IDENTIFICATION AND ANALYSES OF FACTORS INFLUENCING THE SUCCESS OF ERP PROJECTS IMPLEMENTATION: JUDGMENT BY IT PROFESSIONALS IN THAILAND

By

ZEYAD DHEYAA ABBAS AL-SHAIKHLY

A Final Report of the Six-Credit Course
SCM 2202 Graduate Project

Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN SUPPLY CHAIN MANAGEMENT

Martin de Tours School of Management
Assumption University
Bangkok, Thailand

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Declaration of Authorship Form

I, Zeyad Dheyaa Abbas

Declare that this thesis/project and the work presented in it are my own and has been generated by me as the result of my own original research.

[Title of thesis/Project] Identification and analyses of Factors influencing the success of ERP Projects implementation: Judgment by IT professionals in Thailand

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ABSTRACT

Research question – There are a great many ERP implementation projects that do not bring about the planned results, or even end up in project abandonment. ERP projects are large, costly and no company can afford have their investment leading to failure and budget exhaustion without reaching their set targets. This research is conducted to find some of the critical success and failure factors (CSFs) behind Enterprise software implementation.

Design/Methodology/Approach – The Researcher used Purposive Survey, targeting individuals with expertise on the subjects of this research. A Likert scale questionnaire was preliminarily tested and finally provided to ERP industry experts. Responses were collected and statistically analyzed providing importance means and variances of measured factors based on the participants selected demographics.

Results – Direct interviews were used and proven effective with co-workers, and with those located geographically nearby. Phone interviews were used for individuals who agreed to take part but unwilling to meet face-to-face. The researcher used both English and Thai verbal skills to explain needed points before respondent could answers the questions. Internet emailing was also used to reach out to further segments of people that the researches didn't have direct access to. The final form of the questionnaire was given to a total of 200 individuals; only 121 responses are identified to be matching to the researcher's screening criteria. All respondents, regardless to their background, gave a high score for all factors.

Conclusion – This research provides a compilation of all previously identified ERP implementation success factors, through a clearly structured methodological approach. Research sampling method did prove effective since data results showed high reliability between co-variances of all variables selected. Participants in general, gave a very high importance to all 20 factors of our research showing that all factors collected are relevant to the subject of study. Researcher choice of using ANOVA and t-test statistical tools provided the readers with ability to understand mean and

variances of all answers. On an advance level, both tools revealed viable facts about respondents' demographics in relation to their replies to our questionnaire. The researcher used a wide collection of published literature addressing ERP issues in both developed and developing nations. Readers should also make use of given case studies to understand the importance of having a successful ERP implementation

Keywords – Enterprise resources planning (ERP), Critical success factors (CSF)

Paper type – Research paper (Master Degree Graduate project)

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisor, Dr.Chayakrit Charoensiriwath for his support, patience and encouragement while working on this research paper. He provided me with all critical guidance that made this project possible. As an advisor, he was available when needed and given me the space to work on my project as requested; I truly appreciate his qualities as a teacher and recommend him to other supply chain scholars.

I'm also grateful to Acharn Piyawan Puttibarncharoensri , Chairperson of the Department of Industrial Management for her support to all students and for facilitating the right environment that helped me complete all requirements of this degree. I'm indebted to everyone who participated in this project specially those who took time to answer the given questionnaires during my data collection period of this research.

I'm also thankful to my classmates and faculty members who helped me throughout my studies at Assumption University and for the wonderful memories we share.

Finally, and most importantly, I dedicate this research and all other achievements I have made in life to my family. Their endless love and support have been major factors in giving me the strength of mind to finish this degree.

Zeyad AL-Shaikhly
Assumption University
April 2010

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GENERALITIES OF THE STUDY

1.1 Background of the Study

The comprehensive nature of ERP has resulted in complex systems that most often take years to implement. Since, these systems are so large, complex, and require participation across so many functional areas, ERP system implementations are reported to have an uneven record of success in organizations (Peslak, 2006). Clearly, the exploration of this issue deserves significant research attention.

The question of how ERP systems are judged to be a success or failure has merited attention from a research perspective as well. There are a great many implementation projects that do not bring about the planned effects, or even end up in project abandonment. The duration and budget of the implementation projects significantly exceed initial estimates, and the planned scope of the implementation is limited (Soja, 2006).

One of the most misleading legacies of traditional software project management is that the company expects to gain value from the use of the software application as soon as it installs the system. Neither IT practitioners nor researchers have developed a deterministic method to evaluate the related impact. A number of prominently publicized failures have underscored the frustrations and even total meltdowns that enterprises go through in implementing ERP systems. Allied Waste Industries, Inc. decided to pull the plug on a $30 million system built around SAP R/3, while another trash hauler, Waste Management, Inc., called off an SAP installation after spending about $45 million of an expected $50 million on the project. Hershey Food Corp. has also held SAP accountable for order processing problems that hampered its ability to ship candy and other products to retailers around the peak Halloween season (Kim, Lee & Gosain, 2005) As ERP failures have received a great deal of attention, a number of myths associated with these projects have emerged that have tended to cloud ground reality. Also, there have been many studies that have investigated the

factors that lead to ERP implementation success. Most of those studies simply list factors and are lacking in systematic effort in critically evaluating factors (Barlet, Kortrlik & Higins, 2007) Therefore, conducting this research to look at the causes seems crucial in order to explore the conditions having an influence on the project outcome. This research topic is not completely new. Here are some similar findings selected to let readers see how other researchers' approached ERP success issues: A research made by Burns, Turnipseed & Riggs (1991) looked at critical success factors in MRP implementation, suggested dividing potential factors into environmental and methodological, on the basis of 504 survey responses. Environmental factors include, apart from those describing enterprise activity, the product technology level and the organization's willingness to change. The methodological factors are connected with the implementation approach incorporated. World known financial services firm Deloitte & Touche conducted an in depth interview with 164 individuals at 62 Fortune-500 companies (Krasner, 2000). All companies included in the report manufacture consumer products, and all use ERP systems by vendors such as SAP, Baan, Oracle, and PeopleSoft. The study concluded that issues and obstacles occur before going live have a severe financial impact on organizations supply chain. Categories where obstacles can occur in an ERP implementation per survey results: People category, Business process category and Information technology (technical) category

After going live, people issues still dominate, but the emphasis of concern shifts to such areas as ongoing support, business performance, reporting, system transition, and training. Within IT issues, only about 5 percent of respondents considered software functionality an obstacle both before and after going live.

Other research by Peslak (2006) explored the views of top corporate financial executives on the success of implementation of enterprise resource planning (ERP) systems as well as the variables associated with ERP project success. Specifically, relationships between cost and budget performance on overall project success are studied. The final goal was to determine what variables correlated and potentially influenced the first level variables of cost and time performance. Cost was influenced

by modifications to the enterprise system and percentage of effort by consultants versus others. Time was influenced by the size of the company and by the number of modifications. The results clearly suggest that on-time and on-budget performance of ERP projects can be improved by reducing the number of modifications.

1.2 Statement of the Problem

There is a lack of thorough understanding of crucial factors effecting ERP projects implementation success rate. The difficulties and high failure rate in implementing ERP systems have been widely cited in literature but research on critical success factors (CSFs) in ERP implementation is rare and fragmented. To date, little has been done to theorize the important predictors for initial and ongoing ERP implementation success (Nah, 2001).

The ERP system market is one of the fastest growing markets in the software industry. ERP systems are huge and complex systems and deserve careful planning to ensure their success. AMR research in 2004 pointed out that the ERP market would be a $16 billion at the end of 2004 and 70 percent of researched companies believed that the average implementation time of ERP system is from six months to two years. Regarding the investment effort of ERP system, more than 68 percent of companies would apply the Big Bang methodology to change their system and business processes at one time, while investing an average of approximately half million dollars (Huang, chang, Li & lin, 2004).

1.3 Research Objectives

There are many examples of organizations that appear to have gained substantial benefit from the rich functionality of ERP, the strong integration of application data and the opportunity to incorporate best practice models to improve business processes. However, the picture is stained by reports of organizations failing to achieve any of these benefits. The difficulties of ERP implementations have been widely cited in the literature but research on the critical factors for initial and ongoing ERP implementation success is rare and fragmented. This research identifies Critical success factors (CSFs) in ERP implementation; put them into respective categories based on factors covariance relationship. Research then discusses the importance of these factors in ERP implementation to know how ERP practitioners perceive and evaluate ERP impediment. Through a comprehensive review of the literature, 20 factors were identified, collected and put on survey to evaluate their weighted impact researcher then used statistical means of analyzing data collected.

1.4 Scope of the Research

The scope this research is to identify and evaluate factors effecting Enterprise Resources Planning (ERP) Implementation. The researcher viewed widly published literature on the subject both local and global. When the background study was completed, the researches could identify a set of factors believed to have an impact on the success of an ERP implementation. The survey was distributed locally to pre-selected individuals all currently employed in the IT and software industry in Thailand. The SPSS program was then used to analyze the consistency of every factor to our study using statistical method called Cronbach's alpha. This method measures how well a set of items (or variables) measures a latent construct. Based on Alpha results the researcher adjusted the survey and 20 ERP CSFs were identified and distributed again to the full targeted research population. Proportional stratified sampling was used to improve the quality of participants in this study. All participants possess direct experience and expertise in one or more of the following five fields related to ERP: Project management, Consultancy, System development, IT management, and ERP usage. The selected sample is directly involved in the supply chain field in Thailand some with multinational expertise as well. The researcher

mostly used direct interviews, Phone interviews, and Internet based survey distribution. Survey replies was collected and put in SPSS software for analysis. To look at different responses generated in relation to factors categories and demography nature of the responds, the researcher used (ANOVA) a collection of statistical models, and their associated procedures, in which the observed variance is partitioned into components due to different explanatory variables to provide readers with meaningful representation of data variances (Wikipedia, 2009). The summary of the chapter is allocated for findings of this research. The research also gives holistic understanding on ERP and provides a structure for evaluating all factors based on statistical analysis.

