8-2007

The Impact of Organizational Attributes on Project Performance as Measured by On-Time Delivery and Budget

Zeid El-Akkad
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Zeid El-Akkad entitled "The Impact of Organizational Attributes on Project Performance as Measured by On-Time Delivery and Budget." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Industrial Engineering.

Rupy Sawhney, Major Professor

We have read this thesis and recommend its acceptance:

Xuipeng Li, Denise Jackson

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a dissertation written by Zeid El-Akkad entitled “The Impact of Organizational Attributes on Project Performance as Measured by On-Time Delivery and Budget.” I have examined the final electronic copy of this dissertation for form and content and recommended that it be accepted in partial fulfillment of the requirements for the degree of Masters of Science, with a major in Industrial Engineering.

Dr. Rupy Sawhney, Major Professor

We have read this dissertation
And recommended its acceptance

Dr. Xuipeng Li

Dr. Denise Jackson

Accepted for the Council:

Carolyn Hodges

Vice Provost and Dean of the
Graduate School

(Original signatures are on file with official student records)

The Impact of Organizational Attributes on Project Performance as Measured by On-Time Delivery and Budget

A Thesis Presented for
the Master of Science
Degree
The University of Tennessee, Knoxville

ZEID EL-AKKAD
August 2007

DEDICATION

I would like to dedicate this thesis to my parents, Nimer and Hala El-Akkad, for their never-ending support throughout my entire collegiate career, and also to my two brothers, Shaker and Yazan, for their support and inspiration.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank God for giving me the determination to always finish what I start. Secondly, I am grateful to my parents for helping me and always pushing me to be the best that I could be.

I wish to thank the entire faculty and staff of the Industrial and Information Engineering department of the University of Tennessee, Knoxville. I would like to express my gratitude to Dr. Rupy Sawhney in particular for always being there when I needed him. Dr. Sawhney was my advisor and mentor throughout my years at the University of Tennessee.

My gratitude goes out to the graduate research assistants in the Industrial Engineering department at the University of Tennessee for supporting me through my writing of this thesis, and to Britni Holland for editing and proofreading my thesis.

To everyone who helped me get where I am today, thank you.

Lastly, I wish to thank Shelley for always standing by my side and supporting me no matter what.

ABSTRACT

. Before we determine what lean tools are suitable for an office environment and how to modify those tools to make them more suitable and in order to develop a lean office, it is important to understand the different processes and aspects within an office. For this reason, better understanding of office processes and aspects helps facilitate the deployment and implementation and modification of different lean techniques to better suit the office environment. The purpose of this paper is to identify seven different factors to compare against one another and against project performance in terms of on-time delivery and budget. The seven factors are as follows: business sector, size of the organization, office layout, information processing, data flow, location, and interaction or lack of interaction among various departments within an organization. A hypothesis will be developed regarding each of these factors, and subsequently a survey will be created and conducted. A statistical analysis of this survey will be done using primarily a Chi Square test to determine whether our hypotheses can be validated by the data.

TABLE OF CONTENTS

Chapter Page

CHAPTER I 1
Introduction 1
Lean Office and Background 1
Project Management: 4
Goals and Outline 6
CHAPTER II 9
Literature Review 9
Data Interchange 9
Office layout 12
Office Interactions 14
Information Processing 16
Location 17
Size 20
Sector 21
CHAPTER III 25
Methodology 25
Survey 25
Sample Size 26
Significance Testing 28
Chi Square Test 29
Fisher's Exact Test 30
Monte Carlo Simulation 30
CHAPTER IV 32
Results and Discussion 32
Data Interchange Analysis 33
Office layout Analysis 35
Office Interactions Analysis 36
Information Processing Analysis 37
Location Analysis 38
Size Analysis 40
Sector Analysis 42
CHAPTER V 44
Conclusions and Recommendations 44
LIST OF REFERENCES 48
APPENDIX A 52
SURVEY 52
APPENDIX B 55
Vita 71

CHAPTER I
INTRODUCTION

Lean Office and Background

Lean manufacturing is a philosophy that is based on the identification, reduction, and potential elimination of waste to improve overall customer satisfaction. Competitive businesses are more likely to sustain the tough market conditions and lend job security when implementing lean manufacturing principles. Many organizations have responded to this concern by outsourcing their manufacturing bases abroad while still continuing to operate their other administrative units within their borders. However, in an ever-expanding market scenario, companies still find it important to cut costs by adapting the lean manufacturing techniques in their office units. Also, business enterprises estimated that around 60% to 80% of the cost of meeting a customer's specifications is administrative and non-production related. Thus, office environments are now identifying, refining, and implementing the lean manufacturing techniques to copy the triumph achieved in the production environment.

Lean strategies were often conceived as an effective tool on a shop floor, but businesses have improved their productivity up to two or three times by including office spaces in the lean implementation strategies. This evolution has led to the birth of the term *lean enterprise*, which is now a recurring and commonly used terminology following its venture into different segments of

business. Through effective use of lean principles, many firms have raised their productivity significantly by streamlining and reducing their waste. The majority of products generated or services rendered require a considerable amount of time and energy to ensure optimum customer satisfaction. A customer can be won or lost depending a great deal on the administrative processes that go along with the transactions during service. “Lean Office principles and concepts that be applied in any administrative process—generating an invoice, creating an engineering drawing, admitting patients to a hospital, filing an insurance claim, ordering an item on the Internet, and so on--, and the organizations that embrace Lean will be the ones that reduce costs, grow, and provide job security to their employees.” (Shuker)

In order to render the lean deployment meaningful and the lean implementation leaner, the organization must have a deep understanding of office processes and aspects. An insight into the processes and aspects helps businesses classify offices with similar characteristics and develop portable group strategies instead of strategies for isolated units alone. Benefits of getting a broader understanding of the work space can quickly translate to shorter redesigning and process standardization. Businesses' development when large-scale business enterprises are looking to deploy lean office in their international units is of particular importance. Businesses often expend hundreds of work hours, recourses, and capital during a revamp process, and these businesses expect high return of investment on a long-term basis. A broader understanding

of the work space followed by lean office implementation addresses this particular concern of many organizations aspiring to become leaner. More importantly, the implementer is able to test the strategies on a localized dimension while obtaining valuable relevant data before large-scale lean office deployment. An opportunity for a faster and better informed implementation at drastically reduced adaptation cost is consequently provided. The other prominent aspect for establishing a definition of office characteristics and processes includes a broader understanding of the firm's metrics, functionality, and specifics of an office space. Such concepts can be utilized in almost any project. The classification of office processes would better help to facilitate the attempt at lean implementation, making it faster and more feasible.

Although lean concepts have been used in a manufacturing capacity for decades now, because an estimated 60% to 80% of costs of meeting a customer's specifications are administrative and non-production related, it is essential that lean techniques be utilized in an office environment rather than in a manufacturing environment alone. However, the concepts lean cannot be utilized in an office environment without altering the principles. Before we determine what tools are suitable for an office environment and how to modify those tools to make them more suitable and in order to develop a lean office, it is important to understand the different processes and aspects within an office. For this reason, better understanding of office processes and aspects helps facilitate

the deployment and implementation and modification of different lean techniques to better suit the office environment.

For the purposes of this thesis, I formulated an idea of how to study the offices and the different aspects of these offices. In this thesis, I have sought to determine which aspects and which processes of an office are better or worse in terms of on-time delivery and budget. In my research, I came across a journal article “Do Project Management Tools and Outcomes Differ in Organizations of Varying Size and Sector?” by Kimberly Furumo, J. Michael Pearson, and Nancy L. Martin. In their journal article they compared project management tools and outcomes with organizations of different sizes and sectors. The authors of this article compared and contrasted different office attributes with project management tools. My results are compared with theirs and discussed in depth later in this thesis. The ideas presented in the article inspired us to pursue these ideas further.

Project Management:

A project may be defined as an activity that involves carrying out a non-repetitive task, or a particular endeavor undertaken to bring about a certain result or to achieve a particular aim. In business, a project may further be defined as an endeavor to create a specific product or service. A simple project may involve only a few people, but a more complex project usually includes a diverse combination of people and/or organizations and tasks. Essentially, a project is

defined by several basic elements, including a start date; a finishing date; specific tasks that are to be executed; dates by which these tasks should be completed, a limiting budget to which the project must conform; and a sense of the resources, including personnel, which must be involved during the implementation of the project.

