table 7-12.

The statistics revealed that managers with different cultures, such as hierarchists, individualists, egalitarians, fatalists and mixed cultures, perceived ERP implementation risk factors differently. Regarding difficulties in understanding and using ERP systems, approximately less than two thirds of hierarchists (62.5%), half of fatalists (50%), and 42.9% of managers with mixed cultures found ERP systems to be complex and difficult to understand, and felt that the complexity of ERP systems made implementation projects more likely to fail. However, a low percentage of individualists and egalitarians (72% and 69% respectively) believed ERP systems were simple and easy to understand.

As can be noticed from Table 7-12, a high number of hierarchists and individualists (93.8% and 81.8%, respectively) thought that the ERP implementation project goals could not succeed with unclear objectives, and felt that a lack of effective ERP project management methodology hindered the success of an ERP implementation. On the other hand, about a third of egalitarians, and more than half of fatalist managers and managers with mixed cultures thought that both a lack of agreement on project goals and the lack of an effective project management methodology were major causes of ERP project failure. Besides, hierarchists and individualists (90.6% and 72.7%) were more likely to perceive that it was important to have a champion during the implementation of ERP systems than the egalitarians, fatalists and mixed cultures (28.6%, 50% and 53.2% respectively). Table 7-12 clarifies that all of the individualists (100%), and most hierarchists and fatalists (93.8% and 100% respectively) believed that a lack of top management support was a risk factor that would lead to the failure of an ERP implementation, while more than two thirds of manager with mixed cultures (68.8%) and a low number of the egalitarians (14.3%) perceived this as a risk. Conversely, none of the individualists felt that an insufficiency of resources such as time and money would make an ERP implementation more likely to fail but a greater number of hierarchists and egalitarians (87.5% and 83.3% respectively) than the mixed culture group and fatalists (70.1% and 50% respectively) perceived this as a risk. Also, it can be seen from Table 7-12 that large proportion of hierarchists, individualists and egalitarians (96%, 90% and 97% respectively), a little more than mixed cultures (87%), perceived that insufficient training of end-users was an ERP implementation risk; just half of the fatalists (50%) agreed with this proposition. However, the Kruskal-Wallis test indicated that there was a statistically significant difference between managers from different cultural groups regarding their perceptions of the risks of: difficulties in understanding and using ERP systems (p=0.003), lack of agreement on ERP project goals (p=0.000), lack of effective ERP project management methodology (p=0.000), lack of a champion (p=0.000), lack of top management support (p=0.000), insufficiency of resources (p=0.000), and insufficient training of end-users (p=0.030).

The results in Table 7-12 show that all individualists and egalitarian managers were better than hierarchists, fatalists and mixed cultures (28.1%, 25% and 64.9% respectively)at recognising that a failure to redesign business processes and carry out major customisation is a risk to implementing an ERP system. Concerning the lack of management of change, and insufficient discipline and standardisation, it was observed that individualists and egalitarians were the most numerous of the mangers in their perception of these risks. On the other hand, hierarchists and fatalists were the lowest in percentage terms of the managers perceiving both of these risks (9.4% and 25%) while managers with mixed cultures were more aware that insufficient discipline and standardisation resulted in the risk of failure for an ERP implementation systems than a lack of management of change (46.8% and 45.5% respectively). It was also found that a higher number of individualist managers (ranging from 81.8% to 100%), and egalitarians (ranging from 85.7% to 97.6%), than fatalists (ranging from 25% to 75%), hierarchists (ranging from 43.8% to 78.1%), and mixed cultures (ranging from 66.8%, to 81.6%) perceived that unclear or misunderstood users' requirements, a lack of user experience, lack of ability to recruit and retain qualified ERP systems developers, lack of business analysts with business and technology knowledge, failure to mix internal and external expertise effectively, and users' resistance to change were major barriers to the successful implementation of ERP.

However, results from the Kruskal-Wallis test indicated that there were statistically significant differences between managers from different culture groups in terms of their perceptions of the risks of: failure to redesign business processes and carry out major customisation of the ERP (p=0.000), lack of management of change (p=0.000), insufficient discipline and standardisation (p=0.000), unclear or misunderstood users' requirements (p=0.000), resistance to change (p=0.000), lack of ability to recruit and retain qualified ERP systems developers (p=0.000), lack of business analysts with business and technology knowledge (p=0.010), failure to mix internal and external expertise effectively (p=0.040), as major barriers to the successful implementation of an ERP. However, no significant differences were found for the risk factor of a lack of user experience (p=0.302).

The statistics revealed that the egalitarians (85.7% and 95.2%) scored higher than other cultures in their perceptions that a lack of involvement of users in the ERP system, and ineffective communication between users were critical and could cause the failure of an ERP implementation. On the contrary, the individualists (18.2%) were less likely to perceive ineffective communications between ERP users as a risk and hierarchists (12.5%) were the lowest in terms of their perceptions of the importance of a lack of involvement of users in the success of ERP systems. The Kruskal-Wallis test results showed that statistically significant differences between managers from different culture groups in terms of perceiving a lack of involvement of users in the ERP system (p=0.000) and ineffective communication between users (p=0.000) as risks.

Generally, it is clear from Table 7-12 that egalitarian and individualist managers were the managers (90.5% and 81.8% respectively) in Jordan organisations most concerned with the risk factors associated with implementing ERP systems whilst hierarchists and mixed culture managers, less than egalitarian and individualist managers (68.8% and 71.4% respectively) believed that the overall implementation of an ERP system was risky. The fatalists scored the lowest of them all (50%) in terms of their perceptions of ERP implementation risk factors.

In brief, the results showed, when comparing managers with different types of culture (hierarchists, individualists, egalitarians, fatalists and mixed cultures) that there was significant differentiation in their perceptions of all of the risk factors which were likely to occur during the implementation of ERP systems, with the exception of the lack of users' experience where no significant differences were found among managers with different cultures. Therefore, hypothesis H3a that said: "*There is a significant difference between managers in terms of their different cultures and their perceptions of patterns of risk factors associated with ERP implementation*" is supported for 17 risk factors but not supported for one, namely the lack of users' experience. In other words, it is clear that the type of culture has an influence on managers in terms of their perceptions of the risk factors associated with the implementation of ERP systems. However, culture does not have an effect on their perception concerning the lack of users' experience which means that the perceptions of this risk factor are similar in managers regardless of their culture.

Comparing the mean ranks, individualist and egalitarian managers were more likely than other managers to perceive 9 factors associated with the implementation of ERP systems as risks since they scored a higher mean rank. Those risk factors were: failure to redesign business processes and make major customisation of the ERP, lack of change management, insufficient discipline and standardisation, unclear or misunderstood users' requirements, resistance of users, lack of users' experience, lack of ability to recruit and retain qualified ERP systems developers, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise. However, egalitarians gained a higher mean rank than other managers regarding ineffective communication between users, and the lack of involvement of users in the ERP systems.

Regarding the mean rank of other risk factors, hierarchists had a higher mean rank than other managers regarding their perception of the difficulties in understanding and using ERP systems. Also, hierarchists and individualist managers were more likely to perceive 4 risk factors associated with the implementation of ERP systems than egalitarians, fatalists and mixed cultures. These four factors were: lack of agreement on project goals, lack of an effective project management methodology, lack of a champion, and lack of top management support. Hierarchists and egalitarians were the managers most likely to perceive that insufficiency of resources and insufficient training of end-users as risks factors that could make an ERP system fail.

Table 7-12: Differences in perceptions of risk factors during the implementation of an ERP system according to types of culture

| Risk factors during implementation of ERP systems | culture | N | Frequency | | | Mean rank | Asymp. Sig. |
|---|---|---|---|---|---|---|---|
| | | | disagree | Neutral | agree | | |
| 1. Difficulties in understanding and using ERP systems | Hierarchists | 32 | 10 (31.3%) | 2 (6.3%) | 20 (62.5% | 108.02 | 0.003 |
| | Individualists | 11 | 8(72.7%) | 2(18.2%) | 1(9.1%) | 67.55 | |
| | Egalitarians | 42 | 29 (69.0%) | 4 (9.5%) | 9 (21.4%) | 65.48 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 70.13 | |
| | Mixed | 77 | 36(46.8%) | 8(10.4%) | 33(42.9%) | 86.12 | |
| 2. Failure to redesign business processes and make major customisation of ERP | Hierarchists | 32 | 21 (65.6%) | 2 (6.3%) | 9 (28.1%) | 48.23 | 0.000 |
| | Individualists | 11 | - | - | 11 (100.0%) | 95.86 | |
| | Egalitarians | 42 | - | - | 42 (100.0%) | 118.49 | |
| | Fatalists | 4 | - | 3 (75.0%) | 1 (25.0%) | 48.38 | |
| | Mixed | 77 | 16 (20.8%) | 11 (14.3%) | 50 (64.9%) | 79.13 | |
| 3. Lack of top management support | Hierarchists | 32 | 1 (3.1%) | 1 (3.1%) | 30 (93.8%) | 108.08 | 0.000 |
| | Individualists | 11 | - | - | 11 (100.0%) | 123.36 | |
| | Egalitarians | 42 | 27 (64.3%) | 9 (21.4%) | 6 (14.3%) | 40.76 | |
| | Fatalists | 4 | - | - | 4 (100.0%) | 102.00 | |
| | Mixed | 77 | 16 (20.8%) | 8 (10.4%) | 53 (68.8%) | 89.94 | |
| 4. Insufficiency of resources | Hierarchists | 32 | - | 4 (12.5%) | 28 (87.5%) | 94.05 | 0.000 |
| | Individualists | 11 | 10 (90.9%) | 1 (9.1%) | - | 15.36 | |
| | Egalitarians | 42 | 5 (11.9%) | 2 (4.8%) | 35 (83.3%) | 101.19 | |
| | Fatalists | 4 | - | 2 (50.0%) | 2 (50.0%) | 86.00 | |
| | Mixed | 77 | 14 (18.2%) | 9 (11.7%) | 54 (70.1%) | 79.07 | |
| 5. Lack of management of | Hierarchists | 32 | 26 (81.3%) | 3 (9.4%) | 3 (9.4%) | 42.91 | 0.000 |
| | Individualists | 11 | 3 (27.3%) | 2 (18.2%) | 6 (54.5%) | 106.91 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **change** | Egalitarians | 42 | 4 (9.5%) | 3 (7.1%) | 35 (83.3%) | 114.71 | |
| | Fatalists | 4 | 1 (25.0%) | 2 (50.0%) | 1 (25.0%) | 70.25 | |
| | Mixed | 77 | 31 (40.3%) | 11 (14.3%) | 35 (45.5%) | 80.69 | |
| 6.**Insufficient discipline and standardisation** | Hierarchists | 32 | 28(87.5%) | 1 (3.1%) | 3(9.4%) | 39.08 | 0.000 |
| | Individualists | 11 | 4 (36.4%) | - | 7(63.6%) | 97.36 | |
| | Egalitarians | 42 | 4 (9.5%) | 4 (9.5%) | 34 (81.0%) | 115.11 | |
| | Fatalists | 4 | 1 (25.0%) | 2 (50.0%) | 1 (25.0%) | 72.00 | |
| | Mixed | 77 | 29 (37.7%) | 12 (15.6%) | 36 (46.8%) | 83.34 | |
| 7.**Unclear/ misunderstood users' requirements** | Hierarchists | 32 | 8 (25.0%) | 4 (12.5%) | 20 (62.5%) | 63.02 | 0.000 |
| | Individualists | 11 | 1 (9.1%) | - | 10 (90.9%) | 110.91 | |
| | Egalitarians | 42 | 1 (2.4%) | 1 (2.4%) | 40 (95.2%) | 105.43 | |
| | Fatalists | 4 | - | 1 (25.0%) | 3 (75.0%) | 70.63 | |
| | Mixed | 77 | 13 (16.9%) | 9 (11.7%) | 55 (71.4%) | 76.81 | |
| 8.**Lack of champion** | Hierarchists | 32 | - | 3 (9.4%) | 29 (90.6%) | 116.02 | 0.000 |
| | Individualists | 11 | 3 (27.3%) | - | 8 (72.7%) | 92.91 | |
| | Egalitarians | 42 | 23 (54.8%) | 7 (16.7%) | 12 (28.6%) | 60.74 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 53.13 | |
| | Mixed | 77 | 25 (32.5%) | 11 (14.3%) | 41 (53.2%) | 82.64 | |
| 9.**Lack of agreement on project goals** | Hierarchists | 32 | - | 2 (6.3%) | 30 (93.8%) | 115.61 | 0.000 |
| | Individualists | 11 | 2 (18.2%) | - | 9 (81.8%) | 99.00 | |
| | Egalitarians | 42 | 19 (45.2%) | 9 (21.4%) | 14 (33.3%) | 60.24 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 49.00 | |
| | Mixed | 77 | 17 (22.1%) | 15 (19.5%) | 45(58.4%) | 82.42 | |
| 10. **Lack of effective project management methodology** | Hierarchists | 32 | - | 2 (6.3%) | 30 (93.8%) | 118.86 | 0.000 |
| | Individualists | 11 | 2 (18.2%) | - | 9 (81.8%) | 94.50 | |
| | Egalitarians | 42 | 19 (45.2%) | 9 (21.4%) | 14(33.3%) | 59.26 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 51.38 | |
| | Mixed | 77 | 17 (22.1%) | 16 (20.8%) | 44 (57.1%) | 82.12 | |
| 11. **Insufficient training of end-users** | Hierarchists | 32 | - | 1 (3.1%) | 31 (96.9%) | 92.50 | 0.030 |
| | Individualists | 11 | 1 (9.1%) | - | 10 (90.9%) | 74.36 | |
| | Egalitarians | 42 | 1 (2.4%) | - | 41 (97.6%) | 94.42 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 28.50 | |
| | Mixed | 77 | 7 (9.1%) | 3 (3.9%) | 67 (87.0%) | 77.97 | |
| 12. **Ineffective communications between users** | Hierarchists | 32 | 13 (40.6%) | 5 (15.6%) | 14 (43.8%) | 66.00 | 0.000 |
| | Individualists | 11 | 9 (81.8%) | - | 2 (18.2%) | 25.86 | |
| | Egalitarians | 42 | 2 (4.8%) | - | 40 (95.2%) | 116.01 | |
| | Fatalists | 4 | 1 (25.0%) | - | 3 (75.0%) | 69.13 | |
| | Mixed | 77 | 22 (28.6%) | 12 (15.6%) | 43 (55.8%) | 82.02 | |
| 13. **Resistance of users** | Hierarchists | 32 | 13 (40.6%) | 5 (15.6%) | 14 (43.8%) | 58.27 | 0.000 |
| | Individualists | 11 | - | - | 11 (100.0%) | 115.23 | |
| | Egalitarians | 42 | - | 2 (4.8%) | 40 (95.2%) | 106.63 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fatalists | 4 | 3 (75.0%) | - | 1 (25.0%) | 33.50 | |
| | Mixed | 77 | 12 (15.6%) | 9 (11.7%) | 56 (72.7%) | 79.44 | |
| 14. **Lack of involvement of users in the ERP system** | Hierarchists | 32 | 25 (78.1%) | 3 (9.4%) | 4 (12.5%) | 53.11 | 0.000 |
| | Individualists | 11 | 8 (72.7%) | 1 (9.1%) | 2 (18.2%) | 53.73 | |
| | Egalitarians | 42 | 3 (7.1%) | 3 (7.1%) | 36 ( 85.7%) | 123.86 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 83.38 | |
| | Mixed | 77 | 37 (48.1%) | 8 (10.4%) | 32 (41.6%) | 78.38 | |
| 15. **Lack of user experience** | Hierarchists | 32 | 4 (12.5%) | 3(9.4%) | 25 (78.1%) | 84.00 | 0.302 |
| | Individualists | 11 | - | 1 (9.1%) | 10 (90.9%) | 92.09 | |
| | Egalitarians | 42 | 1 (2.4%) | - | 41 (97.6%) | 91.90 | |
| | Fatalists | 4 | 1 (25.0%) | 1 (25.0%) | 2 (50.0%) | 45.00 | |
| | Mixed | 77 | 7 (9.1%) | 7 (9.1%) | 63 (81.8%) | 79.48 | |
| 16. **Lack of ability to recruit and retain qualified ERP systems developers** | Hierarchists | 32 | 5 (15.6%) | 9 (28.1%) | 18 (56.3%) | 73.67 | 0.000 |
| | Individualists | 11 | 1 (9.1%) | - | 10 (90.9%) | 108.59 | |
| | Egalitarians | 42 | 1 (2.4%) | 5 (11.9%) | 36 (85.7%) | 105.42 | |
| | Fatalists | 4 | 3 (75.0%) | - | 1 (25.0%) | 37.63 | |
| | Mixed | 77 | 6 (7.8%) | 20 (26.0%) | 51 (66.2%) | 74.43 | |
| 17. **Lack of business analysts with business and technology knowledge** | Hierarchists | 32 | 4 (12.5%) | 5 (15.6%) | 23 (71.9%) | 75.20 | 0.010 |
| | Individualists | 11 | - | 2 (18.2%) | 9 (81.8%) | 92.68 | |
| | Egalitarians | 42 | - | 3 (7.1%) | 39(92.9%) | 103.00 | |
| | Fatalists | 4 | 2 (50.0%) | | 2 (50.0%) | 45.00 | |
| | Mixed | 77 | 6 (7.8%) | 8 (10.4%) | 63(81.8%) | 77.00 | |
| 18. **Failure to mix internal and external expertise effectively** | Hierarchists | 32 | 5 (15.6%) | 3 (9.4%) | 24 (75.0%) | 79.52 | 0.040 |
| | Individualists | 11 | - | 1(9.1%) | 10 (90.9%) | 104.41 | |
| | Egalitarians | 42 | - | 5 (11.9%) | 37 (88.1%) | 96.51 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 46.13 | |
| | Mixed | 77 | 10 (13.0%) | 9 (11.7%) | 58 (75.3%) | 77.01 | |
| **Overall total of ERP implementation risks** | Hierarchists | 32 | - | 10 (31.3%) | 22 (68.8%) | 75.97 | 0.004 |
| | Individualists | 11 | - | 2 (18.2%) | 9 (81.8%) | 86.64 | |
| | Egalitarians | 42 | - | 4 (9.5%) | 38 (90.5%) | 106.25 | |
| | Fatalists | 4 | 1 (25.0%) | 1 (25.0%) | 2 (50.0%) | 40.00 | |
| | Mixed | 77 | 1 (1.3%) | 21(27.3%) | 55 (71.4%) | 76.03 | |

### 7.7.6 *Statistical findings regarding differences in perception of ERP operational risks according to culture (H3b)*

Cross tabulation and the Kruskal Wallis test were used in order to investigate whether there were any significant differences among the different culture groups of managers (hierarchists, individualists, egalitarians, fatalists and mixed cultures) in terms of their perceptions of each risk factor related to the operation of ERP systems. The results of the cross tabulation and the Kruskal-Wallis test are presented in Table 7-13. By reviewing Table 7-13, a moderate differentiation was found in the perception of risks related to ERP operation according to different cultures. It was obvious that hierarchists (69.4%) perceived as slightly higher than egalitarians, the mixed culture group and individualists (54.8%, 53.2% and 45.5% respectively) that working with two systems in parallel (the old system and the ERP system) could make the operation of ERP less risky; just 25% of fatalists recognised this as a risk factor. Also, the majority of hierarchists (93.8%) believed that sharing passwords among ERP users is more likely to allow fraud to occur and that this could affect the integrity of a company's information. Conversely, the lowest proportion of individualist mangers (9.1%), and around half of fatalists, egalitarians and mixed cultures (50%, 47.6% and 46.8% respectively) believed that sharing passwords among ERP users was a major security risk which increased the possibility of fraud occurring. Table 7-13 shows that a higher number of hierarchist managers (ranging from 78.1% to 81.3%) than individualists (ranging from 54.5% to 63.6%), egalitarians (ranging from 61.9% to 71.4%), fatalists (25% ) and mixed cultures (ranging from 55.8%, to 70.1%) perceived the following as risk factors: namely, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. They were aware that those risk factors had a major potential to cause financial misstatements. However, the Kruskal-Wallis test results indicated that there were statistically significant differences between managers from different culture groups in terms of their perceptions of the risk factors related to sharing passwords among users ($p=0.000$) and incorrect entry of data ($p=0.043$), while no significant differences were found for their perceptions of working with two systems in parallel ($p=0.065$), repetition of errors ($p=0.056$), flowing of errors ($p=0.071$)and illogical processing ($p=0.473$).

Concerning the suitability of ERP software and ERP security risks, it was observed that a great number of hierarchists, individualists, egalitarians and mixed cultures perceived both of these risks to be at the same level of importance with only slight differences. On the other hand, 25 % of fatalists felt that if the ERP software was suitable for the company and met all its needs, the possibility of the ERP operation failing was reduced. They also realised that unauthorised access to data or to the system by outsiders (hackers) or insiders (employees) was a major risk associated with operating an ERP system as this could cause major losses to a company and have a direct impact on the company's financial statements. Conversely, a low proportion of hierarchists, individualists, egalitarians and managers with mixed cultures (18.8%, 9.1%, 11.9% and 11.7% respectively) thought that the output information provided by an ERP system was often inaccurate, too late to be useful, inconsistent and incomplete; none of the fatalists perceived this. However, the Kruskal-Wallis test results indicated that there was a statistically significant difference between managers from different culture groups in terms of their perceptions of the risks related to ERP security risks (p=0.031) while no significant differences were found regarding their perceptions of the suitability of ERP software (p=0.031), and a lack of ERP information quality (p=0.794).

Overall, it is clear from the analysis that hierarchist managers in Jordan organisations, who scored the highest (75%), who were most concerned with the risk factors associated with the operation of ERP systems, while egalitarians, mixed cultures and individualists (58.4%, 57.1% and 45.5% respectively) believed that, overall, the operation of ERP systems is risky; none of the fatalists perceived risk factors that could impact on the operation of ERP systems.

In brief, it was expected that the perception of risk factors associated with the operation of ERP systems would be different among different groups relating to managers' culture. However, the results, which came from comparisons between managers with different cultures (hierarchists, individualists, egalitarians, fatalists and mixed cultures) showed that there was significant differentiation in perceptions, where the p-value was less than 0.05, concerning only three of the 9 risk factors related to the operation of ERP systems: namely, ERP security risks, sharing passwords among ERP users and incorrect entry of data.

Regarding the other six risk factors, there were no significant differences in the perceptions of all the other ERP risk factors among the managers with different cultures. These can be seen in Table 7-13. Therefore, hypothesis H3b that stated: "*There is a significant difference between managers' different types of culture and their perceptions of patterns of the risk factors associated with ERP operation*" is supported for three risk factors but not supported for the other six. In other words, it is clear that different types of culture have an influence on managers' perceptions of three risk factors associated with the operation of ERP systems but do not have an effect on their perceptions of other risk factors where the perceptions of these risk factors are similar among all the managers regardless of their culture.

Table 7-13: Differences in perceptions of risk factors during the implementation of ERP according to types of culture

| Risk factors during operation of ERP systems | culture | N | Frequency | | | Mean rank | Asymp. Sig. |
|---|---|---|---|---|---|---|---|
| | | | disagree | neutral | agree | | |
| 1. ERP software suitability | Hierarchists | 32 | 3 (9.4%) | 4 (12.5%) | 25 (78.1%) | 82.83 | 0.073 |
| | Individualists | 11 | - | 2 (18.2%) | 9 (81.8%) | 95.32 | |
| | Egalitarians | 42 | 1 (2.4%) | 5 (11.9%) | 36 (85.7%) | 93.74 | |
| | Fatalists | 4 | 1 (25.0%) | 2 (50.0%) | 1 (25.0%) | 28.25 | |
| | Mixed | 77 | 3 (3.9%) | 9 (11.7%) | 65 (84.4%) | 79.38 | |
| 2. Working with two systems in parallel | Hierarchists | 32 | 7 (21.9%) | 4 (12.5%) | 21 (65.6%) | 95.58 | 0.065 |
| | Individualists | 11 | 6 (54.5%) | - | 5 (45.5%) | 58.91 | |
| | Egalitarians | 42 | 17 (40.5%) | 2 (4.8%) | 23 (54.8%) | 77.08 | |
| | Fatalists | 4 | 3 (75.0%) | | 1 (25.0%) | 46.50 | |
| | Mixed | 77 | 32 (41.6%) | 4 (5.2%) | 41 (53.2%) | 87.42 | |
| 3. Security risks | Hierarchists | 32 | 2 (6.3%) | 7 (21.9%) | 23 (71.9%) | 74.64 | 0.031 |
| | Individualists | 11 | - | 3 (27.3%) | 8 (72.7%) | 75.68 | |
| | Egalitarians | 42 | - | 2 (4.8%) | 40 (95.2%) | 97.96 | |
| | Fatalists | 4 | 2 (50.0%) | 1 (25.0%) | 1 (25.0%) | 27.88 | |
| | Mixed | 77 | 4 (5.2%) | 11 (14.3%) | 62 (80.5%) | 83.30 | |
| 4. Sharing passwords | Hierarchists | 32 | - | 2 (6.3%) | 30 (93.8%) | 125.81 | 0.000 |
| | Individualists | 11 | 8 (72.7%) | 2 (18.2%) | 1 (9.1%) | 39.77 | |
| | Egalitarians | 42 | 18 (42.9%) | 4 (9.5%) | 20 (47.6%) | 67.98 | |
| | Fatalists | 4 | 2 (50.0%) | - | 2 (50.0%) | 60.25 | |
| | Mixed | 77 | 27 (35.1%) | 14 (18.2%) | 36 (46.8%) | 81.84 | |
| 5. Incorrect entry of data | Hierarchists | 32 | 6 (18.8%) | - | 26 (81.3%) | 104.55 | 0.043 |
| | Individualists | 11 | 4 (36.4%) | - | 7 (63.6%) | 72.45 | |
| | Egalitarians | 42 | 11 (26.2%) | 4 (9.5%) | 27 (64.3%) | 77.50 | |
| | Fatalists | 4 | 2 (50.0%) | 1 (25.0%) | 1 (25.0%) | 47.13 | |
| | Mixed | 77 | 16 (20.8%) | 7 (9.1%) | 54 (70.1%) | 81.49 | |
| 6. Repetition of errors | Hierarchists | 32 | 3 (9.4%) | 3 (9.4%) | 26 (81.3%) | 102.69 | 0.056 |
| | Individualists | 11 | 4 (36.4%) | - | 7 (63.6%) | 76.36 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Egalitarians | 42 | 11 (26.2%) | 1 (2.4%) | 30 (71.4%) | 80.06 | |
| | Fatalists | 4 | 3 (75.0%) | - | 1 (25.0%) | 40.00 | |
| | Mixed | 77 | 18 (23.4%) | 6 (7.8%) | 53 (68.8%) | 80.68 | |
| **7. Flowing of errors** | Hierarchists | 32 | 6 (18.8%) | 1 (3.1%) | 25 (78.1%) | 100.97 | 0.071 |
| | Individualists | 11 | 4 (36.4%) | 1 (9.1%) | 6 (54.5%) | 71.45 | |
| | Egalitarians | 42 | 10 (23.8%) | 6 (14.3%) | 26(61.9%) | 74.56 | |
| | Fatalists | 4 | 3 (75.0%) | - | 1 (25.0%) | 48.38 | |
| | Mixed | 77 | 18 (23.4%) | 7 (9.1%) | 52 (67.5%) | 84.66 | |
| **8. Illogical processing** | Hierarchists | 32 | 5 (15.6%) | 1 (3.1%) | 26 (81.3%) | 93.41 | 0.473 |
| | Individualists | 11 | 4 (36.4%) | - | 7 (63.6%) | 84.27 | |
| | Egalitarians | 42 | 10 (23.8%) | 6 (14.3%) | 26 (61.9%) | 79.99 | |
| | Fatalists | 4 | 3 (75.0%) | - | 1 (25.0%) | 50.38 | |
| | Mixed | 77 | 18 (23.4%) | 16 (20.8%) | 43 (55.8%) | 82.91 | |
| **9. Information quality** | Hierarchists | 32 | 23 (71.9%) | 3 (9.4%) | 6 (18.8%) | 85.77 | 0.794 |
| | Individualists | 11 | 9 (81.8%) | 1 (9.1%) | 1(9.1%) | 79.27 | |
| | Egalitarians | 42 | 30 (71.4%) | 7 (16.7%) | 5 (11.9%) | 79.74 | |
| | Fatalists | 4 | 4 (100.0%) | - | - | 60.63 | |
| | Mixed | 77 | 57 (74.0%) | 11 (14.3%) | 9 (11.7%) | 86.40 | |
| **Overall total: risks ERP of operation** | Hierarchists | 32 | 2 (6.3%) | 6 (18.8%) | 24 (75.0%) | 102.67 | 0.011 |
| | Individualists | 11 | 3 (27.3%) | 3 (27.3%) | 5 (45.5%) | 64.14 | |
| | Egalitarians | 42 | 6 (14.3%) | 12 (28.6%) | 24 (57.1%) | 80.33 | |
| | Fatalists | 4 | 2 (50.0%) | 2 (50.0%) | | 24.38 | |
| | Mixed | 77 | 8 (10.4%) | 24 (31.2%) | 45 (58.4%) | 83.10 | |

Comparing the mean rank, hierarchist managers are more likely than other managers to perceive six of the factors associated with the operation of ERP systems as risks since they have the highest mean rank. Those risk factors were: working with two systems in parallel, sharing passwords among users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. In terms of the mean rank of the other three risk factors, the mean rank for each culture (egalitarians, individualists, hierarchists and mixed cultures) regarding their perceptions of the suitability of ERP software, ERP security risks, and the quality of output information of ERP systems, these appear to be approximately in the same mean rank while it seems that fatalists achieved the lowest mean rank for all those risk factors above.

### 7.8 Summary

This chapter has presented the statistical analysis of the quantitative data collected using a questionnaire. The descriptive study showed that 14 out of 18 risk factors associated with the implementation of ERP systems and studied in this research, were considered important as more than half of the managers agreed that these were risk factors. Moreover, eight out of nine risk factors associated with the operation of ERP systems were seen as important since more than half of managers agreed that these were risk factors.

By analysing the questionnaire data using cross tabulation, and the Mann-Whitney and Kruskal-Wallis tests, it was revealed that there is a gap among managers in terms of their perceptions of the risk factors associated with the implementation and operation of ERP systems. The culture of managers was the factor that showed most difference between the managers according to their perceptions of the risk factors associated with the implementation and operation of ERP systems. It was also observed that there was significant differentiation in terms of the managers' perceptions of all of the risk factors that could occur during the implementation of ERP systems, except lack of users' experience where no significant difference was found among managers from a point of view of different cultures. In contrast, only three risk factors relating to the operation of ERP systems revealed differences among the managers with different types of culture.

Relating to the managers' ERP expertise, significant differences were found in their perceptions of ten risk factors associated with the implementation of ERP systems and six risk factors related to their operation. On the other hand, only four risk factors which could occur during the implementation of an ERP system and six factors relating to the operation of an ERP were perceived significantly differently among managers with different jobs or professions.

Finally, this chapter also showed those risk factors that were perceived as most important by each group of managers with different jobs/professions (IT managers, financial accounting managers, audit managers and other managers), different levels of ERP expertise (high or low), types of culture (hierarchist, individualist, egalitarian fatalist and mixed). Now the implications of the results of the analysis of the qualitative and quantitative data are comprehensively discussed in the next chapter, the discussion chapter.