1.5 Limitations of the Research

The researcher used only a small sample of surveyed people per segmented category. The researcher also did not focus on the topic of research to address critical success factors of ERP implementations per particular business or industry. Perhaps the results would vary as to those of the current research.

1.6 Significance of the Study

The value of this paper is that it presents companies wishing to implement ERP as well as vendors and consultants with a set of critical success factors that are applicable to local Thai and global markets in general. Understanding the critical success factors would lead to a smoother implementation path thus saving companies heaps of money and wasted time. Data extraction and judgment was made by ERP field experts only. The value of the findings comes from the collective knowledge of all surveyed participants. This research didn't focus on the number of participants alone, but rather looked at qualifications of target population surveyed with regards to the subject of this research.

1.7 Definition of Terms

An Expert Witness – is someone who by virtue of education, training, skill, or experiences is believed to have knowledge in a particular subject beyond that of an average person and sufficient enough that others may rely on officially or legally (Wikipedia encyclopedia, 2009)

Critical Success Factor (CSF) – is a business term for an element which is necessary for an organization or project to achieve its mission (Woo, 2007)

Success - is a degree or measurement of succeeding in something. It's also defined as a favorable or desired outcome (Webster, 2009)

Enterprise Resource Planning (ERP) - are commercial software packages that enable the integration of transaction-oriented data and business processes throughout an organization (Kim, Lee & Gosain, 2005)

Likert Scale - is a psychometric scale commonly used in questionnaire and is the most widely used scale in survey. When responding to a Likert question the respondents reply with level of agreement to statements in the question. Median value represents the point on the Likert scale at which half the responses are above and half are below; whereas mode value represents the point on the Likert scale that occurs most frequently. The scale is named after Rensis Likert who published a report describing its use (Katerattanakul, 2006)

Material Requirement Planning (MRP) – is software based production and material control system used to co-manage manufacturing processes. (Beheshti, 2006)

Risk Assessment - Process as risk identification, risk analysis, and risk prioritization. Risk identification produces lists of project-specific risk items that are likely to compromise a project's success. Risk analysis assesses the loss in probability and magnitude for each identified risk item. Risk prioritization produces a ranked ordering of risk items that are identified and analyzed (Huang, chang, Li & lin, 2004)

CHAPTER II

LITREATURE REVIEW

Enterprise resource planning (ERP) systems have become a de facto standard for large and mid-sized organizations to run all their major functional and process operations. Generally, ERP consist of a series of functional modules that are integrated through standard business processes and includes all the data and information about vendors, customers, employees, and products. The common modules include accounting, sales and marketing, logistics, purchasing, manufacturing, human resources, and inventories.

The effective implementation of such a system can bring about many benefits, beginning with the most general, such as enterprise management and information flow enhancement. Consequently, improvement of economic indicators is achievable, which finally leads to an increase in enterprise profitability. However, the achievement of such benefits depends upon the effective implementation of the full functionality of the ERP system, which is quite difficult. There are a great many implementation projects that do not bring about the planned effects and thus considered a wasted cause. In this chapter, the researcher will focus on giving readers background first on the development of ERP term, then will go over various relevant literatures addressing the critical success and failure factors of ERP implementations.

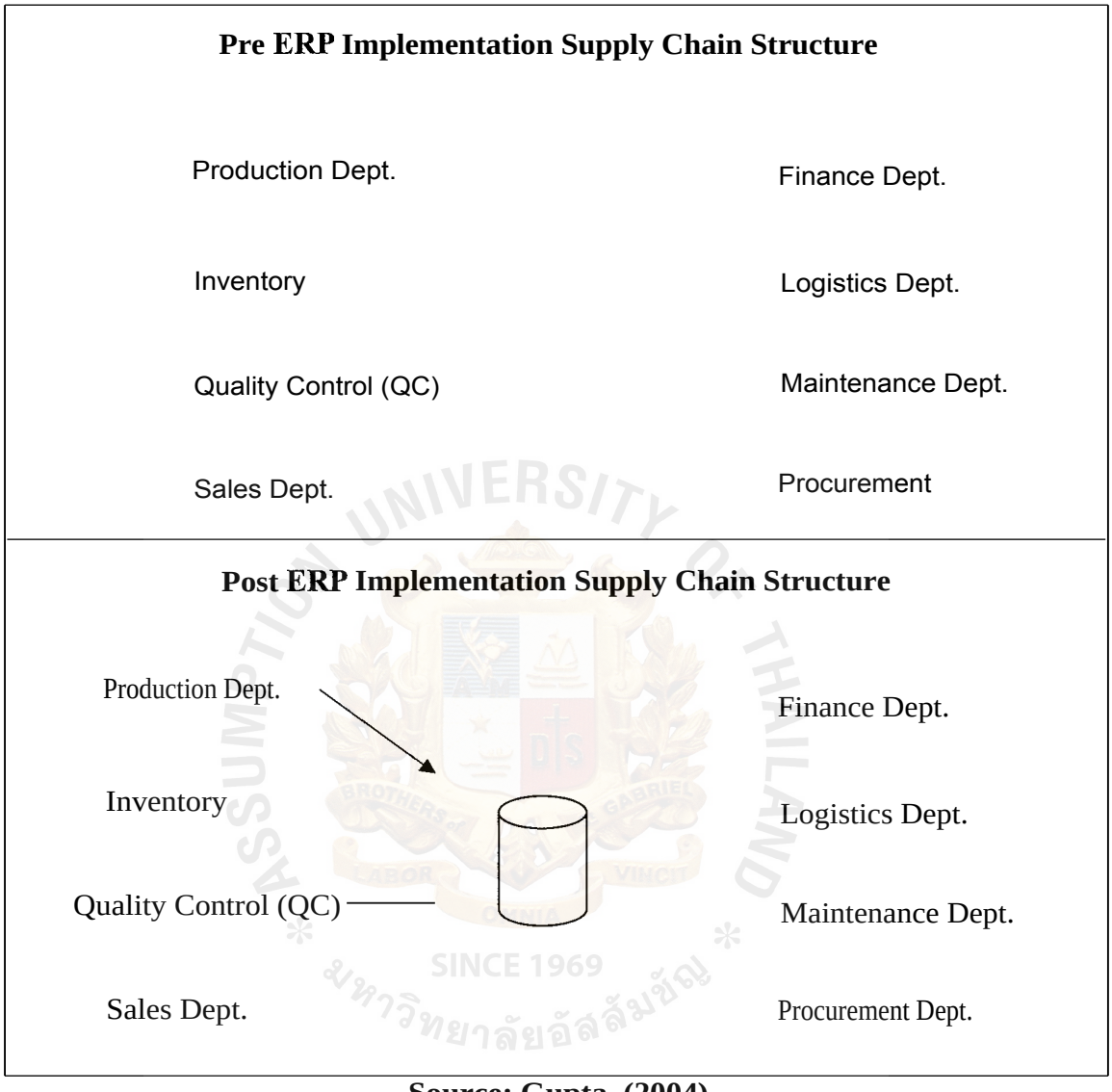
2.1 Background of Enterprise Resources Planning (ERP)

The development of the notion of enterprise engineering is a relatively recent phenomenon apparently triggered by the popularity of two major philosophies enterprise resource planning (ERP), and business process re-engineering (BPR). Their first appearance in the early 1990s have filled the corporate landscape. For example, they are said to be employed in nearly all of the US Fortune 500 companies (Buonanno, 2005). ERP systems are packaged software applications, the majority (60 percent) of projects costs are devoted to setup, installation, and customization of the software (Katerattanakul, 2006). The concept of ERP goes back to material resource

planning (MRP) which was born in the 1960s. A review of the literature suggests that ERP systems are used by small, medium and large corporations as well as government agencies and non-profit organizations. In recent years a growing stream of research has focused on the competitive advantage of ERP and the importance of considering the organization's business models and core competencies when making decisions for or against it. To take advantage of the competitive capabilities of ERP systems, managers and employees must understand the basic principles of ERP so that it can be used to its fullest potential (Beheshti, 2006).

(Laukkanen, 2007) ERP help managers in the manufacturing firms to reduce lead times, boost up their productivity and improve customer satisfaction. Before that systems like management information systems (MIS); integrated information systems (IIS); executive information systems (EIS); corporate information systems (CIS); and enterprise wide systems (EWS) had evolved. The raw material needs were calculated in MRP by forecasting on actual customer orders. Prior to this, card systems and spreadsheets were used to keep track. MRP-II widened the scope, by including a host of services like customer ordering, inventory control, production control, finance and accounting, etc. ERP came into picture only in 1993. It not only incorporated features of MRP-I and II, but also others like marketing support and post-sale field service, that increased flexibility.