Most organizations aspire to have their projects completed on time while also meeting quality objectives and meeting the budget requirement. To this end, project managers are now commonly found within all industries, and the project management position is rapidly becoming recognized as a professional career path.

Project management may be defined as a disciplined attempt by an organizational management of resources in a way which delivers all the work required to accomplish a project within predetermined time and cost constraints. Project management is a carefully thought-out, coordinated effort with a goal of accomplishing a specific effect. The application of knowledge and techniques to an activity in order to meet requirement and deadlines of a certain project is a type of project management. The designation of project purposes and ambitions, the specification of tasks, the defining of project purposes, the defining of resources to be used, and the identification of tight budgets and time deadlines for project completion are all included in project management.

Project management is often subdivided into major categorical phases. These phases may include project planning, implementation, and evaluation.

I decided to see if there is a relationship between whether a project comes in early or late and our classification criteria. I have also sought to determine whether the project came in under or over budget with my characteristics.

Goals and Outline

The lack of directly related research articles led to a multi-pronged search effort to acquire the basis used for classification. The first successful step in this direction was the procurement of articles by Hirschiem, Raymond R. Panko, David watsell, G. Bracchi et.al. Their work primarily concentrated on office classification for automation. Office automation and lean office deployment are two different techniques with different goals, but both require a well differentiated and a well defined environment before implementation. The manuscripts on office automation provided the appropriate direction towards several other articles on similar topics.

The purpose of this thesis is, first, to identify and research seven different factors to compare against project performance in terms of on-time delivery and budget. The seven factors are as follows: business sector, public or private; size of the company, small, medium, or large; office layout, cubicles, shared offices, or closed-door offices; information processing, routine or non-routine; data flow,

electronic or hard copy; location within the United States or abroad; and interaction or lack thereof among various departments within an organization. I will examine and explain these seven factors later in this thesis.

Secondly, I will acquire literature regarding these seven factors, and from this literature I will determine whether there is a suggested difference or correlation between the attributes in terms of budget and on-time delivery. I will develop hypothesis regarding each of these factors, and I will then conduct a survey. I will undertake a statistical analysis of this survey to determine if my hypothesis can be validated by the data. My intention of this thesis is to define office attributes so other people can use the knowledge I gain from it in their own projects. My intention is that people will be able to refer to the findings and conclusions in this paper in a project management capacity. The following diagram (fig. 1) is an outline of the process undertaken for this thesis. I will be explain each step in detail later in this thesis.

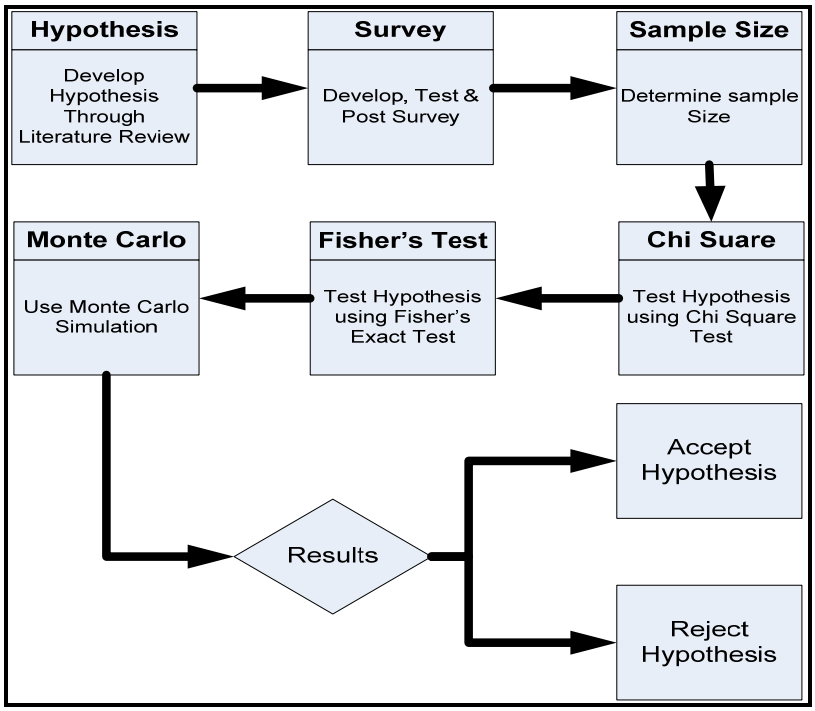

Figure 1, Outline

CHAPTER II
LITERATURE REVIEW

Data Interchange

Electronic data interchange has revolutionized the process by which transactions within an organization are carried out, especially within the sales and merchandising departments. Electronic data interchange offers numerous benefits to an organization, including such advantages as reduced costs, reduced inventory levels, faster turnaround, higher information quality, and the like. Electronic data interchange also presents an organization with such beneficial opportunities as increased operational efficiency, improved customer service, better relationships with trading partners, enhanced ability to compete, and, in some cases, strategic advantage over competition. These benefits and the explanations for them are presented by Charalambos L. Iacovou, Izak Benbasat, and Albert S. Dexter in their essay "Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology." According to Iacovou, Benbasat, and Dexter, these benefits can be divided into two categories: direct benefits, which are advantageous immediately, and indirect benefits or opportunities that are presented to an organization through the utilization of electronic data interchange. Following are the benefits, direct and indirect, that are, according to Iacovou, Benbasat, and Dexter, potentially available to an organization that implements electronic data interchange, and the reasons why each of these benefits may be accrued by an organization employee electronic data interchange:

Organizations using electronic data interchange are likely to experience reduced transaction costs because paperwork is reduced or eliminated, resulting in labor savings. This is a direct benefit of using electronic data interchange.

Organizations using electronic data interchange are predisposed to improved cash flow because they experience faster processing and exchange of information than organizations which do not implement electronic data interchange. This is a direct benefit of using electronic data interchange.

Organizations using electronic data interchange will probably encounter a reduction in inventory levels because of a shorter order cycle and a reduction in ordering costs. This is a direct benefit of using electronic data interchange.

Organizations using electronic data interchange are likely to experience higher information quality within their organization than they had experienced prior to implementation. This is likely to occur as a result of increased timeliness, accuracy, and accessibility of information. This is a direct result of using electronic data interchange.

Organizations using electronic data interchange may experience an increase in operational efficiency due to improved internal operations resulting

from time and cost reduction and better information management. This is an indirect result of using electronic data interchange.

Organizations using electronic data interchange may see an improvement in customer service and customer satisfaction because of shorter lead times and the more up-to-date information regarding transaction status. This is an indirect result of using electronic data interchange.

Organizations using electronic data interchange may encounter improved relationships with trading partners. This is due largely to the fact that trust is enhanced through an increase in the share of information. Nuisance factors such as errors in orders are possibly eliminated. There is also an increased ability to participate in Just-In-Time programs. This is an indirect result of using electronic data interchange.

Finally, some organizations using electronic data interchange may experience an increased ability to compete, as well as a strategic advantage over their competitors due to increased ability to reach new markets and increased ability to provide better services at a lower cost. This is an indirect result of using electronic data interchange.

According to the late Gerardine De Sanctis, former professor of business at Duke University, “Electronic linkages, such as those enabled by electronic

data exchange, will become increasingly important in new organizational forms. Further, interfirm relationships, particularly trust, will take on preeminent importance in the management of electronic linkages." (Hart and Saunders 1997)

This thesis will test project performance in terms of budget and on-time delivery in order to evaluate the following hypotheses:

H1: Projects using electronic data flow are more likely to be delivered early than projects using hardcopy data flow.
H2: Projects using electronic data flow are more likely to go under-budget than projects using hardcopy data flow.

Office layout

Office layout is another factor which this thesis will address and attempt to discern whether there is any correlation between office layout within an organization and on-time delivery and budget.

Mahbub Rashid and Craig Zimring of the Georgia Institute of Technology conducted a study of five office layouts throughout three different organizations and reported their findings in their essay "Organizational constructs and the structure of space: A comparative study of office layouts." According to Rashid and Zimring, the term *organizational constructs* refers to mechanisms and techniques with which an organization defines its characteristics and actions,

including its physical environment. Some examples of organizational constructs as defined by Rashid and Zimring in their essay include communication between offices within the organization, which may be affected either positively or negatively by the organization's special setting; control, which may be lessened or exacerbated based on the organization's special setting, exercised by the powers that be over those employed by the organization; boundaries imposed in the spatial setting of an organization; privacy of an individual within an office spatial setting, which may affect that individual's ability to perform; and an individual's status within an organization, which may or may not be impacted by the interaction he is allowed with his coworkers within the particular setting of that organization.