# 8 Chapter Eight: Discussion of empirical findings (interviews and survey)

## 8.1 Introduction:

Organisations are still experiencing failure with ERP systems in terms of both the implementation and/or the operation of these systems in spite of the fact that most of the risk factors which could lead to such failure have been identified in previous studies. So why are organisations still failing with these systems? Are they making the same errors over and over again? Is something wrong with the systems or is something wrong with the implementation or operation? This research has attempted to expand the existing research into ERP risk factors by integrating those aspects that have not previously been given much attention in order to answer the questions above. The perception and recognition of ERP risk factors are believed by the researcher to be significant to achieve a successful ERP implementation and operation and should also reduce the rate of failure of these systems. However, no research has examined empirically risk perception issues regarding ERP. Therefore, as presented in Chapter One, the purpose of this research was to understand the risk factors associated with the implementation and operation of ERP systems from the perspective of managers in Jordan. In particular, the research was concerned to investigate how managers in Jordan perceived those risk factors and what, from their point of view, were most important of these risk factors. Also, this research aimed to investigate the extent to which those risk factors were perceived by different groups of managers, why their perceptions were either different or similar, and whether their profession, ERP expertise and culture had an effect on their perceptions of the ERP risk factors. In order to achieve these research objectives, the researcher conducted an exploratory pilot study by carrying out semi-structured interviews and a survey by designing a questionnaire.

Drawing on the analysis of both the qualitative and quantitative data, this chapter discusses the issues and themes that were presented in Chapters Six and Seven, and shows how these results link with the discussion of the literature review presented in Chapters Two, Three and Four, together with the research objectives mentioned in Chapter One. The results are discussed in the context of the research questions. Based on the nature of the research questions of this thesis, the following discussion concentrates on (1) understanding and classifying the risk factors associated with the implementation and operation of ERP systems from the most to the least important factors from the point of view of managers in Jordan; and (2) the impact of the culture, ERP expertise and profession of the managers on their perception of those risk factors that could lead to failure in the implementation and operation of ERP systems.

## 8.2 Risk factors associated with the implementation and operation of ERP systems

The first aim of this research was to investigate the risk factors that could lead to the failure of the implementation and operation of ERP systems. This section gives some brief information about what risk factors affect the failure or success of ERP systems' implementation and operation in Jordan, and how these could be managed. By reviewing the literature and conducting semi-structured interviews with managers who have had experience of ERP systems to address this research issues, it was revealed that ERP systems have been implemented for more than 13 years in the large, medium companies in Jordan, and they have been adopted in different sectors such as manufacturing, service and finance. Organisations in Jordan have implemented products from a range of vendors, such as Oracle, SAP, Baan, JD. Edwards, and other providers such as Great Plains, Acc-Pac, Navision, Axapta, Scala and Ross. Majority of the Jordanian companies have implemented ERP systems for many reasons that can be summarized as follows:

1- Get rid of the old legacy systems.
2- Obtain an international integrating solution.
3- Operate their business more efficiently.
4- Compete effectively with rival companies.
5- Acquire one database since the volume of data was too high in their company.
6- Obtain accurate data and information on time.
7- Produce financial reports they required quickly and easily.

During the interviews, some interviewees claimed that implementing an ERP system has had a positive impact on companies. The system has fulfilled the companies' requirements, and they have achieved many great benefits from implementing the ERP program. However, other Jordanian companies showed low satisfaction with these systems because the benefits were not up to the expectations (or very few). Implementation and operation of ERP systems have been one of the most significant challenges for most of the organisations in different countries in the world (Fahy, 2001). Davenport (1998) and Wright and Wright (2002) argue that implementing ERP systems is a never-ending struggle. Implementing and operating these systems have produced many risks related to the way of implementing ERP systems, complexity of these systems, people, and knowledge. As for Jordanian companies, there are many concerns about the implementation of ERP systems because such systems are unfamiliar in the Kingdom. Consequently, managers and decision-makers will be confused because they do not have enough information about ERPs so that they feel inconvenient to implement these systems.

In spite of the fact that organizations in Jordan are generally enthusiastic about the adoption of ERP systems, they have been struggling with implementation of these systems. Interviewees pointed out ERP systems were not often suitable for companies in Jordan because they consider them as western software. Rabaai (2009) notices that the Jordanian organizations usually suffer from a cultural clash when ERP systems are inconsistent with the Jordanian culture. Since ERP systems are designed in developed countries, it seems to be particularly specialised for such countries, not developing ones. ERP systems are western systems and so they may be more suitable for companies in the West rather than companies in the Middle East where each company has its own policy, procedure, and its own way of dealing with the system. Molla and Loukis (2005, p.3) point out that, "As ERP systems diffuse into developing countries, it is essential to be aware of the implications of cultural assumptions embedded in ERP software and those reflected in developing country organisations. Such awareness can assist in assessing ERP suitability; in devising mechanism to mitigate the impact of cultural misfit; and in increasing value from relatively expensive ERP investments." A review of the literature (e.g. Soh, Kien et al. 2000; Van Everdingen, Van Hillegersberg et al. 2000; Hong and Kim 2002) emphasizes that some countries in Asia and the Middle East may not have sufficient capabilities to use such systems because they face problems regarding a mismatch with local, cultural, economic, and regulatory requirements. Each country has its own specificities: organizational, cultural, political and economic. Avison and Malaurent (2007) found out that the main reasons for making implementation of ERP systems unsuccessful are the national cultural factors. Huang and Palvia (2001) also argue that implementation of ERP systems in developing countries faces many obstacles due to the national and organisational culture. These obstacles can be summarized as economic status and growth, infrastructure, government regulation, low IT maturity, small firm size, and lack of process management and BPR experience. However, selecting an inappropriate ERP system which does not meet all the needs of the company is one crucial aspect that was considered and perceived by managers to be a risk factors that might cause the implementation of ERP systems to fail. Thus, mismatches between organisational requirements and ERP systems require a lot of changes to be made to the company's business processes which, in turn, could increase the possibility of ERP failure (Hong, 2002). Conversely, a misfit could lead the companies to carry out a major customisation instead of reengineering their business processes to fit the ERP systems. Rabaai (2009, p.11) reports that the "lack of fit with organisational culture is indicated by the extensive customisations that were required in the Jordanian organisations surveyed."

Customisation is a major risk factor that can make the implementation of ERP systems fail in many Jordanian companies. Reengineering the company's business processes to fit the ERP processes is recommended instead. This result is also supported by Sumner (2000), Wright and Wright (2002) and Huang et al. (2004). This study found out that there is a critical difference of opinion among interviewed managers, particularly between the IT managers and other managers (e.g., financial accounting managers, HR managers, production managers and internal auditing managers). Customisation was recognised and accepted by IT managers as risky, while it was not recognised as a risk factor by other managers. IT managers claimed that customisation caused many problems with regards to the performance of ERP systems in the company, and that it costed the company a huge amount of money and more time to implement these systems while it eliminated their benefits. This also has been confirmed by Rabaai (2009). ERP systems are designed in a standard way and these systems are designed to suit the business processes of most companies, but, in some cases, the ERP systems do not fully correspond with the business processes of the company. Here, the company should change its business processes instead of modifying the ERP systems. Consequently, a failure to reengineer business processes and carry out major customisation will most probably have an effect on the accuracy of the information produced within these systems; this may then lead to financial misstatements. Such a result confirms the findings of previous studies (Wright and Wright 2002; Soh et al. 2000).

Similarly, on organizational risks, IT managers rather than financial accounting managers and other managers perceived lack of top management support as one of the risk factors that could hinder effective ERP implementation in Jordan. Top management should be involved in each stage of an implementation so there should be regular meetings (weekly or monthly) in order to control the progress of project, make sure that everything is happening on time, identify difficulties and problems, and make recommendations. This finding is in agreement with the results of Kweku Ewusi-Mensan (1997) Bingi et al. (1999), Al-Mudimigh et al. (2001) and Al-Mashari et al. (2003b). In most of the Middle East countries, particularly Jordan, Rabaai (2009, p.11) found that “top management consider themselves to have more important obligations, responsibilities, and meetings. Consequently, top management often develop report mechanisms to keep them informed of a project’s progress without any actual and deep involvement in the project.” However, a lack of top management support is also more likely to increase the resistance of users to accepting these systems, a lack of change management, and delay in completing the implementation of the ERP system as scheduled.

The potential of failure of ERP systems are not attributable only to the factors related to organizational, project management, and technical skill. This study addresses other risk factors associated with users (see Table 8.1), and they found to be important risk factors that can cause the failure of the implementation of the ERP system. While it is reported in the literature that ERP systems are complex (Brown 1997; Bingi, Sharma et al. 1999; O'Leary 2000; Soh, Kien et al. 2000), this study found that minority of the participants agreed that ERP systems are complex and difficult to understand. They believed that employees find it difficult to get the ERP system to do what they want it to do, and they said that learning to use the ERP system had been difficult for employees. One of the explanations for these results could be related to sample selection. The participants in this research are managers with ERP experience working in different departments (such as IT managers, auditors, and financial and accounting managers) in Jordanian companies. Thus, it is noticeable that IT managers, rather than accounting financial managers, auditing managers, and other managers, did not perceive difficulties in understanding and using ERP systems which can be an important risk factor that could make the implementation of ERP systems fail. On contrary, Rabaai (2009) showed that a low number of respondents believed that it is easy to use ERP systems in Jordan.

On the users' aspects, difficulties of understanding ERP systems could be due to the fact that insufficient training of users, lack of users' involvements in the ERP systems, resistance of user and lack of users experience within ERP systems. What is more, this study found out that insufficient training of end-users is the major risk factor that could threaten the implementation of ERP systems as well as increase the possibility of entering incorrect or inaccurate data into the systems; this, in turn, might lead to the flowing of errors with or without being discovered. Finally, this could produce incorrect information resulting in financial misstatements being made. This result is consistent with those of Wright and Wright (2002). Rabaai (2009) mentioned that the issue in Arabic organizations is that they lower down the importance of the tarining users effectively in order to reduce the the potential of failure ERP implementation. Rabaai (2009, p.9) also said that Arabic organizations consider "training end-users as an additional cost to be avoided as much as possible. As a cheaper substitute to training, organisations often provide end-users with printed manuals describing the system's functionality, as happened in the majority of organisations surveyed here." In this study, some of the managers mentioned that the training which is usually provided for users is basic training, not a lot of detailed information about the systems is provided. Thus, managers should make sure that users are well-trained and learn how to use these new systems effectively before they start performing their work using ERP systems. Some of interviewees suggested that training should be performed at different levels based on users experience with using computer generally and ERP systems particularly in order to increase their skill and knowledge with these systems.

In addition to training end-users effectively, end-users should be involved and participate in the implementation of ERP systems. This study indicated that less than half of the participants perceived that lack of involvement of users in the ERP system was a critical risk which could cause the failure of the implementation. Parr and Shanks (2000), Wright and Wright (2002), Al-Fawaz et al. (2008) and Rabaai (2009 ) also discussed that insufficient users' involvement in implementation of ERP system could enhance the risk of ERP implementation failure.

Further, Resistance to ERP systems is a phenomenon that is noticed in many cultures, not only in Jordan. As supported by Welti 1999; Gupta 2000; Jarrar, Al-Mudimigh et al. 2000; Aladwani 2001; Huang, Chang et al. 2004; Bhatti 2005, this study revealed that the IT managers were more concerned about the resistance of users as another important risk factor that could threaten the success of an ERP system implementation in Jordan. The resistance of users, in turn, may be caused by users' lack of experience with ERP systems, or they may be afraid that these systems will replace them (Aladwani 2001). To reduce the resistance of users, there should be sufficient training programmes, an adequate amount of user involvement in the implementation, and effective communication between users. Also, managers should provide effective orientation concerning ERP systems, their benefits, and reasons for having these systems. Huang, Chang et al. (2004) mentioned that managers should spend more time and efforts to deflate users' fear of ERP systems and thus reduce their resistance.

Again, on the users' aspect, this study revealed that incorrect entry of data being made by users is the main risk factor to be avoided in order to reduce the possibility of getting invalid information which leads to make an inaccurate decision. Wood and Banks 1993; Bragg 2001; Abu-Musa 2006 showed that incorrect entry data may increase the level of error in financial statements and could threaten the success of the information system . As supported by Musaji (2002); and Wright and Wright (2002), this study found that simple mistakes made by employees when they performed their work using an ERP system are more likely to lead to the risk of errors flowing and to serious mistakes which could affect financial data and financial statements. Flowing of errors is one of the critical risk factors that are suggested in this study, and it could have an effect on the operation of ERP systems, validity and reliability of financial statement. This factor is in agreement with Musaji (2002), Umble and Umble (2002) and Hunton et al. (2004). However, this study showed that, in order to reduce the number of incorrect data entries made by users, three issues should be considered. Firstly, the company should have an effective control system (Wright and Wright, 2002). Secondly, users should understand ERP systems and the most effective ways of performing their work correctly and accurately. This is supported by Kapp, Latham et al. (2001); they added that users should know the type and nature of the most common errors in order to avoid them. Third, users should be trained well and should also be involved in the ERP implementation. This is in agreement with the finding of Wright and Wright (2002).

Further, the possibility of failure of ERP systems is not only due to the incorrect entry of data by users, but it is also related to security risk. This study shows that security risk is one of the significant risk factors which should be paid more attention to in order to reduce the company losses, reduce errors and fraud, and increase the validity of financial statements produced by ERP systems. Some authors (Wright and Wright, 2002; Hunton, Wright et al. 2004; Abu-Musa 2006) also claimed that security risk is a significant risk that could be seen in ERP systems. Unauthorized access to data or system by either outsider (hackers) or employees is a major security risk which results in errors in financial statement. Wright and Wright (2002, p.112) suggest that "financial statement errors may be increased if access is adequately considered during ERP implementation."

This study found that the perception of security risk as was viewed differently by different managers in Jordan. IT managers were concerned about bugs and hackers as a major security risk, and did not see the sharing of passwords as a major risk; while financial accounting managers see the biggest risk are lack of segregation of duties among users, unlimited access, licenses not secure, and sharing passwords among users. As supported by Abu-Musa (2006), financial accounting managers and audit managers mentioned that poor segregation of users duties and sharing passwords allow users to access wide data or change some data, which is a critical security risk which would make defalcation more likely to happen.

Another interesting point found in this study is the conflict of opinion between IT managers and financial accounting managers regarding to the working with two systems in parallel, and testing ERP system before going live. on the one hand, IT managers believed that the working with old systems in parallel with the new ERP system after going live is one of the greater risk factors that could have an effect on the performance of ERP systems generally, and on users particularly, as this could put more pressure on the users, confuse them, lead them to make many mistakes, and increase the resistance of users. However, financial accounting managers perceived that using two systems at the same time is more probably to convince users towards ERP system as they give a chance to compare between working with the old systems and the new ones. Also, it increases the confidentiality with accuracy and reliability of information produced by these systems.

On the other hand, it is very necessary to test ERP systems before going live and using them (Nah et al., 2001; Musaji, 2002). Since there are complex infrastructure of software and hardware to apply ERP systems, different types of testing are required. Some of these tests are functional tests be sure that business processes are working, integration tests to make sure that business processes of the organization and other business processes are working together, and regression tests to affirm that coherent and repeatable outcomes can result from certain processes and data (Anderson, Nilson et al. 2009). It was noted from the findings on this issue that there is disagreement among managers in Jordan. IT managers are very confident about the ERP systems, and they believed that the testing process is not so important because they have implemented them many times. Financial managers, on the other hand, consider that testing is necessary before going live. They believe that to start using ERP systems without testing would be so risky and could lead to the repetition of errors or illogical processing risk. In turn, most of risk factors associated with the operation of ERP systems could lead to lack of accuracy and correctness of information produced by these systems, such as incorrect entry data, illogically processing, security risk, sharing passwords, working with two systems in parallel, repetition of errors, and flowing of errors.

In brief, the results of the analysis of the qualitative data, presented in the previous six chapters, illustrates that risk factors which could lead to the failure of ERP systems seem to be mainly due to culture, human and organisational factors. These factors include understanding of these systems as well as failure to understand and manage risk factors. The first result from the interview data was to identify 12 risk factors that could lead to the failure of the implementation of an ERP system, and 9 risk factors that were likely to have an impact on the effectiveness of the operation of these systems. Most of the risk factors associated with the implementation of ERP systems are supported by the literature, and appear similar to the experience in the USA and Europe. However, while few of the risk factors related to the operation of ERP systems exist in the current relevant literature, such as the suitability of the ERP system and security risks, others are new and have not been previously mentioned as important risk factors but which could make the operation (post-implementation) of ERP systems fail. These factors include working with two systems (old and new) in parallel, sharing passwords, incorrect entry data, repetition of errors, flowing of errors, illogical processing, and lack of information quality. These risk factors are not considered theoretically and in detail in the ERP literature but they were shown to be important during the pilot study. These risk factors are not new since they have been addressed in other studies in the area of information systems but they have not been mentioned as risk factors related to ERP systems. This thesis contributes theoretically by adding seven factors which could cause the operation of ERP systems to fail. In addition, two risk factors which were not mentioned by managers in Jordan exist in the literature, such as lack of agreement on the project's goal, and the lack of an effective project management methodology. A comparison of - the risk factors for ERP implementation cited in the literature with the factors developed in this thesis is shown in Table 8-1 and Table 8-2.

Table 8-1: Comparison of the literature-cited risk factors for ERP implementation with the factors developed in this thesis

| Risks factors related to the operation of ERP systems | Authors |
|---|---|
| 1. Difficulties in understanding and using ERP systems | (Brown 1997; Bingi, Sharma et al. 1999; O'Leary 2000; Soh, Kien et al. 2000; Bradford and Florin, 2003) |
| 2. Failure to redesign business processes and making major customisation of ERP | (Sumner 2000; Wright and Wright 2002; Huang, Chang et al. 2004; Bradford and Florin 2003; Bancroft et al., 1998 ) |
| 3. Insufficiency of resources | (Welti 1999; Somers and Nelson 2001; Somers and Nelson 2004; Huang, 2004) |
| 4. Lack of management of change | (Somers and Nelson 2001; Somers and Nelson 2004; Huang, 2004; Sumner 2000; Nah et al., 2001) |
| 5. Lack of top management support | (Kweku Ewusi-Mensan 1997; Davenport 1998; Sumner 2000; Somers and Nelson 2001; Umble and Umble 2002; Huang, Chang et al. 2004; Bingi, Sharma et al. 1999) |
| 6. Lack of champion | (Sumner 2000; Nah, Lau et al. 2001) |
| 7. Ineffective communications between users | (Welti 1999; Kumar and Van Hillegersberg 2000; Parr and Shanks 2000; Sumner 2000; Huang, 2004) |
| 8. Insufficient training of end-users | (Wright and Wright 2002; Huang, Chang et al. 2004; Sumner 2000) |
| 9. Unclear/ misunderstanding users' requirements | (Musaji, 2002) |
| 10. Resistance of users | (Welti 1999; Gupta 2000; Jarrar, Al-Mudimigh et al. 2000; Aladwani 2001; Huang, Chang et al. 2004; Bhatti 2005; Sumner,2000; Bradford and Florin 2003) |
| 11. Lack of involvement of users in the ERP system | (Parr and Shanks 2000; Wright and Wright 2002; Al-Fawaz, Al-Salti et al. 2008) |
| **12.** Mixed skills | (Sumner 2000; Willis and Willis-Brown 2002; Bhatti 2005; Wright and Wright, 2001; Huang, 2004) |

One of the important points that is discussed here is that failure to recognise one risk factor could lead to a failure to be aware of the other risk factors. Consequently, this could have a serious effect on the implementation and/or operation of ERP systems. By analysing the semi-structured interviews, it was found that there are relationships within and between the risk factors associated with the implementation and operation of ERP systems. So, some of the risk factors associated with the implementation of ERP systems mentioned above could lead to the occurrence of other risk factors related to either the implementation or the operation of these systems. Moreover, some of operational risk factors could have an effect on other operational risk factors, as shown above.

Table 8-2: Comparison of literature-cited risk factors for ERP operation with the factors developed in this thesis

| **Risks factors related to the operation of ERP systems** | **Authors** |
|---|---|
| 1. ERP software suitability | Soh, Kien et al. 2000; Van Everdingen, Van Hillegersberg et al. 2000; Hong and Kim 2002) |
| 2. Working with two systems in parallel | New |
| 3. Security risks | (Wright and Wright, 2002; Hunton, Wright et al. 2004; Abu-Musa 2006; Musaji, 2002) |
| 4. Sharing passwords | New |
| 5. Incorrect entry data | (Musaji, 2002; Wright and Wright, 2002) |
| 6. Repetition of errors | (Musaji, 2002) |
| 7. Flowing of errors | (Musaji, 2002; Wright and Wright, 2002) |
| 8. Illogical processing | (Musaji, 2002) |
| 9. Information quality | (Wang , 2006 ) |

Finally, it is important to understand these complex relationships within and between the risk factors associated with the implementation and operation of ERP systems, as well as the extent of the influence of each one on the others in order to increase the chances of success and reduce the risk of failure in the of implementation and operation of these systems.

As shown in Chapter Three (the literature review), most previous studies focused on understanding either the critical success factors or risk factors that make the implementation of ERP systems more effective in companies. However, they did not pay more attention to the complex relationships between those success or risk factors. This current study offers only brief information about the influences of these risk factors on each other, since this thesis is more concerned with understanding managers' perceptions of ERP risk factors and the interaction between their perception of those risks and their culture, profession/job, and ERP expertise, rather than focusing on the importance of linkages and relationships among those risk factors.

## 8.3 Perceptions of ERP implementation and operation risk factors

The second objective of this thesis was to investigate the impact of those ERP risk factors perceived as significant from the point of view of managers in the Jordanian organisations on either ERP implementation or operation. This was achieved by examining both the managers' agreement and disagreement, as well as through ranking the risk factors as well. A list of ERP risk factors was developed based on previous studies such as those of Loch, Carr et al. 1992; Sumner 2000; Wright and Wright 2002; Huang, Chang et al. 2004; Abu-Musa 2006 and the available literature in this area. However, other risk factors were suggested in the pilot study and were then included in the list to be investigated for the first time in the Jordanian environment.

This study revealed that the ten most important risk factors in terms of ERP implementation in Jordan were: (1) insufficient training of end-users, (2)lack of user experience, (3) lack of business analysts with business and technology knowledge, (4) failure to mix internal and external expertise effectively, (5) unclear or misunderstanding users' requirements, (6) resistance of users, (7) insufficient resources, (8) lack of ability to recruit and retain qualified ERP system developers, (9) failure to redesign business processes and making major customisation of the ERP system, (10) lack of top management support. These were perceived as the most significant risk factors related to the implementation of ERP systems in Jordanian companies. These results, however, are not consistent with other studies such as Sumner 2000; Wright and Wright 2002; Huang, Chang et al. 2004), since this study and each of those mentioned above applied different methods and technical tools to collect the data. For more details about the results of the studies carried out by the authors above, see the below Figure 8-1.

**ERP implementation risks factor Sumner 2000**

1. danger of customization,
2. challenge of re-engineering business processes to fit the process which the ERP software supports,
3. investment in recruiting and re-skilling technology professionals,
4. the challenge of using external consultants and integrating their application-specific knowledge and technical expertise with existing teams,
5. the challenge of recruiting and retaining business analysts who have both business knowledge and technology knowledge,
6. lack of top management support,
7. lack of champion,
8. ineffective communications,
9. Lack of training.

**ERP implementation risks factor Huang et al. 2004**

1. Lack of top management support,
2. Ineffective communications with users,
3. Insufficient training of end-user,
4. Fail users to get user support,
5. Lack of effective project management methodology,
6. Attempting to build bridges to legacy applications,
7. conflicts between user departments,
8. The composition of project team member,
9. Fail to redesign business process,
10. Unclear/Misunderstanding changing requirements.

**ERP implementation risks factor in Jordan**

1. Insufficient training of end-users
2. Lack of user experience
3. Lack of business analysts with business and technology knowledge
4. Failure to mix internal and external expertise effectively
5. Unclear/misunderstood users' requirements
6. Resistance of users
7. Insufficiency of resources
8. Lack of ability to recruit and retain qualified ERP systems' developers
9. Failure to redesign business processes and make major customisation of ERP
10. Lack of top management support

**ERP implementation risks factor in Wright and Wright 2002**

1. lack of involvement of users implementing these systems
2. insufficient training
3. failure to redesign business process
4. major customization,
5. Insufficient internal expertise,
6. Lack of analysts with the knowledge of business and technology,
7. Failure to mix internal and external expertise effectively,
8. unable to comply with the standard which ERP software supports,
9. Lacked adequate controls.

Figure 8-1 Difference in the importance of ERP risk factors related to the implementation of ERP systems from most important to less important between this research (Jordan) and previous studies

In relation to the main risk factors could threaten ERP operation from the viewpoints of Jordanian managers, the results of this study revealed that ERP software suitability, security risks, repetition of errors, incorrect entry of data, flowing of errors, illogical processing, working with two systems in parallel, sharing passwords, and lack of information quality were perceived as the most significant risk factors related to the operation of ERP systems in Jordanian companies.

Recognising all the risk factors presented in this study would most probably lead to an increase the successful implementation and operation of ERP systems while, if these risk factors were to remain unrecognised, this could increase the probability of these systems failing. Wheatley (2000) pointed out that a great number of occurrence of ERP failures are related to insufficient training consequently of a perception of the technical issues as more important than the nature of business process flows, insufficient resource, and inadequate training. When managers understand these risk factors well, and know the extent of their effect on the implementation and operation of these systems, they will better be able to manage. As shown in Table 8-3, fourteen ERP implementation risk factors were perceived as risk by more than half of the manager participants in Jordan, while less than half of these managers perceived the other four factors as risks. Besides, eight of the ERP operation risk factors were perceived as risky by more than half of the managers participating in the study, while less of half of the managers perceived the others to be risk factors.

Table 8-3 Risk factors related to the implementation and operation of ERP systems from most important to less important

| **Risk factors during the implementation of ERP systems** | **Risk factors during the operation of ERP systems** |
|---|---|
| 1. Insufficient training of end-users | 1. ERP software suitability |
| 2. Lack of user experience | 2. Security risks |
| 3. Lack of business analysts with business and technology knowledge | 3. Repetition of errors |
| 4. Failure to mix internal and external expertise effectively | 4. Incorrect entry of data |
| 5. Unclear/misunderstood users' requirements | 5. Flowing of errors |
| 6. Resistance of users | 6. Illogical processing |
| 7. Insufficiency of resources | 7. Working with two systems in parallel |
| 8. Lack of ability to recruit and retain qualified ERP systems' developers | 8. Sharing passwords |
| 9. Failure to redesign business processes and make major customisation of ERP | 9. Information quality |
| 10. Lack of top management support | |
| 11. Ineffective communications between users | |
| 12. Lack of agreement on project goals | |
| 13. Lack of effective project management methodology | |
| 14. Lack of champion | |
| 15. Insufficient discipline and standardisation | |
| 16. Lack of management of change | |
| 17. Lack of involvement of users in the ERP system | |
| 18. Difficulties in understanding and using ERP systems | |

## *8.4* Differences and similarities in the perception of risk factors in the implementation and operation of ERP systems

The third aim was to investigate the managers' perceptions of risk factors related to the implementation and operation of ERP systems, as well as factors that could have an effect on their perceptions. This study showed that there is a huge number of risk factors are likely lead to failure of ERP systems. All of the risk factors presented in this thesis should be noticed by managers in order to avoid them and achieve a successful and effective implementation and operation of these systems. This study revealed that the perception of risk factors related to the implementation and operation of ERP systems is different among managers. As mentioned previously, none of the previous studies has examined the relationship between perceptions of ERP risk factors and the profession, level of ERP expertise, and culture of those studied. This thesis has examined the effect of those factors on perceptions of ERP risk factors. The results of this are discussed in the following sections.

### 8.4.1 *Relationship between participants' profession and perceptions of risk factors in the implementation and operation of ERP systems*

Based on questionnaire survey data, and the findings of cross-tabulation and the Kruskal-Wallis H test, it was revealed that there are significant differences among managers from different jobs or professions (e.g. IT managers, accounting/ financial managers, auditing managers, and others) in terms of their perception of Technical knowledge risk factors related to the implementation of ERP systems. These were: (1) difficulties in understanding and using ERP systems, (2) failure to redesign business processes and making major customisation of the ERP, (3) lack of business analysts with business and technology knowledge, and (4) failure to mix internal and external expertise. Regarding the other 14 residual risk factors, no significant differentiation was found in the perceptions of all the other ERP risk factors among the managers with different jobs or professions. In other words, there were differences among managers in their perceptions of some of organizational and project management risk factors but this difference was not considered significant in the following: (1) lack of change management, (2) insufficient discipline and standardisation, (3) resistance of users, (4) lack of a champion, (5) lack of agreement on project goals, (6) lack of effective project management methodology, and (7) ineffective communication between users. In the case of the other seven risk factors related to the implementation of ERP systems, it was found that managers with different jobs recognised similar factors as important risks, including (1) lack of top management support, (2) insufficiency of resources, (3) unclear or misunderstanding users' requirements,(4) insufficient training of end users, (5) lack of involvement of users in the ERP system, (6) lack of users' experience, and (7) lack of ability to recruit and retain qualified ERP systems developers.

Regarding the risk factors that could make the operation of ERP systems fail, this study clearly found significant differences between managers with different jobs in terms of their perceptions of six out of nine risk factors: namely, (1) working with two systems in parallel, (2) sharing passwords between users, (3) incorrect entry of data, (4) repetition of errors, (5) flowing of errors, and (6) illogical processing. However, there was no significant differentiation in the perceptions among the managers with different jobs regarding three other ERP operation risk factors: namely, ERP software suitability, ERP security risks, and lack of ERP information quality. In other words, there were similarities in perception of those three risk factors among managers but with differences which were not significant.

By comparing IT managers, accounting /financial managers, auditing managers and other managers, it was found that they responded similarly to some risk factors and differently to the other risk factors that were likely to occur during the implementation and operation stages of ERP systems (see Figure 8-2). Accounting financial managers, auditing managers, and other managers, rather than IT managers, perceived project management risk as the most important risk factors that could make the implementation of ERP systems fail. These were: (1) difficulties in understanding and using ERP systems, (2) lack of a champion, (3) lack of agreement on project goals, (4) lack of effective project management methodology, and (5) ineffective communication between users. On the other hand, IT managers were more concerned about the technical knowledge and organizational risk factors: (1) failure to redesign business processes and carrying out major customisation of the ERP, (2) lack of change management, (3) insufficient discipline and standardisation, (4) resistance of users, (5) lack of business analysts with business and technology knowledge, and (6) failure to mix internal and external expertise.

According to the risk factors related to the operation of ERP systems, financial accounting managers, auditing managers, and other managers who participated in this study perceived a higher level of risk with five factors in the operation of ERP systems compared with IT managers. These were: sharing passwords between users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. IT managers, on the other hand, seemed to have little concern about these risk factors, but they perceived working with two systems in parallel as a risk could lead to operation of ERP systems less success.