Figure 2.1: Pre and Post ERP Data Structure



Source: Gupta, (2004)

In the early 1990s, Asia witnessed radical changes such as globalization, trade liberalization and privatization. Information and communication technology solutions floated to the surface as a way to run business in an effective and efficient manner (Huang & Palvia, 2006). In Thailand, Local based organizations increasingly played attention to the importance of using IT to gain advantage in competitive market. The Thai government also backed up various IT programs and subsidizing ERP implementations especially for SMEs (SIPA, 2009).

Looking at published Thai governmental statistics on business capital by industry one can see that among the largest sectors in the country as of 2009 are manufacturing and communication sectors. This rapid growth in these sectors is due to ever improving country infrastructure and business environment (MICT, 2009) Having ERP is an important tool to re-enforce strong supply chains that allow companies to comply with ISOs and other world standards. Having successful ERP deployments to the country's largest Sectors will eventually result in a positive outcome to the country.

Figure 2.2: Company Capital Registration by Industry

Summary of Business Registration Establishment (excluded Public limited Companies)

	ไตรมาส 3/51 Q 3/08	ไตรมาส 2/52 Q 2/09	ไตรมาส 3/52 Q 3/09
รวม	12,183	9,124	12,186
	54,323.67	30,992.60	31,243.4

	จำนวน / Number				หุนจดทะเบียน (ล้านบาท) / Registered Capital (M Baht)			
	ไตรมาส 3150 Q 3/07	lama 3151 Q3/08	ไตรมาส 2/52 Q 2/09	ไตรมาส 3/52 Q 3/09	ไตรมาส 3/50 Q 3/07	ไตรมาส 3/51 Q 3/06	ไตรมาส 2/52 Q 2/09	ไตรมาส 3/52 Q 3/09
ตามประเภทธุรกิจ								
รวม	0,561	12,1	9,124	12,186	62 46 7	23.	30.	31,2 4
1 การเกษตร ป่าไม้ ล่าสัตว์ และการประมง			87	95	6	.20	2.	774.40
2 การทำเหมืองแร่ และเหมืองหิน				7		.07	4.	25.)
3 การทำ หมืองแร และ มือง กา จัด	30		25	A	2	448.25	5.	151 30
4 การไฟฟ้า ก๊าซและก๊าซ ระ	1,	1,3	1,001	1286	1,7	93	9, 4.	990A
5 การ วส	29		41	65	8	42	1.	267.7)
6 การ วส การ ย ขายปลี และซ่อมรถ ยา	1, 11	1,4	1250	1.7	3,	0 40	2, 8.	443.23
7 จัก าน ย ๆ ลงใ สำนบคลลและของ ครัว น	3,	4,3	3.271	4,310	24	189.9	5, 3	019.10
8 รง ระบ ะกัดตาคาร	36	6		562	7,	676.32	3, 4	195.69
9 ก ส่ง านที่เก็บ แล		8	64	794	1,4	919.22	1, 1.	835A
10 ตัว างง งก งิน	05	1	7	102	24	870.05	8.	284A
11 บริ ต้า อสัง มทรพ การให้ แล บริ ทา	2,214	2,7	1,98	2,674	1,8	459.04	6, 5.	970.A
12 ก รบร และ รป้องกันประ ม ภาคบังคั		-	-	-			-	-
13 การศึก						3.05	259.2	91.85
14 ก านสุขภ พแ านสังคมสงเ		1		101	1	4 7	146.8	14A
15 รมชน สังค แล รส่ว	242	2	235	3	71	6	427.6	550
16 ลูกจางใน ว่วนบุ	-	-	-	-			-	
17 องค์ก ระหว่างประเทศ ประเทศอื่น ๆ และสมาชิก	-	-					-	
18 อื่น ๆ	-	-		-			-	

Source: Department of Business Development, (2009)

ERP implementation in general is relatively less expensive in Asia compared to Europe or USA due to cheaper consultancy man day rates and software license costs, yet they are complex undertakings and perhaps more difficult to successfully deploy in other regions, but once they are successfully implemented, significant improvements can be achieved such as easier access to reliable information, elimination of redundant data and operations, reduction of cycle times, increased efficiency hence reducing costs (Huang, 2006)

2.2 Defining ERP Project Success

Success means a degree or measurement of succeeding in something. It's also defined as a favorable or desired outcome (Webster, 2009)

In ERP implementations, management needs to define a set of criteria for measuring project success. An old proverb says, if you don't know where you want to go, the road you take does not matter. Project managers must take steps to bring all participant stakeholders on to the same page as far as success measurement is concerned. This may involve calling for multiple interactive sessions with stakeholders and going over the project charter. Once success criteria are defined and acceptable, then project managers must consciously report status on the distance traveled or Milestones (Kim, 2005)

Research by Peslak (2006) found that both cost and time performance relative to the budget will significantly define the success ratings of ERP implementations. Results from the survey of the research clearly suggest that on-time and on-budget implementations directly impacted success level of ERP projects. Similar researchers looked at different measures to define success. Other topics in this chapter will review different critical success measures compare and contrast them. From collected factors a list will be created and distribute to respondents of this research to provide their own judgment on those measurements.

2.3 Review of ERP Critical Success factors (CSFs)

In this section a collection of 20 selected factors from different literature reviews on ERP taking in consideration different elements covering four major categories: Organization, Resources, Project Approach and Technology. These four categories are a result of grouping all variables identified in CSF based on their nature

Table 2.1: ERP Critical Success Factors

CATEGORY	CRITICAL SUCCESS FACTORS (CSFs)
ORGANIZATION	1. Management support 2. Tolerance to change 3. Business Process Re-engineering 4. Assigned Financial budget 5. Technology Awareness
RESOURCES	6. Knowledge on subject of training 7. In-house resource skills 8. External resource mix 9. Resource availability 10. User satisfaction
APPROACH	11. Agreement on project goal 12. Team members composition 13. Implementation methodology 14. Project Champion 15. Monitoring and evaluation
TECHNOLOGY	16. Software Standard features support 17. Possibility of integration with other system 18. ERP platform 19. Current IT infrastructure support 20. ERP Complexity level

2.3.1 Management support – Top management support is needed throughout the implementation. The project must receive approval from top management aligned with strategic business goals. This can be achieved by tying management bonuses to project success. Top management needs to publicly and explicitly identify the project as a top priority (Fiona, 2001). Senior management must be committed with its own involvement and willingness to allocate valuable resources to the implementation effort. Lack of control over project milestones is found to have direct impact on project success (Huang, 2004). A research on Chinese manufacturers shows that involvement of project management is one of the most important factors in

implementation of information systems, such as ERP. The decision to implement ERP comes from top management However, it is common to find that management involvement stops as soon as they have allocated the resources and formed the project team. The result is an absence of visible top management support is prioritization of such projects and eventually a deviation from original set goals (Woo, 2007)

2.3.2 Tolerance to Change – Most companies that implement ERP are unlikely to have processes and structures compatible with the structure, tools, and types of information provided by ERP systems. For this reason, it is likely that companies implementing ERP will need to reengineer, at a minimum, their key processes to support the requirements of the ERP system (Woo, 2007)

Change management is important task to perform since the starting phase of the project and throughout the entire implementation life cycle. Enterprise wide culture and structure change should be managed, which include people, organization and culture change (Fiona, 2001). A culture with shared values and common aims is conducive to success. Organizations should have a strong corporate identity that is open to change. An emphasis on quality, a strong computing ability, and a strong willingness to accept new technology would aid in implementation efforts. Management should also have a strong commitment to use the system for achieving business aims (Kim, Lee & Gosain, 2005) a similar study by Shivers-Blackwell and Charles (2005) also focused on testing several hypotheses among which is the relationship between perceived ERP benefits and readiness toward change. Meaning that if an individual believes that change benefits him/her, then he/she is more willing to participate in that change.

2.3.3 Business Process Re-engineering **(BPR)** – Another important factor that begins at the project phase is BPR and minimum customization. It is inevitable that business processes are molded to fit the new system. Aligning the business process to the software implementation is critical. Organizations should be willing to change the business to fit the software with minimal customization. Software should not be modified, as far as possible (Themistocleous, Irani & OKeefe, 2001). Modifications should be avoided to reduce errors and to take advantage of newer versions and releases. Process modeling tools help aid customizing business processes without changing software code (Fiona, 2001). Broad reengineering should begin before choosing a system. In conjunction with configuration, a large amount of reengineering should take place iteratively to take advantage of improvements from the new system. Then when the system is in use reengineering should be carried out with new ideas. Quality of business process review and redesign is important. In choosing the package, vendor support and the number of previous implementers should be taken into account (Huang, 2004). A research by Schniederjans & Kim (2003) studied the correlation between Business Process Reengineering (BPR) and ERP implementations.

2.3.4 Assigned Financial budget – Should be closely identified with maintaining scope during an implementation. Cost overruns and developmental delays are costly, sometimes fatal results of ineffective planning. Home Depot, Lockheed Martin, and Mead Corporation are examples of companies that attributed their success of meeting ERP implementation budget to planning (Soja, 2006) .