Another factor to be considered when analyzing office layout is acoustical quality and disturbances within an organizational environment. According to the essay "Stress and Open-Office Noise" by Gary W. Evans and D. Johnson, disquietude within an organization is perhaps the most widespread disturbance in the organizational environment. In spite of this, noise within the office is less likely to receive attention than are such architectural and engineering concerns as thermal, ventilation, et cetera. (Salter et al. 2003) While acoustical quality and the annoyance of noise are not well considered by office designers and organization owners, they can nevertheless likely have a negative impact on organizational performance.

Examined within this thesis are closed-door offices, shared offices, and offices with a cubicle layout. These three office types have been chosen because the majority of employees work in these three types of settings. Each of these office layouts has its advantages and disadvantages. Communication could certainly be easier in a shared office because it makes coworkers more accessible and eliminates the need to go from office to office to speak to coworkers. On the other hand, it could be difficult and disruptive to have to share an office as it would be difficult to concentrate on work with all coworkers interacting around you. This thesis suspects that the type of office layout found within an organization has a significant impact upon project performance in terms of budget and on-time delivery. Consequently, the following hypotheses may be developed.

H3: There is a relationship between the layout of the office and whether the project met on-time delivery requirements.

H4: There is a relationship between the layout of the office and whether the project met budget requirements.

Office Interactions

In an organized office environment, there are generally a number of departments that function on their own and in connection with one another. In their essay "The Design Requirements of Office Systems," Giampio Bracchi and Barbara Pernici generalize that "the elements that are needed to perform office

work are distributed among several office workers in the same or different departments…" (Bracchi and Pernici 1984) Often, one project may be assigned to more than one department within an organization. This thesis proposes that this collaboration between departments in an organization for the purpose of completing a single project might, in fact, be detrimental to the completion of the project on time and within budget.

Offices fundamentally differ from one another in terms of internal and external communication network. The kind of network utilized by an organization is a key factor when determining the nature of one department's interaction with other departments.

Certainly, there is a tremendous amount of interaction between departments within a single organization. As stated above, this thesis contends that it is not always beneficial, indeed, that it is perhaps even detrimental for a program to be undertaken by more than one department in an organization. If a department does interact with other departments in order to complete a project, it will be less likely to finish its project on time and within budget as there are likely to be more people to please when departments must interact with one another. It is also more likely in this case that there will be more constraints on a project than if a department was allowed to work on the project alone. If a department has to interact with other departments while implementing a project, confusion is much more likely to be created than if the department worked on the project

alone. Attempts by more than one department to manage a project could result in added time and delay. It might be beneficial, therefore, for one department to be involved per program. From these thoughts, the following hypotheses may be developed

H5: Projects that required interactions with other departments are more likely to be delivered late than projects that do not have interactions.
H6: Projects that require interactions with other departments are more likely to go over-budget than projects that do not have interactions.

Information Processing

Information processing may generally be defined as the processing of information in any manner which is detectable to an observer of the process. For the purpose of this thesis, it can more specifically be described as the manner in which an organization ascertains, digests, and comprehends information.

Information processing can be subdivided into two main categories: routine and non-routine. As Ramon R. Panko contends in his essay “38 Offices: Analyzing Needs in Individual Offices,” examples of routine information processing in an organization can be found within the departments such as accounting, payroll, billing, reproduction, and the word processing center. Panko says that some examples of non-routine information processing may be found in

the offices of line managers, legal departments, corporate planning departments, marketing departments, and within the engineering discipline. These non-routine information processing procedures, Panko says, “are comparatively few, and the support of procedures is not central to improved performance” in these departments. (Panko 1984)

Within routine organizations, project implementers are going to be able to predict outcomes because they have repeated the processes over and over. Conversely, non-routine organizations will encounter a number of factors which will have to be forecasted, and this could lead to very inconclusive data.

This thesis predicts that organizations with routine information processing will be on time and under budget, while organizations with non-routine information processing will be behind schedule and over budget. Therefore, the following hypotheses may be developed:

H7: Projects in a non-routine office are more likely to be delivered late than projects in a routine office.

H8: Projects in a non-routine office are more likely to go over-budget than projects in a routine office.

Location

It is undeniable that there are many differences between the United States and the majority of international companies, but does this distinctness extend

beyond history and culture to encompass business organizations and the programs they run as well? Will a program implemented in the United States have a different outcome than the same project implemented in a foreign country? This thesis proposes that there will in fact be a difference in terms of budget and on-time delivery between projects conducted in the United States and projects conducted internationally.

According to Chao C. Chen's essay "New Trends in Rewards Allocation Preferences: A Sino-U.S. Comparison," organizations in foreign countries tended to be more driven by economical and financial concerns than organizations within the United States. Also, it was found that organizations in international companies tended to disperse rewards much more unequally than organizations in the United States. Conversely, organizations in the United States are more likely to be motivated by a since of humanism, preferring to distribute rewards based upon performance.

Companies based within the United States are assumed to have better resources and more highly educated employees, as the United States is home to some of the best universities and graduate colleges in the entire world. Moreover, there are very high standards of quality of products, as well as better technologies and faster transportation in the United States than in many international companies. These advantages will make on-time delivery much more achievable than it would otherwise be.

Regarding budget, products are often less expensive in international countries than are the very same products when sold in the United States. International countries generally have a lower minimum wage and, therefore, their employees receive less compensation than employees in United States' organizations do. Also, international companies have fewer obstacles to overcome. For example, some countries are unconcerned about their environment and lack the strict environmental laws that are present in the United States. For these reasons, budgets are likely to be greater within the United States.

It is the contention of this thesis that programs implemented by organizations in the United States will have a different outcome in terms of budget and on-time delivery than those projects conducted within organizations of international countries.

H9: There is a relationship between the location of the organization and whether the project met on-time delivery requirements.

H10: There is a relationship between the location of the organization and whether the project came in within budget.

Size

It as a reasonable assumption that there is a relationship between a company's size—small, medium, or large—and its project management and project performance.

Of course, both sizes, small to medium as well as large, have their advantages and disadvantages when it comes to project implementation. As pointed out by Furumo, Pearson, and Martin, small to medium companies are more likely than large companies to have limited financial resources and, consequently, fewer employees, lower technical expertise, and less developed management skills. With fewer employees, there is often a resultant lack of specialization within an organization, leading to restricted technical expertise. This is likely to have a negative impact upon the outcomes of projects undertaken within the organization. On the other hand, however, the fact that small to medium-sized organizations have more limited financial resources will likely result in these organizations' employees being more responsible with these resources, managing them more closely than a larger company would. Managers are more prone to regulate their finances and budgets more closely. Also, because small to medium organizations generally have fewer employees than larger organizations, they are more likely to have one central physical location where all of these employees are located. This single location may be beneficial in that it allows for more ease in communication. Consequently, it will likely be simpler for them to accomplish more projects on time than a larger

company with scattered locations. Larger companies might have more procedures for a project to implement due to the existence of more departments and, consequently, more people to please. These procedures lead to much more external interaction and more obstacles to overcome.

While research regarding project management and performance and how they are related to the size of an organization is scarce and difficult to come by, this thesis presumes that there is a relationship between an organization's size and its project management. Further, this thesis surmises that there is a correlation between the size of an organization and its project performance in terms of on-time delivery and budget.

H11: There is a relationship between the size of the company and whether the project met on-time delivery requirements.

H12: There is a relationship between the size of the company and whether the project met budget requirements.

Sector

One may reasonably assume that there is a significant difference between management which is designed for public and government organizations and management which is designed for private business sector organizations. In his essay "Management information systems in public and private organizations: an empirical test," S. Bretschneider studies public management information systems

and ultimately determining that they are different from management information systems in private sector organizations, and he stated several reasons for this believe.

There is likely to be a far greater and more pronounced interdependence throughout organizations in the public sector than there is in organizations within the private sector. This more pronounced interdependence, Bretschneider contends, consequently results in greater oversight within an organization, and this, in turn, causes more procedural steps to be necessary in the implementation of a project. It also leads to a greater number of delays.