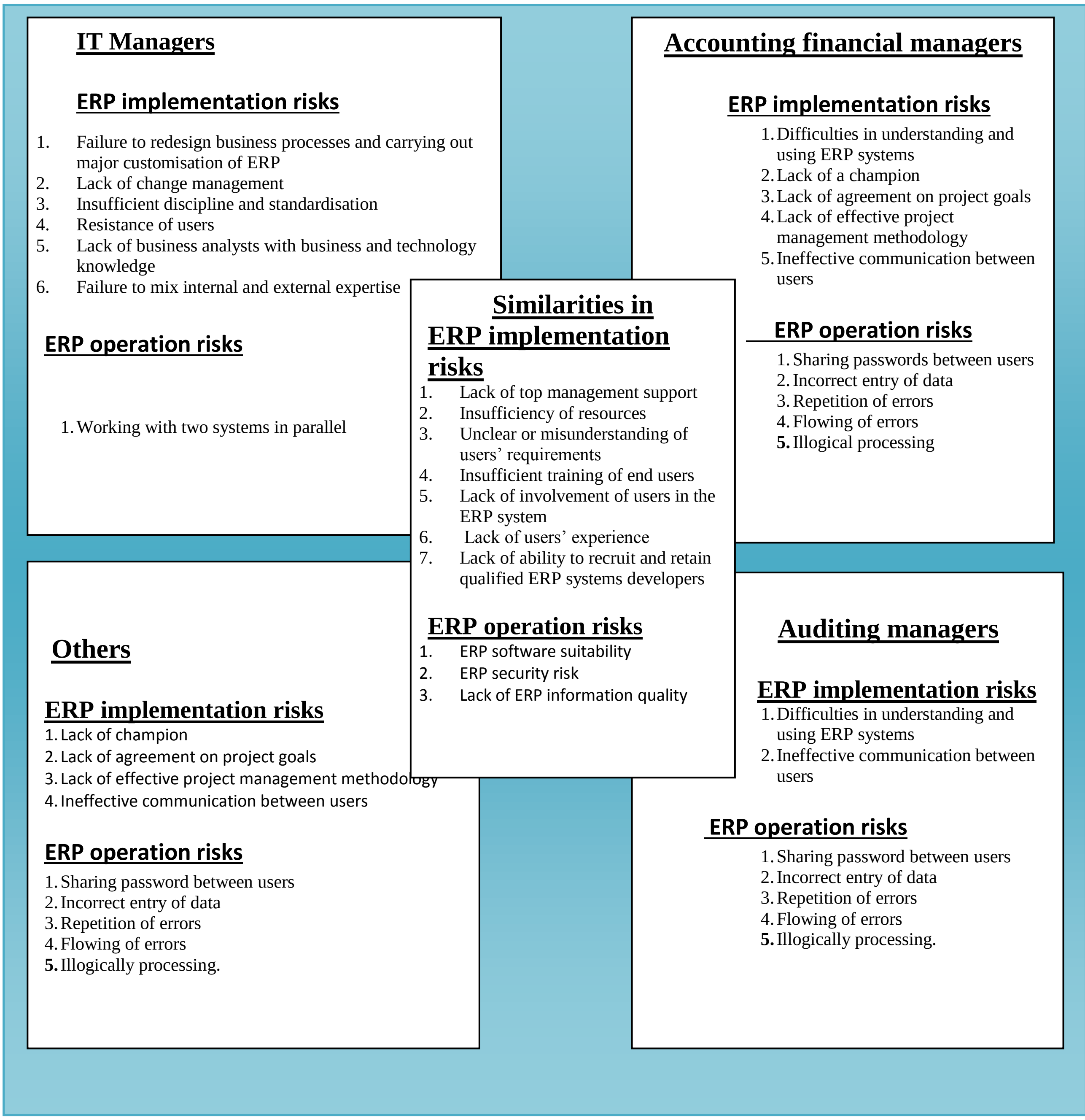


Figure 8-2 Difference and similarities in perceptions of ERP risk factors among managers with different jobs or professions

Generally, from the interpretation of the qualitative and quantitative data, this study highlighted that financial accounting managers, auditing managers, and other managers perceived more risk factors related to ERP operation than IT managers, while most of the managers, including IT managers, had a higher perception of risk factors related to the implementation of ERP systems. This can be explained by multiple reasons. Firstly, IT managers were not fully aware of the greater exposure to risk associated with the operation of ERP systems compared to risk factors that could occur during the implementation of these systems because they are responsible for managing ERP implementation (Hong and Kim 2002) and are less involved in the operation of ERP systems than financial accounting managers, auditing managers and other managers who are more involved in the operation of these systems. Thus, they are more concerned about implementation risk factors than ERP operation risk factors. However, financial accounting managers, auditing managers, and other managers are more concerned about risk factors that could make the ERP operation fail due to the focus of their roles. Financial accounting managers are responsible for providing reliable and valid data without any errors so the quality of data can be ensured. Therefore, they are worried about the negative impact of these systems on the quality of data. For example, financial accounting managers, auditing managers, and other managers perceived that sharing passwords among users could seriously increase the occurrence fraud or defalcation. Also, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing could all finally make the information produced by ERP systems unreliable, incorrect and inaccurate. While they saw working with two systems in parallel make them more confident in terms of the reliability and accuracy of the data and financial information that were produced by the ERP systems.

Secondly, IT managers believed that implementing the ERP effectively would make the operation of these systems effective as well, as claimed by an IT interviewee. One researcher (Park and Kusiak 2005) said clearly that a successful implementation of an ERP system does not lead to success in the operation of the system, nor does it automatically guarantee full benefits. By conducting interviews with financial accounting managers, this study revealed that the success of an ERP implementation could reduce the possibility of failure of the system's operation but this does not necessarily mean the ERP operation will be success. For example, incorrect entry data by users could be related to the lack of training of end-users, lack of users' experience, and a lack of users' involvement in ERP systems, but it is also related to users' mood and stress.

### 8.4.2 *Relationship between ERP expertise and perceptions of risk factors related to ERP implementation and operation*

Regarding the cross-tabulation and the Mann-Whitney test, significant differences were found between the managers with high levels and low levels of ERP expertise in terms of their perceptions of ten of risk factors related to organisational, users and technical knowledge. These ten risk factors were: (1) difficulty to understand and use ERP systems by employees, (2) failure to redesign business processes and making a major customisation, (3) lack of change management, (4) insufficient discipline and standardisation, (5) unclear or misunderstanding users' requirements, (6) ineffective communication between users, (7) resistance of users, (8) lack of involvement of users in the ERP system, (9) lack of business analysts with business and technology knowledge, and (10) failure to mix internal and external knowledge. However, there was no significant differentiation in the perceptions of the other eight risk factors between the two groups of managers who possessed either low or high levels of ERP expertise. In the other words, there were differences between the two groups of managers in terms of five out of the eight risk factors but these differences were not considered as significant. These factors were: (1) lack of a champion, (2) lack of agreement on project goals, (3) lack of effective project management methodology, (4) lack of users' experience, and (5) lack of ability to recruit and retain qualified ERP systems developers. However, managers with both high and low levels of ERP expertise had similar perceptions with regard to (1) insufficient of training of end-users, (2) insufficiency of resources, and (3) lack of top management support.

According to the risk factors associated with the operation of ERP systems, this study revealed that there were significant differences in perceptions for six out of nine risk factors between the two groups of managers who possessed low or high levels of ERP expertise. These were: (1) working with two systems in parallel, (2) sharing passwords between users, (3) incorrect entry of data, (4) repetition of errors, (5) flowing of errors, and (6) illogical processing. Relating to the other three risk factors, there were no significant differences in the perceptions of those risk factors between managers with high and those with low levels of ERP expertise. Those risk factors were: suitability of ERP systems, security risks, and lack of information quality. In other words, there were differences in perception of those three risk factors between the managers with high and low levels of ERP expertise but these differences were not considered as significant.

By comparing managers who had a low level of ERP expertise with those who had a high level of ERP expertise, and their perceptions of risk factors associated with the implementation and operation of ERP systems, it found that such managers' perception of ERP implementation risk factors was much greater when they had a high level of ERP expertise compared to those who had a lower level of such expertise (see Figure 8-3). Particularly, managers with a high level of ERP expertise were more concerned with the 14 risk factors related to organizational, project management, users , and technical knowledge risk: These were (1) failure to redesign business processes and making major customisation of an ERP, (2)lack of change management, (3)insufficient discipline and standardisation, (4)unclear or misunderstanding of users' requirements, (5) lack of a champion, (6)lack of agreement on project goals, (7) lack of effective project management methodology,(8) ineffective communication between users, (9) resistance of users, (10) lack of involvement of users in the ERP system, (11) lack of users' experience, (12) lack of ability to recruit and retain qualified ERP systems developers, (13) lack of business analysts with business and technology knowledge, and (14) failure to mix internal and external expertise. However, managers with low ERP expertise recognised as risk factors difficulties in understanding and using ERP systems. This is quite a logical result since the managers with high ERP expertise would be likely to believe these systems are easy to understand and use.

In relation to ERP operational risk factors, this study revealed that those with a low level of ERP expertise were more worried about five risk factors related to the operation of ERP systems, although these did not appear to be thought of as very important (or were even ignored) by managers with a high level of ERP expertise. These risk factors were: (1) sharing passwords between users, (2) incorrect entry of data, (3) repetition of errors, (4) flowing of errors, and (5) illogical processing. Whereas, high level of ERP expertise, on the other hand, seemed to have concern about working with two systems in parallel as a risk could lead to operation of ERP systems less success. Both types of manager (i.e. those with both high and low levels of ERP expertise) were concerned about the ERP software's suitability, ERP security risks, and lack of information quality.

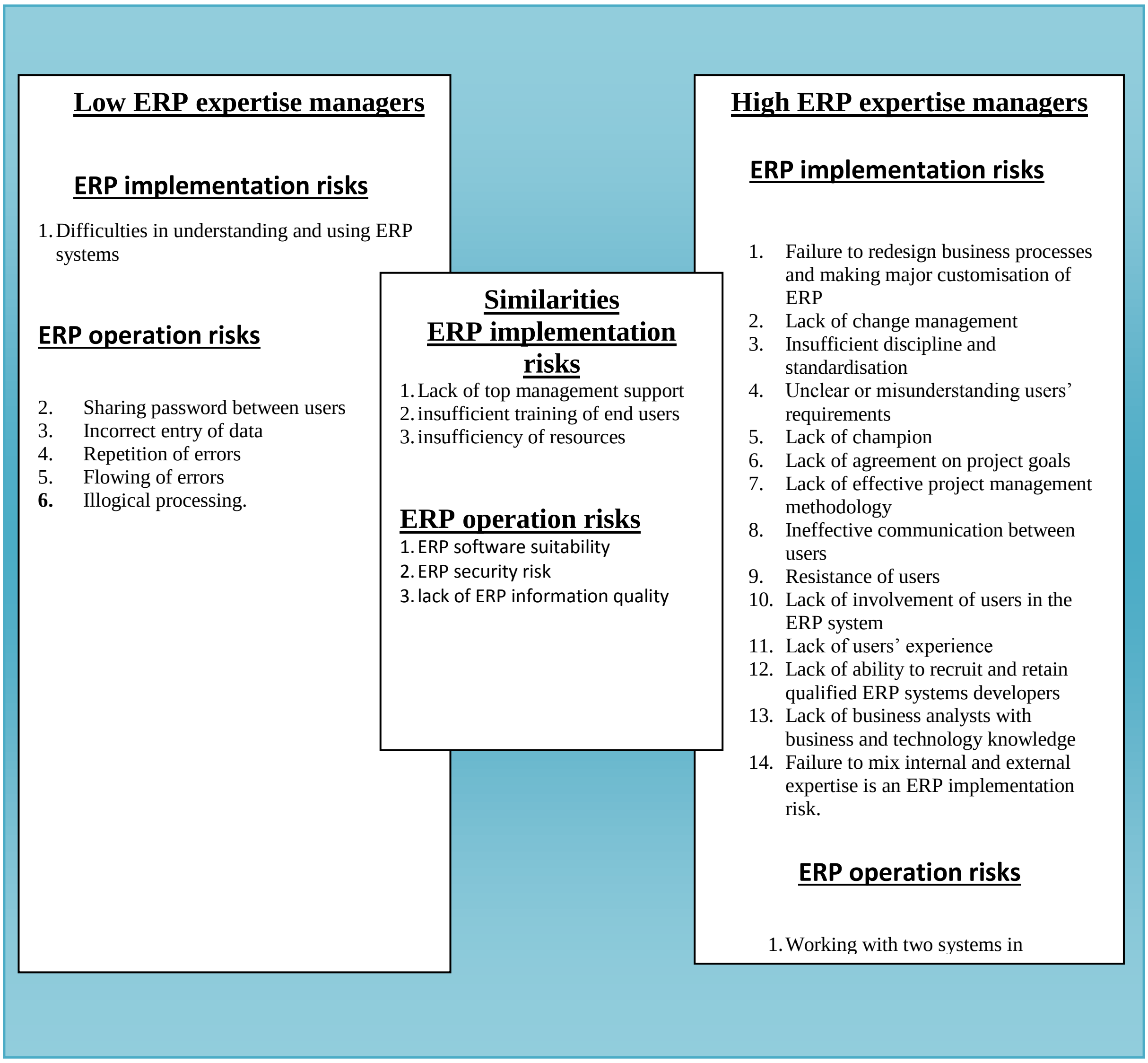


Figure 8-3 Difference and similarities in perceptions of ERP risk factors among managers with different levels of ERP expertise

In reviewing the literature, Wright and Wright (1997); Brazel (2005); and Du, Keil et al. (2007) indicated that individuals with high levels of expertise were more likely to recognise or assess risks compared with individuals with low expertise. Wildavsky (1990) also reported that the more people know about technological risks or about technology in general, the more they are worried about it. Thus, the perception of risks mirrors such knowledge. This study revealed that managers with higher levels of ERP expertise sometimes had higher perceptions of risk factors, particularly those related to the implementation of ERP systems; at other times, they had a lower perception of risk factors, especially those associated with the operation of ERP systems. This could be because the ERP expertise of managers interacted with their job or profession to explain their perception of risk factors associated with the implementation and operation of ERP systems. It seems that majority of IT managers (49.4%, N= 40. [See appendix 4]) had high ERP expertise, while most financial accounting managers, auditing managers, and others managers had low levels of ERP expertise (75.3%, N=64 [See appendix 4]).

### 8.4.3 *Relationship between culture and perceptions of ERP implementation and operation risk factors*

Cultural theory (as mentioned in pervious chapters) has been used to explain perceptions of risk (Douglas, 1982a; Douglas and Wildavsky, 1982b; Thompson et al., 1990). Douglas clarified her cultural theory by introducing the grid-group theory of society (Douglas and Wildavsky, 1982b). The grid-group theory, however, divided people's culture into four different cultures with different "ways of life"; these are hierarchy, individualism, egalitarianism and fatalism (Douglas and Wildavsky, 1982b). By applying Douglas' grid–group cultural theory in this research, a view was taken of managers in Jordanian companies who participated in this research regarding the risk factors associated with the implementation and operation of ERP systems. Most participant managers in this study had mixed culture bias (n=77), egalitarians (n=42), and hierarchists (n=32). While just small number of respondents were individualists (n=11) and fatalists (n=4). These results might reflect general tendencies among the managers in Jordanian organizations; but it is also more possible to reflect attributes of the instrument used to measure the culture bias, since similar findings were obtained using Dake's questionnaire by Sjoberg (1995) in Sweden and Brazilian samples and by (Brenot et al., 1998). in France. In addition, these sample results were quite similar to those of Marris et al. (1998) who also applied Dake's measures for cultural bias. In their sample they found 22 egalitarians, nine individualists, five hierarchists and five fatalists. Eight respondents had no cultural bias as their all four scores below the mean, and the remaining 80 respondents showed mixed bias as they had more than one score above the mean. Therefore only 32 percent allocated clearly to only one of the cultural bias. This may indicate that cultural biases are not an inherent attributes of individuals that can be captured by questionnaires items used by Dake (Marris et al., 1998).

Moreover, it mentioned previously that the construction of the cultural biases is based on two dimensions (grid and group). This means that each cultural bias comprises two dimensions, and the neighbouring type of culture is sharing one the same dimensions with its next neighbour. Coughlin and Lockhart (1998) and Rippl (2002) said that each type of culture shares some ideological ground with its neighbour. For example, fatalism culture which is next to the individualistm culture on the group dimension and Hierarchism culture on the grid dimension. So it is possibly will agree with the group items but would refuse the grid items of the measurement for individualism; and more likely to agree with the grid items but would refuse the group items of the measurement for Hierarchism. Therefore, it is assumed that people can allocate themselves within one culture type, or choosing more than one culture in the course of their lifetimes. Rayner (1992) and Tansey and O'Riordan (1999) mentioned that there is substantial argument among cultural theorists on the point that cultural theory has two different perspectives: stability and the mobility view.

Douglas favours the stability view. She holds that individuals' thoughts are consistent in a cultural bias whatever the social context (Douglas, 1996a). Tsohou et al., (2006, p203).said that "Individuals will choose to attach themselves to social structures with the same type of cultural bias in all areas of their life (e.g. home, work, social life). It is therefore implied that individuals conform to this bias over time and regardless of the social context". individuals from hierarchical families will prefer hierarchical jobs and hierarchical organisations (Tansey and O'Riordan, 1999). In spite of Douglas designed the grid-group gently, it recognise the limitations of typologies , since The typology is static, and is not developed to show the processes of change (Tansey and O'Riordan, 1999)

In contrast, Rayner favours the mobility view. Rayner (1992, p. 107-108) said that "cultural theory is limited only to predicting how things can be said in a particular context... Appeals to the common good are unlikely to carry much weight in the competitive marketplace but arguments about opportunities for individual advancement might do well ... individuals may flit like butterflies from context to context, changing the nature of their arguments as they do". Individuals might attach themselves to social structures with different types of cultures in different situations or parts of life **(**Tsohou et al., 2006; Marris et al., 1998). Members of one cultural group can easily move and be members of other culture group. the same person can be a member of different cultural groups in different social contexts of his or her life, for example people could be hierarchical at home and individualistic at work (Rayner, 1992).

As a result, Thompson et al.(1990) states that there are five types of culture as it can seen in Figure 8-4. This fifth type named either the hermit or autonomy that are viable combinations of culture bias and relations (Mamadouh, 1999). Wildavsky (1987) claim that each way of life need other to be viable, so there is interdependence among cultural types. Thompson (2011, p39) mentioned that "Each way of life undermines itself. Individualism would mean chaos without hierarchical authority to enforce contracts and repel enemies. To get work done and settle disputes the egalitarian order needs hierarchy, too. Hierarchies, in turn, would be stagnant without the creative energy of individualism, uncohesive without the binding force of equality, unstable without the passivity and acquiescence of fatalism. Dominant and subordinate ways of life thus exist in alliance yet this relationship is fragile, constantly shifting, constantly generating a societal environment conducive to change".

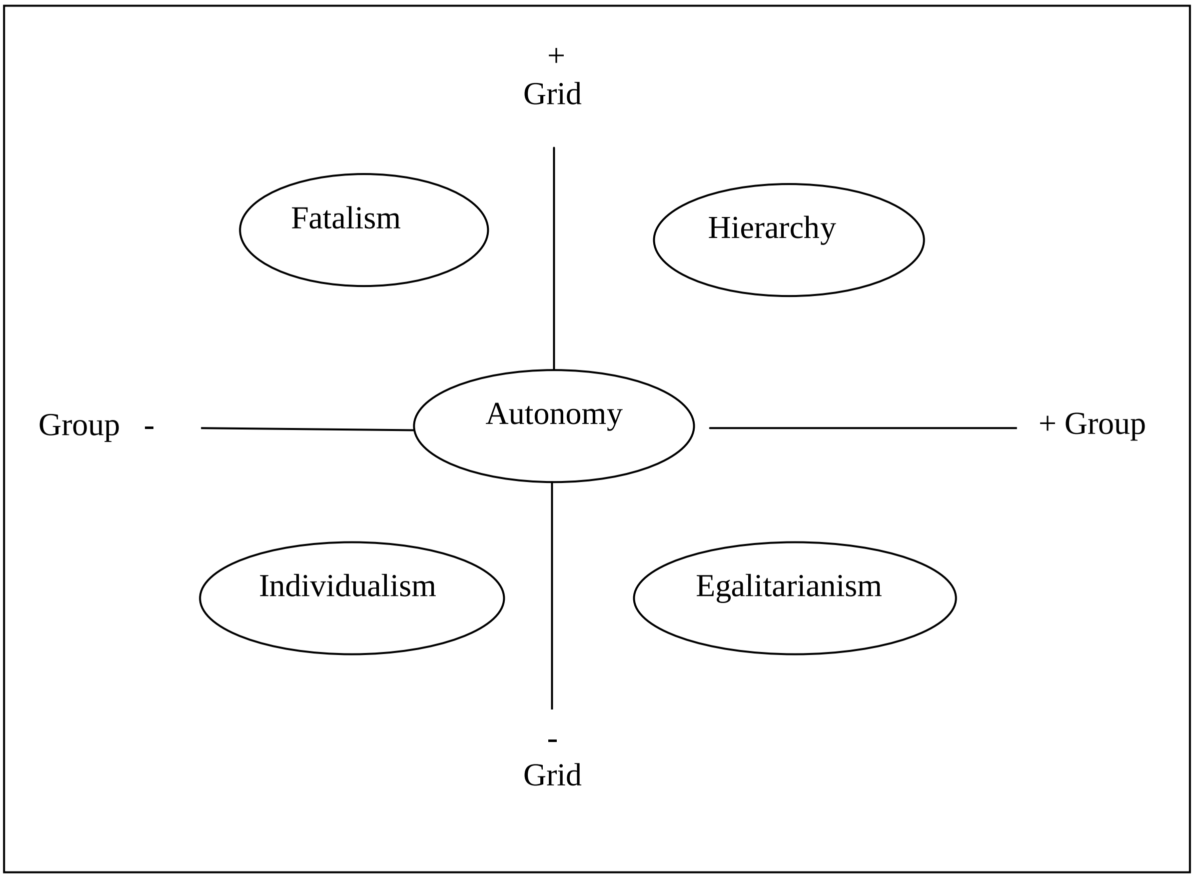


Figure 8-4 five types of culture biases (Thompson et.al., 1990, p.8)

However, (Raynes, 1992) said that there is an unexpectedly meagre of empirical support for the Douglas culture theory. Oltedal et al. (2004) claims that Douglas culture theory could be more appropriate before the globalisation. Poortinga and Pandey (1992, p.10) said "culture becomes manifest in shared constraints that limit the behaviour repertoire available to members of a certain group in a way different from individuals belonging to some other group". Increasing of broadly communication between different cultures could reduce diversity between cultures and may increase diversity within the same culture (Oltedal et al., 2004).

One of the aims of this thesis was to investigate whether the different managers' culture would affect their perceptions of risk. The cultural theory explains the perception of risk by using different types of worldview. However, the culture theory appears to be generally a useful factor in terms of perceptions of risk and for distinguishing among managers based on their culture. In the findings in Chapter Seven, it was shown from the results of the Kruskal-Wallis test that there was significant differentiation among managers from different types of culture (i.e. hierarchists, individualists, egalitarians, fatalists, and mixed cultures) in terms of their perceptions of 17 out of 18 risk factors which were more likely to occur during the implementation of ERP systems. However, no significant difference was found among managers with different cultures in terms of their perception of lack of users' experience. In other words, there were differences, but these were not considered to be significant, among managers with different cultures in terms of their perception regarding the lack of users' experience.

In accordance with the risk factors that could make the operation of an ERP system fail, this thesis found significant differences between managers from different cultures in their perception of three out of nine risk factors: namely, (1) ERP security risks, (2) sharing passwords among ERP users, and (3) incorrect entry of data. However, there were no significant differences in perceptions regarding the other remaining six risk factors among managers with different types of culture. In other words, there were differences but these were not considered as significant. These six risk factors were: (1) ERP software suitability, (2) working with two systems in parallel, (3) repetition of errors, (4) flowing of errors, (5) illogical processing, and (6) lack quality of the output information of the ERP.

As supported by Douglas and Wildavsky (1982b,a) and Wildavsky and Dake (1990), this study found that each type of culture and social structure (hierachists, individualists, egalitarians, fatalists, and mixed culture) had different perceptions of those risks that were likely to occur during the implementation and operation stages of ERP systems. Egalitarians showed a higher level of perception than other managers regarding the risk of ineffective communication between users and lack of involvement of users in the ERP system while both egalitarian and individualist managers were more likely to recognise nine risk factors associated with the implementation of ERP systems than other managers. These were: failure to redesign business processes and making major customisation of ERP, lack of change management, insufficient discipline and standardisation, unclear or misunderstanding of users' requirements, resistance of users, lack of users' experience, lack of ability to recruit and retain qualified ERP systems developers, lack of business analysts with business and technology knowledge, and failure to mix internal and external expertise. Also, egalitarians and hierarchists were the managers most likely to perceive insufficiency of resources and insufficient training of end-users as risk factors that could make ERP systems fail. In contrast to egalitarians, managers who were largely individualists or hierarchists perceived the following to be greater risk factors: lack of agreement on project goals, lack of effective project management methodology, lack of a champion, and lack of top management support. The hierarchists, however, saw difficulties in understanding and using ERP systems as a higher risk than managers of other cultures.

In terms of ERP operational risk factors, hierarchist managers perceived five of the risk factors associated with the operation of ERP systems as more important than other managers. Those risk factors were: sharing passwords among users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. Regarding the other three risk factors, the mean rank appeared to be approximately the same for each culture (i.e. egalitarians, individualists, hierarchists and mixed culture) regarding their perceptions of: ERP software suitability, working with two systems in parallel, ERP security risks, and lack of quality of output information of ERP systems. However, fatalists appeared to have the lowest mean rank for those risk factors mentioned above.

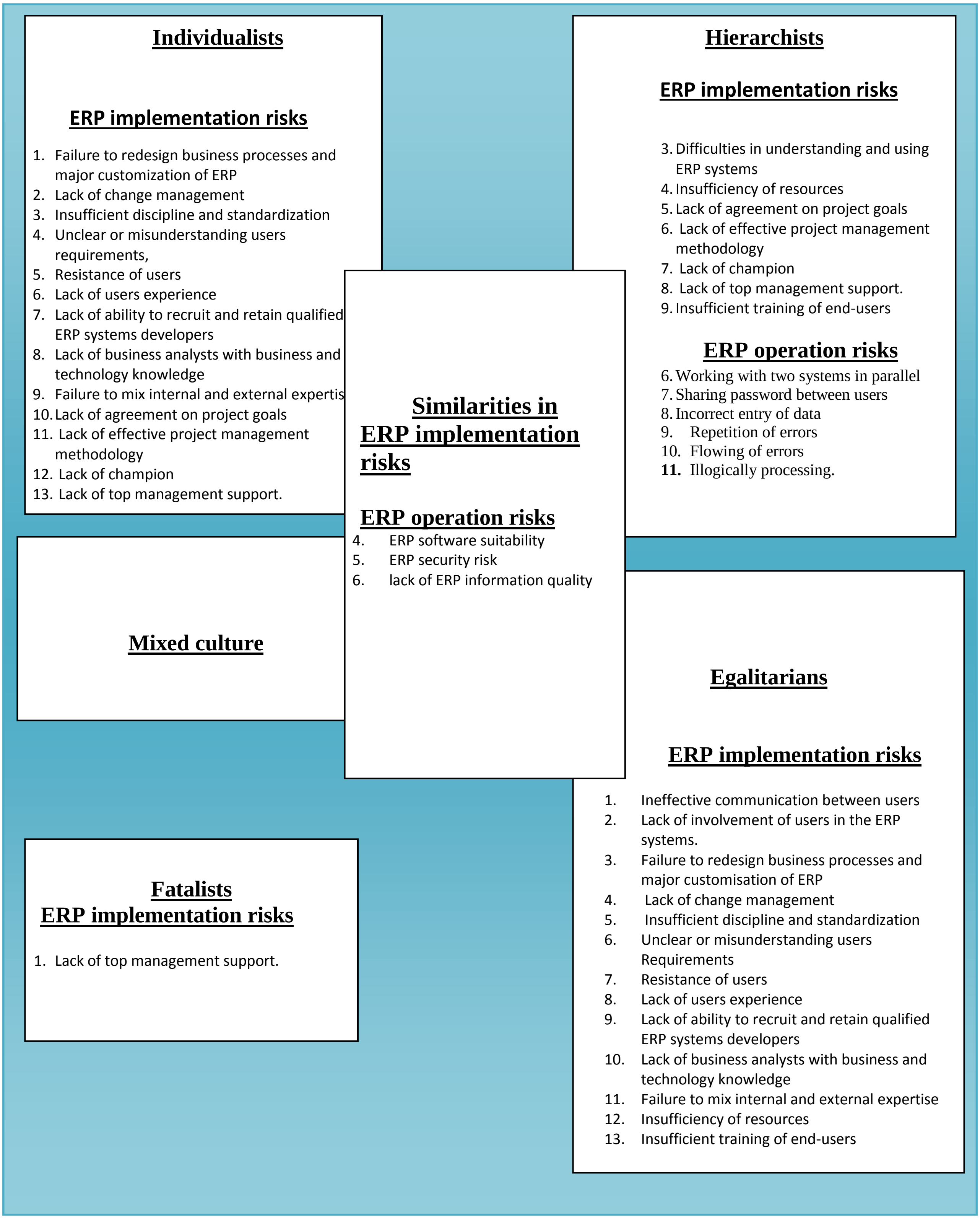


Figure 8-5 Difference and similarities in perceptions of ERP risk factors among managers with different culture

Egalitarians and individualists had the highest perception of risk factors that could make the implementation of ERP systems fail with 13 out of the 18. On the other hand, managers with a hierarchist culture had the highest perception of risk factors could make the operation of such systems fail with six out of the nine. This could be because the culture of managers interacted with their job or profession and ERP expertise to explain their perceptions of risk factors associated with the implementation and operation of ERP systems. It seems that most hierarchist managers were financial accounting managers, auditing managers and other managers (24 out of 32 hierarchist managers) who had a low level of ERP expertise (20 out of 24 hierarchist managers [See appendix 4]) since these groups of managers were more worried about six of the risk factors associated with the operation of ERP systems than others managers. Most egalitarians and individualists, however, were IT managers who had high ERP expertise; these groups of managers were more worried than other managers about most of the risk factors associated with the implementation of ERP systems.

#### 8.4.4 *Summary of findings regarding research question 3*

The empirical study that was undertaken in this thesis suggests that there is a critical difference in terms of perception among the managers in Jordan who were participants in this research according to their different cultures, levels of ERP expertise, and professional jobs. Culture had a stronger effect on their perceptions of risk factors than either profession or ERP expertise. This speculation was supported by the analysis of variance (i.e. the Mann-Whitney and Kruskal-Wallis tests) which was presented in Chapter Seven. It was clear that there was a significant disparity in terms of their perceptions of 17 out of 18 risk factors related to the implementation of ERP systems. According to the risk factors related to ERP operations, however, there was a significant difference between managers with different types of culture in their perception of three out of nine risk factors. Since culture was not significantly associated with perception for the other six risk factors concerned with ERP operation, it was found that different cultures made a difference to managers' perceptions of risk factors but not significantly so. In terms of profession and ERP expertise, these were found to be significantly linked to the perceptions of six of the risk factors associated with ERP operations since it was found that ERP expertise was significantly associated with the perceptions of ten risk factors related to the implementation of ERP while different professions made the perception of four risk factors significantly different.

Consequently, awareness of the risk factors by managers helps avert failure ERP systems. Hakim and Hakim (2010, P.205) indicated that "lack of awareness of top-level managers and decision-makers itself is a major barrier preventing any successful implementation of ERP systems". It has been said that risks cannot be managed until they are recognised as risks that threaten the possible success of implementing of ERP. A point that has arisen from the results of this study is that some of these risk factors have been perceived, while other risk factors have not by either IT managers or financial and accounting managers, managers with high or low levels of ERP expertise, individuals, hierarchists, egalitarians or fatalists. Each different group of managers were concerned about different types of risk factors. In short, some of the risk factors were obvious to some managers and not at all obvious to others. On the whole, there is a lack of awareness of the risks related to the implementation and operation of ERP systems by different managers as they tend to perceive those risk factors that are more related to their profession, culture or level of ERP experience. It is risky to perceive and assess only part of the landscape of risk and ignore other risks or not consider them as important for the success these systems. Interestingly, in this regard, none of the managers perceived all the risk factors related to the implementation and operation of ERP systems that were discovered in the literature and in this empirical study. Although the respondents were all managers, they were not familiar with all the risks concerning ERP systems. Renn, Jaeger et al. (2000) and Lion and Meertens (2005) indicated that people could find it difficult to have a rational perception of risk and may therefore rarely be able to make rational decisions about risks. However, one reason that may lead an ERP system to fail is that managers cannot not see and perceive all the risk factors since they pay attention to some but are not aware of others. Keil, Cule et al. (1998) explained that ERP failure is often attributed to managers who do not take prudent measures to understand and manage the risks related to these projects. A precise awareness of these risk factors could lead to success in the ERP implementation and realise all the ERP benefits (Bingi et al., 1999).