2.3.5 Technology Awareness – Refers to degree of IT literacy currently available in an organization pre-implementation stage. From a financial perspective, having IT literate staff could massively reduce costs associated to training while it can shorten the learn curve of such new supply chain oriented systems (Arif, 2005)

Since ERP was first introduced into organizations, there has been an ongoing effort to Understand the evolution of IT awareness. The growth curve has become a standard, and widely known (Voordijk & Stegwee, 2005). This research offers framework of

study which divides IT readiness into four different stages: Initiation, Contagion, Control and Integration. The fourth stage in IT Maturity is the use of information resources to provide new benefits and support the overall company business strategies. Responsibility for operating the systems is transferred to the users and conventional data processing activities are tightly controlled by IT personals. Other research by Shivers-Blackwell and Charles (2005) tested a hypothesis which indicates that there is a significant positive relationship between computer awareness and ERP project success. A survey of 238 participants most of which were fresh graduates confirmed the hypothesis.

2.3.6 Knowledge on Subject of Training – Training users to use ERP is important because ERP is not easy to use even for highly educated managers with good IT skills. Adequate training can help increase success for ERP systems (Woo, 2007). The team should be familiar with the business functions and products so they know what needs to be done to support major business processes. The sharing of information within the company, particularly between the implementation partners, and between partnering companies is vital and requires partnership trust (Kim, Lee & Gosain, 2005) Training, re-skilling and professional development of the IT workforce is critical. User training should be emphasized, with heavy investment in training and re-skilling of developers in software design and methodology. Employees need training to understand how the system will change business processes. There should be extra training and on-site support for staff as well as managers during implementation. A support organization (e.g. help desk, online user manual) is also critical to meet users' needs after installation (Fiona, 2001).

2.3.7 In-house Resource Skills – Refers to availability of well-trained and knowledgeable personnel within the organization to cover all BPR areas resulting from new implementation. The "people element" and training aspect of an ERP implementation have historically received the least amount of attention. The paradox of this is that when this factor is ignored or downplayed, primarily because it does not have the largest quantifiable benefit, expenses are greatly increased in the long run. By treating resource training with little regard and financial support, it is not hard to realize the reality of delay, confusion and financial ruin that may result. The people element must be handled on two levels. At one level, employees must be trained on the new system in order to use it to continue day-to-day operations. The second level is educational exposure (Gargeya, 2005)

2.3.8 External Resource Mix – The reinforcement of a "team environment" is critical to the overall success of an ERP implementation. Members of the project team should be encouraged to support each other together with external participants, being team members of software implementers, to work towards common goals. This also leads to a "cross-pollination" effect, resulting in a more collaborative and self-sufficient mix of talent and responsibilities. In many cases, individual branches of the same organization have their own ways of doing things, and each function/department operates with different procedures and business requirements. Not unexpectedly, the larger, more global companies cite their diversity as an obstacle to success. Individual units and groups are often companies in their own right, and do not wish to be assimilated into one corporate culture (Gargeya, 2005)

2.3.9 Resource Availability – The ERP project should be consultants' top and only priority and their workload should be manageable. Team members need to be assigned full time to the implementation. As far as possible, the team should be co-located together at an assigned location to facilitate working together (Nah, 2001)

2.3.10 User Satisfaction – is critical to ERP implementation. Expectations at every level need to be communicated. Management of communication, education and expectations need to be clearly passed on to system end users. User input should be managed in acquiring their requirements, comments, reactions and approval on every step in the project (Wu, 2006). User satisfaction is regarded as the best surrogate measure of IS success. It is defined as the sum of one's feelings and attitudes toward a variety of factors related to the delivery of information products and services. A system without user satisfaction is less likely to be used and to produce beneficial results to a user community and the organization (Robey, Coney & Sommer, 2006). Results from research by Shivers-Blackwell and Charles (2005) showed significant positive relationship between users perceived satisfaction and ERP project success.

2.3.11 Agreement on Project Goal – Customers and vendors should legitimize their goals and objectives. A shared vision of the organization and the role of the new system and structures should be communicated to employees (Nah, 2001). New organizational structures, roles and responsibilities should be established and approved. Policies should be set by top management to establish new systems in the company. In times of conflict, managers should mediate between parties. Additionally, a clear business plan and vision to steer the direction of the project is needed throughout the ERP life cycle. A business plan that outlines proposed strategic and tangible benefits, resources, costs, risks and timeline is critical (Gargeya, 2005)

2.3.12 Team Members Composition - ERP teamwork and composition is important throughout the ERP life cycle. The ERP team should consist of the best people in the organization constituting of a strong cross-functional team (Huang, 2004). The team should have a mix of consultants and internal staff so the internal staff can develop the necessary technical skills for design and implementation both business and technical knowledge are also essential (Robey, 2006). The problem of coordination is counted as one of the most important issues leading to failure of a number of ERP implementations (Kim, Lee & Gosain, 2005). Cross-functional coordination may be enabled by project management structures such as a "steering committee", consisting of senior management from different corporate functions.

2.3.13 Implementation Methodology – There should be a clear business model of how the organization should operate behind the implementation effort. There should be a justification for the investment based on an approach and the change tied directly to the direction of the company. Project mission should be related to business needs and should be clearly stated (Fiona, 2001). Goals and benefits should be identified and tracked. The business plan would make work easier and impact on work will be more noticeable if a good project methodology is followed. Then the project must be formally defined in terms of its milestones. The critical paths of the project should be determined. Timeliness of project and the forcing of timely decisions should be managed. Deadlines should be met to help stay within the schedule to budget and to maintain credibility (Woo, 2007)

2.3.14 Project Champion – Project sponsor commitment is critical to drive consensus and to oversee the entire life cycle of implementation. Someone should be placed in charge and the project leader should champion the project throughout the organization. There should be a high level executive sponsors who have the power to set goals and legitimize change. (Fiona, 2001) states that a business leader should be in charge so there is a business perspective. Transformational leadership is critical to success as well. The leader must continually strive to resolve conflicts and manage resistance. A research by Gargeya and Brady (2005) indicated that among all surveyed companies, all respondents agreed that project champion plays a vital role in leading successful ERP adaptation. Also, Successful implementation is only achievable when project Champion have strong commitment to the project. His or her attitude will affect not only the flow of funds and information to the project, but also the subordinates view of the project, its future impact upon the company as a whole, and its impact upon the employees as valued and capable individuals.

2.3.15 Monitoring and Evaluation - monitoring and evaluation come into play at the shake down phase. Milestones and targets are important to keep track of progress. Achievements should be measured against project goals. The progress of the project should be monitored actively through set milestones and targets. Two criteria may be used (Fiona, 2001).

Woo (2007) suggest that communication is essential tool in monitoring the projects and for creating approval and widespread understanding of tasks. It is also tool for announcing, explaining or preparing people for change. Effective communication can increase commitment to change as well as for reducing confusion and resistance to change. Project management based criteria should be used to measure against completion dates, costs and quality. Then operational criteria should be used to measure against the production system. Monitoring and feedback include the exchange of information between the project team members and analysis of user feedback. There should be an early proof of success to manage skepticism. Reporting should be emphasized with custom report development, report generator use and user training in reporting applications. Management needs information about the effect of ERP on business performance. Reports or processes for assessing data need to be designed. These reports should be produced based on established metrics. It must include effective measurable project goals that meet business needs and are reasonable. Additionally, performance should be tied to compensation (Katerattanakul, Hon & Lee, 2006).

2.3.16 Software Standard Features Support – The overall ERP architecture should be established before deployment, taking into account the most important requirements of the implementation and how much of the standard features in ERP can be applied before reaching to customizations. This prevents reconfiguration at every stage of implementation (Fiona, 2001).

When the features of the software application do not correctly fit the business requirements two possible strategies can be identified: First, Change the business processes to fit the software with minimal customization. Second, Modify the software to fit the processes. This choice would slow down the project, could affect the stability and correctness of the software application and could increase the difficulty of managing future releases, because the customizations could need to be torn apart and rewritten to work with the newer version (Buonanno, Faverio, Ravarini & Tagliavini, 2005).

2.3.17 Possibility of Integration With Other System - There is a choice to be made on the level of functionality and approach to link the system to legacy systems. In addition, to best meet business needs, companies may integrate other specialized software products with the ERP suite. Interfaces for commercial software applications or legacy systems may be needed to be developed in-house if they are not available in the market (Fiona, 2001). Survey by Themistocleous, Irani & OKeefe (2001) show that 82% of respondents outlined that ERP integration is the biggest barrier to ERP implementation success. The objectives of the presented study were to identify and present the problems associated with ERP systems.

2.3.18 ERP Platform – There are two types of ERP (Wu, 2006): ERP package developers; they are ERP producers and/or vendors, e.g. Oracle. They are the groups who have developed or implemented the ERP system and will maintain it into the future. Developers using an ERP system; are staff involved in configuring and implementing the ERP-based system using requirements stated by the internal project team. They may also be internal to the user organization and possibly part of the IS/IT group or external to the organization, They could also be external contractor with special expertise in the implementation of the particular ERP system, or even a consulting group within the ERP producer/service suppliers.

2.3.19 Current IT Infrastructure Support – Appropriate IT and existing legacy systems are important in the initial chartering phase of the project. A stable and successful business setting involves existing business processes, organization structure, culture, and information technology. It determines the IT and organizational change required for success (Huang, 2004).

