E-PROCUREMENT SUCCESS

THESIS

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Jason R. Eaton

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Abstract

The Air Force currently funds projects chartered with studying and developing e-Procurement systems. Through review and analysis of various e-Procurement projects, factors attributing to successful implementation of e-Procurement systems will be deduced and provided as a useful guide for federal agencies initiating e-Procurement projects. By identifying critical success factors this research should: 1) improve pre-implementation planning, 2) improve spend decisions, and 3) decrease implementation time by eliminating unnecessary steps.

This research utilized the current literature to identify specific factors important in the e-Procurement implementation process. Once the factors were determined, a survey was developed to measure the factors in organizations with an e-Procurement system. All fifty state governments were contacted to determine if they had implemented e-Procurement systems and, if they responded affirmatively, were surveyed regarding what they have identified as the factors most instrumental in their e-Procurement implementation. The survey looked specifically at six key areas of e-Procurement implementation: 1) technology, 2) management, 3) processes, 4) suppliers, 5) budget, and 6) benefits. Each organization's tangible and intangible benefits were assessed to further substantiate the value organizations should be getting from e-Procurement.

The survey results were limited because only nine of the thirty-five states that responded actually had an e-Procurement system in place. However, since the sample came from the entire population of state governments, some factors did show a better degree of explaining the variance in the model. A multiple step-wise regression was

performed, even though there was a high risk of type I and II error due to the small usable response rate, that highlighted level of customization of the e-Proucrement system, utilization of reverse auctioning, director background, life-cycle cost review, and when users were trained as the most important factors in e-Procurement implementation success. When using the Standard Least Squares regression, with a single independent variable against the success variable, only life-cycle cost review and director background emerged as factors that explain a significant amount of variance.

By accomplishing a survey of the state governments' e-Procurement efforts, it was understood that the general applicability of the success factors and models developed in this research would be limited to the population of state governments. While the results are not generalizable, the survey can be used in the future to study other populations' e-Procurement efforts. As the survey is refined and expanded into other areas, the final resulting factors can then be used as foundational principles for organizations desiring to begin an e-Procurement program.

The Department of Defense and the Air Force can benefit from the research by utilizing the survey to analyze some of the e-Procurement projects that are coming on line. And while the model applicability is limited, the survey itself was designed to be applicable to any sector or industry and can be used by organizations as a pre-implementation tool to analyze if there are any areas of weakness. The more information that can be gathered during the initial phases of rollout can have a significant impact when full deployment of the system nears.

I. Introduction

Background

The rapidly changing pace of the global business world compels organizations to take quick, decisive action when considering new technological developments. The risk of losing customers or suppliers to more agile firms presents a tremendous external risk to companies that do not have the ability to recognize the important emerging technological trends and implement them at the proper time. While keeping up with current business innovations to stay competitive is not a new idea, the urgency in today's business markets demands that it be given far greater attention than it has received in the past. The new competitive landscape of the twenty-first century favors companies that are "gazelle-like" and quick to move when new technologies and opportunities emerge (Hitt and Reed, 2001:30-31). One technological innovation that has had a tremendous impact on organizations in the past decade is the movement of utilizing the ever-increasing power of the Internet to allow more complex business-to-business transactions, commonly called e-Commerce.

Summary of Current Knowledge

The study of implementing electronic means to make business processes, including procurement, more efficient started more than twenty-five years ago. At that time computers were connected on primitive networks. However, the costs were

prohibitive for all but the largest companies to implement robust electronic business packages and, even then, mostly dealt with internal production and management systems. With the rapid expansion of the World Wide Web in the 1990's, the ability for companies to network their electronic systems became cheaper and more reliable which truly brought for the age of e-Business, and therefore e-Procurement practices.

Private sector companies were the first to move into the implementation of e-Procurement. E-Procurement success stories became common during the mid to late 1990's, promising decreased costs and increased productivity. Much like the Total Quality Management eruption, government organizations also looked at what business was doing and tried to mandate it into existence for their organizations. Through these early years of e-Procurement, the information technology was treated as a panacea for any organization and little attention was paid to the proper implementation and use of e-Procurement. Both the government and private sector were trying to force fit their business requirements into prepackaged systems with little regard for organizational strategy. While some benefits may arise from this approach, no amount of electronics can win out over a well thought out procurement strategy.

Around the turn of the millennium, business theory and electronic systems finally started uniting. In the procurement realm, private organizations arrived at the realization that implementing an e-Procurement system in an organization with bad procurement processes only allows you to accomplish those bad processes electronically. In the past three years, research and trade journals have focused on steps and factors that successful e-Procurement organizations utilized in implementing their systems. But while the

documentation in the private sector is emerging, the federal sector research has yet to take off.