In this case, managers should perceive risk factors as a first step in order then to be able to assess and manage their ERP benefits as well as problems that could occur. One interviewee mentioned that no formal risk management was undertaken when Jordanian companies implemented ERP systems. Most Jordanian companies do not follow systematic methods to study and identify the expected risks that could happen during the implementation or operation of ERP systems. Thus, the reason for an ERP project to fail is that often managers do not follow systematic methods for risk management. This could mean that managers do not give enough attention to risks that could happen during or after the implementation and operation of ERP systems. Hall and Kutsch

(2007) found in their paper that IT projects often fail because project managers have not used any mechanism at all for risk management. Interviewees' comments were as follows:

> Risk is when not everyone is aware of that risk.
>
> Internal auditing manager (1)

> There is no systematic way for the estimation of risk to be undertaken.
>
> IT manager (6)

> No proper risk management was introduced when the project started. For an ERP project to be successful proper risk management should be applied at the planning phase and should be monitored throughout the whole project.
>
> IT manager (3)

However, the identification, assessment and management of risk are critical for the success of ERP systems. Risks should be identified and managed before starting the implementation of ERP systems. Managers should think of and predict risk factors, and be aware of the extent of the likelihood of their occurrence, as well as their impact on the success of these systems.

Furthermore, communication is very important among managers, particularly in discussing the risk factors that threaten the implementation and operation of ERP systems. However, this could be difficult, especially with managers who are from a hierarchical culture, as they believe that organising roles and planning for risks is better than having a chat or a talk to identify the risk factors. Moreover, even communication is considered an issue among managers who are from different professions. It was noticed in some of the companies that IT managers complained that other managers did not have enough background knowledge about the ERP systems and their requirements. Other managers, however, complained about the IT managers. They felt they did not have sufficient support from the IT managers because they thought that they did not have enough knowledge about business. Thus, the lack of communication among managers could be another risk factor that could make ERP systems fail. One comment from an interviewee focused on this conflict:

> Usually, there is conflict between the accountancy staff and managers, and the IT people and managers because IT managers do not have knowledge about accounting and accountancy managers do not have experience in IT. So there is a gap between IT and accountant managers.

> Really, IT managers are thinking all the time about technical and programming issues and how they will write this and that code. So they are totally separate from financial issues. On the contrary, accountant managers are separate from IT issues as all they are interested in is accounting and financial issues. ERP systems try to break this gap and make a bridge between IT and accountant managers.

Communication is an important issue that should be considered by managers when they plan to implement and operate ERP systems in their company. Cliffe, Champion et al. (1999) indicated that a better way of implementing an ERP system is that management should take into account the sharing of risks among stakeholders. Cliffe, Champion et al. (1999) also suggested that adopting ways of sharing the risks associated with an ERP systems by all team managers when implementing ERP systems, means that companies could avoid costly and highly disruptive failures. Instead, good communication could offer valuable information, allow managers to share such information, and gain more knowledge about risk factors that they perceive could threat the success of the implementation and operation of ERP systems. Moreover, communication not only brings knowledge, it also has an impact on managers and makes them change their behaviour and their ways of thinking about the risk factors. Also, communication is considered as an effective way of persuading people to be aware of these known risk factors. In other words, communication and sharing information with managers, particularly those who have a different culture, different profession, and different levels of ERP expertise, will help them to think about and interpret the risk factors which could, in turn, affect the use of these systems in different and more accurate ways, by learning from the experience of others.

Furthermore, learning from other companies' experience and knowledge, and hearing of the problems and errors they faced during the implementation and operation of ERP systems, is another way that could help to increase awareness of risk factors that could occur and make the implementation and operation of ERP systems unsuccessful. Kolb (1984) mentioned that it is worse for companies to carry on making mistakes that might have been previously recognised by others.

## 8.5 Conclusion

An ERP system is a very large and complex project. Implementing such a package imposes on users to think strategically, plan precisely, and negotiate with other divisions and departments (Bingi et al., 1999). Therefore, companies should not make a quick decision to install an ERP system but should have a clear understanding of its business implications (Davenport, 1998) and be aware of the significant issues before implementing such programs (Bingi et al., 1999). Otherwise, implementing such a system could be a failure and a great amount of money could be wasted. Alternatively, a poorly implemented ERP system could weaken the main sources of a company's competitive advantage (Davenport, 1998).

This chapter has discussed the findings from both the qualitative and quantitative data presented in Chapters Six and Seven, linking them with the discussion of the literature review presented in Chapters Two, Three and Four in order to answer the research questions mentioned in Chapter One.

The following chapter summarises and concludes the research's aims and offers the main research findings; it also provides information about the contributions made by this thesis to the body of theoretical and practical knowledge. Then, an overview of the limitations of this thesis is reviewed, followed by highlighting the recommendations and suggestions for future research.

# 9 Chapter Nine: Conclusion and suggestions for further research

## 9.1 Introduction

The aim of this thesis was to gain a better understanding of the level of awareness of managers regarding risk factors associated with ERP systems. Drawing on the current literature and the findings of a qualitative pilot study, this thesis identified the risk factors associated with implementation and operation of ERP systems from the viewpoint of managers in Jordan. Furthermore, divergences in the viewpoints among managers in Jordan, such as IT managers, accounting and financial managers, and others managers, were obtained by analysing the qualitative interviews from the pilot study. This thesis was used a survey to:

1. Identify the most important risk factors affecting the implementation and operation of ERP systems from the point of view of managers in Jordan.
2. Identify the similarities and differences in managers' perceptions of those risks related to the implementation and operation of ERP systems.
3. Investigate whether there are any differences in perception regarding the risk factors associated with the implementation and operation of ERP systems among managers with different job specifications: e.g. IT managers, accounting and financial managers, auditing managers, and others.
4. Examine whether differences in the level of ERP expertise among managers have an effect on the perception of risks associated with complex ERP systems.
5. Explore whether there is difference between managers from different types of culture (e.g. Hierarchism, Individualism, Egalitarianism and Fatalism) in their perception of the risk factors related to the implementation and operation of ERP systems.

This chapter aims to summarise and conclude the research's aims, together with the major research findings; these are presented in Section 9.2. Sections 9.3 and 9.4 provides information about the contributions and implication of this thesis to the body of theoretical and practical knowledge; this is followed, in Sections 9.5 and 9.6, by highlighting the limitations of this thesis, offering recommendations, and making suggestions for future research.

## 9.2 Summary of research findings

Based on the literature review and the empirical results of previous studies in this area, together with results from the pilot study, a problem area clearly arose in terms of the high level of failure in the implementation of ERP systems (Umble et al., 2003; Al-Mashari et al., 2003b; Holland and Light, 1999; Griffith et al., 1999; Hong and Kim, 2002), the regularity and frequency of such failures (Urwin, 2002; Aladwani, 2001; Griffith et al., 1999), and the uniqueness of the ongoing risks regarding ERP systems (Sumner, 2000; O'Leary, 2002; Wright and Wright, 2002; Huang et al., 2004; O'Leary, 2000; Hunton et al., 2004; Musaji, 2002). As discussed in previous chapters, research into perceptions of risk factors related to ERP systems has been generally overlooked. While it is recognised that a lack of awareness of ERP risk factors is one of the reasons for the high failure rate of ERP systems (Griffith, 1999; Keil et al., 1998), the research concerning the perception of risk factors associated with the implementation and operation of ERP systems; and the interaction between such perception and culture, ERP expertise, and profession, was not empirically validated. Many researchers have simply ignored this issue. Furthermore, reviewing the literature showed a gap in terms of giving details about issues related to ERP systems in developing countries, particularly Jordan. Therefore, this current thesis has been concerned with exploring and understanding those risk factors that are more likely to have an impact on the success or failure of the implementation or operation of ERP systems in Jordan from the perspective of managers. Understanding such risk factors, as Huang et al., 2004 mentioned, required the identification of: (1) what the risk factors were; and (2) which of these risks factors managers perceived to be more important from their point of view. Thus, the starting point was to identify risk factors and managers' perception of those risk factors that might lead to the failure of the ERP implementation and operation, as well as to discover if those risk factors were perceived wholly or partially. A conceptual framework of perceptions of ERP of risk factors was developed with regard to the literature of ERP systems to help in undertaking this research. The culture theory of risk, the concept of ERP expertise, and professional backgrounds were addressed in order to show the distinctive interactions among different groups of managers and their perception of the risk factors with regard to the implementation and operation of ERP systems. This was done by conducting an empirical study using a qualitative pilot study and a quantitative survey.

As presented in Chapter Five (the research methodology), the exploratory and explanatory study was examined by the combined use of qualitative and quantitative methods, adopted through semi-structured interviews and a questionnaire survey. The pilot study for the semi-structured interviews was used in this thesis since there is little information available in the literature on the risks related to the implementation and operation of ERP systems, and no ERP research has been conducted in Jordan. This was also done in order to identify the risk factors that could occur during the implementation and operation of ERP systems from the viewpoint of managers in Jordan. By conducting semi-structured interviews, it was found that 12 risk factors were likely to cause an ERP system implementation to fail and 9 risk factors were likely to have an impact on the effectiveness of these systems at the operational stage (i.e. the post-implementation stage). Following the pilot study, a questionnaire was designed based on the literature and results from the pilot study. The survey questionnaire was carried out to rank the most important risk factors that were thought to have an effect on the implementation and operation of ERP systems from the point of view of managers in Jordan, as well as to examine whether differences in culture, ERP expertise and/or profession affected the perceptions of those risks factors. With a larger pool of data from various managers with high and low levels of ERP expertise, from different professions or jobs, and from different cultures, more results and conclusions were drawn. As discussed in the previous chapter, two important conclusions were drawn from the analysis.

Firstly, the empirical evidence from the findings allowed the identification of numerous risk factors that might possibly to lead to failure in the implementation and operation of ERPs. The important risk factors presented in this thesis emphasise that (1) insufficient training of end-users, (2) lack of user experience, (3) lack of business analysts with business and technology knowledge, (4) failure to mix internal and external expertise effectively, (5) unclear or misunderstanding of users' requirements, (6) resistance of users, (7) insufficient resources, (8) lack of ability to recruit and retain qualified ERP system developers, (9) failure to redesign business processes and carrying out major customisation of the ERP system, and (10) a lack of top management support were the factors perceived by managers in Jordan as being most likely to make the implementation of an ERP system fail. Furthermore, the results of this study show that (1) ERP software suitability, (2) security risk, (3) repetition of errors, (4) incorrect entry of data, (5) flowing of errors, (6) illogical processing, (7) working with two systems in parallel, (8) sharing passwords, and (9) lack of information quality were reported as the most significant risk factors related to the operation of ERP systems in Jordanian companies.

Secondly, the analysis showed that, in spite of certain similarities in the perception of risk factors associated with the implementation and operation of ERP systems among Jordanian managers, there were discernible differences in the identification and perception of those risk factors among managers from different cultures, different professions/jobs, and with different levels of ERP expertise. It was found that culture is indeed critical in explaining the perception of managers of those risk factors associated with the implementation (but not the operation) of ERP systems. It was shown that 17 out of 18 ERP implementation risk factors were perceived differently among Jordanian managers from different types of culture. Furthermore, the level of ERP expertise and the professional backgrounds of the managers were critical in explaining their perception of risk factors associated with the operation of ERP systems, as opposed to such perceptions associated with the implementation of ERP systems. It was found that there were significant differences among managers with different jobs or professions, and with different levels of ERP expertise, in terms of six of risk factors related to the operation of ERP systems. These were: working with two systems in parallel, sharing passwords between users, incorrect entry of data, repetition of errors, flowing of errors, and illogical processing. Regarding the risk factors related to the implementation of ERP systems, it was revealed that the perception of managers with different levels of ERP expertise were significantly different in terms of ten risk factors related to the implementation of ERP. It also was shown that different jobs made the perception of four risk factors related to the implementation of ERP systems significantly different (see Table 9-1) while this did not have a significant effect on the perception of other risk factors.

In this thesis, it has been suggested and discussed that perceptions of risk factors can help to explain why many companies still fail when implementing and operating ERP systems. Since there was some agreement and disagreement among the managers concerning the risk factors that are more likely to make the implementation and operation of ERP systems unsuccessful, this study has come to the conclusion that managers did not perceive all the risk factors associated with the implementation and

Table 9-1: Significant differences in the perception of risk factors related to the implementation and operation of ERP systems

| Risk factors | | Significant differences in perception of risk factors according to: | | |
|---|---|---|---|---|
| | | Profession or job | ERP expertise | Culture |
| **ERP Implementation risk factors** | 1. Difficulties in understanding and using ERP systems | √ | √ | √ |
| | 2. Failure to redesign business processes and carrying out major customisation of ERP | √ | √ | √ |
| | 3. Lack of top management support | | | √ |
| | 4. Insufficiency of resources | | | √ |
| | 5. Lack of management of change | | √ | √ |
| | 6. Insufficient discipline and standardisation | | √ | √ |
| | 7. Unclear/misunderstanding concerning users' requirements | | √ | √ |
| | 8. Lack of champion | | | √ |
| | 9. Lack of agreement on project goals | | | √ |
| | 10. Lack of effective project management methodology | | | √ |
| | 11. Insufficient training of end-users | | | √ |
| | 12. Ineffective communication between users | | √ | √ |
| | 13. Resistance of users | | √ | √ |
| | 14. Lack of involvement of users in the ERP system | | √ | √ |
| | 15. Lack of users' experience | | | |
| | 16. Problem with recruiting qualified ERP system developers | | | √ |
| | 17. Lack of business analysts with business and technology knowledge | √ | √ | √ |
| | 18. Failure to mix internal and external expertise effectively | √ | √ | √ |
| **ERP Operational risk factors** | 10. ERP software suitability | | | |
| | 11. Working with two systems in parallel | √ | √ | |
| | 12. Security risks | | | √ |
| | 13. Sharing passwords | √ | √ | √ |
| | 14. Incorrect entry data | √ | √ | √ |
| | 15. Repetition of errors | √ | √ | |
| | 16. Flowing of errors | √ | √ | |
| | 17. Illogical processing | √ | √ | |
| | 18. Information quality | | | |

operation of ERP systems; rather, they perceived risk factors that were more likely to be related to their profession, culture or their level of ERP experience. It is dangerous to perceive and assess only a partial risk which could threaten the success of the ERP system, while ignoring other risks or failing to consider them as important for the success of the systems. Therefore, to reduce the high rate of ERP failure, managers who are responsible for the implementation and operation of these systems, as well as top management, should be more aware of the risk factors that could threaten the success of their ERP system.

## 9.3 Contribution of the study to the body of knowledge

The main contribution of this thesis in terms of both of academic theory and practice are presented in this section. As previously stated, this thesis has proposed a framework for identifying the risks factors associated with ERP implementation and operation, and the extent of the perception of those risk factors by different managers as well as identifying the factors that could affect their perceptions.

The overall research outcomes and findings of this thesis contribute to the body of the knowledge on both ERP implementation and operation, and the perception of risk. The thesis adds a new aspect to the existing academic knowledge through the development of a series of critical risk factors that must be carefully considered to reduce the failure, not only of the implementation of an ERP system project, but also its operation (i.e. post-implementation). This research plays a role in bridging the gap in the existing literature related to the implementation and operation of ERP systems by offering an empirical study of risk factors and the perception of these factors by managers. In essence, this is a unique contribution to understanding the area of risks factors which are related to both the implementation and operation of ERP systems. Not only does it address risk factors from a business perspective, it also addresses them from an IT perspective. Since the risk factors concerning ERP operation have not been highlighted in other studies, this thesis offers new theoretical insights to the existing literature. Moreover, this thesis confirms some of the factors stated in the literature and adds several new factors, such as working with two systems (old and new) in parallel, sharing passwords, incorrect entry data, repetition of errors, flowing of errors, illogical processing, and lack of information quality. In addition, groups of managers (such as accounting and financial managers, IT managers, and others, who have at least one year ERP expertise or more) are important considerations and need more attention. The research framework of this thesis shows that the perception of ERP risk factors varies among those managerial groups and highlights the influence of managers' groups in their perceptions of the risk factors, as well as identifying the most important factors.

This research also contributes to achieving an understanding of these complex relationships within and between the risk factors associated with the implementation and operation of ERP systems, together with extent of the influence of each one on others in order to increase the likelihood of success and reduce the failure in the implementation and operation of these systems. As shown in Chapter Three (the literature review), most studies have focused on understanding either the critical success factors or risk factors that make the implementation of ERP systems more effective in companies. However, these studies did not pay attention to the complex relationships between such success or risk factors. This current study gives some information about the influences of these risk factors on each other since this thesis is more concerned with understanding the managers' perceptions of ERP risk factors and the interaction between their perceptions of these risks and their culture, profession/job and ERP expertise, rather than focusing on the importance of linkages and relationships among the risk factors themselves. However, future research could investigate in more depth the effect of the risk factors that could occur during the implementation of an ERP system on each other, and the impact of implementational risk factors on operational ones, as well as how each operational risk factor could affect others during the implementation of an ERP system.

In addition, as the application of theories and models of the culture theory of risk in the area of information systems and ERP implementation and operation are still not yet quite established, this research can be seen as a step towards the application of this theory. One of the most significant contributions of this thesis relate to the application of the culture theory of risk in the area of perceptions of risk factors associated with the implementation and operation of ERP systems. This extends the study of culture theory by applying a grid-group model to investigate significant differences in perceptions of risk factors among managers from different cultures, such as hierarchists, individualists, egalitarians, fatalists and mixed cultures. This study is the first study to explore the relationship between culture, profession and ERP expertise, and perceptions of the risk factors associated with implementing and operating ERP systems.

## 9.4 Implications for managers

For practitioners who willing to implement ERP systems, this thesis helps managers in the companies in Jordan in the future to be more aware of the implementation and operation of ERP systems. Since implementing and operating ERP systems involve many people from different backgrounds and with different characteristics, such as different cultures (hierarchical, egalitarian, fatalistic and individualistic), different disciplinary backgrounds (including IT, accounting, management, marketing, manufacturing engineering, etc.) and level of ERP expertise (low or high expertise), risk factors related to the implementation and operation of ERP systems are viewed from a variety of perspectives. Each different group of managers are concerned about different types of risk factors so some risk factors were obvious to some managers but were not evident to others. On the whole, there is a general lack of awareness of the risks related to the implementation and operation of ERP systems by different managers. However, the results of this thesis can help organisations' top management, IT managers, accounting and financial managers, and other managers to increase their awareness about the risk factors associated with the implementation and operation of ERP systems. Understanding these risk factors and their effects on the success or failure of the implementation and operation of ERP systems in organisations could be useful for practitioners and improve their experience. Also, focusing on those risks factors that are more important, especially in companies in Jordan, will lead to an increase in the rate of success of these systems in future, and will therefore increase the efficiency and effectiveness of ERP procedures during their implementation and operation.

## 9.5 Limitations of the research

There are some limitations in this current thesis; these include limited time, accessibility of information, generalisation, and data bias. The following section discusses and addresses the limitations.

First, this study focused on a limited number of variables that might affect perceptions of risk related to the implementation and operation of ERP systems. These included the level of ERP expertise, culture and the profession or job of the participants. Other relevant variables associated with perceptions of risk, such as the behaviour, age, gender, and type of education of managers; different sized organisations; different sizes of ERP system, or different vendors, could be added to improve the understanding of perceptions of risk factors in the implementation and operation of ERP systems.

Second, bias is a common issue in data collection and analysis in many social science studies. Participants in this research may have provided biased information as they were perhaps unwilling to provide candid answers; also, the researcher could be biased when interpreting the qualitative data thus making incorrect conclusions about the findings.

Third, as this thesis conducted a survey questionnaire, a further limitation is associated with the statements that were developed based on reviewing the literature and from the data resulting from the exploratory pilot study. The questionnaire did not contain all statements which were considered important in measuring some ERP risk factors because this study included a number of risk factors and the questionnaire was already long. In addition the researcher cannot establish who answered the questions. Another limitation relating to the questionnaire relates to the sample. The results could be biased because the group samples were not equal.

Fourth, perhaps the greatest limitation of this study is that it does not provide possible remedies or solutions to the issue of the high rate of failure of ERP systems or offer suggestions to make managers more attentive to the ERP risk factors in order to achieve a higher degree of success in the implementation and operation of ERP systems. Moreover, it was difficult to find other empirical evidence within the ERP literature regarding perceptions of risk factors as a theoretical means which might have helped to explain the findings in this research thesis.

Fifth, the results of this study cannot be generalised.  The purpose of this study was to obtain an in-depth understanding of the phenomena rather than represent the population. It aimed to explore the understanding of managers of risk factors that might affect the implementation and operation of ERP systems.

## 9.6 Future research

This research intended to investigate the perception of risk factors associated with the implementation and operation of ERP system in Jordan organisations since no research had been carried out in the field of ERP systems in Jordan. This study also concentrated on differences in perceptions of the risk factors associated with the implementation and operation of ERP systems according to the culture, level of ERP expertise, and profession or job of managers. Further research could be undertaken to extend and improve this research. There is a need to extend the methodologies that were applied in this research in order to explore further the perceptions of risk factors associated with the implementation and operation of ERP systems in the UK or in other European or Middle East countries to find out how these perceptions might vary from those discovered in the Jordanian context. A comparative study could be carried out to investigate the significant differences between developing and developed countries regarding the ERP risks investigated in this study.

Moreover, this study ignored perceptions concerning the importance of risk factors that could make ERP implementation and operation less successful according to different sizes of company as what ERP risk factors are important for a small- or medium-sized company could be different for a large company. Also, managers who work in a company which has implemented a different type of ERP system could perceive ERP risk factors differently. Another point which was not considered in this study was that managers who are working in companies that implement whole ERP packages could have different perceptions of ERP risk factors than those who work in companies who implement a portion of an ERP system in. Thus, there is a need for future research to cover all the points mentioned above.

The current study has offered very brief information about the influences of these risk factors on each other. It was noticed that there are interrelationship between the risk factors. Some of the implementation risks could lead to another risk in the operation of these systems; for example, inadequate training and a lack of user involvement in the implementation process could lead to the risk of entering data incorrectly. So, future research could perhaps investigate in more depth the interrelationship between the risk factors, and the effect that each risk factor which could occur during the implementation of an ERP system could have on another, as well as the impact of implementation risk factors on operational risk factors, and how each operational risk factors could effect the others.

Since this study included many risk factors associated with ERP, future research should select just a few risk factors and consider these, thus limiting the number of items in a questionnaire related to perceptions of the risk factors associated with the implementation and operation of ERP systems. In spite of the fact that both culture and levels of ERP expertise have been validated in previous ERP or IS research studies, the concept of measuring perceptions of risk factors has not yet been undertaken in ERP or IS research. Thus, more research should be undertaken to obtain further validation in this area.

## 9.7 Conclusion

This study has presented a comprehensive understanding of the risk factors associated with the implementation and operation of ERP systems from the perspective of managers in Jordan. In particular, the research has shown how managers perceive those risk factors and what are considered to be the most important risk factors from their points of view. The qualitative and quantitative findings provide convincing empirical evidence that most of the risk factors associated with the implementation and operation of ERP systems are perceived differently among managers in Jordan. The different interpretations and views of managers of these risk factors are more likely to make ERP systems fail in many different ways; this shows that their understanding of such risk factors interacts with their personal and cultural values. Douglas' culture theory of risk was applied to examine the different perceptions risk. This culture theory has not been applied (or rarely so) in the area of the perception of risk factors associated with Information and Communication Technology (ICT) generally, and in the implementation and operation of ERP systems in particular.

The important lessons learned from the pilot study and the survey presented in this thesis are more likely to help companies in Jordan and implementation teams in the future to understand the risk factors that could influence the success of the implementation and operation of ERP systems. This research has made a useful contribution to the accounting and management information systems' knowledge.

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# 10 Appendixes

## 10.1 Appendix 1A: consent letter and Interview questions

UNIVERSITY OF
NEWCASTLE UPON TYNE

Khansaa Tezeny
The University of Newcastle upon Tyne Business School,
3th Floor, Armstrong Building,
University of Newcastle,
Newcastle upon Tyne, UK
NE1 7RU

Dear sir/ madam
I am currently conducting doctoral research in relation to understanding the risks associated with implementing Enterprise Resource Planning (ERP) systems in companies in Jordan and how managers are trying to manage it. A summary of my research is attached with this letter and provides more detail about the background and my proposed research.

I am writing to ask you to assist me in my research. I am seeking to interview managers in order to identifying and assessing the risks related to ERP systems. Each interview will take approximately half an hour.

All the information used in this research will be kept anonymous and in strict confidence. In return for your contribution, I will prepare a report on my results and include recommendations and the implications of my findings which will provide information which may be useful to your company.

Anything I write for publication or for my thesis will not allow the company to be identified (unless the company wishes otherwise) and I will invite you to comment on any papers intended for publication. I am also willing to consider other conditions you find important in order to participate in the study including signing a confidentiality agreement.

I hope that you will be able to help me. Your contribution is essential to the success of my research and in turn I hope that my contribution would be of value to the company.

If you need further information or would like to discuss any queries, please do not hesitate to contact me via email khansaa.tezeny@ncl.ac.uk. Thank you very much for your assistance, and I look forward to hearing from you soon.

Your sincerely
Khansaa Tezeny
Doctoral Researcher
The University of Newcastle upon Tyne Business School,
3th Floor, Armstrong Building,
Newcastle upon Tyne, UK, NE1 7RU

## Interview questions

**Can you tell me first about yourself**

1. Name:
2. What is your role in company?
3. What qualifications do you have?
4. How long have you been in this role?
5. How many years do you have experiences with ERP systems?

**B. Can you tell me about this company?**

1. When was it founded?
2. What kind of business area do you consider your company?
3. How many people work at your company?
4. What is the company strategy? Is it cheapest goods, or fast, or best quality?

**C. Can you tell me about Implementing of ERP systems in your company?**

1. What ERP functions are currently implemented at your company?
2. Which ERP system is your company currently using?
3. When did you decide to implement ERP systems?
4. Who made decision to implement ERP systems?
5. How many months was the ERP implementation planned to take?
6. How many months did the implementation actually last?
7. In what year was the implementation of your ERP system completed?
8. How did you implement ERP systems?
9. What was the total cost of implementation of the ERP system?
10. What reasons justified the implementation of the ERP system?
11. What are ERP benefits has your company received?
12. What are ERP problems have your company faced in implementing and operating these systems?

**D. Risks introduced or exacerbated of ERP systems**

1. What is the perception of risks introduced by ERP from your point of view?
2. What sorts of risks are uniquely associated with the ERP systems?
3. What are the sources of theses risks?
4. What types of risks are similar or different among the managers?

**E. Management of ERP-related risk.**

1. How does company deal with the risks associated with implementation of enterprise resource planning systems?
2. What can company do to minimize these risks?
3. Has your company had redesign business process when ERP systems were implemented?
4. Is there any relationship between the failure to redesign business process and incidence the risks?
5. Have you received training about how to use ERP systems to perform your task in company?
6. Who do conduct Training on the ERP system
7. How much training has you received?
8. How effective was the training provided by the Implementation Staff?
9. Does the training factor affect your perception of risk of ERP?
10. Is there any relationship between the technical ability and incidence the risks?

11. Is there any relationship between the strength and weakness of the control and incidence the risks?
12. Do any other factors affect your perception of risks or incidence the risks
13. Do any other factors do affect your perception of risks or incidence the risks more than others?
14. Is there anything else you think I should to know?
15. Do you have anything more you want to bring up?
16. Is there anybody else that you think is could be helpful to do talk to?