2.3.20 ERP Complexity Level **-** ERP packages may be configured to more closely fit an enterprise's structure, business practices and workflow Configuring the system involves making compromises and has limitations, given the adaptability of the software and the effort involved. This fine-tuning of the standard system is a key process in the implementation and requires translating business needs into appropriate parameter settings (Kim, Lee & Gosain, 2005)

2.4 Hypotheses

A tentative assumption made in order to draw out and test its logical or empirical consequences. A useful hypothesis is a testable statement which may include a prediction. Hypotheses should not be confused with a theory. Theories are general explanations based on a large amount of data (Webster, 2009)

Hi. All identified factors have an impact on ERP implementations success rate. This particular assumption is put forward to test whether factors under study do impact the variables or factors chosen. This hypothesis was derived from the topic of this research that focuses on looking at different success factors of ERP. This particular hypothesis is a test type hypothesis. It's a method for deciding which of the two contradictory claims the correct one is. In carrying out a test, we initially assume that a particular one of the two is the correct one. This claim will be rejected in favor of the second (alternative) claim if sample evidence is incompatible with the initial assumption. It is important to perform tests to find whether at all selected factors have value to ERP implementations. If they do then our assumption carried is proven and factors are relevant to our subject of study.

H2. Demographics of people involved in ERP projects impacts their response to importance level of different factors effecting ERP implementation success. This particular statement is put forward to test whether people demographics or different backgrounds have an impact on their response to questions relating to established success factors of ERP projects. After producing the first Hypothesis of this study, it is important to look at this research population and their background. To learn whether someone's background has an effect on his/her response to our questions is also learning more about this research direction. This hypothesis is also derived from our research topic which emphasize on obtaining opinions from ERP field experts. As with the first hypothesis, the researcher also using test type hypothesis that favors the assumption of an existing relation between respondents' auxiliary factors and their responses.

CHAPTER III

RESEARCH METHODOLOGY

This chapter will guide readers through the research methodology. The section will include data collection methods, sampling design, determination of sample size, and data analysis techniques.

3.1 Methods of Research Used

A review of vast literature helped the research to formulate the theoretical questions about the subject. Further reviews on various sub-topics relating to ERP help the researcher refine the questions and scope this study and eventually helped to understanding the critical factors that lead to success or failures of ERP project implementation.

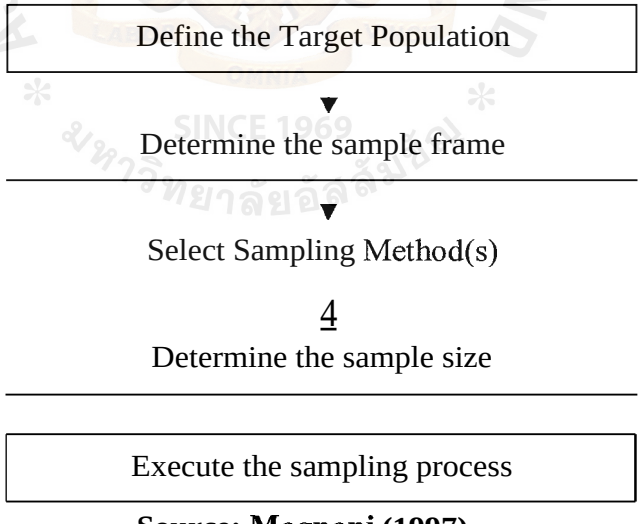
First, the researcher conducted a qualitative analysis among colleagues and industry experts investigating backgrounds related to ERP implementation. Findings from such discussions lead to subjects related to implementation details and all areas involved in creating successful ERP adaptation. Why do many ERP implementations result in failures? The idea of conducting quantitative research has become an indefinite next step investigating factors causing the success of ERP projects and their importance. The researcher decided to use questionnaire survey as a tool for collecting data. Data collected from surveyed participants were used to evaluate factors importance to ERP project implementation. Our purposive survey focused on sample of carefully selected individuals to fit with the research objectives.

Pilot study – A pilot survey was conducted to confirm the completeness and importance of each item in the instrument. A likert Scale questionnaire was developed. Around 50 respondents pre-selected from the previously interviewed firms were asked to fill out a copy of the questionnaire and asked to assess the importance of each item. The importance rating of each item was given scores of 1 (not important at all) to 5 (very important). The results indicated that each item scored 4 or higher in over 80 percent of the responses, suggesting that little further wording revision or new items were needed, Thus establishing instrument completeness. Inter-item consistency results showed that all correlations between two adjective pairs of each item were higher than 0.7 in reliability, indicating that there were no "double-barreled" conflicts among assigned categories (Factors)

3.2 Sampling Design Process

The sampling design process involves five steps as illustrated in Figure number 3.1

Figure 3.1: Sampling Design Process



Source: Magnani (1997)

3.2.1 Define Target Population

A purposive sampling is used to indentify targeted population for this research which is focused around IT professionals in Thailand. All participants must possess direct experience and expertise in one or more of the following five fields related to ERP: Project management, Consultancy, System development, IT management, and ERP usage. All are involved in the Software implementation and IT industry in Thailand. Participants with no ERP related background are not included in the target population. The researcher mostly used direct interviews with people working in ERP industry, Phone interviews, and Internet based survey distribution. The researcher distributed online survey to members of "Linked In" Supply chain online network. Linked **In** is world known business community. The site allows registered users to maintain a list of contact details of people they know and trust in business. The researcher used this website to reach out for more targeted population for the survey, in order to send them the questionnaire. All participants are actual employees in the IT industry in Thailand under one of the five selected research segments mentioned in the survey questionnaire

3.2.2 Sampling Frame

Selected participants were selected from multinational IT and supply chain services providers having local presentation in Thailand (Gartner group data quest survey, 2005) listed world largest ERP and supply chain providers who are local in Thailand. Under the umbrella of all shown organizations lie the well-known ERP solution offered directly and indirectly through a chain of certified solution vendors.

The sampling frame must be representative of the population. In Science, however, representative sampling is the only justified procedure for choosing individual objects for use as the basis of generalization, and is therefore usually the only acceptable basis for ascertaining truth. A frame may also provide additional secondary information about its elements; when this information is related to variables or groups of interest, it may be used to improve survey design. Additionally, this information can be used to ensure that a sample taken from that frame covers all demographic

categories of interest (Bartlet, 2001). Non-probability sampling is any sampling method where some elements of the population have no chance of selection. It involves the selection of elements based on assumptions regarding the population of interest, which forms the criteria for selection. Hence, because the selection of elements is nonrandom, non probability sampling does not allow the estimation of sampling errors. Purposive sampling is used in this research to target specific population believed to possess most knowledge on subject of research. Experts in ERP field are identified to be under five segments / groups. All respondents were pre-screened before distributing the survey to each. Respondents typically IT managers, ERP consultants, ERP project managers, and programmers are all involved in the Software implementation. Thailand is still booming in field of IT and ERP has a relatively short life when compared with knowledge and expertise available in the United States or Europe. Therefore finding enough expertise to participate in this research is deemed difficult. In addition, unwillingness to take part in our survey left the researcher to reach out to target population through direct survey distribution. Other issue was sizing the targeted population for our research which leads us to use rather more subjective and less expensive means of conducting the survey by using purposive sampling. The researcher also used proportional quota sampling to specify the minimum number of participants per sampled segment. The researcher is not concerned with having numbers that match each proportion in the target population. Instead, there should be enough participants to represent all groups in the population. This method is the non probabilistic analogue of stratified random sampling in that it is typically used to assure that smaller groups are adequately represented among target surveyed population (Oloruntoba, 2006).

3.2.3 **Sampling Methods**

Stratified Purposive sampling is used in this research. This described as a selection of sampling units within the segment of the population with the most information on the characteristic of interest. The procedure effectively assigns zero probability of inclusion to units towards the tails of the distribution believed to have minimal information or relevancy to all research subjects (Magnani, 1997). In most cases of purposive sampling, it is assumed that the person(s) making the sample selection is/are knowledgeable about the underlying dimensions on which the phenomena under study vary and are thus able to select the sample in such a way that these are appropriately covered (i.e., free from bias). A real-world example of using stratified sampling would be for a US political survey. If the respondents needed to reflect the diversity of the population of the United States, the researcher would specifically seek to include participants of various minority groups such as race or religion, based on their proportionality to the total population as mentioned above. A stratified survey could thus claim to be more representative of the US population than a survey of simple random sampling or systematic sampling.

The researcher used proportional quota sampling to specify estimated minimum number of participants per segment in each expertise category (Oloruntoba, 2006). Three steps were involved in conducting the purposive non proportional survey. The first step which was background screening was made by asking face-to-face questions and online profile check for respondents. This was done to determine respondent's eligibility and pass them the survey inquiry. The second step, was to send a Pre-Survey questionnaire. The researcher sent out a trial survey to all individuals to establish questionnaire variables reliability. Data collected was analyzed to improve the quality of questions given. The last and third step was to send out the final survey form to all the target population. The researcher is not concerned with having numbers that match each proportion in the target population. This method is used to assure that smaller groups are adequately represented among target surveyed population (Provided that strata are selected based upon relevance to the criterion, instead of availability of the samples)

3.2.4 Determine Sample size

Selected participants are people who are currently working for IT and supply chain service providers having local operations in Thailand. Among Global Companies having local presentation is a list taken from Gartner group data quest survey 2006 (see Table 3.1). Under the umbrella of all shown organizations lies world's most - known ERP solutions offered directly and indirectly through a chain of certified solution vendors in Thailand. There are also small local firms with abilities of providing customized IT solution that are not included in a given company count due to their small market share.