On the public side, state governments, which often serve as fast acting test cases for the federal government's programs, have been implementing and documenting some of the factors that public organization's can utilize for success. While the amount of information from the states is far less than the information from the private sector, it is proliferating rapidly with the growing success of e-Procurement. The federal government's body of knowledge of e-Procurement is very thin. While several studies were accomplished during the 1990's, they mostly espoused the benefits that the federal government could realize in implementing the systems. And, while all government organizations have been mandated to use electronic means as much as possible for day-to-day business, no guidance has been set to instruct the organizations how to accomplish the mandate.

In summary, although the current knowledge on e-Procurement implementation is sparse, there is a high degree of enthusiasm in both the business and academic community on this topic. The federal government's interest in e-Procurement is to further the goal stated in 1993's National Performance Review (NPR) of increasing the efficiency of the government through electronic means. However this goal has been slow in coming, both for the federal government as a whole, and for individual agencies and organizations attempting the change.

Scope

This thesis attempts to develop a model for the Air Force to use in their e-Procurement assessment and implementation. In doing this, only the fifty state

governments will be surveyed due to the relative similarities (fairness laws, ethics acts, etc.) found between state and federal organizations. The survey will only include states that have a working e-Procurement system that their organization utilizes in day-to-day procurement operations, not those who are in the process of implementing (this limitation will be discussed further in chapter 3). While the choice of population limits the applicability of the results to other organizations, it is a good starting point to begin the research with.

In developing the factors instrumental in successful implementation, the researcher has focused on the most prevalent factors found during the literature review. As stated earlier, the majority of the literature applies to private sector companies whose main goal is making money. In identifying the factors, the researcher manipulated the scope of some of the factors in the interest of application to the goals and workings of government organizations. Therefore, some of the factors are private sector ideas in a public sector format, but that was only done to fit the focus of the thesis (discussed more in chapter 2). In attempting to get a measure that was valid for both private and public sectors, it is hoped that the survey can be applied in its current state to any organization.

Conclusion

In accomplishing a survey of public sector organizations' e-Procurement efforts, it is supposed that the general applicability of the success factors and lessons learned will become more apparent. The study will attempt to validate the likelihood of success able to be attributed to implementing key principles. Additionally, the study is hoped to reassess the degree of benefit that can be attributed to previously identified key success

factors. The final resulting factors can then be used as foundational principles for any government organization desiring to begin an e-Procurement program.

II. Literature Review

Introduction

This review covers e-Procurement, whether implemented alone or as part of a larger e-Commerce system; it concerns both private and federal organizations. Although the process is very new, the concept of e-Procurement has grown rapidly in the past decade, and more specifically in the past four years. The novelty of the idea limits the amount of published literature on successful e-Procurement implementations in peer-reviewed journals. However, many trade journals from both the computer and purchasing worlds provide insight into the emerging world of e-Procurement. This literature review examines the factors thought to affect implementation. Through examples found in trade journals, magazines, and government publications, the factors will be illustrated and defined.

Background

The technological developments and movement toward a global marketplace over the past decade have forced companies to restructure their business practices in order to gain competitive advantage or even to survive. One aspect of the restructuring has been the transition of several business processes into the electronic environment of cyberspace, commonly referred to as e-Business. While e-Business includes all aspects of doing business in an electronic environment, two specific areas deal primarily with external transactions, specifically the e-Commerce and e-Procurement processes. E-Commerce aims to enhance a company's ability to sell its products and services via the world-wide web as well as manage downstream customers. E-Procurement enables improvement in

purchasing raw materials, services, and obtaining resources from upstream suppliers via transactions in the web-based environment.

The several benefits to organizations implementing the principles of e-Procurement will be the focus of this study. The benefits include decreased administration and overhead costs, decreased labor hour cost per transaction, more accurate and timely business intelligence, more timely payment, and enhanced cash flow management (Atkinson, 2001:23). However the most striking benefit will be to get organizations to analyze their procurement processes. This will allow organizations to really analyze how their procurement strategies fit with the overall strategy and revise them if need be. The dangers of implementing an e-Procurement system without a self-evaluation of the organization will be shown to be disastrous.

Federal as well as private sector organizations are implementing or developing e-Procurement systems to realize these benefits. Federal agencies, however, are finding great difficulty implementing e-Procurement solutions because of federal policies and required processes. Federal agencies also have to deal with funding, limited availability of technological capability, and the wide range of commodity items that are sought by federal government procurement offices (Drake, 1992:1). And though federal acquisition is going through major reform initiatives, the federal acquisition process is necessarily a slow and deliberate process for most acquisitions in order to protect the public trust that the government serves.