**Thank you.**

## 10.2 Appendix 1B: theme and transcription

| Themes | Transcript | interviewees | code |
|---|---|---|---|
| Difficulties in understanding ERP systems | I would say that Baan system is difficult; particularly in Jordan | Plant manager (2, 4 years) | Complexity |
| | I cannot say ERP system is easy to use and easy to understand | Financial manager (4, 3 years) | Not easy to understand<br>Not easy to use |
| | Really, the disaster in my opinion is when the users do not understand these systems, do not know what to do, and how they have to do it | Financial manager (4, 3 years) | Not easy to learn |
| | The more people understand ERP systems, the more success of these systems will be. | Financial manager (5) | Understand – success |
| | The better understanding ERP systems, the better use of these systems, the less errors could occur. | HR manager (4,3 years) | Understand- errors |
| | Other risk could we faced related to end user was inability to understand the integration process of this system. They do not imagine that any process done on JDE, it has financial effect directly and will effect on the next user as well. | IT manager (4, 6 years) | Integration |
| | Some risks are inherent in the system itself. For example, the complexity of ERP system, which make it difficult to be understanding by users, are inherent risk inside the system. To reduce this kind of risk, we should have a good training for each user on his module in ERP system to get a good understanding with his module. | Financial manager (2, 4 years) | Understand-training |
| | ERP is not easy system, it is need all people to work together, and if one of the team does not have the will to work on the ERP system, this is really a disaster, which it will affect of each other | IT Manager (1) | Understand -willing to use |
| Failure to redesign business processes and make major customisation | "As you know every company implemented ERP system did not accept as it, but they did customization." | IT manager (6, 7 years) | customization |
| | You know the redesign business process is a big problem. I believe that ERP system is not redesign your work or restructured" | Production manager (1,3 years) | redesign business process |
| | Really a major customization is a big problem and lead sometimes to failure in implementation ERP system | IT manager (3, 7 years) | customization |
| | Even our company have agreed with supplier to implement Oracle system as it without any changeable, but when the supplier started implementation of the project, he faced a lot of problems. For example, key users changed their mind and they became demanding modifications according to their requirements. Each of end user wants oracle system as his requires to fit his department requirements, and they did not think what the reflection of their requirement on others. So there was kind of contradiction in the ideas and requirements. Really, each person sees ERP systems from his viewpoint and how it will help his department to perform their works. There was no integral viewpoint to ERP systems in general. Finally there was a disagreement between supplier and our company. However, in the end we stopped implementing oracle system, after we spent one year in implementing | IT manager (4, 6 years) | Modifications |
| | In our company, significant modifications have been made to the ERP system to meet our policies and ways of working, which was really a disaster. The company has taken 7 years to implement the ERP but finally this has failed and a large amount of money has been spent. | IT manager (3, 7 years) | Delay implementation<br>Cost |
| | Because an ERP system is a ready-made system, it sometimes does not achieve all the company requires so that the company has to change its business processes to suit the ERP system. The company should not customize or make any changes to the ERP to suit their old ways of working. Really, if they do any customizing of the ERP, they will get a lot of problems. In my opinion, I definitely refuse customization. Really, these people are not aware of the problems and so want to make modifications. | IT manager (2, 6 years) | Customization |
| | In my opinion, if the ERP system does not achieve the aims of the company, and the company wants to customize the ERP system, it is better to design new software to meet what they need, and satisfy their way of working instead of buying an expensive ready-made package then carry out a lot of customization on it. Another point: if the redesign of a business process is not planned well, it can be a real disaster. | IT manager (3, 7 years) | Suitability of ERP |
| | You could not implement an ERP system if you did not make a full study of your business processes first, then compare these with the system functions to see if you need to change your business processes or not. But, most of the times work flow in the company differs from the ERP system functions because ERP system functions are at an international standard. So, when the business processes in the company are not at the same level as international standards as it is in ERP systems, you have to change your business processes. Some companies refuse to change their business processes so they change the processes in the ERP system to fit their way in working. | IT manager (8, 7 years) | change business processes |
| | I think it is better to customise the ERP system; this is better than redesigning the business processes | Financial manager (3, 4 years) | Customization |

| | | | |
|---|---|---|---|
| | "We did not redesign business process but we do only simple modification on business process." | Financial and accounting manager (6, 4 years) | modification |
| | There are some kinds of weakness I can see it in the system but still you can never get ERP perfect as you want. So we have to customize ERP to fit your needs | Financial and accounting manager (1, 9 years) | Customization |
| | they did not redesign the business process which is wrong. This why sometimes I say I need the export department expenses, it is not there. They are using the old chart of account, so there is no cost centre pertain to the export department. So I do not how much been expense in term of export activities, salaries, travelling expenses. so I have to do it in manual. So it is in my plan to redesign chart of account. It is one of my priorities, I have done a basic thing but still I think the chart of account need redesign to give you more details about cost centre. For example the IT department do not have cost centre, so all the salaries will charge to general and administrative which is wrong | Financial and accounting manager (1, 9 years) | Customization |
| | Other point I want to talk about is the customization. In our Company we did customization but within specific criteria the permitted by JD.Edward company. So, for inventory, we made definition to each item in the store where 25 persons have defind100000 items in the store. And the same thing was for the definition of the suppliers, customers, and employees. Also, we made a minor customization on sales module because something is not matching 100 % to our needs. For example, in sale department, The truck that becomes filling by the cement usually enrol as empty and it is weighed, it load with10 tons and weighed again .The difference between the truck weight as is  a full and empty should not exceed 5 with thousand increases or decrease. This difference should be identical to the docket card that turns it to a merchant. All these cases not present in the JD.Edward system. Also, we made sub modules and we link it with sale modules. One of these modules named authorities which mean the merchant authorizes any person with loading the goods in stead of him. This case is not present JD.Edward. It is special only in Jordan Company. | Financial manager (4, 3 years) | Customization |
| | Other thing I would like to mention is, due to a huge pressure on Cement Company by volume of merchant order, we obliged to the distribution of the cement among the merchants in a fair way. So we made a small module that allocates to the merchant a specific share in for a specific time and according to his annual consumption. The last customization we made was on the reports system because the form and design of the reports were presented in JD.Edward system were unacceptable. So that we changed all reports that was unacceptable by users and we made a new reports. For example, one user should to get a report after entering sale order. Usually in JDE you should open another screen after you finish entering sale order to print the form of the sale order. And for this reason, we made a exit bar and icon in the same screen of entry sale order, so after he finish entering sale order, he can press on that icon for directly print. Really, we made this customization to make the work of user easier. | Financial manager (4, 3 years) | Customization |
| Lack of top management support | In my company, implementing ERP was personal effort, not because the top management did not want to support it, but because they were so busy with their daily work, so they did not have time. The messy thing was they did not give any priority to the ERP system. That's why it was my challenge because if we do not succeed, why am I here? | IT manager (1, 7 years) | Busy |
| | In June we were delayed by three months in the implementation and our transactions were also late by three months because the system was not implemented. This was a major problem. I did not try to impose the general manager's (GM) decision, I tried to do it by myself, but, in the end, I had to make him interfere and follow up details by himself. This supported me and empowered me to be willing to implement the ERP. He proved to be more interested in this, empowered it, and added some instructions. He was very strict. He supported people and users who were working on the system. However, in the end, everybody wanted to finish his/ her work and so on. | IT manager (1,7 years) | Delay implementation<br><br>Willing to use<br><br>Instruction, users' support |
| | In our company, they implemented the ERP system over 7 years.... one of the reasons for this was that the upper management were not involved in each stage of implementation, and their support was not strong as it should have been. | IT manager (3, 7 years) | Delay implementation<br>Stage involvement<br>strong support |
| | Really, there was no good business team that was supported by high-level management and that was responsible for the success of this project. | IT manager (4, 6 years) | Project success |
| Insufficiency of Resources | In our part of the world, while we don't respect the timing of the project plan and we don't commit to the tasks and their duration, we will never be able to reach that level of professionalism in ERP implementation. There is a need to respect what is written in the documents (deliverables). In our company, we planned to finish implementing the JDE system in one year, but actually we implemented it within 7 years, and it cost more and more money. | IT manager (3, 7 years) | Respect time<br>money |
| | The problems are that top management does not provide good support, project leaders are not well qualified, users are resistant, it is difficult to customise systems, and user's requirements are often misunderstood; all of these delay the project and make it the cost more money. | IT manager (3, 7 years) | top management leaders<br>resistance<br>customisation<br>user's requirements |
| | In order to reduce the possibility of  implementations of the ERP system failing, they took the decision that this system had to be implemented successfully under any circumstances and for any cost. | IT manager (4, 6 years) | Time<br>Cost |
| Lack of change | Really, at that time we made significant changes that led to the successful | IT manager (4, 6 years) | Changes- upper |

| | | | |
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| management | implementation of the system. The first of these changes was to change the upper management. There was a desire to make any change that the system required. Really, the old upper management was the one of factors that could have lead to failure in implementing the Oracle system because they did not understand the ERP system, and did not want to change of their procedures and work policies. Really, French people from the Lafarge Company helped us to overcome the obstacles and to form a new upper management structure with open-minded mentalities. Changing our top management was a positive point in implementing the JD. Edward system. Also, we changed our procedures, policies and business processes to suit the new system. | | management<br><br>procedures<br><br>work policies<br><br>business processes |
| | To manage and reduce risks, the old ways of doing business have to be changed. | IT manager (3, 7 years) | old ways |
| | Implementing the Baan system imposed some new procedures to comply with the ERP system. Actually, we made very big changes in our financial policies and cost accounting policies in order to avoid failure in the implementation. | IT manager (1, 7 years) | changes - financial policies<br>cost accounting policies |
| | Implementing an ERP system had a positive impact on my department. It added value to the IT team. It has added more and more to our responsibilities; it has added more to our tasks. | IT manager (7, 6 years) | Tasks.<br>responsibilities |
| | When we talked about an ERP, the first thing that came to my mind was the finance because the biggest part of the implementation would take place in the finance department so you would generally expect to see big changes there, as well as in other departments such as the manufacturing department which would use other modules such as bills of material, the order point for the inventory. There was often too much pressure on us to get the ERP system implemented in the finance department. | Financial manager (1, 9 years) | changes – finance<br>manufacturing |
| Unclear/ misunderstood users' requirements | First of all, we have to do master data or mapping. I mean consultants have to meet the purchasing, warehouse, financial manager, and each user to know the way of their working and how consultant will deal with the ERP to meet customer needs. For example, we ask the purchasing department the way of their purchasing of material, how to introduce your supplier, the type of material you buy national and international, paid time for supplier, and the list of the suppliers' names. Also, he ask the warehouse manger about number of store that he to open, number of location in the store, how he wants to introduce the location, and names of locations. So the consultant has to make analysis to the their work first to design the parameter on the system. After the consultants understand the working nature of company, they get agreement with the customer about the way of dealing with the program to know if the program cover the company or customer needs. | IT manager (2) | Users' requirements |
| | Some companies that moved from manual system to automated complex system such as ERP system directly, they failed because the key users do not know the right requirements that they provided to suppliers. These companies did double implementation which cost them a huge amount of money." | Financial manager (3) | |
| | Usually, customization depends on the key users' requirements. So, in our department, the users had experience of the financial system as they had worked with it for two years. This helped them to define their requirements to the ERP supplier. Thus, they knew what their requirements were, and what difficulties they faced in getting some information in the old system; they wanted to avoid such problems with the new system. | Financial manager (8, 4 years) | Users- ERP/ IS experience |
| | Top management in our company planned to finish the Baan implementation and to go live with it within 6 months, but actually the implementation took more than 14 months due to the lack of knowledge of both the customers (users) and the supplier (the Baan provider). The internal staff did not understand what was required of the ERP and the supplier did not know the internal culture of the company. | IT manager (1, 7 years) | Users- ERP/ IS experience<br><br>Supplier- business experience |
| Lack of a champion | To successfully implement an ERP, you should have a good champion, who has the ability to make proper decisions in the implementation. | HR manager (4, 4 years) | Make decisions |
| | To make the ERP system a success, the project manager should be from an IT and Accounting department. One of the problems that we faced while implementing our ERP systems was that the ERP project leader was from the IT department and did not have experience in business. | Financial manager (6, 4 years) | Business. Experience<br><br>IT experience |
| | The project leader should work hard, know everything, and be involved in every step. | Plant manager (2, 4 years) | Knowledge |
| | One of the biggest risks from my viewpoint is that IT people do not have any knowledge or experience of accounting and financial systems; they are a supporting team to the ERP system. As you know, ERP systems are accounting systems. Really, it is strange for IT people to support an accounting system when they do not even know if this account is a debit or credit. They do not know if this account is payable or receivable. | Internal auditing manager (5, 5 years) | accounting experience |
| | It's no surprise that there is a lack of IT people with knowledge in the accounting field. They don't know the basic things such as debits or credits. For example, before we went live with the ERP system, we tested it. So while we were testing the balances' system, we found a 700,000JD variance between the debit and credit accounts. As you know, it must be zero. So we complained and asked the supplier to | Financial manager (8, 4 years) | accounting experience |

| | | | |
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| | review it again to detect the errors in the system. They came back saying that they had reduced the variance to 3000 JD and the IT leader accepted this variance. This is impossible. The IT people do not have any background in business. They do not know if this account is in credit or debit, or whether an amount is expenditure or revenue.<br><br>In my opinion, there should be two leaders, one leader from the business department to define the needs for each department, and another from the IT department who should implement the business departments' needs. Then the business department should test the system to see if it meets their requirements. After that, the leader should approve it. | | two leaders |
| Lack of training of end-users | In my opinion, a company can minimize the risk of failure of its ERP systems, firstly by training its staff and raising awareness among them. | Financial manager (3, 2 years) | Training |
| | No one on the staff knew what ERP was before the company implemented it. Even after implementing these systems in our company, the information that we got about it was not enough. | HR manager (4, 3years) | ERP knowledge<br><br>Lack of information |
| | We did not give them enough information about ERP to stop them getting confused. | IT manager (8, 7 years) | Confusion |
| | As you know training is an important factor because it has an influence on other risks that are associated with failure in the implementation of ERP. If users are not trained well, they could face difficulties in understanding and then they cannot use these systems or they use them but make a lot of errors. | Financial manager (4, 3 years) | difficulties in understanding<br><br>data errors |
| | Another type of risk is that users are not trained well, and do not have sufficient knowledge in ERP systems. So we should not let users do any data processing using an ERP system or we should not give them authorization to access the ERP system except after a long period of experimenting and not until we have made sure that the user has a clear understanding of the functions he is utilizing. So, we should not give him authorization until we have made sure that his work on the ERP system will not affect the confidentiality and health of our financial information | Financial manager (2, 4 years) | ERP knoweldge<br><br>confidentiality of financial information |
| | I think it is better to start training with general information on ERP systems, how to use these systems, and problems that could be made for other users if any wrong numbers or letters are entered. Then give them a chance to practise in order that they don't forget what they have been taught. Then, see what their opinion is about these programs, the difficulties and problems they faced using it, and how to sort them out. Then continue training, and so on.... | HR manager (4, 3 years) | Methods of training<br><br>Theoretical - practical<br><br>Flowing errors |
| | But you know the other problem that we faced was that when we had implemented the ERP they called for training which is usually 20 days. Really, they need to get training gradually. They need first primary or basic training for 3 or 4 days which introduces what people can do for with basic functions and then let them go and start working by themselves with supervision to follow them up. Then, after another 30 or 60 days they could have more training as they will have questions and they will know what they are talking about. They need to have training in different phases like phase 1, phase 2, and phase 3; really, I would prefer that. | Financial accounting manager (1, 9 years) | trained in stages. |
| | We start training users. So we plan a time for training each department in the company such as users from the purchasing, warehouse and financial departments. Also, we give the users a chance to work on the Baan system for testing only before we go live. That helps us to break down the fear of using this system and reduces resistance to the Baan system; also users become familiar with the system. | IT manager (2, 6 years) | Resistance |
| | When we decided to implement Scala, we had a two-day seminar inside the company for main or key users and we explained to them about the ERP system and the objectives for its implementation in our company. Really, this step helped us to reduce the risk of users being resistant to this system. After that, we put on a one-week training course by the supplier for them which gave them just general ideas about Scala. Then we offered training from a person inside the company who had a great deal of experience with Scala. He gave them more detail about how they could do their work on Scala. | Plant manager (6, 4 years) | Resistance |
| | The problem here is not about providing the training but about how to train users.... | Financial manager (7, 3 years) | quality and precision |
| | Before we implemented the ERP system in the Company, we worked on a simple system named "act software". Staff in the company had not worked on an ERP system before as they were working on a manual system using paper, so it was difficult to move the employees from manual working to a complex ERP system. The act software was specialized for a small company. We worked with this system for two years until the employees were used to using computers and doing their work by using a financial system. They got knowledge and experience in using a financial system which helped them to use ERP systems. | Financial manager (8, 4 years) | Train gradually |
| | So in my company, the end users were provided with good training. The employees had previous experience and knowledge about how to deal with the systems that we designed in 1995, such as a sales system, inventory system and the accounting system, but these systems were not coherent and unified. They were in Arabic, not English. So we completed for them the information that they needed in order to do their work on the JD.Edward system through training. In addition, we improved their | Financial manager (4, 3 years) | train according to level of expertise |

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| | English language skills until they had the ability and skill to deal with the English screens that were presented on this system. A decision was made by the Company that we had to implement the JD.Edward system in English." | | |
| | Some companies reduce the users' training because it is expensive. | IT manager (2, 6 years) | external consultants, |
| | In our company we always have new training due to staff turnover. | Plant manager (2, 4 years) | turnover. |
| | Users who work on the Baan system should have a flow chart or system mapping. They should study and understand this mapping so make sure that the mapping is correct and leads to correct and reliable financial information. If the mapping is wrong, the information that you get from the system will be wrong | Financial manager (2, 4 years) | clear flow chart |
| User Resistance | First of all, the main risk that could actually face any company is a kind of resistance to introducing the ERP system; this is normal especially in this part of the world (i.e. the Middle East) | Financial manager (1, 9 years) | Resistance |
| | The risk is that when people are not willing to use ERP systems, it is risky to implement such systems. | Plant manager (2, 4 years) | unwilling |
| | Really, the Oracle system is an excellent package, but there was discomfort about implementing an integrated system on the part of key users. For example, the purchasing department had its own preferred, special and separate purchasing system; in the inventory department, there were two stores and each of them has a motivation which differ from others. Therefore, each department was uncomfortable about implementing an integrated system. | IT manager (4, 6 years) | uncomfortable |
| | Because users are sometimes not familiar even with the PC, imagine the difficulties that we have had in implementing an ERP system. They feel more confident with dealing with books and a pen. | Financial manager (1, 9 years) | Unfamiliar |
| | We moved directly from a manual system to a fully integrated automated system. One of the difficulties was that users were against the change because they were afraid of using these systems. They do not have any background in or knowledge of this system. | Financial manager (5, 7 years) | Fear<br>Knowledge |
| | The staff are unwilling to implement a JD. Edward system because they think this system will replace them. Due to the computer literacy that was available there was a high risk of accepting the system and there was huge resistance to dealing with it. | IT manager (3, 7 years) | unwilling |
| | Usually, managers tell them that using ERP will make their workload lower then that means the company will say: "Why do we have 10 people in the finance department or another department? well, let's make them seven". | Financial manager (4, 3 years) | Replace users |
| | If they are sure that the result on their job will be positive and it will make their work easier, they will not mind this implementation. I would say it is the uncertainty of whether they will be able to cope with the new changes; they are not sure about that. | Financial manager (3, 2 years) | uncertainty |
| | The people are unwilling to use the ERP system because they are against any change. They are used to controlling a thing in a certain way, so if they want to change they have to create a new method of control and therefore they do not want to do this. | IT manager (1, 7 years) | Traditional users |
| | Users were unhappy with using the Scala system because the people do not like changing. | Financial and accounting manager (6, 3 years) | Unwilling |
| | You need to make the ERP very clear to everyone involved in this process; this can help a company to move ahead. Also, the reason why we are having an ERP must be made very clear. | Financial manager (1, 9 years) | Orientation |
| | To overcome the resistance of users, we should motivate them, know what difficulties and problems they have with the ERP systems and sort them out. | Financial manager (3, 2 years) | Motivation |
| | We have to convince users to accept these systems. They should explain the reasons for implementing these systems and the benefits of ERP systems. We should give users a chance to express their desires and interests openly. | Financial manager (4, 3 years) | Convincing |
| | In the beginning of the implementation, we found a lot of resistance to using the Baan. So you have to find ways or methods to overcome this resistance, such as giving rewards, or giving warnings to deter him or her, explaining the features of the ERP system and how the ERP will make their work easier | IT manager (2, 6 years | Rewards<br>Warnings |
| | We need to clarify that ERP system, we need to think about the employees in a positive way because they served the company for 13 or 14 years, and it is not right to get rid of them because you have an ERP. But if you find problems and find that some people are resisting after starting the implementation, I would not hesitate to get them retired; this happened to me. I have tried my best to explain the benefit that we will get after implementing an ERP, how the company can move ahead, what plans we have, but there are still some people who will have a negative attitude or they are not willing to cooperate and I will not allow them to negatively affect the ERP process. So I will get them removed and it may have to be the end of their service. Sometimes you have to make such decisions and what I will say is that I try to be fair to them. | Financial manager (1, 9 years) | Force |
| | Really, believe me, in most companies in Jordan, there is something wrong here. I will not say it is a bad culture but, as you know, it is not like it is in Britain. Because | Financial manager (7, 3 years) | Orientation |

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| | they do not get people oriented it does not help in trying to make the process helpful or peaceful. It is very important to orient people and make them well aware of the reasons why we need to get the ERP system implemented. | | |
| | So we cancelled the old system and we forced them to use the new system. | Financial and accounting manager (6, 3 years) | Force |
| | In my opinion, implementing a simple system for a short period before implementing an ERP system is better than implementing it directly. This helps users to get experience in using a financial system which leads to defining clearly the requirements for customization, and to reducing the users' resistance. | Financial manager (8, 4 years) | Users experience |
| Lack of involvement of users in the ERP system | The company could face a lot of problems when there are not enough users involved to work on it. Many staff here were not well involved in the implementation process. They selected one employee, and they focused on this employee, which was really a big mistake. Unfortunately, four months ago he moved to another company so he took 80% percent of the knowledge with him; that is a real problem. When you do not pass on knowledge to all of the employees, that will be risk. Really, now we are suffering because the one who had a detailed knowledge of the ERP is not here. It is very important to get all employees involved in the implementation and, in the end, equal information will be distributed across all the employees, so if one leaves, you will not suffer | Financial manager (4, 3 years) | Number of participations |
| | A second point that could have lead to failure in implementing the JD. Edward was the formation of a team from the IT and business departments who were not well qualified. In my opinion, it is important to choose good staff to be involved in the implementation stage. | IT manager (4, 6 years) | Users from different departments |
| | The point I would say here is, when the users who are involved are unqualified, the communication could be poor. | Financial manager (4, 3 years) | communication between users |
| Ineffective communications between users | Poor communication between users causes delays in the implementation of the project which is then not delivered on time | Plant manager (2, 4 years) | delays implementation |
| | As users come from different departments and different backgrounds, communication can be ineffective. | Financial manager (4, 3 years) | different backgrounds |
| Skill mix | Technical support or consultants are very important because if I face any problems, I do not want to wait many months until they sort this out for me. So, it is very important to choose suppliers who will provide you with a reliable ERP system, who have a large number of client and a good reputation, have many success stories from companies about getting their ERP system implemented, are very knowledgeable about implementing an ERP system, and have had experience of most of the problems that arise from these systems, as well as knowing how to deal with them to sort them out. Therefore, before choosing an ERP system supplier, you should ask them for a list of their clients, then go and meet their financial manager and the IT manager and ask them what problems they faced when they implemented this system. Have they achieved the aims that they planned? Really, this step is very important. | Financial accounting manager (1, 9 years) | ERP Expertise provider |
| | Last year there was Bann conference in the Emirates for all companies which had implemented Baan in the Middle East and we raised a problem with Baan's IT support staff. One company in Egypt moved from Baan to an Oracle system because the Oracle vendor was very active and expert. The problem was not to do with technical risks or technical bugs: the problem related to staff knowledge. | Production manager (1, 3 years) | ERP Expertise provider |
| | The IT staff and manager do not have proper knowledge about financial applications and this was a big problem we faced. So, if we had any questions, she would say I do not know how to sort it out. Really, this was strange. So now we are doing training for IT employees on Baan which is really too late. You should be able to rely or depend on a consultant to sort out any problems. Sometimes you need a consultant if there is a complicated problem, but if we have a simple problem it should be sorted out by IT employees if they have good qualifications and expertise in Baan. | Financial manager (1, 9 years) | external consultants |
| | If we do not get expert consultants, the company could face difficulties in the implementation of the ERP and be unable to implement it. | Financial manager (7, 3 years) | delays implementation |
| | I got many consultations, but they were unsatisfactory. | HR manager (8, 3 years) | external consultants |
| | I faced a lot of problems as the customer is unconscious to do a good thing and the supplier is optimistic that this customer will do perfectly. And actually I was the only one standing in the middle. | IT manager (1, 7 years) | lack of users' experience. |
| | Another kind of risk related to ERP systems is that users who are using ERP systems do not have any knowledge or background in IT. | Financial manager (6, 4 years | Lack of users' experience. |
| ERP Operation | Even if the implementation of the ERP systems is completed, this does not mean that everything will be fine and the systems will be working well. | Financial manager (3, 2 years) | |
| ERP software suitability | I would say we will take a big risk if we do not have a proper system. Some managers could make a wrong decision in terms of having sometimes a very basic ERP which does not fulfil what they need, and then they will have a problem. Or, on | Financial manager (1, 9 years) | Making decision |

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| | the contrary, they may have something that is very complicated like having SAP. SAP is a huge software package which we do not need and may perhaps not be utilized by more than 20 people. | | |
| | We used to calculate costing in a way that an item had more than one cost, according to detailed of raw materials cost needed for each finished item, its place or location in the company. But, when we implemented the Baan, we implemented standard costs for all items, whatever they were. Actually, using the ERP forced us to do it this way. | Production manager (1, 3 years) | Standardisation (e.g. cost of the products |
| Security risk | It seems to me that the biggest risk is the small bug that is not monitored by any of the modules. Then it will be like a virus which affects all the modules and you will not know about it. | IT manager (6, 7 years) | small bug<br><br>virus |
| | The risk of hacking relates to any system, not only to ERP systems. However, you should have good security to protect your network by having a firewall, a hardware firewall, and a software firewall. | IT manager (1, 7 years) | Hacking<br>Firewall |
| | If you manage your ERP with limited authorization, you will be safe. | Internal auditing manager (3, 2 years) | authorization |
| | There is no restriction or control on the main store. I mean that any user who has a password to access the Scala system can access the main store and take material or transfer it to a secondary store. In my opinion, this is risky. As we have a main store and a secondary store for raw materials in the company, employees usually take what they need in terms of raw materials from the secondary store. We should not allow employees to enter the main store. This kind of risk occurred in our company. After the secondary store was empty, one of the employees gained access to the main store and took raw materials as he needed to finish the goods. This is absolutely a big risk. We discovered that when we did a monthly inventory of the raw materials. We found that the main store had fewer raw materials than it was supposed to have. So we went back to the Scala system and we found that employee x had withdrawn raw material from the main store. | Plant manager (6, 4 years) | authorization |
| | If we did not segregate the duties between users, there would be a significant risk. So we should separate duties, such as, one user enters data, another user submits it to GL. | Financial manager (5, 7 years) | lack of segregation |
| | Another type of risk we suffered in our Company which had an effect on control is the problem of licenses. As you know, licensees are expensive. Therefore, the company bought licensees for only 20 users but actually they gave these licenses to 60 users. So every two or 3 users use the same password. For example, the GL accountant and the AP accountant had the same password. This is really a big security risk because we did not segregate duties among users, we did not limit access to data, and so, if any mistake occurs, we will not know who is responsible for it. | Internal auditing manager (5, 5 years) | Licenses |
| | In my opinion, the risk comes from end users. Each user has a password to use the Oracle system. Sometimes, the user gives his password to his colleague to do his job tomorrow because he will be late or absent. In this case, the user has caused two kinds of risk: the security risk of not having a secure password and the risk caused by the non-separation of duties among employees. | Financial manager (5, 7 years) | Sharing password |
| | They thought that if they bought fewer licenses and gave them to many users, they would save money. | Internal auditing manager (5, 5 years) | licenses |
| | Control is important to reduce risk. For example, each user using the ERP system should have authorisation depending on his duties. For example, as a financial manager, I do not have authorisation to enter data or do any processing. My role is only to produce reports. This authorisation should be linked to the position of the user. Users should have limited access to the ERP system to be able to perform their work. Also, duties should be segregated among users. | Financial manager (2, 4 years) | authorisation |
| | You should buy licenses for each user. You should give authorization to each user depending on his job description. Authorization should be not given without the manager's agreement. You should have firm control over users to prevent them from giving their username and password to their friends or giving any information related to their work or related to the company to another person. Also, you should change passwords three times or more per year. Actually, in our company, the employees change every time so often but the passwords remain the same. Really, this is a big risk. | Internal auditing manager (5, 5 years) | licenses<br><br>Authorization |
| | In reality, giving one password to three or four users may increase the risk of fraud and defalcation. | Internal auditing manager (5, 5 years) | Sharing passwords |
| | Authorization should depend on the description of users' work. We have to give them limited access to the ERP system. Each user has a code. In the case of any error in the entry of data, we can know who entered this data | Financial manager (8, 4 years) | Authorization |
| Working with two systems in parallel | One point I would like to make is the fact that having two systems or having your old system running with new system encourages the users who are resisting the change. This might also make the change take longer since, because they still use the old system, they might be not too interested in working on a new system. They will focus more on the old system so you have to take a firm decision about working on | IT manager (5, 7 years) | Resistance |

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| | the new system with no more use of the old systems. | | |
| | We were working on the old system alongside the Scala because we were not sure if the Scala provider had implemented the material production control (MPC) module accurately. The suppliers of Scala had a good deal of experience in implementing the financial module in Scala, but they did not have much experience with the MPC module. Really, knowing how to do something is very important. So, their evaluations were wrong because it was the first time they had implemented the MPC and they were not expecting the volume of orders that we have in our company. Also, the crystal report was not built correctly by the suppliers. So after three months working on the crystal report, we found that the report did not read accurately from the Scala system. | Plant manager (6, 4 years | confident<br>reliability<br>data accuracy |
| | We did double work as we were doing work on the old systems and on Scala. We did a monthly inventory for the two systems, then we compared the results that we got from the two systems to see the percentage of accuracy between them. | Financial manager (6, 4 years | data accuracy |
| | Usually if you have such risks or if you are feeling uncomfortable about the ERP system, you need to have your current system working with the new system for three to six months. So, you need to make sure you are keeping your data on the other system to make sure the new system is working effectively. Once you have your new system tested and once you have your figures correct for six months, then you get rid of the old system. This is the risk that I can see. Work on two systems at the same time for 6 months. This will convince people in the financial department that this is to the benefit of all of us. Again, I am very keen to make employees part of the process instead of imposing things on them. If you introduce a thing in a friendly and convincing way that would help them in doing their tasks more easily | Financial and accounting manager (1, 9 years | Uncomfortable with ERP<br>convincing |
| Incorrect entry of data | The main risk in using ERP systems at the beginning was that users of the system made errors. | Financial and accounting manager (6, 4 years) | incorrect entries of data |
| | In my opinion, the risk is if a user enters wrong data incessantly and does not stop. For example, if a user enters 10,000 pillboxes instead of 1000, this will lead to producing a wrong report which will show that the percentage of the warehouse has increased. So, the user should be more aware when he enters data. Also, we should have another person to check and audit each user's work. | Plant manager (2, 4 years) | Flowing errors<br>Incorrect report |
| | Usually, after I enter any material or item in the JDE system, we should carry out a search operation on it through a system used by a different person such as a stock keeper, the purchasing department, or the engineer whose turn it is to make sure that the item is present on the system. Also, we found that some users wrote that some items that were entered were new and that it was the first time this kind of item had been entered. In reality, this item was not new and it had been entered before into the system many times. But because the user was too lazy to search to see if this item was new or old, or because he was not qualified to make the right search, he wrote on the form that the item was new. Really, we have to make sure many times that users follow the correct work procedures. | Financial manager (4, 3 years) | Incorrect data |
| | I think it is very easy to see these mistakes, as data pass through many users and manager: at least one of them will find the error. | IT manager (1, 7 years) | Easy to find errors |
| | Mistakes will happen, but I will not say these are because of the ERP system; it is not very difficult to get it right. | IT manager (7, 6 years) | Mistakes |
| | In using an ERP system the level of risk is lower because you can see things much faster and all online, so if you have a problem in sales or in collections, you will see it the same day, not as in the case of manual books or basic systems, where it will take longer to detect the error. It is much faster to detect problems when you use an ERP system. | IT manager (3, 7 years) | Easy to find errors |
| | Any error occurring in the company will depend on the level of impact that this error makes. | IT manager (7, 6 years) | Level of error |
| | In the first years of ERP implementation we faced minor and major errors due to our lack of knowledge; really, I had a big folder full of these errors. But the impact of the errors that we experienced in our company was not acceptable. | Financial manager (3, 2 years) | lack of user knowledge |
| | To avoid the risk of incorrect data entry, we check all the transactions many times to make sure that they are correct and free from any errors. For example, each entry that is made by a user will be checked first by his manager. Usually, the manager does not approve any transaction until he compares the original copy that he has and the data entered by the user. After that, the transaction will also be sent to an internal auditor to be checked and approved. | IT manager (5, 7 years) | Checking transaction<br>Approve transaction |
| | If an error is made by a user, the next user will notice and correct it so that the error does not expand until it becomes a bigger error. | IT manager (6, 7 years | Checking by next user |
| | So, in my opinion, if we check the entry of data regularly, we will identify mistakes earlier and correct them. In case we do not identify the errors when we review them, we will find them by logical testing. Usually, we identify substantial risks through logical tests that help us to find substantial mistakes which lead to material financial misstatements. For example, a few months ago, one user entered 200,000 JD instead of 20,000JD in the inventory which led to a sharp increase in the inventory. This type of mistake will be found easily by logical testing. But it is difficult to use logical testing to find simple mistakes such as if a user enters 20,100 JD instead of | Financial manager (2, 4 years | logical testing |