A total population of 200 participants was identified to participate in the survey given study time frame. Minimum intended representation per segment is set to 20 participants. This number reflects the smallest segment among surveyed population which is for project managers. Responses coming from individuals, regardless of their employer, represent person's opinion on subject of survey. All respondents are employed by one of the 15 identified organizations. The reason for choosing respondents coming from multinational organizations is to obtain local view on ERP while having the possibility to obtain opinions influenced by global view on the subject of research. Collected valid survey replies were 121 in total. Minimum count per segment was still met.

Table 3.1: World Leading Supply Chain and ERP Solution Providers

	Company	Global Revenue (million $)	Year
	SAP	2401.4	2006
2	Oracle Applications	4380.0	2006
	Infor Global Solutions	2100.0	2006
4	The Sage Group	1832.0	2006
5	Microsoft Dynamics	4200.0	2006
6	Unit 4 Agresso	465.2	2005
7	Lawson Software	390.8	2006
	Epicor	384.1	2006
9	Visma	305.5	2005
10	Industrial and Financial Systems (IFS)	288.0	2005
11	QAD	225.0	2006
12	Net Suite	67.2	2006
13	ABAS Software	62.6	2006
14	Ramco Systems	60.1	2006
15	SIV.AG	18.7	2006

Source: Gartner group data quest survey 2006

3.2.5 Execute Sampling process

In this section we will discuss the instrument used to collect data after having a clear set of pre- identified population will be discussed. In line with our research questions, the researcher intended to find out the value importance of CSFs to ERP implementation.

The main research instrument was development through review of ERP literature on project implementation success. Factors identified were put in form of a Pilot questionnaire sent out to about 50 participants. After receiving the results, researcher was advised to include new variables and take out the redundant ones. During the

second round, the researcher reached out to a bigger targeted population using direct interviews and internet. Some participants lacked the ability to understand complex English terms and therefore, All points had to be explained to them verbally in Thai language before they could evaluate the factors. The questionnaire was distributed to all five identified population segments. The segmentation is based on field work with regards to ERP area. Those fields namely are: Project managers, Consultants, System developers, IT managers, and ERP users.

Survey Design and Data Collection

The researcher recruited participants who met the purposive criteria. Non-qualified responses were not included in data analysis. All respondents were informed about the research objectives and questionnaire provided structure. Key terms and definitions were included for further reference.

The used questionnaire resulted in a great insight on the subject research. It allowed the researcher to first apply SPSS program to analyze the consistency of every factor to the study using statistical method called Cronbach's alpha this method measures how well a set of items (or variables) measures an underlying construct. Based on the Alpha results the researcher adjusted the survey. Twenty ERP CSFs were identified and distributed again to the full targeted research population.

To ensure that the minimum targeted sample can be met, the researchers applied more than one technique for collecting data. Direct interviews were used and proven effective with co-workers, and with those located geographically nearby. Phone interviews were used for individuals agreeing to take part but unwilling to meet face-to-face. The researcher used both English and Thai verbal skills to explain needed points before the respondent could answers the questions. Internet emailing was also used to reach out to further segment that the research didn't have direct access to.

3.3 Applied Statistical Methods for Analysis of Data

3.3.1 Data coding and cleaning

Data coding and analysis was done using SPSS program version 15.

3.3.2 Assessment of Internal Consistency

Assessment of consistency of measures involved using concepts: Unidimensionality and Reliability Assessment.

3.3.2.1 Unidimensionality - It measures whether several items that propose to measure the same general construct produce similar scores.

3.3.2.2 Reliability Assessment - is the consistency of a set of measurements or measuring instrument, often used to describe a test. This can either be whether the measurements of the same instrument give or are likely to give the same measurement (test-retest), or in the case of more subjective instruments, such as personality or trait inventories, whether two independent assessors give similar scores (inter-rater reliability). Reliability is inversely related to random error (Chaudhuri, 1992).

Cronbach's Alpha a statistics tool used as a measure of the reliability of a psychometric instrument. It was first named as alpha by Cronbach (1951), as he had intended to continue with further instruments. Cranach's alpha is a coefficient of consistency and measures how well a set of variables or items measures a single, one-dimensional latent construct. Alpha is an unbiased estimator of reliability if and only if the components are essentially τ-equivalent. Under this condition the components can have different means and different variances, but their co variances should all be equal - which implies that they have 1 common factor in a factor analysis.

3.3.3 Method of Statistical Analysis

In this section the tool used through help of SPSS program to analyze variances of all factors is defined.

3.3.3.1 T-Test Of the null hypothesis that the means of two normally distributed populations are equal. Given two data sets, each characterized by its mean, standard deviation and number of data points; some kind of t-test can be used to determine whether the means are distinct, provided that the underlying distributions can be assumed to be normal. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then usually states it state those two groups do not differ is rejected in favor of an alternative hypothesis, which typically states that the groups do differ.

In this research t-test used to look whether auxiliary variables affected the judgments of the respondents is used.

3.3.3.2 Analysis of One Way Variance (ANOVA) is a collection of statistical models, and their associated procedures, in which the observed variance is partitioned into components due to different explanatory variables. ANOVA produces an F statistic, the ratio of the variance among the means to the variance within the samples. The results of a one-way ANOVA can be considered reliable as long as the following assumptions are met: Response variables must be normally distributed or approximately normally distributed, samples are independent and variances of populations are equal.

It was particularly useful to use ANOVA to find differences in opinion between respondents based on different demographics while realizing the co-variance relationship of all variables belonging to their set categories

CHAPTER IV
DATA ANALYSIS

This chapter will present the results of data collected from respondents who are working in the IT industry in Thailand. The following Section will include respondents demographics, reliability assessment, factor analysis and ANOVA presentation.

4.1 Survey Response

The final form of the questionnaire was given to a total of 200 individuals; but only 121 replies were identified to be matching to researcher's screening criteria. Constrains on data collection are described in the last chapter. Table 4.1 shows survey distribution and summary responses:

Table 4.1: Respondents distribution per Segment

Segment	Frequency	Percent
Project management	20	16.5
System consultant	22	18.2
System development	21	17.4
IT manager	22	18.2
System user	36	29.8
Total	**121**	**100.0**

4.2 Respondents Demographics

Under this section the researcher looked at several Auxiliary aspects related to respondents' background classified as below:

4.2.1 Years of Experience in ERP field

The questionnaire looked at the number of years respondents spent working full-time in the area of ERP. About 56% of our survey respondents have between 2 to 4 years of experiences, While 30% possess an experience between 4 to 6 years working experience.

Table 4.2: Respondents Years of Experience

Variable	Frequency	Percent	Cumulative Percent
0.0 – 2 Years	6	5%	5%
2.1 – 4 Years	68	56.2%	61.2%
4.1 – 6 Years	37	30.6%	91.7%
6.1 – 8 Years	10	8.3%	100%
Total:	121	100%	

4.2.2 Source of Direct Experience & Knowledge on ERP

Here we looked at learning source of participants to understand whether such local respondents will assign different weights to (CSFs) than those who experienced international ERP implementations. As shown in Table 4.3, 84% of the respondents worked on local projects and do not have mixed international implementation skills. Although all respondent work for multinational organizations.

Table 4.3: Source of Direct Experience & Knowledge on ERP

Category	Frequency	Percent
Local (Thai)	84.3	84.3
International	15.7	15.7
Total	**100**	**100**

4.2.3 Company Area

An auxiliary look at the respondents' organization origin and management sows that all respondents are working for multinational organizations in Thailand.

Table 4.4: Company Area

Category	Frequency	Percent
International	121	100

4.2.4 Company Size

This variable in demographics of the respondents reflects the size of local operations in Thailand and not total employed staff in case of multinational organizations. Local staffs operate almost independently from other locations although staff exchange happens especially in large scale projects that require special expertise that are not available among the pool of local consultants (See Table 4.5) In this research; one can see that 97% of respondents are working with companies that have less than a 100 staff while only 3% come from relatively larger represented organizations.

Table 4.5: Company Size

Category	Frequency	Percent
100>	118	97.5
200>	3	2.5
Total	**121**	**100**

4.2.5 Company Business

It is important to consider the type of business the respondents perform or come from because it could have an effect on their judgment. Specializations in one area in any business tend to result in response bias and therefore it is necessary to find out such bias will occur in our research after performing the ANOVA test.

Table 4.6: Company Business

Category	Frequency	Percent
Hardware Services Provider	3	2.5
Supply Chain Services Provider	33	27.3
ERP Project Implementer	52	43
Business Consultancy Firm	33	27.3
Total	**121**	**100**

4.3 Descriptive statistics on respondents

Descriptive statistics are used to describe the basic features of the data in a study. This provides simple summaries about the sample and the measures. Together with simple graphics analysis, this forms the basis of virtually every quantitative analysis of data. In this research the likert scale from 1 to 5 which means the factors means can vary. Score distribution is a summary of the frequency of individual values or ranges of values for a variable. The simplest distribution would list every value of a variable and the number of persons who had each value (Shivers-Blackwell & Charles, 2005).

In this study of factors important to ERP, results showing all selected factors having high importance to the success of ERP implementation. This proves the first hypothesis of this research by showing that all selected factors effect ERP success. Following Tables (4.7 to 4.10) showing means of all identified factors. The tables are divided by factors their segments or categories.

Table 4.7: Grouped by Organization Factor

Category	N	Mean
Management support	121	4.20
Tolerance to change	121	4.21
Business Process Re-engineering	121	4.21
Assigned Financial budget	121	4.18
Technology Awareness	121	4.20

Table 4.7 shows all factors under the organization category have a mean higher than 2.5 on a 5.0 scale which means that all factors in this segment highly affect the success of ERP. It can be concluded that all respondents believed that all five factors are of high importance to ERP implementation.