Another difference between public and private sector organizations is that managers of private sector organizations are often prone to be preoccupied with internal coordination, while pubic sector organizations' managers are more concerned with goings on that take place outside of the organization. In consequence, a private sector organization's main concern will likely be in establishing and maintaining management information systems in the bottom line, or the cost benefit analysis. On the other hand, a public sector organization is likely to be more interested in other criteria that compete with the bottom line.

As K. Newcomer and S. Caudle propose in their essay "Evaluating public sector information systems: More than meets the eye," a further characteristic of public sector information systems is the variety of persons involved within the

organization. .

As Kimberly Furomo, J. Michael Pearson, and Nancy L. Martin point out in their essay “Do Project Management Tools and Outcomes Differ in Organizations of Varying Size and Sector?” it is likely that information systems developers will face increased obstacles when working in public sector organizations as opposed to private sector organizations. One reason for this is that the additional level of oversight existent within the public sector organizations necessitates increased coordination and supplementary levels of approval. Because of the increased number of constituents and customers, they predict, projects within the public sector organizations typically are more costly and take longer to implement and complete.

Based upon this information, this thesis will test the following hypotheses to test the relationship between the sector in which an organization exists and its on-time delivery and budget.

H13: Projects in the private sector are more likely to be delivered early than projects in the public sector.

H14: Projects in the public sector are more likely to go over-budget than projects in the private sector.

The following is the summary of the hypotheses in table format (Table 1).

Table 1, Hypotheses

	Delivery			Budget		
	Early	**Late**	**Relation**	**Under**	**Over**	**Relation**
Data Interchange Electronic	**X**			**X**		
Layout			**X**			**X**
Interaction with Department		**X**			**X**	
Information Processing Non-Routine		**X**			**X**	
Location			**X**			**X**
Size			**X**			**X**
Sector Private		**X**				
Public					**X**	

CHAPTER III
METHODOLOGY

Survey

A survey was constructed to determine the validity of the hypotheses. It was tested by employees from the corporate office of Lowe's as well as by five graduate students from the University of Tennessee, a doctor from the University of Tennessee, and the statistics consulting center at the University of Tennessee, where one of their services is survey design and web deployment. Feedback from these persons and organizations were taken and used to reconstruct the survey. The survey was reworded and divided into different categories so that it could be tested throughout various organizations and by a variety of people. It was constructed such that it would take no more than five minutes to complete. The survey was posted online. A final copy of this survey may be found in appendix A.

When the participants answering the survey, they were asked to refer to the last completed project they had participated in. Participants were allowed to fill out more than one survey, provided that it was regarding different projects.

All of the answers submitted were treated as confidential. The information provided was not sent to any third party. All data gathered in connection with this research survey was processed only at the University Of Tennessee.

Sample Size

Determination of the appropriate sample size is a crucial part of study design. Determining sample size is such an important issue because samples that are too large waste precious resources, time, and money, while samples that are too small may lead to inaccurate and inconclusive results.

To be safe two different methods of determining the sample size were used.

The first method for determining sample size is a conservative approach. This method was found in “How to determine appropriate survey sample size” by Pamela Narins. It assumes a simple random sample, a large sample approximation, and that typical sources of error such as non-response, poor administration methods, and highly biased results are trivial.

$$\frac{(Py)(Pn)}{\text{Std Error}^2} = N$$

Py and Pn represent the proportion of people responding to each of the categories in a dichotomous variable (a dichotomous variable is one which has only two response choices, such as "Yes" and "No" or "Male" and "Female"). Even multiple-category or continuous variables can be thought of as dichotomous.

It is always safest to maximize the variation, by assuming a 50/50 split in responses across questions. Thus, the computation of (Py) (Pn) is (.5) (.5), or .25. So, our equation now looks like this:

$$\frac{.25}{\text{Std Error}^2} = \text{N}$$

Deciding the level of accuracy is the next thing to do. A sampling error that is acceptable in this thesis is ±7. For a confidence interval of 95 percent, the standard error multiplied by 1.96 is the sampling error. Therefore, we will first divide the sampling error we have chosen by 1.96 to arrive at the standard error (as shown in step A below). Then, we will square the result to arrive at the denominator of the equation above (as shown in step B).

A. .07/1.96 =0.035714

B. (0.035714) ^2 = 0.001276

So our equation now looks like this:

$$\frac{0.25}{0.001276} = N$$

And finally, we can solve for N:

196 = N

The second method used NQuery Advisor, a well-known software that produces protocol-ready sample size, helped find the most efficient sample size. In addition to assisting in choosing the appropriate sample size for the research study, nQuery Advisor helped specify the standard deviation and effect sizes which are needed to make sample size and power computations.

After computing all the data and parameters of the survey at hand, the software determined that, for a moderate to large affect size, a total number of sixty people would be required; for a small to large affect size, (what this thesis utilized) a total of two hundred people needed to fill out the survey.

Significance Testing

According to Statnotes, the term *significance* may be defined as the percent chance that a relationship uncovered in the data is merely the result an unfortunate sample. Thus, is another sample was taken, nothing might be found. In other words, significance is the chance of erroneously concluding we have a relationship when in fact we do not. If there is 5% or less chance that a relationship is merely the result of chance to chance, social scientists may often conclude that the relationship is actually valid, assuming that, unless a measurement error has occurred, any relationship, no matter how minute it may be, is a true relationship for an enumeration.

In this research, a Chi Square test will be used to determine the significance of the hypotheses. To validate the result, a Fisher's exact test is also going to be used, and variation in the results a Monte Carlo simulation will be included in order that we may exclude and minimize the chances of error. However, the results to be discussed are based mainly upon the Chi Squared test.

Chi Square Test

Pearson's chi-square is by far the most commonly employed type of chi-square significance test. Pearson's Chi Square is so commonly used that it is usually referred to simply as "chi-square." According to Statnotes, the chi-square test is a statistical method which may be used in order to test the hypotheses of no association of columns and rows in tabular data, even nominal amounts of data. Chi Square is more liable to establish significance "to the extent that the relationship is strong, the sample size is large, and/or the number of values of the two associated variables is large." It is commonplace for social scientists to construe a chi-square probability of .05 or less as reason enough to reject the null hypothesis that the row variable is merely randomly related to the column variable.

It is imperative that all observations be independent. A single observation may appear in one cell and only in that one cell, meaning that chi- square is not to be used to test correlated data.

Fisher’s Exact Test

The Fisher's Exact test, which is often presented as an alternative to the Chi Squared test, is a procedure which may be used for data in a two by two contingency table. It is based upon exact probabilities from a specific distribution. The Chi-square test is dependent on a large sample approximation. Therefore, according to Statnotes, it may be desirable to use Fisher’s Exact test when a large sample approximation is inappropriate.

According to chass.ncsu.edu, while there is no minimum amount of data required for Fisher's Exact Test, at least one data value must be present in each row and one data value in each column. Fisher's Exact Test may be used when one of the cells in the table has a factor of zero in it. Also, if one or two of the cells in a two by two table contain huge numbers while one or two of the other cells has numbers less than five, the Fisher's Exact Test may still be used.

The Fisher Exact Test of Significance replaces the chi-square test in small 2-by-2 tables. The Fisher Exact Test tests the probability of getting a table as strong or stronger as the table observed due simply to the chance of sampling.

Monte Carlo Simulation

The Monte Carlo method is also often used to validate data. Monte Carlo methods are a widely-implemented class of computational algorithms used to simulate the behavior of physical and mathematical systems. They are distinguishable from other simulation methods as stochastic by using random

numbers rather than deterministic algorithms. Monte Carlo is most often used to decrease the variation in the result therefore obtaining more valid data.

CHAPTER IV
RESULTS AND DISCUSSION

All of the results and statistical analysis test are found in appendix B for reference. Check appendix B index (50-51). Managers, industrial engineers, executives and many different jobs and companies, such as Boeing and Lowe's, as well as international companies like Tata motors participated in this survey.

Two hundred and fifty six (256) people answered the survey, fifty one point six (51.6) percent of the people that answered the survey were the project managers for the project they were referring to, and forty eight point four (48.4) percent were not. Ninety two point six (92.6) percent were people that are younger than the age of fifty (50). Sixty five point six (65.6) percent of the people that answered the survey were male, and thirty four point four (34.4) percent were female.

Sixty-nine point one (69.1) percent reported that the project was delivered on time. Ten point two (10.2) percent reported that the project was delivered early, while twenty point seven (20.7) percent reported that the project was delivered late. Twenty (20) percent of the population delivered the project over budget, nineteen (19) percent delivered the project under budget, and sixty point eight (60.8) percent delivered the project at the budget requirements.