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| | 20,000 JD. Therefore, the logical tests can be used only to find substantial errors not simple ones. | | |
| | Another way help to detect the errors that relate to financial information, such as errors in accounts receivable, is the reconciliation of balances and by sending statements to customers. For example, if there is error in customer accounts, the customers will ask us to correct it. The non-equality of the accounts shows the presence of a mistake. Reconciliation balances are important things to ensure the reliability of the financial information when using an ERP system. We should reconcile the AP and suppliers' accounts on a regular basis to make sure the figures that are presented in the financial statement are correct. Also, we should reconcile our account with the bank on a monthly basis. | Financial manager (2, 4 years | reconciliation of balances |
| | Usually I use an expert system in auditing to confirm the health of the data. This software assesses the internal control in the company and give us the procedures or audit programs that we have to follow during or at the end of the financial year. Usually we audit around the computer, not through the computer. We define the company's activities and we take data from the company, then we enter them into our software. So we do data processing to get output; after that, we compare our outputs with the company's outputs to make sure that both are the same. If there are any differences between the outputs, we go back to transactions and review them to detect the error and correct it. Also, this software gives the errors that it finds, such as if there is no monthly inventory in the company, it asks what is your opinion and if you see this as significant or not. Or, if it found a difference in the volume of the store, such as 10,000 items are missing and the total volume of the store is 10,000,000 items, it asks if this is significant or not. Usually, if the level of risk is less than 5%, it is acceptable. | Internal auditing manager (2, 2 years) | expert system |
| | Every user has another step that follows after. So if one user does not spot the fault, he should be made responsible too. Then the manager should see that the report contains an error. If he does not revise it, then he at fault too. | IT manager (1, 7 years) | Responsibility |
| | But really we do not face a lot of errors, maybe because we have a good control system in the finance department. Before they post the transaction, they monitor and check the documents they have; they check against the logic tests they have. For example, when sales staff enter the sales order and send it to the delivery department, the finance people then check the whole sales order and they check with the quantities in the warehouse before they execute the cash receipt. So, there are many steps for monitoring. | IT manager (6, 7 years) | Effective control system |
| | Managers in each department are supposed to check the data entered into the system to approve that they are right and to reduce mistakes if they are found. But, in reality, they do not check users' work because, when two auditors checked, they found a lot of errors in the transactions. And, in spite of there being errors in the transactions, managers signed them off. | Internal auditing manager (5, 5 years) | Checking transaction<br><br>Approval |
| | To identify errors in the ERP system, we do an audit for each transaction from beginning to end. For example, when we check the purchase payment transaction, we go back to the beginning of the transaction. So, we check the purchase order, who signed the order, and if he is authorized to sign or not. Then we make sure that the purchases are in the store. After that, we verify that the payment process to the supplier have been carried out correctly | Internal auditing manager (5, 5 years) | Auditing |
| | To prevent these errors from occurring, we require the IT people to build in warning messages that define what is the largest quantity possible in each order. So, if a user enters more than that quantity, a warning message will appear for him to make sure of the amount of the order that he just entered. | Financial manager (6, 4 years) | Errors - warning message |
| | In my opinion, to reduce this kind of error, as I know all data are sent to the GL, we should put restrictions in the GL to prevent any incorrect data being sent there. Also, we should have special security, a good control system, and thorough training for users. | Internal auditing manager (2, 2 years) | restrictions<br>Security system<br>a good control system, and thorough training for users. |
| | Right now we have had a Baan since 2001 yet after 3 or 4 years my staff still do something or certain things incorrectly. So I asked the IT department to arrange more training for us (that is, additional training) in the hope that, when they receive new training, they will realize that 'I am doing this wrong; there is a shorter way that I can take'. Maybe they can also raise or ask deep questions because they know the ERP and are very familiar with it. So again, it is better to make your training gradual, not do it all at once | Financial accounting manager (1, 9 years) | effective training |
| Repetition of errors | So if you want to stop every minute and check and monitor your controls, then you will need a bigger staff for this purpose only, and this is impossible. | IT manager (7, 6 years) | checking and monitoring |
| | Usually a big company would conduct a kind of IT audit to make sure all of the processes are working correctly and test all the processes to make sure that the ERP is functioning correctly. | Internal auditing manager (3, 2 years | IT audit<br>Testing |
| | We should increase the controls in those areas that contain more errors. Also, when the number of ERP users increases, you have to raise the control levels. | Financial manager (8, 4 years) | Controlling |

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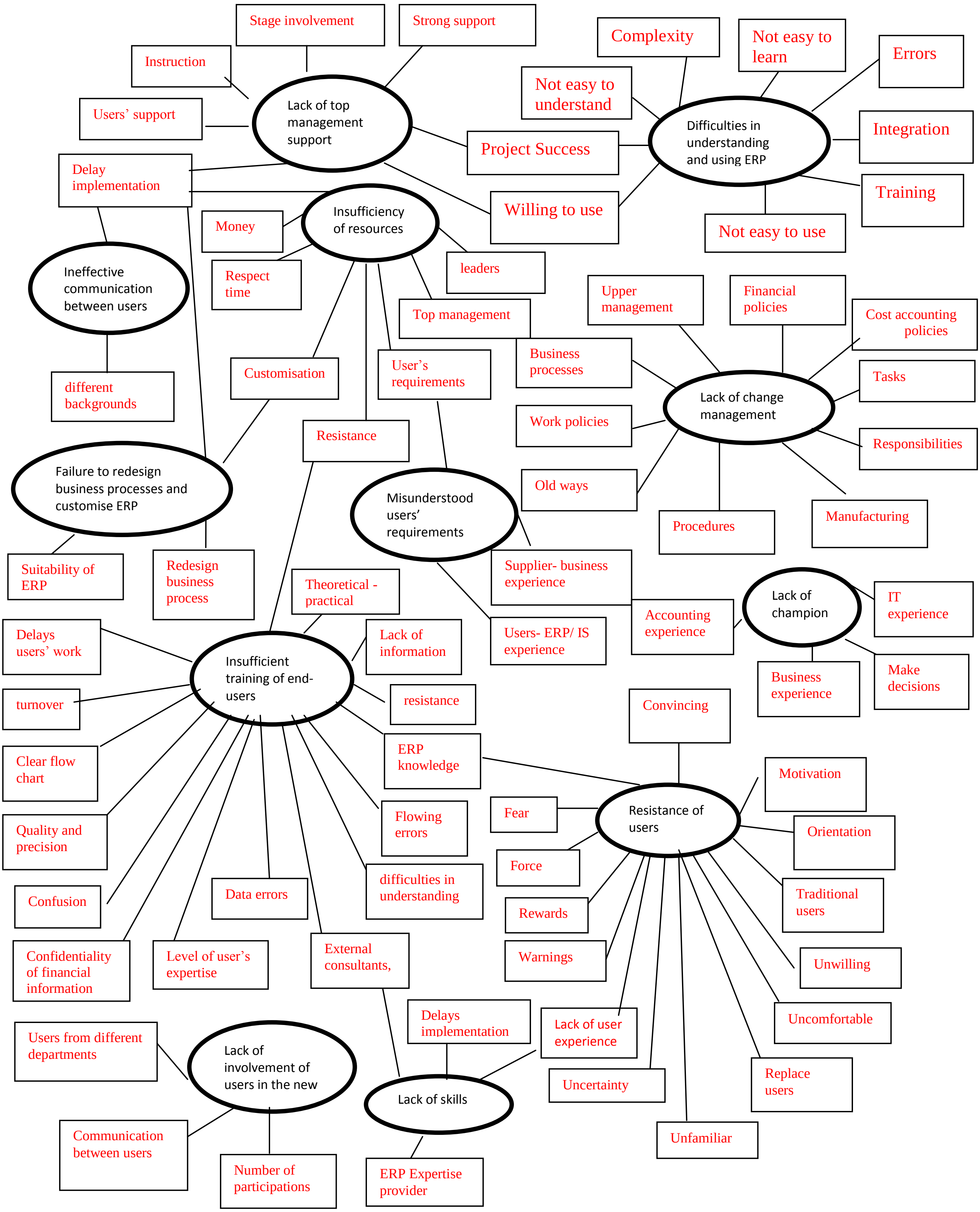
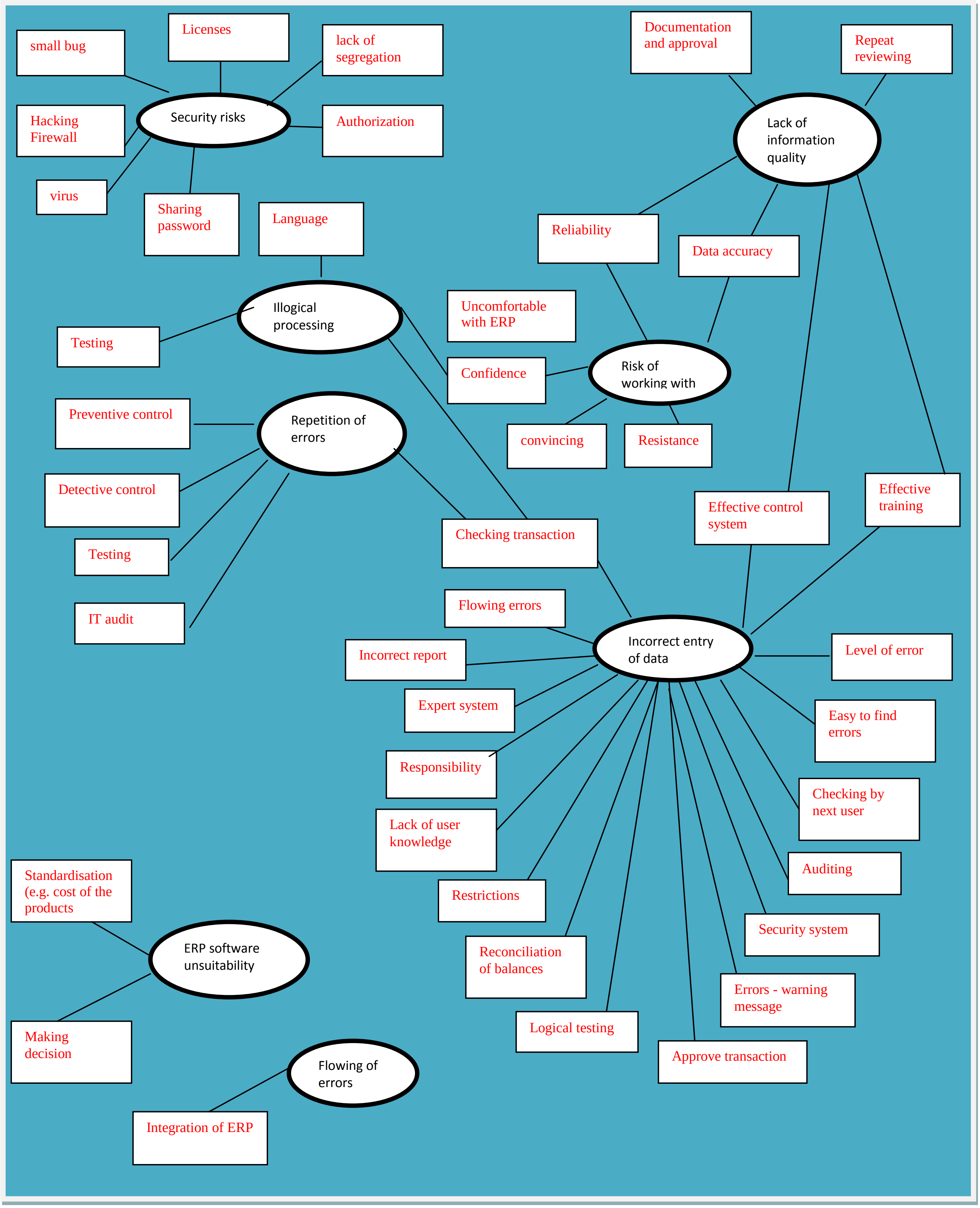
| | Any ERP comes with controls. So, in the case of any mistake or error, you should create a preventive control which will prevent the error or the fault even sometimes before it happens; and, in cases where it has happened, you need to have your detective control. | Internal auditing manager (1, 5 years) | Preventive control<br><br>detective control. |
| Flowing of Errors | As you know, in an ERP system, you have to be in the same date system to execute the transactions because it is a circle; it is all linked together. So if any letter is wrongly entered, this error will follow the letter and will affect what is done in other modules. What we are saying is, if you make a mistake in one department, it will be reflected in another. | Financial manager (3, 2 years) | Integration of ERP |
| | This mistake could be a small mistake and have no impact on the financial statements, but the issue is, when this mistake is not identified at the beginning, it could turn from being a minor mistake to a major one and have an effect on the financial statements and accounting records. | Financial manager (8, 4 years) | Integration of ERP |
| Illogical processing | We have implemented these systems many times without performing a test, and everything was fine. | IT manager (3, 7 years | Confidence |
| | When IT people become delay in implementing their ERP system and cannot finish every step on time that they put in their agenda, they just want to complete the implementation so they try to delete other steps, such as testing a process step. This, in their opinion, is not a risky or the probability of risk may be 1%, and it is not the first time they have implemented ERP modules. | Financial manager (4, 3 years | Testing |
| | But for me, as I am internal an auditing manager, it is risky if the supplier does not test the ERP systems because it makes me worry about validation and the reliability of the business processes which, in the end, may have an effect on the financial statement and my future decisions. So I have to stop them and make them carry out the testing to make sure everything working correctly before we go live. | Internal auditing manager (4, 3 years) | Testing |
| | If the ERP system is not tested properly, this will result in a lot of risks. | Internal auditing manager (1, 5 years) | Testing |
| | To reduce the risk, you have to test the process that we customized to know if it works well or not before you go live. | Financial manager (5, 7 years | Testing |
| | For an assurance of the health of financial information, they should make sure of the set up of the system rather than making sure of the correctness of the information daily through manual checking. I mean, if you have set up your system correctly, have done your mapping correctly, made sure during the implementation process that processing data using a manual system and the ERP system will give the same results in the two systems, all this will confirm that the information that they will get from the ERP system will be reliable. After that, any changes or modifications to the system and set up should have a clear process and clear testing. Also, these changes might or might not affect the level of financial information. | Financial manager (2, 4 years) | Checking ERP Pocesses |
| | We always check on security and any errors in the system. If we have any problems, we inform the provider and then they contact the mother company to get them fixed. | IT manager (1, 7 years | Checking ERP Pocesses |
| | Really, it was a positive point in the success of this system to use the JD. Edward modules in English without making any translation into Arabic as another company did. They translated all the system modules into Arabic and worked on them in Arabic. This led them to face a lot of errors. For example, usually each account in the general ledger has credit and debit sections, so when they translated the general ledger into Arabic, the debit part became the credit and vice versa in some accounts. | IT manager (4, 6 years | Language |
| Lack of information quality | The main risk is the unreliability of data, especially financial data. As you know, the outputs of these systems are financial information that express the financial situation. So, it is a big risk that the data may be incorrect or inaccurate. | Internal auditing manager (8, 4 years | unreliability of data incorrect/ inaccurate. |
| | I want to say that even if the auditor checks the transactions that have been done in the company, that does not mean the report and the information will be 100 percent correct. | Internal auditing manager (5, 5 years | incorrect/ inaccurate. |
| | Each company that implements ERP systems and wants to get accurate information and accurate financial reports from an ERP system, must have a good control system. The work should be organized and documented to prevent the users or managers working just as they want. You have to follow the procedures and policies set by the ERP supplier. Documentation and approval are very important in organizing the authorization and security on the system. Repeated reviews of the system are needed to ensure it works well and is free from any bugs. All users should be well qualified and properly trained. Accounting staff should have experience in IT as well; their English language skills should also be good to be able to deal with the Oracle system or any other ERP system. | Internal auditing manager (5, 5 years | good control system<br><br>Documentation and approval<br><br>Repeat reviewing<br><br>Effective users Training |

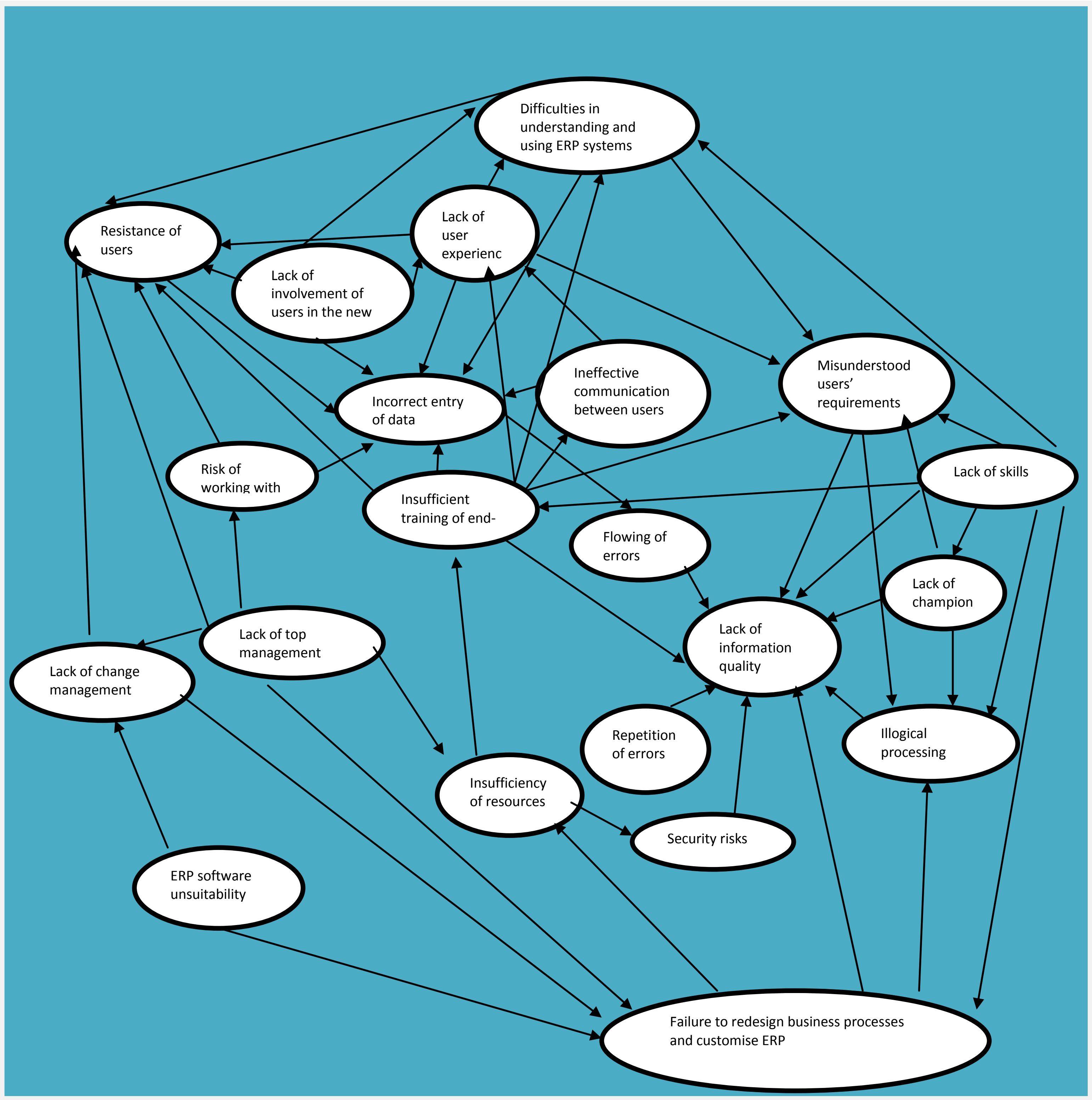
## 10.3 Appendix 1C: Themes and categories



## 10.4 Appendix 1C: Themes and categories



## 10.5 Appendix 1D: thematic map, showing Relationships or connections between themes



## 10.6 Appendix 2A: questionnaire (English version)

Newcastle University

Business School

Armstrong Building
Newcastle upon Tyne
NE1 7RU

Wednesday, 12 July 2007

Dear sir/ madam,

I am currently conducting doctoral research in relation to understanding the risks associated with implementing and operating Enterprise Resource Planning (ERP) systems in companies in Jordan. I am writing to ask you to assist me in my research. I would very much appreciate it if you could find the time to complete this questionnaire.

All the information used in this research will be kept anonymous and in strict confidence. In return for your contribution, I will prepare a report on my results and include recommendations and the implications of my findings which will provide information which may be useful to you and your company.

Anything I write for publication or for my thesis will not allow the company to be identified (unless the company wishes otherwise). I am also willing to consider other conditions you find important in order to participate in the study, including signing a confidentiality agreement.

I hope that you will be able to help me. Your contribution is essential to the success of my research and in turn I hope that my contribution would be of value to you and your company.

If you need further information or would like to discuss any queries, please do not hesitate to contact me via email khansaa.tezeny@ncl.ac.uk. Thank you very much for your assistance, and I look forward to hearing from you soon.

Yours faithfully

Khansaa Tezeny
Doctoral Researcher



**Thank you for your participation in this academic research**

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**UNIVERSITY OF NEWCASTLE**

**Questionnaire**

## Section A : Background information

**Please tell me about yourself and your organization. Please answer every question.**

Q1. What is your gender? Male ☐ Female ☐

Q2. What is your age range?

Under 21 ☐ 21-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ Over 60 ☐

Q3. What qualifications do you have? (Please specify)……….. …..

Q4. Please indicate the length of time you have been employed by your organization?

< 6 months ☐ 6-12 months ☐ 1-2 years☐ 3-5 years ☐

6-10 years☐ > 10 years ☐

Q5. Which of the following best describes your main job responsibility?

IT manger ☐ accounting manger ☐ HR manger ☐ Finance Manger ☐
Other (please specify)………………

Q6. How long have you been in this profession?

< 6 months ☐ 6-12 months ☐ 1-2 years☐ 3-5 years ☐

6-10 years☐ > 10 years ☐

Q7. Please indicate your experiences with ERP systems?

None ☐ < 6 months ☐ 6-12 months ☐ 1-2 years☐

3-5 years ☐ 6-10 years☐ > 10 years ☐

Q8. What type of company is your organization?

Manufacturing ☐ health ☐ financial service ☐ Education ☐ retail ☐ tourism ☐

IT company ☐ pharmaceutical ☐ transportation ☐ other (please specify)………..

Q9. How many people are currently employed in your organization?

< 10 ☐ 11-50 ☐ 51-100 ☐ 101-250 ☐ 251- 500 ☐ >500 ☐

Q10. Which ERP system is your company currently using?

SAP ☐ BAAN ☐ JD. Edward ☐ People soft ☐

Scala ☐ Ross ☐ oracle ☐ other (please specify)
………………

Q11. What ERP modules operate in your company? (Please specify)……….. ……..

Q12. When did your company implement ERP systems?

< 6 months ☐ 6-12 months ☐ 1-2 years☐ 3-5 years ☐

6-10 years☐

Q13. How many months were the ERP implementation planned to take?

< 6 months ☐ 6-12 months ☐ 1-2 years☐ 3-5 years ☐

6-10 years☐

Q14. How many months did the implementation actually last?

< 6 months ☐ 6-12 months ☐ 1-2 years☐ 3-5 years ☐

6-10 years☐

## Section B: Risks factors related to implementing and operation ERP systems

**Based on your experience, please indicate the extent to which you agree or disagree with each of the following statement.**

| Risk factors during implementation of ERP system | Strongly Disagree | Disagree | Somewhat Disagree | Neutral | Somewhat Agree | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| **1. Difficulties in understanding and using ERP Systems** | | | | | | | |
| Q1. ERP systems are complex and difficult to understand | | | | | | | |
| Q2. Employees find it difficult to get the ERP system to do what they want it to do | | | | | | | |
| Q3. Learning to use the ERP system has been difficult for employees | | | | | | | |
| Q4. Overall, the complexity of ERP systems makes implementation projects more likely to fail. | | | | | | | |
| **2. Failure to redesign business processes and major customization of ERP** | | | | | | | |
| Q5. ERP implementation is more likely to fail if the company fails to redesign business process before configuration of the ERP software | | | | | | | |
| Q6. Companies which try to fit the ERP package to their business processes with a minimal amount of business process redesign are more likely to fail. | | | | | | | |
| **3. Lack of Top management support** | | | | | | | |
| Q7. Lack of top management support hinders effective ERP implementation | | | | | | | |
| **4. insufficiency of Resources** | | | | | | | |
| Q8. Successful implementation of ERP systems takes a long time | | | | | | | |
| Q9. ERP Systems implementation failure is often the result of upper management failing allocate adequate financial resources | | | | | | | |
| **5. lack of management of change** | | | | | | | |
| Q10. I believed that ERP implementation is more likely to succeed if the company allocates effort and resources to managing the change process | | | | | | | |
| **6. Insufficient discipline and standardization** | | | | | | | |
| Q11. When companies are unable to comply with the standards which ERP software supports, implementation is more likely to fail | | | | | | | |
| **7. Unclear/ misunderstanding users requirements** | | | | | | | |
| Q12. Communication between the implementation team and the users of ERP systems is crucial to the success of implementation projects. | | | | | | | |
| Q13. ERP implementation failure is less likely, if users of ERP software actively participate in requirements definition | | | | | | | |
| Q14. If ERP system users have technical IT skills, enabling them to effectively express their needs, then the implementation project is less likely to fail. | | | | | | | |
| Q15. Technical people are often unable to understand users' business-requirements | | | | | | | |
| **8. Lack of champion** | | | | | | | |
| Q16. Ineffective project leadership will lead to ERP implementation failure | | | | | | | |
| **9. Lack of agreement on project goals** | | | | | | | |
| Q17. An ERP implementation project goals cannot succeed with unclear objectives | | | | | | | |
| Q18. Agreement on project goals is the key to project success | | | | | | | |
| **10. Lack of effective project management methodology** | | | | | | | |
| Q19. Ineffective ERP project management methodology is a major cause of project failure | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Strongly Disagree** | **Disagree** | **Somewhat Disagree** | **Neutral** | **Somewhat Agree** | **Agree** | **Strongly Agree** |
| Q20. When project management has used a formal implementation plan, the ERP implementation projects are less likely to fail. | | | | | | | |
| **11. Insufficient training of end-users** | | | | | | | |
| Q21. Providing extensive training for end users with the ERP system is critical to minimising the possibility of implementation failure. | | | | | | | |
| Q22. A company which has dedicated resources to making sure employees are very familiar with the ERP system is less likely to fail | | | | | | | |
| **12. Ineffective communications between users** | | | | | | | |
| Q23. Insufficient communications between users from different departments such as finance and IT is a critical threat to implementation success | | | | | | | |
| Q24. Communications between users *within* one department is insufficient, to ensure the success of ERP implementation | | | | | | | |
| **13. Resistance of user** | | | | | | | |
| Q25. Users resistance to change is major barrier to successful implementation of ERP | | | | | | | |
| Q26. If users persist traditional business practice even though ERP changes the way of conducting business, the organization could not see the benefits of ERP | | | | | | | |
| Q27. Where there are many people wishing ERP to fail, it is more likely to fail | | | | | | | |
| **14. Lack of involvement of users in the ERP system** | | | | | | | |
| Q28. The participation of users in the system implementation processes is critical to success of the implementation project | | | | | | | |
| **15. lack of user experience** | | | | | | | |
| Q29. Where users of ERP software are familiar with ERP system implementation life cycle stages, projects are more likely to succeed | | | | | | | |
| Q30. Users familiarity with data processing as a working tool is critical to successful implementation of ERP systems | | | | | | | |
| Q31. If users of ERP software are unfamiliar with this type of application, there is a greater risk of implementation failure | | | | | | | |
| **16. Skill mix** | | | | | | | |
| Q32. The problem of recruiting and retaining qualified ERP systems developers increases the risk of implementation failure | | | | | | | |
| Q33. A lack of business analysts with business and technology knowledge, make the ERP implementation is more likely to fail | | | | | | | |
| Q34. Failure to mix internal and external expertise effectively is a major risk in ERP implementation | | | | | | | |
| **Factors of Risks during operation of ERP system** | | | | | | | |
| **1. ERP software suitability** | | | | | | | |
| Q35. The likelihood of failure of ERP operation is reduced, If the processes built in ERP meet all the needs required by organizational processes | | | | | | | |
| Q36. The possibility of failure of ERP operation is reduced, If the name and meaning of the ERP data items correspond to those of the documents used in the company ( for example sales order sheet, sales reports) | | | | | | | |
| Q37. The possibility of failure of ERP operation is reduced if the input data items of the ERP correspond to those of the documents used in our company. | | | | | | | |
| Q14. The success of ERP operation is threatened, if user interface of the ERP is not well aligned with the business needs of our company | | | | | | | |
| **2. Working with two systems in parallel** | | | | | | | |
| Q39. I think running the old system in parallel with running the new system (ERP) after going live could make the operation of ERP less risky. | | | | | | | |

| 3. Security Risk | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Strongly Disagree** | **Disagree** | **Somewhat Disagree** | **Neutral** | **Somewhat Agree** | **Agree** | **Strongly Agree** |
| Q40. Unauthorized access to data or/ system by *outsider* (hackers) is a major risk associated with operating an ERP system | | | | | | | |
| Q41. Unauthorized access to data or/ system by *outsider* (hackers) could cause major losses to company | | | | | | | |
| Q42. Unauthorized access to data or/ system by *outsider* (hackers) could have direct impact on the company's financial statements | | | | | | | |
| Q43. Unauthorized access to data or/ system by *employees* is a major risk | | | | | | | |
| Q44. Unauthorized access to data or/ system by *employees* could lead to major losses to the company | | | | | | | |
| Q45. Unauthorized access to data or/ system by *employees* could have direct impact on the company's financial statement | | | | | | | |
| **4. sharing password** | | | | | | | |
| Q46. Because the cost of licenses is expensive, it could be better for two or three employees to share the same password. | | | | | | | |
| Q47. Employees' sharing of password is a major security risk | | | | | | | |
| Q48. If employees' share of password, there is possibility of fraud | | | | | | | |
| **5. Process Interdependency Risk** | | | | | | | |
| Q49. I believed that a problem in one business process (e.g., an improperly input of customer sales order) could lead to problems in other processes where an ERP systems has been implemented | | | | | | | |
| Q50. I believe that process interdependency risk in ERP system could have potential for misstatements in the company's financial statements | | | | | | | |
| **6. Incorrect entry of data** | | | | | | | |
| Q51. *Accidental* entry of bad data by employees is a major cause of problems for the company which has implemented ERP | | | | | | | |
| Q52. *Intentional* entry of bad data by employees is a major cause of problems for the company which has implemented ERP | | | | | | | |
| Q53. Incorrect data entry by accidental or intentional causes a loss confidence in the integrity of the company's information | | | | | | | |
| Q54. Incorrect data entry by accidental or intentional is likely to lead to major financial statement misstatements. | | | | | | | |
| **7. Repetition of errors** | | | | | | | |
| Q55. Insufficient program testing is a major source of problem with ERP operation | | | | | | | |
| Q56. Repetition of errors will occur if there has been inadequate checks on entry of master information | | | | | | | |
| Q57. Repetition of errors is likely to lead to major financial statement misstatements. | | | | | | | |
| **8. Flowing of errors** | | | | | | | |
| Q58. Because ERP is an integrated system, the flowing of errors is more likely | | | | | | | |
| **9. Illogically processing** | | | | | | | |
| Q59.ERP system increase the likelihood of a failure to check for unusually large values in input documents, leading to illogical processing | | | | | | | |
| Q60. Illogical processing is likely to occur with ERP unless a company effectively scans output documents | | | | | | | |
| Q61. Overall, illogical processing has a major potential for financial statement misstatements. | | | | | | | |
| **10. Information quality** | | | | | | | |
| Q62. The output information provided by ERP system is often inaccurate | | | | | | | |
| Q63. The output information of ERP systems is often too late | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| to be useful | | | | | | | |
| Q64. The output information provided by ERP systems is often inconsistent | | | | | | | |
| | **Strongly Disagree** | **Disagree** | **Somewhat Disagree** | **Neutral** | **Somewhat Agree** | **Agree** | **Strongly Agree** |
| Q65.The output information content provided by ERP system is often incomplete | | | | | | | |

**Q66. Please review of the risk factors during implementation of ERP System which listed below; and write them in order from the most important to less important of each of them from your view point?**

Risks factors during Implementation of ERP

1. Difficulties in understanding and using ERP Systems
2. Failure to redesign business processes and customization of ERP
3. Lack of Top management support
4. Insufficiency of Resource
5. Lack of change management
6. Insufficient discipline and standardization
7. Unclear/ misunderstanding users requirements
8. Lack of champion
9. Lack of agreement on project goals
10. Lack of effective project management methodology
11. Insufficient training of end-users
12. Ineffective communications between users
13. Resistance of user
14. Lack of involvement of users in the new system
15. Lack of user experience
16. Lack of ability to recruit and retain qualified ERP systems developers
17. Lack of business analysts with business and technology knowledge
18. Failure to mix internal and external expertise effectively

**Q67. Please review of the risk factors during operation of ERP System which listed below; and put them in order of importance of each of them from your view point?**

Risks factors during of operation ERP

1. ERP software unsuitability
2. Risk of Working with two systems in parallel
3. Security Risk
4. Sharing password risk
5. Process Interdependency Risk
6. Incorrect entry data risk
7. Repetition of errors risk
8. Flowing of errors risk
9. Illogically processing risk
10. Risk of information quality

## Section B: culture and expertise

Please indicate to what extant you agree or disagree in the following statements.

| | Strongly Disagree | Disagree | Somewhat Disagree | Neutral | Somewhat Agree | Agree | Strongly Agree |
|---|---|---|---|---|---|---|---|
| **Culture** | | | | | | | |
| Q1. I value regular routines highly | | | | | | | |
| Q2. I think being on time is important | | | | | | | |
| Q3. I like to plan carefully so that financial risks are not taken | | | | | | | |
| Q4. People should be rewarded according to their position in society | | | | | | | |
| Q5. I prefer clear instruction from my superiors about what to do. | | | | | | | |
| Q6. I prefer managers rely on formal rules. | | | | | | | |
| Q7. I prefer relationship between Employer and employee is basically moral, like family links | | | | | | | |
| Q8. I prefer Employees perform best as individuals and individual level training is more effective | | | | | | | |
| Q9. In business, I like task and company prevail over personal relationships | | | | | | | |
| Q10. If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it | | | | | | | |
| Q11 It is just as well that life tends to sort out those who try harder from those who don’t | | | | | | | |
| Q12. Making money is the main reason for hard work | | | | | | | |
| Q13. I like decision making should be based on Group thinking | | | | | | | |
| Q14. If people in this country were treated more equally we would have fever problems | | | | | | | |
| Q15. Employees perform best in in-groups and group level training is more effective. | | | | | | | |
| Q16. I would support a tax change that made people with large incomes pay more | | | | | | | |
| Q17. Cooperating with others rarely works | | | | | | | |
| Q18. The future is too uncertain for a person to make serious plans | | | | | | | |
| Q19. I have often been treated unfairly | | | | | | | |
| Q20. I feel that life is like lottery | | | | | | | |
| Q21. Even if you work hard you never know if that will help you do better | | | | | | | |
| **Expertise of ERP** | | | | | | | |
| Q22. I have received substantial combined informal and formal training in relation to ERP system during my career | | | | | | | |
| Q23. I have substantial experience in ERP system in my career | | | | | | | |
| Q24. I feel comfortable by using ERP system to do my job | | | | | | | |
| Q25. I receive enjoyment from using ERP system | | | | | | | |
| Q26. I have high level of ERP expertise | | | | | | | |

**Thank you for your kind cooperation**

### 10.7 Appendix 2B: questionnaire (Arabic version)

جامعة نيوكاسيل

## استبيان

## الجزء الأول: المعلومات الأساسية

الرجاء الإجابة عن نفسك وعن منظمتك، الرجاء الإجابة على كل سؤال:

س1 ما هو جنسك؟

☐ ذكر ☐ أنثى

س2 ما هو مدى العمر لديك؟

☐ أقل من 21 ☐ 21 - 29 ☐ 30 – 39

☐ 40 - 49 ☐ 50 - 59 ☐ أكبر من 60

س3 ما هي المؤهلات التي لديك؟ (الرجاء التحديد) ......