Table 4.8: Grouped by Resources Factor

Category	N	Mean
Knowledge on subject of training	121	4.17
In-house resource skills	121	4.17
External resource mix	121	**4.19**
Resource availability	121	4.21
User satisfaction	121	4.21

Table 4.8 shows all factors under the resource category have a mean higher than 2.5 on a 5.0 scale which means that all factors in this segment highly affect the success of ERP. It can be concluded that all respondents believed that all five factors are of high importance to ERP implementation.

Table 4.9: Grouped by Project Approach Factor

Category	N	Mean
Agreement on project goal	121	4.04
Team members composition	121	4.04
Implementation methodology	121	4.05
Project Champion	121	4.05
Monitoring and evaluation	121	4.04

Table 4.9 shows all factors under Project Approach category have a mean higher than 2.5 on a 5.0 scale which means that all factors of this segment highly affect the success of ERP. It can be concluded that all respondents believed that all five factors are of high importance to ERP implementation.

Table 4.10: Grouped by Technological Factors

Category	N	Mean
Software Standard features support	121	4.08
Possibility of integration with other system	121	4.08
ERP platform	121	4.12
Current IT infrastructure support	121	4.09
ERP Complexity level	121	4.08

Table 4.10 shows all factors under Technology category have a mean higher than 2.5 on a 5.0 scale which means that all factors of this segment highly affect the success of ERP. It can be concluded that all respondents believed that all five factors are of high importance to ERP implementation.

4.4 Reliability Assessment

The data for this research was constructed using a scaled responses. It is deemed necessary to do readability assessment test for all variables to check if factors are relevant to the subject of study Cronbach's Alpha is commonly used as an estimator of the internal consistency and is therefore used. Cronbach's alpha value will increase as the inter correlations among test items increase, and is thus known as an internal consistency estimate of reliability of test scores (Chaudhuri, 1992). Cronbach's Alpha indicates the degree to which a set of items measures a single uni dimensional latent construct. Thus, Alpha is most appropriately used when the items measure different substantive areas within a single construct. Results from the Alpha test of factors selected in this research shows all variables are reliable with Alpha higher than 0.70. A variable is accepted if it has a value of 0.7 or more (Chaudhuri, 1992).

4.5 t-test is used in this research to find if the differences in respondents' backgrounds have an effect on their score. Among all auxiliaries selected, t-test is most suitable for testing company size and company type variables as the variances are outlined in pairs.

Steps to calculate paired sample t-test and Sample Statistical Significance:

Below is an elaboration on how SPSS software finds statistical significance and thus allows the researcher to determine differences between auxiliary factors of paired groups (Chaudhuri, 1992).

a. Setting up a hypothesis: To calculate the paired sample t-test, first we have to set up the hypothesis. In a paired sample t-test, we set up two hypotheses. The first is null hypothesis; the second hypothesis in the paired sample t-test will be an alternative hypothesis, which assumes that the means of two paired samples are not equal.

b. Thrush hold level of significance: After making the hypothesis, level of significance is set. In most of the cases in the paired sample t-test, significance level is 5% (0.05)

c. Calculating t parameter: The t-value will be positive if the first group mean is larger than the second group and negative if opposite is true.

d. Statistical significance: Once a t value is determined, a p-value can be found by inputting all values in SPSS software. In statistics, a result is called statistically significant if it is unlikely to have occurred by chance. If the calculated p-value is below the threshold chosen for statistical significance (usually 5% (0.05) level) then null hypothesis is rejected in favor of the alternative hypothesis.

Table 4.11: t-test of Company Size Variable

Company size		Mean	Std. Deviation
Organization	100>	4.2	0.66
	200>	4.0	0.00
Resources	100>	4.2	0.60
	200>	3.7	0.58
Project Approach	100>	4.0	0.58
	200>	4.0	0.00
Technology	100>	4.1	0.48
	200>	4.0	0.00

variables	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	T	df	P-Value
Organization	6.3	0.13	0.54	119	0.60
Resources	0.5	0.25	3.3	117	0.13
Project Approach	1.7	0.19	1.52	119	0.88
Technology	2.0	0.15	0.33	119	0.73

Table 4.11 indicate that the company size variable has no effect on any of factors categories given P-Value is higher than 5% significance threshold. This finding helps to answer on the second hypothesis which respondents auxiliary variables effected

their scoring to factor importance. Respondents' company size had no effect on their scoring.

Table 4.12: T-test for Company Type Variable

Company size		Mean	Std. Deviation
Organization	Local(Thai)	4.2	0.63
	International	4.2	0.72
Resources	Local(Thai)	4.1	0.59
	International	4.2	0.60
Project Approach	Local(Thai)	4.0	0.48
	International	3.9	0.60
Technology	Local(Thai)	4.1	0.46
	International	4.2	0.50

variables	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	T	df	P-Value
Organization	1.0	0.30	-0.38	119	0.70
Resources	1.0	0.31	-1.83	119	0.70
Project Approach	1.2	0.26	1.11	119	0.26
Technology	1.4	0.23	-0.99	119	0.32

Table 4.12 indicates that the company type variable also had no effect on any of factor categories given p-Value is way higher than 5% significance threshold. This finding helped to answer on the second hypothesis of this research that respondents' auxiliary variables effected their scoring to ERP factor importance respondent's company type had no effect in this case.

4.6 One Way ANOVA Test (Analysis of Variances) It was particularly useful to use ANOVA in this research find differences in opinion between respondents based on different demographics while realizing the co-variance relationship of all variables belonging to their set categories. Similarly to t test ANOVA was used to test remaining 3 auxiliaries that have more than 2 components. Typically, the one-way ANOVA is used to test for differences among at least three groups, since the two-group case can be covered by a t-test. The results of a one-way ANOVA can be considered reliable as long as the following assumptions are met:

Response variable must be normally distributed, Samples are independent and Variances of populations are almost equal. Similar to t-test, Anova looks at significance level from SPSS calculation against the thrush hold base significance indicator of 5%. If result from SPSS significance is greater than Thrush Hold then we can concluded that the independent variable has no effect on the tested groups.

Table 4.13: ANOVA Test for Participants Years of Experience in ERP

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Organization	Between groups	1.20	3	0.40	0.95	0.41
	Within Group	49.20	117	0.42		
	Total	50.40	120			
Resources	Between groups	0.21	3	0.07	0.18	0.90
	Within Group	43.70	117	0.37		
	Total	43.90	120			
Project Approach	Between groups	1.05	3	0.35	1.40	0.24
	Within Group	29.30	117	0.25		
	Total	30.35	120			
Technology	Between groups	1.09	3	0.36	1.67	0.17
	Within Group	25.54	117	0.21		
	Total	26.64	120			

Table 4.13 indicates that regardless of years of experience in ERP field, all participants placed high importance to factor scoring. The one way Anova test was carried out by SPSS software and it looked at survey set ranges of respondents' years

of experience and tested this auxiliary from survey scores. Tests were carried both ways within factor segments and across all segments.

Table 4.14: ANOVA Test for Different Job Position

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Organization	Between groups	1.36	4	0.34	0.81	0.52
	Within Group	49.03	116	0.42		
	Total	50.4	120			
Resources	Between groups	1.22	4	0.30	0.82	0.51
	Within Group	42.68	116	0.36		
	Total	43.90	120			
Project Approach	Between groups	0.60	4	0.15	0.59	0.66
	Within Group	29.75	116	0.25		
	Total	30.35	120			
Technology	Between groups	0.80	4	0.20	0.90	0.46
	Within Group	25.83	116	0.22		
	Total	26.64	120			

Table 4.14 indicates significance factors from all groups are greater than 5% thus showing that regardless of respondents' different job positions, all participants placed high importance to factor scoring. This finding contribute back to answer the second hypothesis of this research which respondents' auxiliary variables effected their scoring to ERP factor importance. In this case respondent's job position had no impact to their scoring.

Table 4.15: ANOVA Test for Company Business

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Organization	Between groups	1.56	3	0.52	1.24	0.29
	Within Group	48.83	117	0.41		
	Total	50.40	120			
Resources	Between groups	1.30	3	0.43	1.19	0.31
	Within Group	42.60	117	0.36		
	Total	43.90	120			
Project Approach	Between groups	0.63	3	0.21	0.83	0.47
	Within Group	29.72	117	0.25		
	Total	30.35	120			
Technology	Between groups	0.97	3	0.32	1.47	0.22
	Within Group	25.66	117	0.21		
	Total	26.54	120			

Table 4.15 indicate significance factors collected from all groups are greater than 5% thus showing that regardless of respondents' company business, all participants placed high importance to factor scoring. This finding contribute back to answer the second hypothesis of this research which respondents' auxiliary variables effected their scoring to ERP factor importance? In this case respondent's company business had no impact to their scoring.

CHAPTER V
CONCLUSIONS AND IMPLICATIONS

This chapter concludes results from data analysis given in the previous chapter. The researcher will include a conclusion section, research implications, research limitations and direction for future research.

5.1 Conclusions

The first hypothesis is acceptable since all identified factors have an impact on ERP implementation success rate. All factors identified were proven to have a high significance on ERP success according to the survey conducted in Thailand. The second hypothesis is also accepted since results from both t-test and ANOVA showed that company size has a relationship in scoring to factors of Organization category. While company Type has no effect on all four category factors. Participants' years of ERP experience has no relation to technology category factors. Participants' job positions didn't have effect on scoring for all category factors. Company business did have an effect on both Organization and Technology related factors.