Data Interchange Analysis

Of the survey sample, ninety-three point eight (93.8) percent of the population had electronic information flow as a primary function, whereas only six point two (6.2) percent had hardcopy as the primary source of information flow. Surprisingly, of the ten point two (10.2) percent of the people that came in early, an overwhelming one hundred (100) percent used electronic data flow.

Table 2 presents the Chi Square analysis, Fishers Exacts test and Monte Carlo simulation results. The results may also be found in appendix B. Please refer to appendix B index for reference (50-51). A similar table is also provided for every hypothesis, and they are all located in appendix B (52-65).

Table 2, Statistical Analysis Table

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	6.603(a)	2	.037	.036(b)	.031	.041
Fisher's Exact Test	8.049			.017(b)	.013	.020
N of Valid Cases	256					

a 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.47.
b Based on 10000 sampled tables with starting seed 1122541128.

Based on the findings of the Chi Square test (appendix B, 52), it is evident that hypothesis (H1: Projects using electronic data flow are more likely to be delivered early than projects using hardcopy data flow.) is validated.

This difference may be due to any number of components affecting project outcome, including such factors as improved internal operations in the organization implementing the project, increased timeliness and accuracy, more readily accessible information, shorter order cycles, shorter lead times, reduction in ordering costs, reaching new markets, et cetera. It could also be from an increase in the share of information regarding a particular project that is being implemented.

A Chi Square test (appendix B, 53) does not support interaction between the budgets and whether a company uses electronic or hardcopy information flow as the primary use. Approximately eighty (80) percent of the time, the project met the budget requirements no matter if electronic or hardcopy information flow was utilized. Therefore hypothesis (H2: Projects using electronic data flow are more likely to go under-budget than projects using hardcopy data flow.) is rejected.

While electronic data flow may potentially decrease the costs of an operation, perhaps companies have realized this in the past and have already accounted for it. Thus, while this thesis initially presumed that an organization's

use of electronic date flow over hard copy information would make a significant difference, the Chi Square test proved (appendix B, 53) otherwise. Consequently, hypothesis 2 was rejected.

Office layout Analysis

The Chi Square Test (appendix B, 54) concluded that there was no association between the layout of the office and whether or not the project was delivered on time. Forty-four point one (44.1) percent of those surveyed worked in Cubical Offices. Seventeen point six (17.6) percent worked in Shared Space Offices, and thirty-eight point two (38.2) percent worked in Individual Offices. If we look at the cross tab in appendix B we can see that most of the population answered as expected. There was therefore no evidence to support hypothesis (H3: There is a relationship between the layout of the office and whether the project met on-time delivery requirements.).

From this population and by observing the significance level of the Chi Square test (appendix B, 55), the same result could be concluded regarding the layout and the budget of the project. That is, there is no evidence that indicates a difference in the three types of offices mentioned--cubicles, shared or closed-door offices. Therefore, hypothesis (H4: There is a relationship between the layout of the office and whether the project met budget requirements.) is rejected as being of no significance.

As mentioned about, the Chi Square test (appendix B, 54) determined that office layout makes no difference when it comes to a projects on-time delivery. While it does not affect performance in this case, it could potentially have a detrimental affect in other areas. For example, shared office space could lead to an increase in office noise level, and constant interaction with fellow employees could lead to stress. However, in terms of on-time delivery and budget, office layout makes no difference. Thus hypotheses 3 and 4 are rejected.

Office Interactions Analysis

The majority of the project that was involved in this survey shows that there were interactions between the departments to complete the project. Approximately eighty-four point eight (84.8) percent had interactions compared to fifteen point two (15.2) percent who did not. Eighty-six point eight (86.8) percent of the jobs that came late and had an interaction. This is compared to thirteen point two (13.2) percent who did not have interactions. From the Chi Square test (appendix B, 56), we see significance to validate hypothesis (H5: Projects that required interactions with other departments are more likely to be delivered late than projects that do not have interactions.)

As for interactions and budget, twenty (20) percent of all the surveys came in over budget. Of that twenty percent, ninety-six point one (96.1) percent had interactions with other departments compared to three point nine (3.9) percent who did not have any interactions to complete the project. From the Chi Square

test (appendix B, 57) hypothesis (H6: Projects that require interactions with other departments are more likely to go over-budget than projects that do not have interactions.) is validated.

It is apparent from observing the Chi Square tests (appendix B, 56-57) that interaction between departments is detrimental to project implementation. The more interaction there is between offices, the more people that are involved in a project, the confusion there will be. Likewise, the greater the number departments involved, the longer the delays will be. Interaction between departments creates confusion, miscommunication, and, consequently, longer delay. This prevents on-time delivery and may also cause projects to ultimately exceed budget because more time taken to implement a project could in turn result in more costs to the organization. As the Chi Square tests (appendix B, 56-57) shows, hypotheses 5 and 6 are thus validated.

Information Processing Analysis

Forty-nine point two (49.2) percent of the companies identified the information in their office as routine. Fifty point eight (50.8) percent of the companies identified the information in their office as non-routine. There was no significance in the Chi Square tests (appendix B, 58-59) regarding on time delivery or even budget for this case. For the on time delivery of the project, approximately forty-six point two (46.2) percent that were early came from a routine part of the company, and fifty-three point eight (53.8) percent came from

a non- routine. Forty-seven point one (47.1) percent of the projects that were over budget came from a routine organization, and fifty-two point nine (52.9) percent came from a non-routine. Therefore hypothesis (H7: Projects in a non-routine office are more likely to be delivered late than projects in a routine office.) and hypothesis (H8: Projects in a non-routine office are more likely to go over-budget than projects in a routine office.) are rejected.

As the Chi Square tests indicated (appendix B, 58-59), it makes no difference whether an office environment is routine or non-routine so long as the employees of the organization are accustomed to the environment in which they work. Perhaps a more affective measure of the impact of routine and non-routine environments would have been an observation of a new employee entering a new environment that is routine or non-routine. In any event, for the purpose of this thesis, whether an office is routine or non-routine has no impact upon on-time delivery or budget. For this reason, hypotheses 7 and 8 are rejected.

Location Analysis

Forty eight (48) percent of the people that answered this survey were located in a U.S facility, and the remaining fifty-two (52) percent were in international facilities. There was no significance in the Chi Square test (appendix B, 62) to validate evidence regarding on time delivery and whether the company was in an international location or U.S location. The percent of the early project that were reported from the U.S facility covered forty-six point two (46.2) percent

compared to fifty-three point eight (53.8) percent that were international facilities. Therefore hypothesis (H9: There is a relationship between the location of the organization and whether the project met on-time delivery requirements) is rejected.

An organization's location had no affect on on-time delivery. International organizations were just as like to complete projects on time as were organizations located within the United States. It can therefore be concluded that international workers are just as productive as American workers. Hypothesis 9 is consequently rejected.

Regarding the budget, thirty point six (30.6) percent of the companies that came in under budget were from a U.S facility, and sixty-nine point four (69.4) percent came from an international facility. The Chi Square test (appendix B, 63) validates hypothesis (H10: There is a relationship between the location of the organization and whether the project came in within budget.), as there is significance in jobs coming in under budget from international facilities.

As shown above, the Chi Squared test (appendix B, 63) indicates that companies located internationally tend to come in under budget. While products may certainly be less expensive in international countries, lower minimum wage and cheaper transportation could be the reasons for the fact that international

companies tend to come in under budget. Based on this, hypothesis 10 is validated.

Size Analysis

Forty-seven point three (47.3) percent of those surveyed reported that the project they were discussing is for a company that is small to medium in size, while fifty two point seven (52.7) percent reported that it was a large company. Thirty-seven point seven (37.7) percent of the people that delivered the project late were from the small to medium companies, and sixty two point two (62.2) percent were from the large companies. Seventy-three point one (73.1) percent of the population that delivered the project early were from a small to medium sized company in comparison with twenty-six point nine (26.9) percent which were from a large company. By looking at the Chi Square test (appendix B, 64), it is evident that there is significance in the size of the company and whether the project met delivery requirements. Hypothesis (H11: There is a relationship between the size of the company and whether the project met on-time delivery requirements) is therefore validated.

As for the cross tab between the size of the company and whether the project came in within budget, there was no evidence from the Chi Square test (appendix B, 65) to validate the hypothesis; therefore hypothesis (H12: There is a relationship between the size of the company and whether the project met budget requirements) is rejected.