س4 الرجاء الإشارة إلى طول المدة التي أنت تعمل بها في المنظمة؟

☐ أقل من 6 أشهر ☐ 6 – 12 شهر ☐ 1 – 2 سنة

☐ 3 – 5 سنة ☐ 6 – 10 سنة ☐ أكثر من 10 سنوات

س5 ما هو الأفضل من التالي الذي يصف مسؤوليات العمل الرئيسية لديك؟

☐ مدير تكنولوجيا معلومات ☐ مدير محاسبة ☐ مدير موارد بشرية

☐ مدير مالي ☐ غير ذلك (الرجاء التحديد).........

س6 ما هي طول المدة في هذه المهنة؟

☐ أقل من 6 شهور ☐ 6 – 12 شهر ☐ 1 – 2 سنة

☐ 3 – 5 سنة ☐ 6 – 10 سنة ☐ أكبر من 10 سنوات

س7 الرجاء الإشارة إلى خبراتك في أنظمة ERP

☐ لا شيء ☐ أقل من 6 شهور ☐ 6 – 12 شهر

☐ 1 – 2 سنة ☐ 3 – 5 سنة ☐ 6 – 10 سنة

☐ أكثر من 10 سنوات

س8 ما هي نوع الشركة لمنظمتك؟

☐ تصنيع ☐ صحة ☐ خدمات مالية

☐ تعليم ☐ تجارة بالتجزئة ☐ سياحة

☐ شركة تكنولوجيا معلومات ☐ أدوية ☐ نقل

☐ غير ذلك (الرجاء التحديد).....

س9 كم عدد الأشخاص الذين هم حاليا موظفين في منظمتك؟

☐ أقل من 10 ☐ 11 - 50 ☐ 51 – 100

☐ 101 - 250 ☐ 251 - 500 ☐ أكبر من 500

س10 ما هو نظامERP الذي تستخدمه شركتك الآن؟

☐ SAP ☐ BAAN ☐ JD. Edward

☐ People Soft ☐ Scala ☐ Rass

☐ Oracle ☐ Other (Pleas specify)

س11 ما هي نماذج ERPالتي تعمل في شركتك؟ (الرجاء التحديد)......

س12 متى طبقت شركتك أنظمة ERP ؟

☐ أقل من 6 شهور ☐ 6 – 12 شهر ☐ 1 – 2 سنة

☐ 3 – 5 سنة ☐ 6 – 10 سنة

س13 كم عدد الأشهر التي بها تطبيق ERPمخطط له أن يحدث؟

☐ أقل من 6 شهور ☐ 6 – 12 شهر ☐ 1 – 2 سنة

☐ 3 – 5 سنة ☐ 6 – 10 سنة

س14 كم عدد الأشهر التي بها التطبيق أستمر بشكل حقيقي؟

☐ أقل من 6 شهور ☐ 6 – 12 شهر ☐ 1 – 2 سنة

☐ 3 – 5 سنة ☐ 6 – 10 سنة

## الجزء الثاني: عوامل الخطورة التي ترتبط مع تطبيق وعمليات أنظمة ERP

بناءا على خبرتك الرجاء الإشارة إلى المدى الذي تكون به موافق أو غير موافق لكل من الجمل التالية:

| عوامل الخطورة خلال تطبيق نظام ERP | | غير موافق بشدة | غير موافق | بعض الشيء غير موافق | محايد | بعض الشيء موافق | موافق | موافق بشدة |
|---|---|---|---|---|---|---|---|---|
| **1. الصعوبة في فهم واستخدام أنظمة ERP** | | | | | | | | |
| س1 | أنظمة ERP معقدة وصعبة الفهم. | | | | | | | |
| س2 | يجد الموظفين صعوبة للوصول بنظام ERPلما يودون منه أن يعملوا. | | | | | | | |
| س3 | التعلم لاستخدام نظام ERP ذو صعوبة للموظفين . | | | | | | | |
| س4 | تجعل مشاريع التطبيق أكثر ERPبشكل كلي، التعقيد في أنظمة احتمالية للفشل. | | | | | | | |
| **2. الإخفاق في إعادة التصميم للعمليات المتعلقة بالعمل التجاري والتخصيص الرئيسي** | | | | | | | | |
| س5 | أكثر احتمالية للفشل إذا فشلت الشركة في إعادة ERPتطبيق ERPالتصميم للعملية المتعلقة بالعمل التجاري قبل البناء لبرنامج | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| س6 | في عملياتها ERPالشركات التي تحاول التوافق مع مجموعة التجارية مع المقدار ذو الحدود الدنيا في إعادة التصميم لعمليات العمل التجاري أكثر احتمالية للفشل . | | | | | | | |
| | | **غير موافق بشدة** | **غير موافق** | **بعض الشيء غير موافق** | **محايد** | **بعض الشيء موافق** | **موافق** | **موافق بشدة** |
| | **3. الافتقار إلى دعم من الإدارة العليا.** | | | | | | | |
| س7 | الافتقار للدعم من الإدارة العليا يعيق التطبيق الفعال لـERP | | | | | | | |
| **4. عدم الكفاية من الموارد.** | | | | | | | | |
| س8 | التطبيق الناجح لأنظمة ERP يأخذ وقت طويل. | | | | | | | |
| س9 | الفشل في تطبيق أنظمة ERPغالبا نتيجة من فشل الإدارة الأعلى في تخصيص موارد مالية كافية. | | | | | | | |
| **5. الافتقار من الإدارة للتغيير.** | | | | | | | | |
| س10 | أعتقد أن تطبيق ERP هو أكثر احتمالية للنجاح إذا الشركة قامت بالتخصيص للجهود والموارد لإدارة العملية المتغيرة. | | | | | | | |
| **6. معايير وضوابط غير كافية.** | | | | | | | | |
| س11 | عندما لا تستطيع الشركات الامتثال للمعايير التي تقدمه برامج ERP فأن التطبيق ذو احتمالية أكبر للفشل. | | | | | | | |
| **7. عدم الوضوح أو عدم الفهم لمتطلبات المستخدمين.** | | | | | | | | |
| س12 | مهم لنجاح ERPالاتصالات بين فريق التطبيق ومستخدمي أنظمة مشاريع التطبيق. | | | | | | | |
| س13 | ERP إذا مستخدمي برنامج ERPهناك احتمالية أقل لفشل تطبيق يشاركون بشكل فعال في تعريف وتحديد المتطلبات. | | | | | | | |
| س14 | مهارات تكنولوجيا معلومات ERPإذا كان لدى مستخدمي برنامج فنية التي تسمح لهم بالتعبير بفاعلية عن حاجاتهم فأن مشروع التطبيق لأقل احتمالية للفشل. | | | | | | | |
| س15 | الناس الذين لديهم مهارات فنية غالبا غير قادرين على فهم متطلبات العمل التجاري للمستخدمين. | | | | | | | |
| **8. الافتقار للقائد.** | | | | | | | | |
| س16 | .ERPالقيادة غير الفعالة للمشروع تؤدي لفشل في تطبيق | | | | | | | |
| **9. الاختصار إلى ترتيب أهداف المشروع.** | | | | | | | | |
| س17 | لا يمكن تحقيقها بدون وجود ERPأهداف مشروع التطبيق لـ أهداف واضحة. | | | | | | | |
| س18 | الاتفاق في أهداف المشروع هو المفتاح لنجاح المشروع. | | | | | | | |
| **10. الاختصار إلى منهجية إدارة للمشروع فعالة.** | | | | | | | | |
| س19 | هي السبب الرئيسي في ERPمنهجية الإدارة غير الفعالة لمشروع الفشل في المشروع. | | | | | | | |
| س20 | عندما إدارة المشروع تستخدم خطة التطبيق الرسمية فأن التطبيق أقل احتمالية للفشل.ERPمشاريع | | | | | | | |
| **11. تدريب غير كافي للمستخدمين النهائيين.** | | | | | | | | |
| س21 | مهم ERPتقديم تدريب واسع النطاق للمستخدمين النهائيين لنظام في التقليل لاحتمالية الفشل في التطبيق. | | | | | | | |
| س22 | ذو ألفة لهم لديها ERPالشركة التي تكرس الموارد للتأكد أن نظام احتمالية أقل للفشل. | | | | | | | |
| **12. اتصالات غير فعالة بين المستخدمين.** | | | | | | | | |
| س23 | الاتصالات غير الفعالة بين المستخدمين من الدوائر المختلفة مثل المالية وتكنولوجيا المعلومات هو التهديد الأكبر لنجاح التطبيق. | | | | | | | |
| س24 | الاتصالات بين المستخدمين خلال دائرة واحدة غير كافي للوصول .ERPلنجاح تطبيق | | | | | | | |
| **13. المقاومة من المستخدم.** | | | | | | | | |
| س25 | مقاومة المستخدمين للتغيير هي الحاجز الرئيسي للتطبيق الناجح .ERPلـ | | | | | | | |
| س26 | إذا كان لدى المستخدمين إصدار لإتباع الممارسة التقليدية في العمل في الطريقة التي يتم بها العمل ERPالتجاري بالرغم من تغيرات .ERPالتجاري فأن المنظمة لا تشاهد أي مزايا من | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| س27 | فأنه أكثر احتمالية ERPفي المكان الذي يعود الناس الفشل لـ للفشل. | | | | | | | |
| **.14ERP. الافتقار إلى ارتباط المستخدمين في نظام** | | | | | | | | |
| | | **غير موافق بشدة** | **غير موافق** | **بعض الشيء غير موافق** | **محايد** | **بعض الشيء موافق** | **موافق** | **موافق بشدة** |
| س28 | مشاركة المستخدمين في عمليات التطبيق للنظام مهمة لنجاح مشروع التطبيق. | | | | | | | |
| **.15 الافتقار إلى خبرات المستخدمين.** | | | | | | | | |
| س29 | ذو ألفة لمراحل دورة التطبيق لنظام ERPعندما مستخدمي برامج فأن المشاريع تصبح أكثر احتمالية للنجاح.ERP | | | | | | | |
| س30 | علم المستخدمين في معالجة البيانات كأداة ذات عمل هو المهم .ERPللتطبيق الناجح لأنظمة | | | | | | | |
| س31 | علم بهذا النوع من التطبيق ERPإذا لم يكن لدى مستخدمي برامج فأن هناك خطورة كبيرة من الفشل في التطبيق. | | | | | | | |
| **.16 مزج المهارات.** | | | | | | | | |
| س32 | مؤهلين يقلل ERPالمشكلة لاستخدام والاحتفاظ بمطوري برامج فشل التطبيق. | | | | | | | |
| س33 | الافتقار إلى محللين تجاريين بمهارات فنية وتجارية يجعل تطبيق أكثر احتمالية للفشل.ERP | | | | | | | |
| س34 | الفشل في دمج الخبرات الخارجية والداخلية بنجاح هو عامل .ERPخطورة رئيسي في تطبيق | | | | | | | |
| **.ERPعوامل الخطورة خلال عمليات نظام** | | | | | | | | |
| **.1ERP. ملائمة برنامج** | | | | | | | | |
| س35 | تم ERP يتم تقليلها إذا العملية ERPالاحتمالية بفشل عمليات بناءها للوصول للحاجات المطلوبة بواسطة العمليات التنظيمية. | | | | | | | |
| س36 | يتم تقليلها. إذا اسم ومحتوى بنود ERPاحتمالية الفشل لعمليات يتطابق مع تلك الموجودة في الوثائق والمستخدمة في ERPبيانات الشركة (كمثال تقارير المبيعات وغيرها). | | | | | | | |
| س37 | يتم تقليلها إذا كانت بيانات الإدخال ERPالاحتمالية لفشل عمليات تتطابق مع تلك الموجودة في الوثائق والمستخدمة ERPللبيانات لـ بواسطة الشركة. | | | | | | | |
| س38 | ذو تهديد إذا المستخدم الداخل على نظام ERPالنجاح لعمليات غير مرتبط بشكل جيد مع حاجات العمل التجاري للشركة.ERP | | | | | | | |
| **.2 العمل في نظامين في نفس الوقت.** | | | | | | | | |
| س39 | ERP يجعل عمليات ERPاعتقد أن تشغيل النظام القديم مع الجديد أقل خطورة. | | | | | | | |
| **.3 مخاطر الأمن.** | | | | | | | | |
| س40 | الدخول غير المصرح به للبيانات أو النظام بواسطة المستخدمين الخارجين (الهاكرز أو القراصنة) هو الخطر الرئيسي المرتبط مع .ERPتشغيل نظام | | | | | | | |
| س41 | الدخول غير المصرح به لبيانات أو نظام بواسطة المستخدمين الخارجين (الهاكرز أو القراصنة) قد يسبب خسارات كبيرة للشركة. | | | | | | | |
| س42 | الدخول غير المصرح به للبيانات أو النظام بواسطة المستخدمين الخارجين (الهاكرز أو القراصنة) قد يكون به أثر مباشر على البيانات المالية للشركة. | | | | | | | |
| س43 | الدخول غير المصرح به للبيانات أو النظام بواسطة الموظفين هو خطورة رئيسية. | | | | | | | |
| س44 | الدخول غير المصرح به للبيانات أو النظام بواسطة الموظفين قد يؤدي لخسارات رئيسية للشركة. | | | | | | | |
| س45 | الدخول غير المصرح به للبيانات أو النظام بواسطة الموظفين قد يكون له أثر مباشر على البيانات المالية للشركة. | | | | | | | |
| **.4 المشاركة في كلمة السر.** | | | | | | | | |
| س46 | لأن كلفة الترخيص عالية فأنه من الفضل لأثنين أو ثلاثة موظفين للمشاركة في نفس كلمة السر. | | | | | | | |
| س47 | مشاركة الموظفين في كلمة السر خطورة رئيسية من ناحية الأمان. | | | | | | | |
| س48 | المشاركة لدى الموظفين في كلمة السر فيه احتمالية للتلاعب | | | | | | | |

| | | غير موافق بشدة | غير موافق | بعض الشيء غير موافق | محايد | بعض الشيء موافق | موافق | موافق بشدة |
|---|---|---|---|---|---|---|---|---|
| | والخداع. | | | | | | | |
| **5. خطورة الاعتماد في العملية.** | | | | | | | | |
| | | **غير موافق بشدة** | **غير موافق** | **بعض الشيء غير موافق** | **محايد** | **بعض الشيء موافق** | **موافق** | **موافق بشدة** |
| س49 | اعتقد أن المشكلة في العملية في العمل التجاري (مثال المدخلات غير الملائمة لطلبات المبيعات للعملاء) يؤدي للمشكلة في العمليات الأخرى في المجال الذي به أنظمة خطورة رئيسية من ناحية الأمان يتم تطبيقها. | | | | | | | |
| س50 | اعتقد أن خطورة الاعتماد في العملية على نظام ERP يكون فيها احتمالية لسوء الإفصاح عن البيانات المالية للشركة. | | | | | | | |
| **6. الإدخال غير الصحيح للبيانات.** | | | | | | | | |
| س51 | الإدخال في بعض الأحيان لبيانات سيئة بواسطة الموظفين هو الخطر الرئيسي للشركة في تطبيق ERP. | | | | | | | |
| س52 | الإدخال المتعمد لبيانات سيئة بواسطة الموظفين هو الخطر الرئيسي للشركة في تطبيق ERP. | | | | | | | |
| س53 | الإدخال غير الصحيح للبيانات أما غير متعمد أو متعمد بسبب عدم ثقة في تكامل معلومات الشركة. | | | | | | | |
| س54 | الإدخال غير الصحيح للبيانات أما متعمد أو غير متعمد قد يؤدي لسوء إفصاح عن البيانات المالية. | | | | | | | |
| **7. التكرار للأخطاء.** | | | | | | | | |
| س55 | اختبار غير كافي للبرنامج هو المصدر الرئيسي للمشكلة في عمليات ERP. | | | | | | | |
| س56 | تكرار الأخطاء سيحدث إذا لم يكن هناك فحص كافي للبيانات في الإدخال للمعلومات الرئيسية. | | | | | | | |
| س57 | تكرار الأخطاء من المحتمل أن يؤدي لإفصاح خاطئ عن البيانات المالية. | | | | | | | |
| **8. كثرة الأخطاء.** | | | | | | | | |
| س58 | لأن ERP نظام متكامل فأن كثرة الأخطاء قد تحدث. | | | | | | | |
| **9. معالجة غير منطقية.** | | | | | | | | |
| س59 | يزيد الاحتمالية للفشل للقيم الكبيرة غير المعتادة من نظام ERP الوثائق التي يتم إدخالها والذي يؤدي لمعالجة غير منطقية. | | | | | | | |
| س60 | ما لم تتأكد ERP المعالجة غير المنطقية ممكن أن تحدث في الشركة بشكل فعال من المخرجات. | | | | | | | |
| س61 | بشكل كلي فأن المعالجة غير المنطقية الاحتمالية الرئيسية لسوء الإفصاح عن البيانات المالية. | | | | | | | |
| **10. نوعية المعلومات.** | | | | | | | | |
| س62 | هي غالبا غير ERP المخرجات من المعلومات المقدمة بواسطة دقيقة. | | | | | | | |
| س63 | هي غالبا متأخرة ERP المخرجات من المعلومات المقدمة بواسطة في فائدتها. | | | | | | | |
| س64 | غالبا متناقصة. ERP المخرجات من المعلومات المقدمة بواسطة | | | | | | | |
| س65 | هي غالبا ERP المخرجات من محتوى المعلومات المقدم بواسطة غير كاملة. | | | | | | | |

**س66. الرجاء مراجعة عوامل الخطورة خلال تطبيق نظام ERP في ما هو مصنف أدناه وأكتبهم بالترتيب من الأكثر أهمية للأقل أهمية من وجهة نظرك؟**

**عوامل الخطورة خلال تطبيق ERP**

1. الصعوبة في فهم واستخدام أنظمة ERP.
2. الفشل في إعادة تصميم عمليات العمل التجاري والتخصصي لـ ERP.
3. الافتقار إلى دعم الإدارة العليا.
4. عدم كفاية الموارد.
5. الافتقار للتغيير في الإدارة.
6. معايير وضوابط غير كافية.
7. عدم الوضوح أو سوء الفهم لمتطلبات المستخدم.
8. الافتقار للقائد.
9. الافتقار للاتفاق في أهداف المشروع.
10. الافتقار لمنهجية إدارة للمشروع فعالة.
11. تدريب غير كافي للمستخدمين النهائيين.
12. اتصالات غير فعالة بين المستخدمين.
13. المقاومة في المستخدم.
14. الافتقار إلى ارتباط المستخدمين لنظام جديد.
15. الافتقار إلى خبرات المستخدمين.
16. الافقتار للقدرة لاستخدام والمحافظة على أنظمة ERP ذو كفاءة.
17. الافتقار لمحللين للعمل التجاري بخبرة فنية وتجارية.
18. الفشل في مزج الخبرات الخارجية والداخلية بفاعلية.

**س67. الرجاء مراجعة عوامل الخطورة خلال عمليات نظام ERP المصنفة أدناه ورتبها من الأكثر أهمية للأقل أهمية من وجهة نظرك؟**

**عوامل الخطورة خلال عمليات ERP.**

1. عدم ملائمة برنامج ERP.
2. خطر العمل في نظامين في نفس الوقت.
3. مخاطر الأمن.
4. مخاطر المشاركة في كلمة السر.
5. مخاطر الاعتماد في العملية.
6. مخاطر الفصل في المهام.
7. مخاطر إدخال البيانات غير الصحيح.
8. مخاطر التكرار للأخطاء.
9. مخاطر كثرة الأخطاء.
10. مخاطر المعالجة غير المنطقية.
11. مخاطر نوعية البيانات.

الجزء الثالث:

الثقافة والبراعة

الرجاء الاستشارة إلى المدى الذي تكون به موافق أو غير موافق لكل من الجمل التالية:

| | | غير موافق بشدة | غير موافق | بعض الشيء غير موافق | محايد | بعض الشيء موافق | موافق | موافق بشدة |
|---|---|---|---|---|---|---|---|---|
| الثقافة | | | | | | | | |
| س1 | احترم الروتين العادي بشكل عالي. | | | | | | | |
| س2 | اعتقد أن الحضور في الوقت المناسب مهم. | | | | | | | |
| س3 | ارغب في التخطيط بشكل دقيق ولهذا لا تحدث المخاطر المالية. | | | | | | | |
| س4 | يجب مكافأة الناس حسب وضعهم في المجتمع. | | | | | | | |
| س5 | أفضل تعليمات واضحة من رئيسي عن ما يجب عمله. | | | | | | | |
| س6 | أفضل أن يعتمد المدراء على القواعد الرسمية. | | | | | | | |
| س7 | أفضل أن تكون العلاقة بين الموظف وصاحب العمل خلقية بشكل أساسي مثل العلاقات العائلية. | | | | | | | |
| س8 | أفضل الموظفين أن ينجزوا بشكل أفضل حيث الأفراد ومستوى تدريب الأفراد هو الفعال أكثر. | | | | | | | |
| س9 | في العمل التجاري، أفضل أن المهام والشركة تسود على العلاقات الشخصية. | | | | | | | |
| س10 | إذا كان لدى الشخص مظهر جيد ويرغب بالحصول على الثروة فأن هذا الشخص لديه الحق في الاستمتاع بذلك. | | | | | | | |
| س11 | إنها الحياة أيضا التي تفضل أولئك الذين يحاولون بجد عن أولئك الذين لا يحاولون بجد. | | | | | | | |
| س12 | تحقيق المال هو السبب الرئيسي للعمل الجاد. | | | | | | | |
| س13 | لأفضل أن تكون صناعة القرار على أساس تفكير المجموعة. | | | | | | | |
| س14 | إذا كان الناس في هذا البلد تم معاملتهم بمساواة أكثر فسيكون لدى مشاكل كبيرة. | | | | | | | |
| س15 | الموظفين ينجزون أكثر في المجموعات ومستوى تدريب المجموعة أكثر فعالية. | | | | | | | |
| س16 | أدعم التفكير في مقدار الضريبة الذي يجعل الناس ذو الدخل الأعلى يدفعون أكثر. | | | | | | | |
| س17 | التعاون مع الآخرين نادرا ينجح. | | | | | | | |
| س18 | المستقبل غير قابل للتأكيد للشخص الذي يقوم بعمل خطط جدية. | | | | | | | |
| س19 | غالبا تم معاملتي بشكل غير عادل. | | | | | | | |
| س20 | اشعر أن الحياة مثل القرعة. | | | | | | | |
| س21 | حتى عندما يعمل بجد فأنك لا تعرف إذا كان هذا يساعدك على الأداء الأفضل. | | | | | | | |
| الخبرة في ERP | | | | | | | | |
| س22 | لقد تلقيت تدريب رئيسي رسمي وغير رسمي في العلاقة مع نظام ERP خلال مهنتي. | | | | | | | |
| س23 | لدي خبرة رئيسية في نظام ERP في مهنتي. | | | | | | | |
| س24 | اشعر براحة لاستخدام نظام ERP لأداء عملي. | | | | | | | |
| س25 | اشعر بالمتعة في استخدام نظام ERP. | | | | | | | |
| س26 | لدي مستوى عالي من الخبرة ERP. | | | | | | | |

## 10.8 Appendix 3: normality results

**Table C-1 Descriptive and normality results for Risk factors during implementation of ERP**

| Risk factors during implementation of ERP systems | skeweness | Kurtosis | Kolmogorov Smirnov test | | |
|---|---|---|---|---|---|
| | | | Statistic | df | sig |
| 33. Difficulties of understanding ERP systems | .136 | -1.294 | .160 | 166 | .000 |
| 34. Failure to BPR and major customization | -.507 | -.913 | .181 | 166 | .000 |
| 35. Lack of top management support | -.575 | -1.020 | .250 | 166 | .000 |
| 36. Insufficiency of Resource | -.786 | -.179 | .167 | 166 | .000 |
| 37. Lack of management change | -.112 | -1.329 | .185 | 166 | .000 |
| 38. Insufficient discipline and standardization | -.149 | -1.317 | .188 | 166 | .000 |
| 39. Unclear/ misunderstanding Users Requirement | -1.046 | .165 | .169 | 166 | .000 |
| 40. Lack of champion | -.281 | -1.167 | .202 | 166 | .000 |
| 41. Lack of Agreement on project management | -.360 | -1.048 | .175 | 166 | .000 |
| 42. Lack of effective Project management methodology | -.390 | -.879 | .153 | 166 | .000 |
| 43. Insufficient Training of end-users | -2.009 | 4.332 | .289 | 166 | .000 |
| 44. Ineffective Communication between users | -.412 | -1.200 | .189 | 166 | .000 |
| 45. Resistance of Users | -.875 | .022 | .179 | 166 | .000 |
| 46. Lack of involvement of users in the ERP system | .043 | -1.433 | .214 | 166 | .000 |
| 47. Lack of User Experience | -1.503 | 2.873 | .194 | 166 | .000 |
| 48. Lack of ability to recruit and retain qualified ERP systems developers | -.764 | .707 | .192 | 166 | .000 |
| 49. Lack of business analysts with business and technology knowledge | -1.162 | 1.849 | .223 | 166 | .000 |
| 50. Failure to mix internal and external expertise effectively | -1.185 | 1.456 | .223 | 166 | .000 |
| Overall total implementation ERP risks | -.602 | .768 | .082 | 166 | .008 |

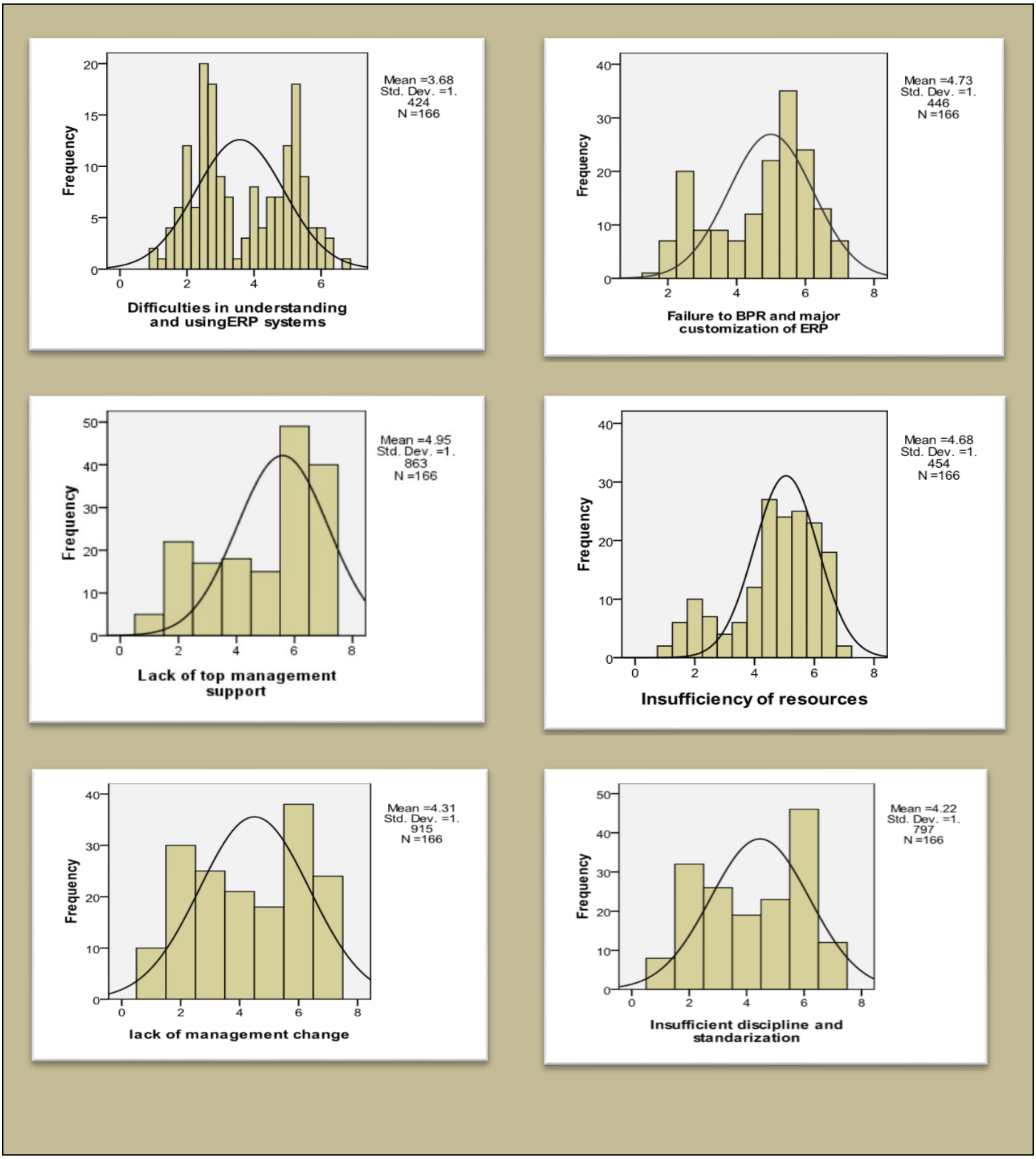
**Table C-2 Descriptive and normality results for Risk factors during operation of ERP systems**