Reliability tests showed all respondents, regardless of their backgrounds, gave a high score to all 20 factors. Research sampling method did prove effective since data results showed high reliability between co-variances of all variables selected. Participants in general, gave a very high importance to all 20 factors of the research showing that all factors collected are relevant to the subject of study. Researcher choice of using ANOVA and t-test statistical tools provided the readers with ability to understand mean and variances of all answers. On an advanced level, both tools revealed viable facts about respondents' demographics in relation to their replies to the questionnaire. The researcher used a wide collection of published literature addressing ERP issues in both developed and developing nations. The readers should also make use of given case studies to understand the importance of having a successful ERP implementation. Throughout chapter two, readers can find literature collected under each ERP factor collected. A main driver of this study was taken from real life examples of ERP critical success factors (CSFs). The research also allocated

one section to discuss CSFs in developing nations like Thailand. It seems that both Organizational and external factors play a bigger role in ERP deployment success. Things like public infrastructure and globalization are among factors discussed and believed to have a positive impact.

5.2 Research Implications

This research provides a compilation of all previously identified ERP implementation success factors, through a clearly structured methodological approach. The same factors could be incorporated into development of strategies to overcome ERP software implementation hurdles in real life.

In Thailand, there is no published research yet discussing experts' opinion on subject of ERP. The researcher found it even more difficult to locate articles on the ERP subject discussing success or failure of ERP as of today. Lack of proper local research material is believed to be the newness of ERP technology in Thailand. There are few countable local companies providing customized Supply chain solutions and as shown, majority of Implementations are still done by multinational companies. From all other international sighted literature, very few research uses ANOVA statistical technique to look at evaluation process of factors effecting ERP success. This also gives a power to scholars to apply similar methodologies to their own research. The value of this paper is also that it presents companies wishing to implement ERP as well as vendors and consultants with a set of critical success factors that are proven to be applicable in Thailand. Understanding those critical success factors would lead to a smoother implementation path.

This research advanced the knowledge of SPSS by providing readers with a framework of analysis to identify factors using this statistical software. The research also advanced the knowledge of readers on the ERP subject and success factors by giving them wide lectures covering most issues related to implement new systems today. This research also helps readers understand the co-relation of all factors identified by providing a categorization of all factors. Such categorization was not taken from other researches but rather build after successfully lunching a pilot survey

which helped the research understand the behavior of ERP CSFs using statistical alpha tools. All factors given are implied to any ERP implementation. The readers will use this research to validate their past understanding of such factor. all collection of opinions from industry experts and is quiet relevant to the business of ERP Implementation.

5.3 Limitations and Future Direction

Readers of this research should perceive this study as an attempt to enter into the field of Exploring more critical success factors on the ERP subject. Unfortunately, the sample population could not cover all IT companies involved in the ERP industry in Thailand. This caused our data to be limited to surveyed population. Part of the reason behind lack of respondent was difficulty to access the right people. Another part was time limitations related to deadlines of submitting this research. The researcher planned to distribute further questionnaires to include smaller segments in this research. Perhaps readers should take upon this opportunity to come up with similar researches in Thailand.

Further research can be done to focus on a particular industry such as manufacturing as it seems to have a one of the biggest capital investments in Thailand and known globally by heavy supply chain investment nature. Findings from sighted literature shows that manufacturing is the birth place of ERP theories and is still quiet relevant to research upon.

There is still a chance of respondents' biases when using purposive survey. Experts in single fields of work tend to be bias if they allow their judgment to incorporate with personal experiences rather than pure facts. To avoid such miss-happening the research needs to first include more participants, and second have a stronger screening methodology applied to address biases.

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APPENDICES

APPENDIX A:

SURVEY INSTRUMENT

PART 1
GENERAL INSTRUCTIONS

This survey is intended to capture your expert opinions on different critical Factors influencing the success of ERP Projects implementation. You will be asked to evaluate each identified factor importance on scale from 1 to 5, one being least important and five being most influential to their factor.

DEFINITION OF KEY TERMS

Success – is a degree or measurement of succeeding in something. It's also defined as a favorable or desired outcome (Webster, 2009)

Material Requirement Planning (MRP) – is software based production and material control system used to co-manage manufacturing processes. (Beheshti, 2006)

Enterprise Resource Planning (ERP) - are commercial software packages that enable the integration of transaction-oriented data and business processes throughout an organization (Kim, Lee & Gosain, 2005)

Critical Success factor (CSF) – is a Business term for an element which is necessary for an organization or project to achieve its mission (Woo, 2007)

An Expert Witness – is someone who by virtue of education, Training, Skill, or experience is believed to have knowledge in a particular subject beyond that of an average person sufficient enough that others may rely on officially or legally (Wikipedia encyclopedia, 2009)

Risk assessment - Process as risk identification, risk analysis, and risk prioritization. Risk identification produces lists of project-specific risk items that are likely to compromise a project's success. Risk analysis assesses the loss in probability and magnitude for each identified risk item. Risk prioritization produces a ranked ordering of risk items that are identified and analyzed. By (Huang, 2004)

Likert Scale - is a psychometric scale commonly used in questionnaire and is the most widely used scale in survey. When responding to a likert question the respondents reply with level of agreement to statements in the question. Median value represents the point on the Likert scale at which half the responses are above and half are below; whereas mode value represents the point on the Likert scale that occurs most frequently. (Katerattanakul, 2006)

PART 2: QUESTIONNAIRE, DEMOGRAPHICS DETAILS

CRITERIA	MEASURES ADOPTED IN THIS QUESTIONNAIRE
PERSONAL DATA	• Name (Not mandatory) _____ • Years of experience in ERP system (select one only) : 0-2 ☐ 2-4 ☐ 4-6 ☐ 6-8 ☐ 8-10 ☐ Over ☐ • Which of the following ERP areas represent your current Position? (select one only) Project management ☐ System consultant ☐ System development ☐ IT manager ☐ System User ☐ None ☐ • The source of your direct Experience & Knowledge on ERP subject? Local (Thai) ☐ International ☐
COMPANY DATA	• Company size, local based staff? 100 > ☐ 200 > ☐ 300 > ☐ 400 > ☐ 500 > ☐ 600 > ☐ 700 > ☐ 1000 < ☐ • What best describe your company's business? (select one only) A. IT& Network services provider ☐ B. Hardware services Provider ☐ C. Supply chain Services provider ☐ D. ERP project implementer ☐ E. Business Consultancy firm ☐ F. Others _____ ☐

PART 3
QUESTIONNAIRE

ORGANIZATION – perhaps it's the most central of all selection criteria is to understand whether the organization is ready for process change? How the company's resources and money are can be stretched to fit the adaptation of new way of working or whether such change will bring about tangible profit margins on the long run? *Please indicate the extent to which of the following factors contributes to the ultimate success of ERP projects.*

Organization contribution to **ERP** success	Extremely Low (1)	Moderately Low (2)	Average (3)	Moderately High (4)	Extremely High (5)

Factor	(1)	(2)	(3)	(4)	(5)
1. Management support					
2. Tolerance to change					
3. Business Process Re-engineering					
4. Assigned Financial budget					
5. Technology Awareness					

RESOURCES – In the absence of in-house expertise, enterprises have turned to outside consultants to facilitate the ERP implementation process. Management of in-house and external human resources in a coordinated process is critical for success of ERP success and has been shown to be impediments to successful implementation. *Please indicate the extent to which of the following factors contributes to the ultimate success of ERP projects.*

Resources contribution to ERP success	**Extremely Low (1)**	**Moderately Low (2)**	**Average (^{3})**	**Moderately High (4)**	**Extremely High (5)**

Factor	**(^{1})**	**(2)**	**(^{3})**	**(4)**	**(^{5})**
1. Knowledge on subject of training					
2. In-house resource skills					
3. External resource mix					
4. Resource availability					
5. User satisfaction					

PROJECT APPROACH – Implementing an ERP system is a careful exercise in strategic thinking, precision planning, and negotiations with departments and divisions that requires careful selection and the appropriate project management structure and methods. *Please indicate the extent to which of the following factors contributes to the ultimate success of ERP projects.*

Project Management contribution to ERP success	**Extremely Low (1)**	**Moderately Low (2)**	**Average (3)**	**Moderately High (4)**	**Extremely High (5)**

Factor	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
1. Agreement on project goal					
2. Team members composition					
3. Implementation methodology					
4. Project Champion					
5. Monitoring and evaluation					

TECHNOLOGY – ERP packages may be configured to more closely fit an enterprise's structure, business practices and workflow. Configuring the system involves making compromises and has limitations, given the adaptability of the software and the effort involved. This fine-tuning of the standard system is a key process in the implementation and requires translating business needs into appropriate parameter settings. *Please indicate the extent to which of the following factors contributes to the ultimate success of ERP projects.*

Technology Design contribution to ERP success	**Extremely Low (1)**	**Moderately Low (2)**	**Average (^{3})**	**Moderately High (4)**	**Extremely High (5)**

Factor	**(^{1})**	**(^{2})**	**(^{3})**	**(^{4})**	**(^{5})**
1. Software Standard features support					
2. Possibility of integration with other system					
3. ERP platform					
4. Current IT infrastructure support					
5. ERP Complexity level					