The Chi Squared test (appendix B, 64) indicates that the size of an organization is significant to whether a project is delivered on-time. These findings are in disagreement with Furumo, Pearson, and Martin's contention that an organization's size has no impact on its ability to deliver projects on time. This variation may be due to sample size—they used only one hundred people—or on the fact that they surveyed mainly project leaders. It could also be a result of the fact that smaller companies generally facilitate easier internal interactions, have fewer offices involved, and that decision makers are more readily available than they are in larger companies. Also, as this thesis included international companies while Furumo, Pearson, and Martin only considered companies based in the United States, the difference in demographics could account for the different findings. Whatever the reason, the Chi Square test (appendix B, 64) indicates that size does have an impact, and thus hypothesis 11 is confirmed.

The Chi Square test (appendix B, 65) indicated that there was no correlation between an organization's size and whether its projects were under budget. In this case, this thesis concurs with Furumo, Pearson, and Martin's conclusion. The fact that budget is not impacted by the size of the organization could be due to the fact that, while larger companies may have greater financial resources than smaller companies, they both have guidelines that govern how they spend their resources. Based on the findings of the Chi Squared tests (appendix B, 65), hypothesis 12 is rejected.

Sector Analysis

Sixty-eight point two (68.2) percent of the population that answered the survey were in a private company, and thirty-one point seven (31.7) percent were in a public company. A Chi Square test (appendix B, 66) showed that there was significance between the sector of the organization and whether the project was delivered on schedule. Private sector companies delivered the project early eighty-four point six (84.6) percent of the time, while the public sector organizations delivered the project early fifteen point four (15.4) percent of the time. Therefore, hypothesis (H13: Projects in the private sector are more likely to be delivered early than projects in the public sector.) is validated.

There was no evidence in the Chi Square (appendix B, 67) to validate hypothesis (H14: Projects in the public sector are more likely to go over-budget than projects in the private sector.) because there was no evidence to prove that there was any significance between the interactions of the sector and the budget. Regardless of whether the company was public or private, the data responses were consistent on whether it was early, late, or on time.

As the Chi Squared test (appendix B, 66) indicated, there is a difference between public and private sector organizations in terms of their on-time delivery. To this point, this thesis agree with Furumo, Pearson, and Martin, who also found substantial difference between public and private sector companies and whether

they delivered their projects on time. This difference could be attributed to the fact that there are fewer constraints in private sector companies than in public sector companies, and, consequently, there are fewer obstacles to be overcome when implementing a project. Because of this difference, hypothesis 15 is validated.

There is no evidence in the Chi Squared test (appendix B, 67) between which sector an organization exists in and the budget. This is in concurrence with Furumo, Pearson, and Martin's contention. As such, hypothesis 16 cannot be validated.

The following is the summary of accepted hypotheses (Table 3).

Table 3, Summary of accepted hypothesis

	Delivery		Budget	
	Early	Late	Under	Over
Data Interchange	X			
Interaction/s with Department/s		X		X
International Location			X	
SME's Size	X			
Private Sector	X			

CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

In 1913, Henry Ford became the first person to successfully integrate the interchangeable parts with the standard work and conveyance system to develop the flow production system, and it was in the 1930s that lean production finally took its shape at the hands of Taichii Ohno, a Toyota employee who was particularly inspired by the Ford production systems. The concepts of lean manufacturing have been in existence and in use for several decades now, and my research began when I sought to implement lean in the office environment. As business enterprises have estimated that around 60% to 80% of the cost of meeting a customer's specifications is administrative and non-production related, it is essential that lean techniques be utilized in an office environment rather than in a manufacturing environment alone. Of course, the tools of lean cannot be transferred from the manufacturing environment to the office environment without some alterations of the principles. Before we can seek to understand the tools that are suitable for an office environment and how to modify those tools to make them more suitable, we must first gain an understanding of the different processes and characteristics within an office. Consequently, a better understanding of office processes and characteristics helps facilitate the deployment and implementation and modification of different lean techniques to better suit the office environment.

To this end, I formulated for this thesis an idea of how to study the offices and the different aspects of the office environments. I have determined some of which aspects and which processes of an office environment are better or worse in terms of on-time delivery and budget. I have compared and contrasted different office categories with project management tools and explored my ideas and findings in my thesis.

In this thesis, I identified and researched seven different factors to compare against one another and against project performance in terms of on-time delivery and budget. Literature regarding these seven factors was acquired, and from this literature it was hypothesized which condition would favorable over the other. Fourteen hypotheses were developed regarding these factors and, subsequently, a survey was conducted. Many different companies within the United States, including Boeing and Lowe's participated in this survey, as well as international companies like Tata motors. A statistical analysis of this survey was created to determine whether these hypotheses could be validated by the data. Of these fourteen hypotheses, six were validated using the statistical analysis.

From the research, the following conclusions were gathered:

Organizations which used electronic data flow in their projects are more likely to have those projects delivered early than organizations whose projects used hardcopy data flow.

Projects that required interactions with other departments are more likely to be delivered late than projects in which departments do not have to interact with one another. Also, projects that require the department implementing a project to interact with other departments are more likely to go over-budget than they would be if they did not have to interact with other departments.

There is a correlation between the location of the organization, be it within the United States or an international country, and whether the project came in within budget. American companies tended to go over budget more often than International companies.

The size of an organization impacts whether the project will meet on-time delivery requirements. Smaller companies were more likely to be on-time than larger companies.

Projects undertaken in organizations within the private sector are more likely to be delivered early than projects undertaken by organizations within the public sector.

Although they were not in this thesis, many factors could be analyzed using the same project performance. Other factors could be tested to see if there is a relationship between their attributes and project performance. Some factors

which could be tested include the complexity of the project, the resources given and available for the project, and the skill set of the project leader.

LIST OF REFERENCES

LIST OF REFERENCES

Bracchi, Giampio, and Barbara Pernici. "The Design Requirements of Office Systems." ACM Transactions on Office Information Systems 2(1984): 151-170.

Bretschneider, Stuart. "Management information systems in public and private organizations: an empirical test." Public Administration Review 50(1990): 536-545.

Chen, Chao C.. "New Trends in Rewards Allocation Preferences: A Sino-U.S. Comparison." Academy of Managment Journal 38(1995): 408-428.

"Chi-Square Significance Test", from Statnotes: Topics in Multivariate Analysis. Retrieved: 02/26/2007 from http://www2.chass.ncsu.edu/garson/pa765/chisq.htm

Cook, Thomas D., and Donald T. Campbell. Qausi-Experimentation: Design and Analysis Issues for Field Settings. New Ed. Boston, MA: Houghton Mifflin Company, 1979.
Evans, Gary W., and Dana Johnson. "Stress and Open-Office Noise." Journal of Applied Psychology 85(2000): 779-783.

"Fisher Exact Test of Significance**",** from *Statnotes: Topics in Multivariate Analysis.* Retrieved: 02/28/2007 from http://www2.chass.ncsu.edu/garson/pa765/fisher.htm

Furumo, Kimberly, J. Michael Pearson, Nancy L. Martin. "Do Project Management Tools and Outcomes Differ in Organizations of Varying Size and Sector?" Interdisciplinary Journal of Information, Knowledge and Management 1(2006): 23-36.

Hart, Paul, and Carol Saunders. "Power and Trust: Critical Factors in the Adoption and Use of Electronic Data Interchange." Organization Science 8(1997): 23-42.

Hirschheim, R.A.. "Understanding the Office: A Social-Analytic Perspective." ACM Transactions on Office Information Systems 4(1986): 331-344.

Jensen, KL, E Arens, and L Zagreus. "Acoustical Quality in Office Workstations, as Assessed by Occupant Surveys." Indoor Air (2005)

Knorr-Siedow, T. “Knowledge management and enhanced policy application; in: Van Kempen, R. et alter.” Restructuring large housing estates in Europe, Bristol, (2005): 321-341

LIST OF REFERENCES CONT'D

Lacovou, Charalambos L., Izak Benbasat, and Albert S. Dexter. "Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology." EDI Adoptions in Small Firms (1995): 465-485.

Malhotra, Y "Knowledge Management for E-Business Performance: Advancing Information Strategy to "Internet Time"", Information Strategy: The Executive's Journal 16(2000): 5-16.