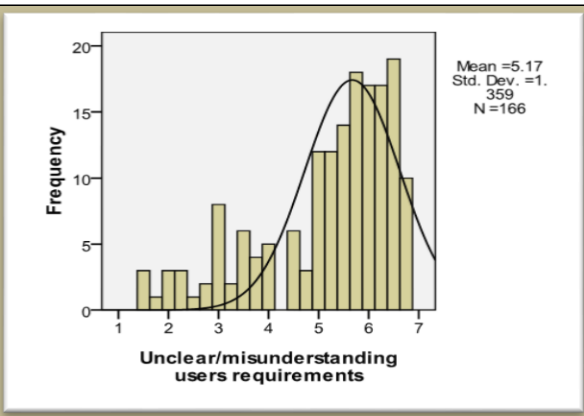
| Risk factors during operation of ERP systems | skeweness | Kurtosis | Kolmogorov-Smirnov test | | |
|---|---|---|---|---|---|
| | | | Statistic | df | sig |
| 1. ERP Suitability | -1.008 | 1.052 | .161 | 166 | .000 |
| 2. Working with two systems in parallel | -.212 | -1.178 | .197 | 166 | .000 |
| 3. Security Risk | -1.048 | 1.583 | .115 | 166 | .000 |
| 4. Sharing Password | -.246 | -1.242 | .128 | 166 | .000 |
| 5. Incorrect Entry Data | -.747 | -.728 | .186 | 166 | .000 |
| 6. Repetition of Errors | -.753 | -.594 | .173 | 166 | .000 |
| 7. Flowing of errors | -.703 | -.609 | .161 | 166 | .000 |
| 8. Illogically Processing | -.667 | -.612 | .151 | 166 | .000 |
| 9. Information Quality | 1.229 | .866 | .250 | 166 | .000 |
| Overall total operation ERP risks | -.450 | -.165 | .085 | 166 | .006 |

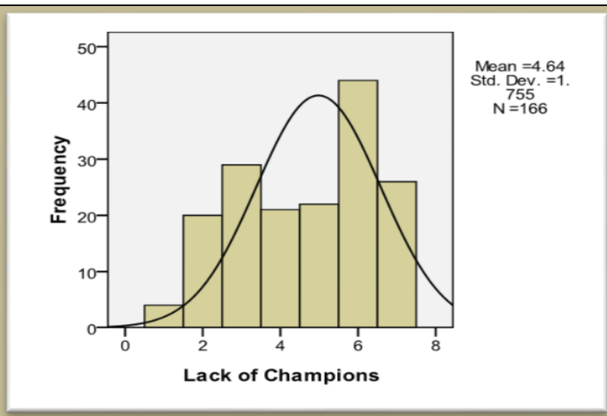
**Table C-3 Descriptive and normality results for four types of culture and level of ERP expertise**

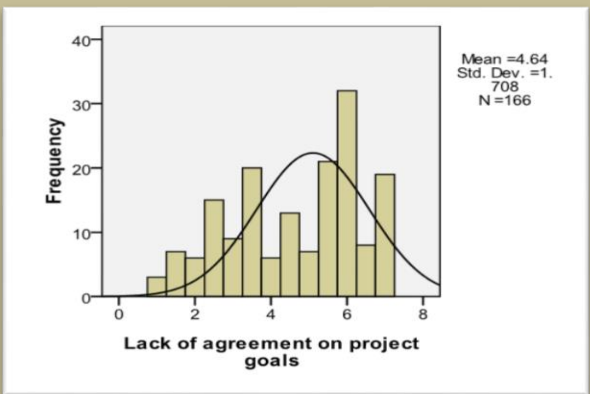
| Independent variables | skeweness | Kurtosis | Kolmogorov-Smirnov test | | |
|---|---|---|---|---|---|
| | | | Statistic | df | sig |
| Hierarchism | .288 | -1.648 | .202 | 166 | .000 |
| Individualisms | 1.335 | .993 | .224 | 166 | .000 |
| Egalitarianisms | .002 | -1.573 | .191 | 166 | .000 |
| Fatalisms | 1.406 | 1.550 | .189 | 166 | .000 |
| ERP Expertise | -.428 | -.084 | .079 | 166 | .013 |

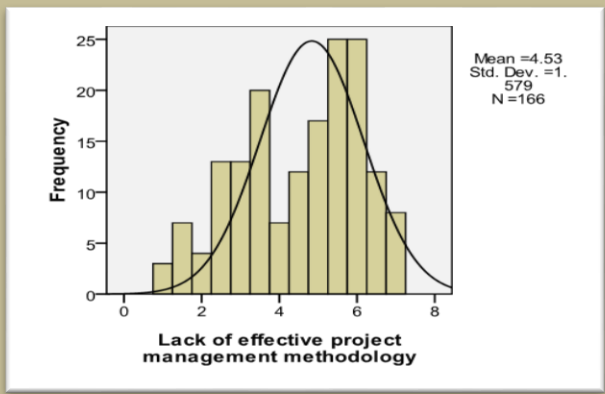
**Figure C-1 Normality distribution test for risk factors during implementation of ERP systems**

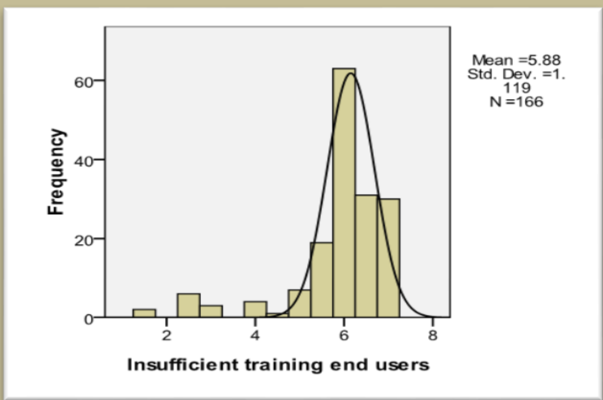


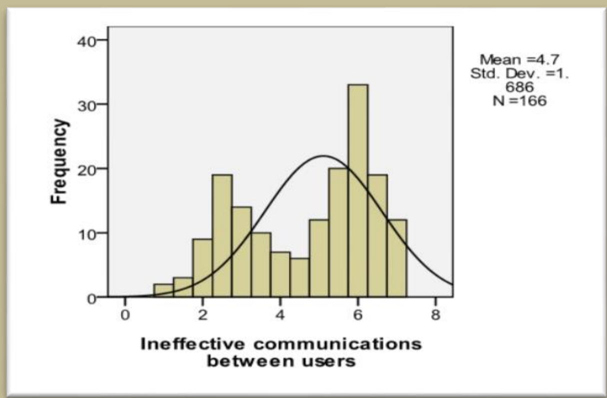

Frequency
Mean =5.17
Std. Dev. =1.
359
N =166
Unclear/misunderstanding
users requirements

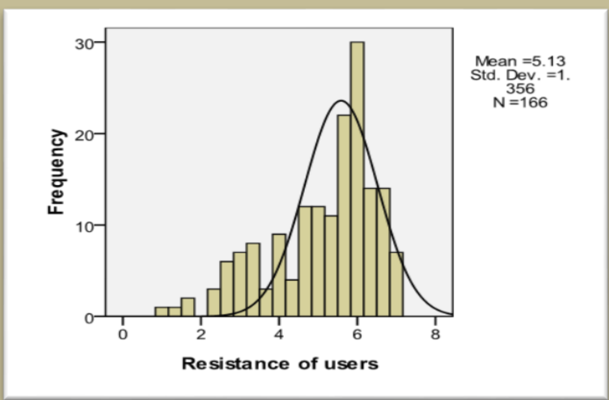

Frequency
Mean =4.64
Std. Dev. =1.
755
N =166
Lack of Champions

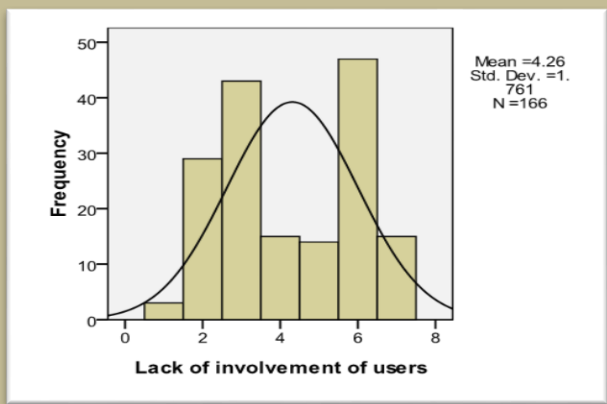

Frequency
Mean =4.64
Std. Dev. =1.
708
N =166
Lack of agreement on project
goals


Frequency
Mean =4.53
Std. Dev. =1.
579
N =166
Lack of effective project
management methodology


Frequency
Mean =5.88
Std. Dev. =1.
119
N =166
Insufficient training end users


Frequency
Mean =4.7
Std. Dev. =1.
686
N =166
Ineffective communications
between users


Frequency
Mean =5.13
Std. Dev. =1.
356
N =166
Resistance of users


Frequency
Mean =4.26
Std. Dev. =1.
761
N =166
Lack of involvement of users

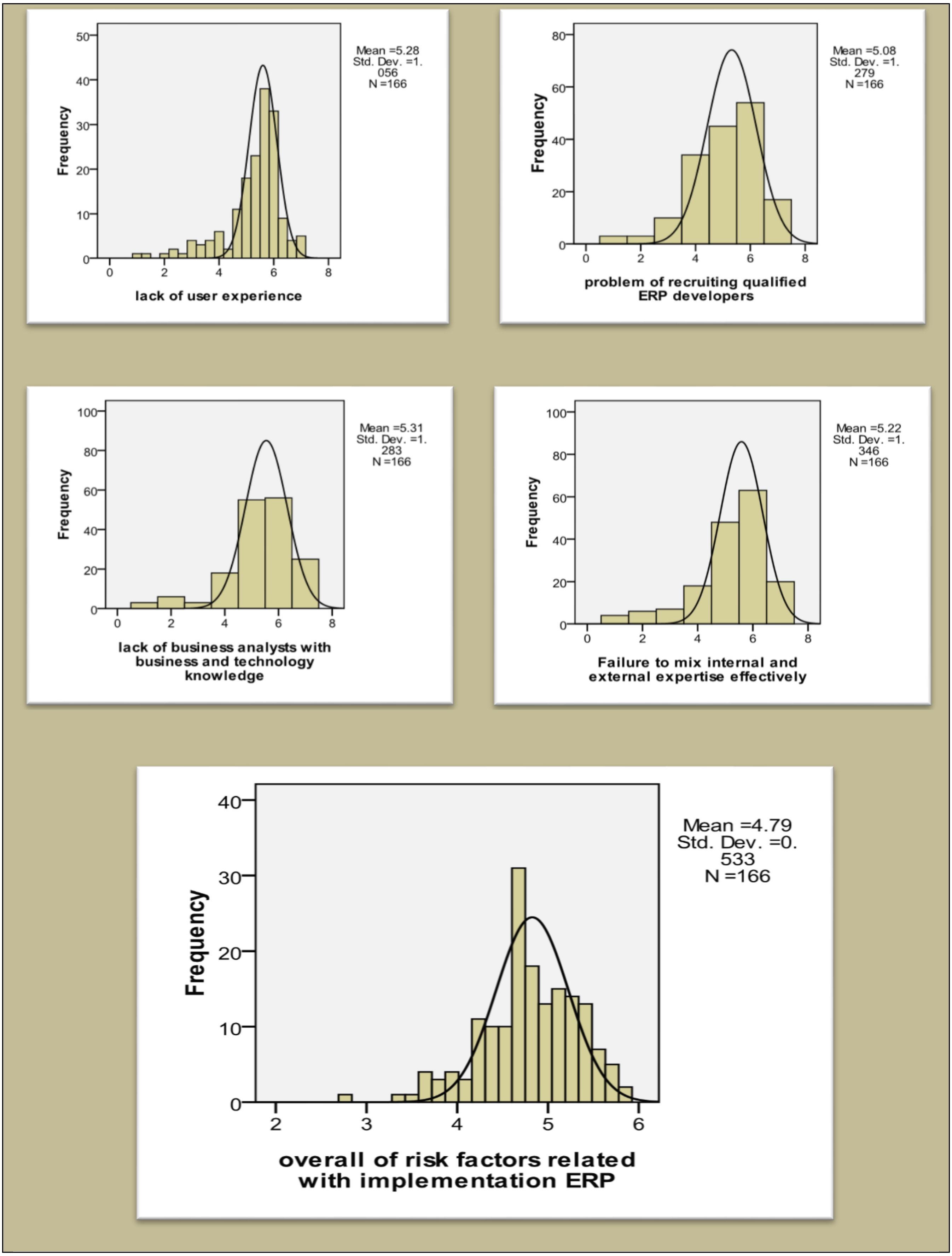
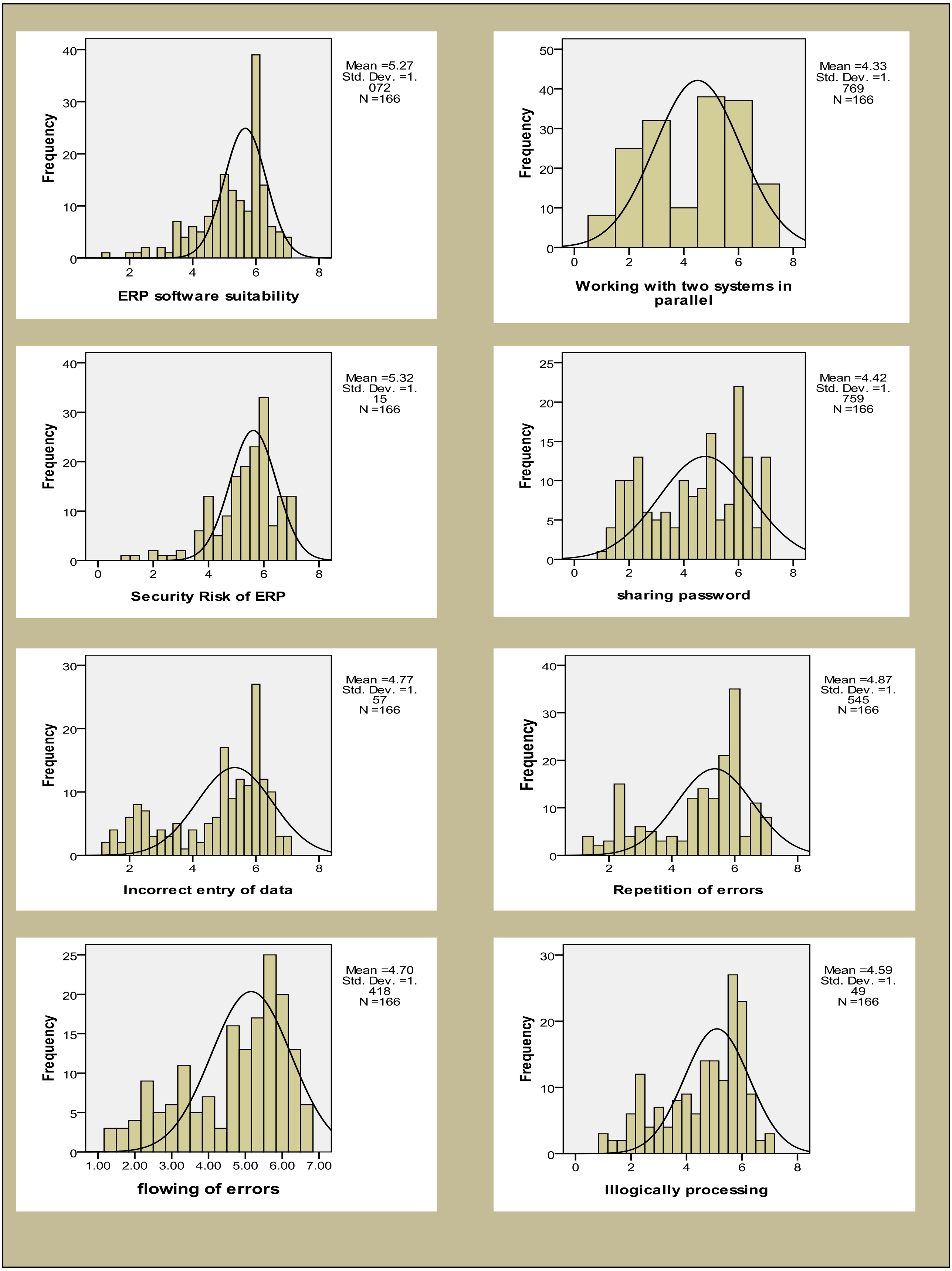

Frequency
Mean =5.28
Std. Dev. =1.
056
N =166
lack of user experience
Frequency
Mean =5.08
Std. Dev. =1.
279
N =166
problem of recruiting qualified
ERP developers
Frequency
Mean =5.31
Std. Dev. =1.
283
N =166
lack of business analysts with
business and technology
knowledge
Frequency
Mean =5.22
Std. Dev. =1.
346
N =166
Failure to mix internal and
external expertise effectively
Frequency
Mean =4.79
Std. Dev. =0.
533
N =166
overall of risk factors related
with implementation ERP

**Figure C-2  Normality distribution test for risk factors during operation of ERP systems**



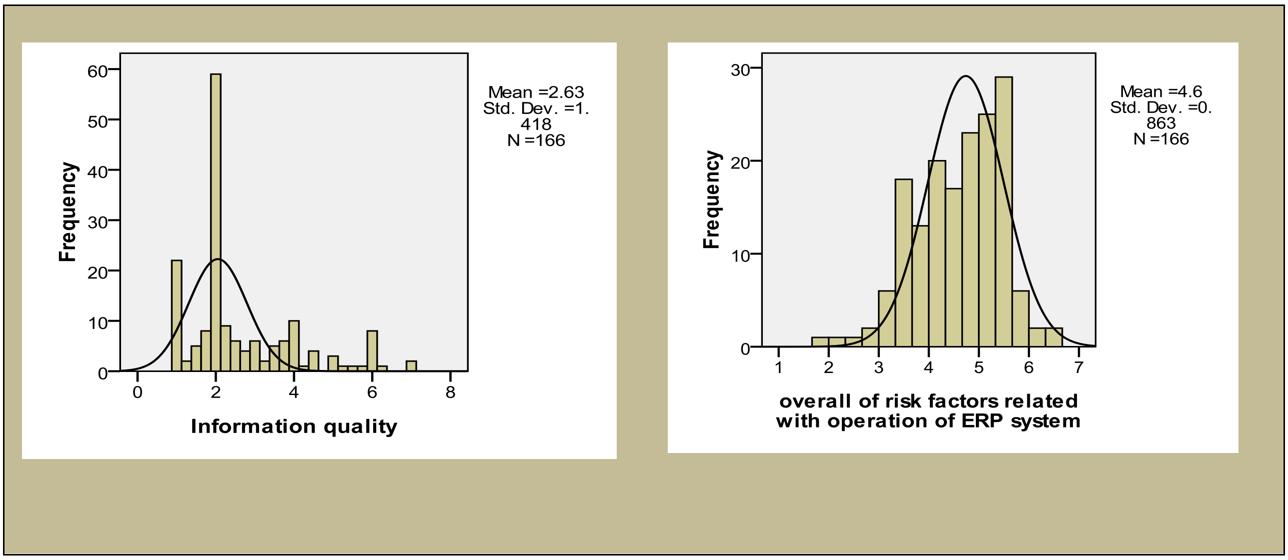
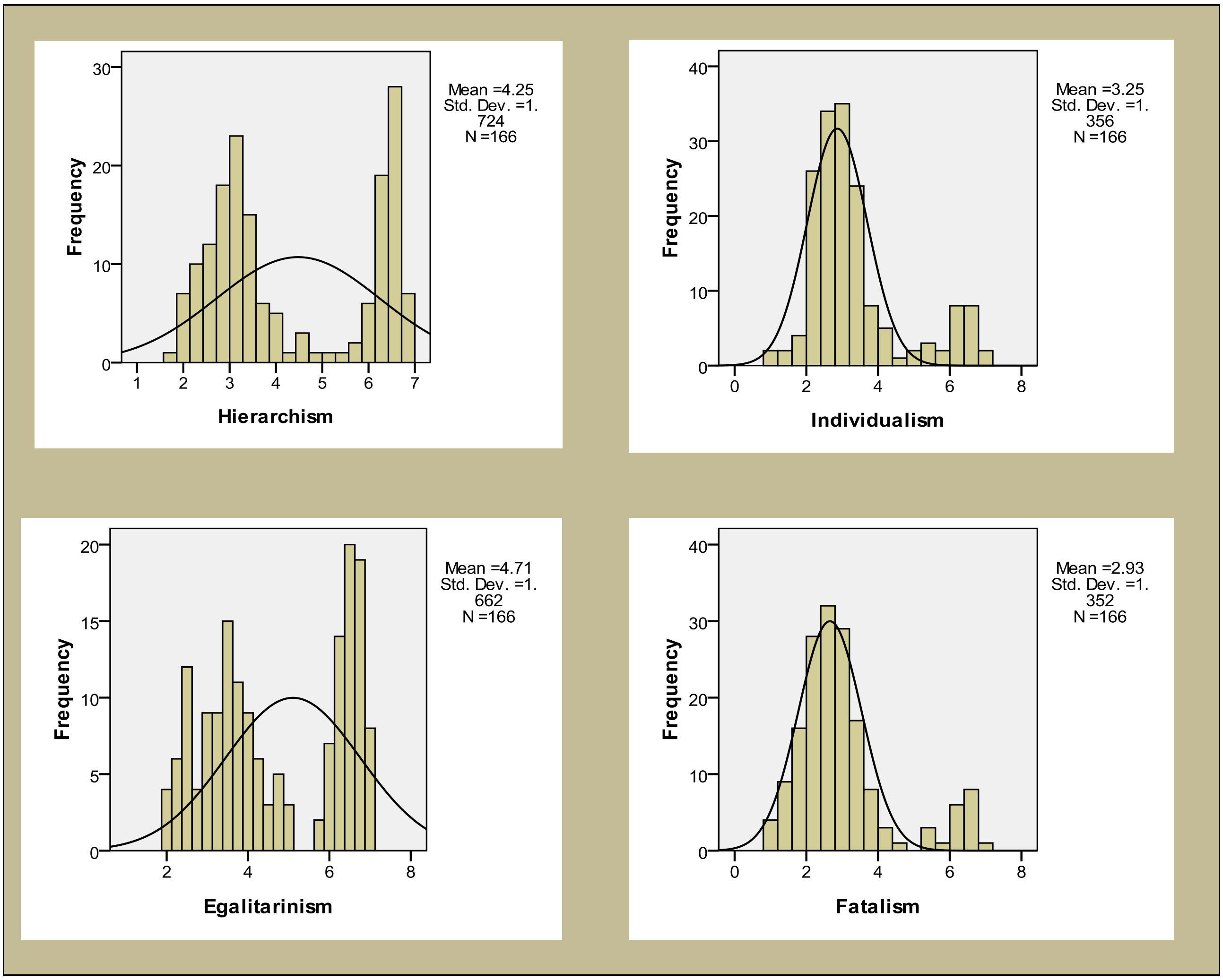
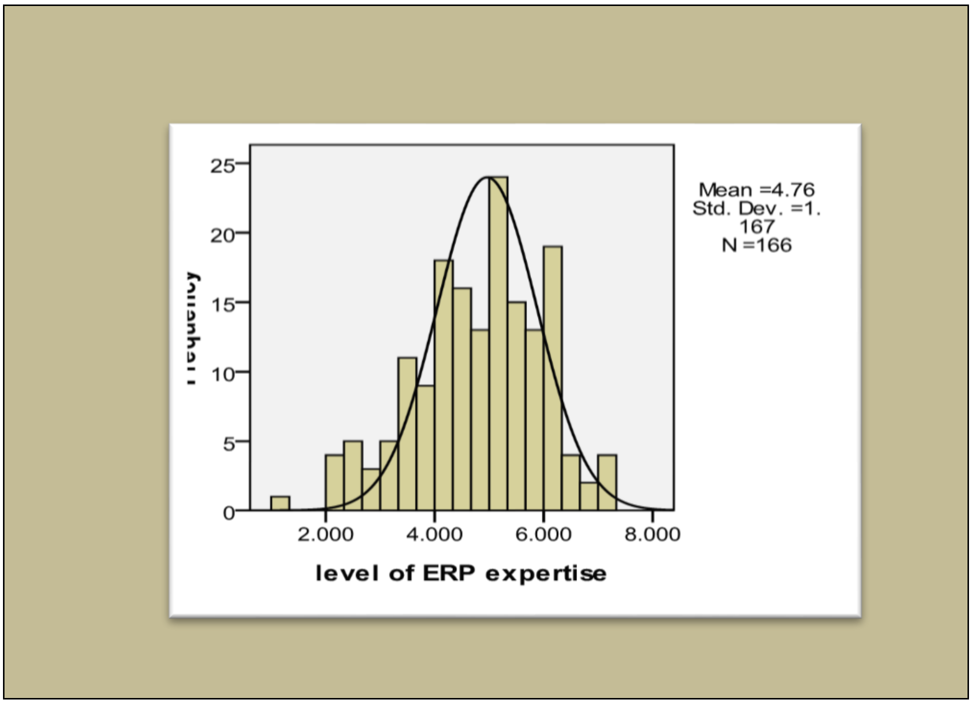



**Figure C-3 Normality distribution test for four types of culture**



**Normality distribution test for level of ERP expertise**



## 10.9 Appendix 4: Respondents information related to their profession, ERP expertise, and culture

**Number of the respondents regarding to their Profession job and level of ERP expertise**

| Expertise of ERP | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| low ERP expertise | IT Manger | 21 | 24.7 | 24.7 | 24.7 |
| | CFO | 34 | 40.0 | 40.0 | 64.7 |
| | auditor | 19 | 22.4 | 22.4 | 87.1 |
| | other | 11 | 12.9 | 12.9 | 100.0 |
| | Total | 85 | 100.0 | 100.0 | |
| high ERP expertise | IT Manger | 40 | 49.4 | 49.4 | 49.4 |
| | CFO | 22 | 27.2 | 27.2 | 76.5 |
| | auditor | 7 | 8.6 | 8.6 | 85.2 |
| | other | 12 | 14.8 | 14.8 | 100.0 |
| | Total | 81 | 100.0 | 100.0 | |

**Number of the respondents regarding to their Profession job and culture**

| culture | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Hierarchists | IT Manger | 8 | 25.0 | 25.0 | 25.0 |
| | CFO | 13 | 40.6 | 40.6 | 65.6 |
| | auditor | 5 | 15.6 | 15.6 | 81.3 |
| | other | 6 | 18.8 | 18.8 | 100.0 |
| | Total | 32 | 100.0 | 100.0 | |
| Individualists | IT Manger | 6 | 54.5 | 54.5 | 54.5 |
| | auditor | 1 | 9.1 | 9.1 | 63.6 |
| | other | 4 | 36.4 | 36.4 | 100.0 |
| | Total | 11 | 100.0 | 100.0 | |
| Egalitarians | IT Manger | 15 | 35.7 | 35.7 | 35.7 |
| | CFO | 16 | 38.1 | 38.1 | 73.8 |
| | auditor | 8 | 19.0 | 19.0 | 92.9 |
| | other | 3 | 7.1 | 7.1 | 100.0 |
| | Total | 42 | 100.0 | 100.0 | |
| Fatalists | IT Manger | 3 | 75.0 | 75.0 | 75.0 |
| | CFO | 1 | 25.0 | 25.0 | 100.0 |
| | Total | 4 | 100.0 | 100.0 | |

| | | | | | |
|---|---|---|---|---|---|
| Mix culture | IT Manger | 29 | 37.7 | 37.7 | 37.7 |
| | CFO | 26 | 33.8 | 33.8 | 71.4 |
| | auditor | 12 | 15.6 | 15.6 | 87.0 |
| | other | 10 | 13.0 | 13.0 | 100.0 |

**Number of the respondents regarding to their culture, profession job, and level of ERP expertise**

| culture | Expertise of ERP | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|---|
| hierarchists | low ERP expertise | Valid | IT Manger | 4 | 16.7 | 16.7 | 16.7 |
| | | | CFO | 12 | 50.0 | 50.0 | 66.7 |
| | | | auditor | 4 | 16.7 | 16.7 | 83.3 |
| | | | other | 4 | 16.7 | 16.7 | 100.0 |
| | | | Total | 24 | 100.0 | 100.0 | |
| | high ERP expertise | Valid | IT Manger | 4 | 50.0 | 50.0 | 50.0 |
| | | | CFO | 1 | 12.5 | 12.5 | 62.5 |
| | | | auditor | 1 | 12.5 | 12.5 | 75.0 |
| | | | other | 2 | 25.0 | 25.0 | 100.0 |
| | | | Total | 8 | 100.0 | 100.0 | |
| individualists | low ERP expertise | Valid | IT Manger | 3 | 75.0 | 75.0 | 75.0 |
| | | | other | 1 | 25.0 | 25.0 | 100.0 |
| | | | Total | 4 | 100.0 | 100.0 | |
| | high ERP expertise | Valid | IT Manger | 3 | 42.9 | 42.9 | 42.9 |
| | | | auditor | 1 | 14.3 | 14.3 | 57.1 |
| | | | other | 3 | 42.9 | 42.9 | 100.0 |
| | | | Total | 7 | 100.0 | 100.0 | |
| egalitarians | low ERP expertise | Valid | IT Manger | 5 | 35.7 | 35.7 | 35.7 |
| | | | CFO | 1 | 7.1 | 7.1 | 42.9 |
| | | | auditor | 6 | 42.9 | 42.9 | 85.7 |
| | | | other | 2 | 14.3 | 14.3 | 100.0 |
| | | | Total | 14 | 100.0 | 100.0 | |
| | high ERP expertise | Valid | IT Manger | 10 | 35.7 | 35.7 | 35.7 |
| | | | CFO | 15 | 53.6 | 53.6 | 89.3 |
| | | | auditor | 2 | 7.1 | 7.1 | 96.4 |
| | | | other | 1 | 3.6 | 3.6 | 100.0 |
| | | | Total | 28 | 100.0 | 100.0 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| fatalists | low ERP expertise | Valid | IT Manger | 1 | 50.0 | 50.0 | 50.0 |
| | | | CFO | 1 | 50.0 | 50.0 | 100.0 |
| | | | Total | 2 | 100.0 | 100.0 | |
| | high ERP expertise | Valid | IT Manger | 2 | 100.0 | 100.0 | 100.0 |
| mix culture | low ERP expertise | Valid | IT Manger | 8 | 19.5 | 19.5 | 19.5 |
| | | | CFO | 20 | 48.8 | 48.8 | 68.3 |
| | | | auditor | 9 | 22.0 | 22.0 | 90.2 |
| | | | other | 4 | 9.8 | 9.8 | 100.0 |
| | | | Total | 41 | 100.0 | 100.0 | |
| | high ERP expertise | Valid | IT Manger | 21 | 58.3 | 58.3 | 58.3 |
| | | | CFO | 6 | 16.7 | 16.7 | 75.0 |
| | | | auditor | 3 | 8.3 | 8.3 | 83.3 |
| | | | other | 6 | 16.7 | 16.7 | 100.0 |
| | | | Total | 36 | 100.0 | 100.0 | |