Malhotra, Y "Integrating Knowledge Management Technologies in Organizational Business Processes: Getting Real Time Enterprises to Deliver Real Business Performance", Journal of Knowledge Management 9(2005): 7-28.

Mason, Richard O., and Ian I. Mitroff. "A Program for Research on Management Information Systems." Management Science 19(1973): 475-487.

McAdam, Rodney, and Renee Reid. "SME and large organisation perceptions of knowledge management: comparisons and contrasts." Journal of Knowledge Management 5(2001): 231-241.

Narnins, Pamela "How to determine appropriate survey sample size" http://www.ryerson.ca/~mjoppe/ResearchProcess/SurveySampleSize.htm Retrieved: 04/28/2007

Newcomer, Kathryn E., and Sharon L. Caudle. "Evaluating Public Sector Information Systems: More Than Meets the Eye." Public Information Review 51(1991): 377-384.

Panko, Raymond R. "38 Offices: Analyzing Needs in Individual Offices." ACM Transactions on Office Information Systems 2(1984): 226-234.

Premkumar, G., K. Ramamurthy, and Sree Nilakanta. "Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective." Journal of Management Information Systems 11(1994): 157-186.

Rashid, Mahbub, and Craig Zimiring. "Organizational constructs and the structure of space: A comparative study of office layouts." Proceedings. 4th International Space Syntax Symposium London (2003): 1-20.

Rausser, Gordon. "Private/Public Research: Knowledge Assets and Future Scenarios." American Journal of Agricultural Economics 81(1999): 1011-1027.

LIST OF REFERENCES CONT'D

Reuber, A. Rebecca, and Eileen Fischer. "The Influence of the Management Team's International Experience on the Internationalization Behaviors of SME's." Journal of International Business Studies 28(1997): 807-825.

Shuker, D. T. "Value Stream Management for the Lean Office: 8 steps to planning, mapping, and sustaining lean improvements in administrative areas." Newyork, NY, USA: Productivity Press (2002).

Straub, Detmar W., Donna L. Hoffman, Bruce W. Weber, and Charles Steinfield. "Measuring e-Commerce in Net-Enabled Organizations: An Introduction to the Special Issue." NFORMATION SYSTEMS RESEARCH. 13(2002): 115-124.

Wastell, David G, P White, and P Kawalek. "A Methodology for Business Process Redesign: Experiences and Issues." Journal of Strategic Information Systems 3(1994): 23-40.

APPENDIX A

SURVEY

General Information	
1) Were you the project leader for this project?	Yes No
2) What is your age?	Under 30 30-39 40-49 50-59 Over 60
3) What is your gender?	Male Female
4) Was the project you are discussing for a company of 500 or fewer employees?	Yes No
5) Is the company in the private or public sector?	Private public
6) Routine processing type offices have the same inputs, processes and are expected to have the same outputs. You can see *many* standardized procedures in this office. Examples: accounting, payroll, and billing Non Routine based processing systems include processes that have different inputs, process and outputs. You can hardly see any standardized procedure in this office Examples: Legal department, corporate planning. Is the information processing in *your* office predominantly??	Routine non routine
7) Did the project require interactions with other departments or offices?	Yes No
8) Was your information flow **primarily** electronic or hardcopy?	Electronic Hardcopy
9) Estimate the percent of time the information was electronic	0-20 21-40 41-60 61-80 81-99
10) Was the project done in a U.S facility or an international facility?	US facility International Facility
11) Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices??	Cubical layout Closed door offices Shared space offices
12) What is the most important metric for your project?	Customer satisfaction , lead time , throughput , on- time delivery , other
Performance	
13) Was the project delivered on time, early or late?	On Time Early late
14) What percent of time was early or late?	

15) Was the project over or under budget?	Over budget Under budget On budget
16) What percent was it over or under budget?	
Information	
17) Company Name	
18) Job Title	
19) Comments(optional)	
20) If you would like to see the results and outcome of the survey please submit your email address here (optional)	

APPENDIX B

DATA ANALYSIS

Index of Research Comparison

1) Was the project delivered on time, early, or late * Was your information flow primarily electronic or hardcopy?.....52

2) Was this project over or under budget? * Was your information flow primarily electronic or hardcopy?.....53

3) Was the project delivered on time, early, or late * Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices……54

4) Was this project over or under budget? * Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices?.....55

5) Was the project delivered on time, early, or late * Did the project require interactions with other departments?.....56

6) Was this project over or under budget? * Did the project require interactions with other departments?.....57

7) Was the project delivered on time, early, or late * Is the information processing in your office predominantly?.....58

8) Was this project over or under budget? * Is the information processing in your office predominantly?.....59

9) Was the project delivered on time, early, or late * Was the project done in a U.S facility or an international facility?.....60

10) Was this project over or under budget? * Was the project done in a U.S facility or an international facility?.....61

11) Was the project delivered on time, early, or late * Was the project you are discussing for a company of 500 or fewer employees?.....62

12) Was this project over or under budget? * Was the project you are discussing for a company of 500 or fewer employees?.....63

13) Was the project delivered on time, early, or late * Is the company in the private or public sector?.....64

14) Was this project over or under budget? * Is the company in the private or public sector?.....65

Was the project delivered on time, early, or late * Was your information flow primarily electronic or hardcopy?

Crosstab

			Was your information flow primarily electronic or hardcopy?		
			Electronic	Hardcopy	Total
Was the project delivered on time, early, or late	On time	Count	145	32	177
		Expected Count	146.6	30.4	177.0
	Early	Count	26	0	26
		Expected Count	21.5	4.5	26.0
	Late	Count	41	12	53
		Expected Count	43.9	9.1	53.0
Total		Count	212	44	256
		Expected Count	212.0	44.0	256.0

Chi-Square Tests

				Monte Carlo Sig (2-sided)99% Confidence Interval		
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	6.603(a)	2	.037	.036(b)	.031	.041
Fisher's Exact Test	8.049			.017(b)	.013	.020
N of Valid Cases	256					

a 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.47.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is .266.

Was this project over or under budget? * Was your information flow primarily electronic or hardcopy?

Crosstab

			Was your information flow primarily electronic or hardcopy?		
			Electronic	Hardcopy	Total
Was this project over or under budget?	Over budget	Count	43	8	51
		Expected Count	42.2	8.8	51.0
	Under budget	Count	40	9	49
		Expected Count	40.5	8.5	49.0
	On budget	Count	128	27	155
		Expected Count	128.3	26.7	155.0
Total		Count	211	44	255
		Expected Count	211.0	44.0	255.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	.133(a)	2	.936	.949(b)	.943	.954
Fisher's Exact Test	.158			.947(b)	.941	.952
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.45.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is .218.

Was the project delivered on time, early, or late * Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices?

Crosstab

			Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices?			
			Cubical Layout	Individual offices	Shared space offices	Total
Was the project delivered on time, early, or late	On time	Count	79	29	69	177
		Expected Count	78.1	31.1	67.8	177.0
	Early	Count	13	4	9	26
		Expected Count	11.5	4.6	10.0	26.0
	Late	Count	21	12	20	53
		Expected Count	23.4	9.3	20.3	53.0
Total		Count	113	45	98	256
		Expected Count	113.0	45.0	98.0	256.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	1.563(a)	4	.815	.820(b)	.810	.830
Fisher's Exact Test	1.585			.822(b)	.812	.831
N of Valid Cases	256					

a 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.57.

b Based on 10000 sampled tables with starting seed 1122541128.

c The standardized statistic is .147.

Was this project over or under budget? * Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices?

Crosstab

			Were most of the offices involved in the project of a cubical layout, individual offices or shared space offices?			
			Cubical Layout	Individual offices	Shared space offices	Total
Was this project over or under budget?	Over budget	Count	25	11	15	51
		Expected Count	22.6	8.8	19.6	51.0
	Under budget	Count	20	7	22	49
		Expected Count	21.7	8.5	18.8	49.0
	On budget	Count	68	26	61	155
		Expected Count	68.7	26.7	59.6	155.0
Total		Count	113	44	98	255
		Expected Count	113.0	44.0	98.0	255.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	2.865(a)	4	.581	.588(b)	.576	.601
Fisher's Exact Test	2.900			.585(b)	.573	.598
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.45.

b Based on 10000 sampled tables with starting seed 1122541128.

c The standardized statistic is .784.

Was the project delivered on time, early, or late * Did the project require interactions with other departments?

Crosstab

			Did the project require interactions with other departments?		
			Yes	No	Total
Was the project delivered on time, early, or late	On time	Count	155	22	177
		Expected Count	150.0	27.0	177.0
	Early	Count	16	10	26
		Expected Count	22.0	4.0	26.0
	Late	Count	46	7	53
		Expected Count	44.9	8.1	53.0
Total		Count	217	39	256
		Expected Count	217.0	39.0	256.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	12.109(a)	2	.002	.005(b)	.003	.007
Fisher's Exact Test	9.953			.008(b)	.006	.010
N of Valid Cases	256					

a 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.96.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is .829.

Was this project over or under budget? * Did the project require interactions with other departments?

Crosstab

			Did the project require interactions with other departments?		
			Yes	No	Total
Was this project over or under budget?	Over budget	Count	49	2	51
		Expected Count	43.2	7.8	51.0
	Under budget	Count	38	11	49
		Expected Count	41.5	7.5	49.0
	On budget	Count	129	26	155
		Expected Count	131.3	23.7	155.0
Total		Count	216	39	255
		Expected Count	216.0	39.0	255.0

Chi-Square Tests

				Monte Carlo Sig (2-sided)99% Confidence Interval		
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	7.290(a)	2	.026	.028(b)	.024	.033
Fisher's Exact Test	8.130			.018(b)	.015	.022
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.49.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is 1.755.

Was the project delivered on time, early, or late * Is the information processing in your office predominantly?

Crosstab

			Is the information processing in your office predominantly?		
			Routine	Non Routine	Total
Was the project delivered on time, early, or late	On time	Count	90	87	177
		Expected Count	87.1	89.9	177.0
	Early	Count	12	14	26
		Expected Count	12.8	13.2	26.0
	Late	Count	24	29	53
		Expected Count	26.1	26.9	53.0
Total		Count	126	130	256
		Expected Count	126.0	130.0	256.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Monte Carlo Sig (2-sided)	Monte Carlo Sig (2-sided)99% Confidence Interval	
				Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	.614(a)	2	.736	.736(b)	.724	.747
Fisher's Exact Test	.630			.736(b)	.724	.747
N of Valid Cases	256					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.80.
b Based on 10000 sampled tables with starting seed 1156607048.
c The standardized statistic is .761.

Was this project over or under budget? * Is the information processing in your office predominantly?

Crosstab

			Is the information processing in your office predominantly?		
			Routine	Non Routine	Total
Was this project over or under budget?	Over budget	Count	24	27	51
		Expected Count	25.0	26.0	51.0
	Under budget	Count	21	28	49
		Expected Count	24.0	25.0	49.0
	On budget	Count	80	75	155
		Expected Count	76.0	79.0	155.0
Total		Count	125	130	255
		Expected Count	125.0	130.0	255.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Monte Carlo Sig (2-sided) Sig.	Monte Carlo Sig (2-sided) 99% Confidence Interval Lower Bound	Monte Carlo Sig (2-sided) 99% Confidence Interval Upper Bound
Pearson Chi-Square	1.240(a)	2	.538	.520(b)	.507	.533
Fisher's Exact Test	1.241			.520(b)	.507	.533
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 24.02.
b Based on 10000 sampled tables with starting seed 1156607048.
c The standardized statistic is -.784.

Was the project delivered on time, early, or late * Was the project done in a U.S facility or an international facility?

Crosstab

			Was the project done in a U.S facility or an international facility?		
			US facility	International Facility	Total
Was the project delivered on time, early, or late	On time	Count	89	88	177
		Expected Count	85.0	92.0	177.0
	Early	Count	12	14	26
		Expected Count	12.5	13.5	26.0
	Late	Count	22	31	53
		Expected Count	25.5	27.5	53.0
Total		Count	123	133	256
		Expected Count	123.0	133.0	256.0

Chi-Square Tests

				Monte Carlo Sig (2-sided)99% Confidence Interval		
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	1.299(a)	2	.522	.533(b)	.520	.546
Fisher's Exact Test	1.304			.533(b)	.520	.546
N of Valid Cases	256					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.49.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is 1.137.

Was this project over or under budget? * Was the project done in a U.S facility or an international facility?

Crosstab

			Was the project done in a U.S facility or an international facility?		
			US facility	International Facility	Total
Was this project over or under budget?	Over budget	Count	25	26	51
		Expected Count	24.6	26.4	51.0
	Under budget	Count	15	34	49
		Expected Count	23.6	25.4	49.0
	On budget	Count	83	72	155
		Expected Count	74.8	80.2	155.0
Total		Count	123	132	255
		Expected Count	123.0	132.0	255.0

Chi-Square Tests

				Monte Carlo Sig (2-sided)99% Confidence Interval		
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	7.860(a)	2	.020	.021(b)	.017	.024
Fisher's Exact Test	7.906			.020(b)	.016	.023
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 23.64.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is -1.224.

Was the project delivered on time, early, or late * Was the project you are discussing for a company of 500 or fewer employees?

Crosstab

			Was the project you are discussing for a company of 500 or fewer employees?		
			Yes	No	Total
Was the project delivered on time, early, or late	On time	Count	82	95	177
		Expected Count	83.7	93.3	177.0
	Early	Count	19	7	26
		Expected Count	12.3	13.7	26.0
	Late	Count	20	33	53
		Expected Count	25.1	27.9	53.0
Total		Count	121	135	256
		Expected Count	121.0	135.0	256.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	8.943(a)	2	0.011	0.013(b)	0.01	0.016
Fisher's Exact Test	8.904			.014(b)	0.011	0.017
N of Valid Cases	256					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.29
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is .520

Was this project over or under budget? * Was the project you are discussing for a company of 500 or fewer employees?

Crosstab

			Was the project you are discussing for a company of 500 or fewer employees?		
			Yes	No	Total
Was this project over or under budget?	Over budget	Count	24	27	51
		Expected Count	24.0	27.0	51.0
	Under budget	Count	23	26	49
		Expected Count	23.1	25.9	49.0
	On budget	Count	73	82	155
		Expected Count	72.9	82.1	155.0
Total		Count	120	135	255
		Expected Count	120.0	135.0	255.0

Chi-Square Tests

				Monte Carlo Sig (2-sided)99% Confidence Interval		
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	.000(a)	2	1.000	1.000(b)	1.000	1.000
Fisher's Exact Test	.022			1.000(b)	1.000	1.000
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 23.06.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is -.009.

Was the project delivered on time, early, or late * Is the company in the private or public sector?

Crosstab

			Is the company in the private or public sector?		
			Private	Public	Total
Was the project delivered on time, early, or late	On time	Count	123	54	177
		Expected Count	121.0	56.0	177.0
	Early	Count	22	4	26
		Expected Count	17.8	8.2	26.0
	Late	Count	30	23	53
		Expected Count	36.2	16.8	53.0
Total		Count	175	81	256
		Expected Count	175.0	81.0	256.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	6.668(a)	2	.036	.040(b)	.035	.045
Fisher's Exact Test	6.587			.041(b)	.036	.046
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.23
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is 1.356

Was this project over or under budget? * Is the company in the private or public sector?

Crosstab

			Is the company in the private or public sector?		
			Private	Public	Total
Was this project over or under budget?	Over budget	Count	35	16	51
		Expected Count	34.8	16.2	51.0
	Under budget	Count	34	15	49
		Expected Count	33.4	15.6	49.0
	On budget	Count	105	50	155
		Expected Count	105.8	49.2	155.0
Total		Count	174	81	255
		Expected Count	174.0	81.0	255.0

Chi-Square Tests

				Monte Carlo Sig		
					(2-sided)99% Confidence Interval	
	Value	df	Asymp. Sig. (2-sided)	Sig.	Lower Bound	Upper Bound
Pearson Chi-Square	.051(a)	2	.975	.984(b)	.980	.987
Fisher's Exact Test	.058			.984(b)	.980	.987
N of Valid Cases	255					

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.56.
b Based on 10000 sampled tables with starting seed 1122541128.
c The standardized statistic is .162.

VITA

Zeid El-Akkad was born in Amman, Jordan, on April 3, 1980. He attended high school at the New English School in Amman. He then moved to the United States, where he received his Bachelor of Science degree in Industrial Engineering from the University of Tennessee, Knoxville, in spring 2004. He then continued at the University of Tennessee, Knoxville, in pursuit of his Master of Science in Industrial Engineering in spring 2007. His practical experience ranges from small to medium companies like Koide to larger companies such as Boeing and British Petroleum.