E-Commerce

While e-Commerce currently means different things for different people, further reference to it in this thesis will follow the Organization for Economic Cooperation and

Development's (OECD) definition. OECD states e-Commerce, "refers generally to all forms of transactions relating to commercial activities, including both organizations and individuals that are based on the processing and transmission of digitized data, including text, sound, and visual images" (Carter, 2002:2). The activities mentioned in the definition are usually defined to take place through a computer; however, they can also include transactions such as phone calls and fax transmissions also. The inclusion of phone and fax meet the spirit of the definition as phone and fax lines are digitized forms of communications that will eventually be run from the computer. Some businesses use the term e-Business interchangeably with e-Commerce. For purposes of this thesis, e-Business will be the subset of e-Commerce that deals specifically with business-to-business (B2B) transactions (Carter, 2002:3). When referencing other material, e-Business may be used to refer to e-Commerce and will be noted if there is a discrepancy between a reference and the intended meaning.

The concept of e-Commerce began long before the term arrived in everyday language. While the first computers arose for the needs of the military in the Manhattan Project, the following generations of computers after World War II were decidedly aimed at assisting businesses. As computing power increased and the knowledge of programming proliferated, applications to the business grew beyond mere automation and paperwork into the forecasting, scheduling, and other upper-level management functions. International Business Machines (IBM) thrived during this era by introducing the mainframe computer to deal with the complexities of business (IBM, 2002). While this development assisted businesses in their attempts to become more efficient, and thus more profitable, the systems were aimed mainly at internal use.

When the logical step of developing the ability for computers to communicate with each other over great distances first appeared, the floodgates opened for business possibilities. Like any new technological innovation, businesses were wary and slow to move on trusting their organizations to electrical impulses. In addition, the infrastructure costs necessary to utilize the technology were prohibitive to all but the largest businesses, and large businesses are traditionally the most resistant to change. But, while connections and willingness were limited at first, the growth over the past two decades spawned what is now referred to as the Internet. The ability to reach customers and suppliers globally for a minimal cost invited a shift in how companies think about doing business.

While e-Commerce alone represents a worthy topic for any business to discuss, many other scholarly ideas of the past decades arose from the ability that a computer network allows business. Ideas like Business Process Reengineering, Supply Chain Management, and Activity Based Costing are ideas that are good business practices for any business to implement, with or without a high ability for technology. However, the amount of human resources necessary to attempt any of these solutions without a technological system to assist the process would be both time and cost prohibitive. This wealth of new academic ideas that arose from the technology revolution emphasizes one point that will surface several times in this thesis: the goal of applying "e" to anything is not to have an electronic method of doing business, the goal is to assist managers and leaders in implementing good business decisions through increased breadth and depth of knowledge.

E-Procurement

Although e-Commerce includes all aspects of doing business in an electronic environment, there are two types of external transactions that garner a high visibility in the e-World. The first type of external transaction is selling through electronic means. Although the term e-Selling is little used, it applies to either B2B sales or business-to-consumer (B2C) sales (Chaudhury, 2002:7). In this branch, businesses look to market and sell their products via the Internet. They also seek better management of their downstream customers to enhance their business appeal through increased timeliness of delivery and increased quality of goods or services. E-Procurement, on the other end of the business, enables improvement in purchasing raw materials, services, and obtaining resources from upstream suppliers via transactions in the web-based environment.

Through the early years of e-Procurement, the ability to purchase electronically was treated as a panacea for any organization that desired to cut costs quickly. Businesses saw the short-term gains of decreased administration costs and faster procurement turnaround time and paid little attention to the proper implementation and use of e-Procurement. Both the government and private sector were trying to force fit their business requirements into prepackaged systems with little regard for organizational strategy. While some benefits may arise from this approach, no amount of electronics can take the place of a well thought out procurement strategy. Around the turn of the millennium, business theory and electronic systems finally started uniting. In the procurement realm, private organizations arrived at the realization that implementing an e-Procurement system in an organization with bad procurement processes only allows you to accomplish those bad processes electronically.

As seen in the figure below (Figure 1), the linkage between the different e-Commerce applications is intricate and a lot of overlap occurs in systems. This view is a gift of the Supply Chain Management view of businesses that realizes all aspects of a business must work together to increase efficiency in the organization. If your procurement side does not receive good business data from the manufacturing and marketing side, their job will not contribute to the betterment of the organization. Conversely, if the organization's procurement process is broken, then the ability to manufacture and sell quality goods will be hampered. Therefore, for a business to fully realize the greatest benefits from implementing any "e" type system, the entire supply chain must be analyzed and set up in a manner that takes advantage of the new technology (Carter, 2002:36). While the entire supply chain is important, this study will focus on the e-Procurement side of the supply chain and its implementation.

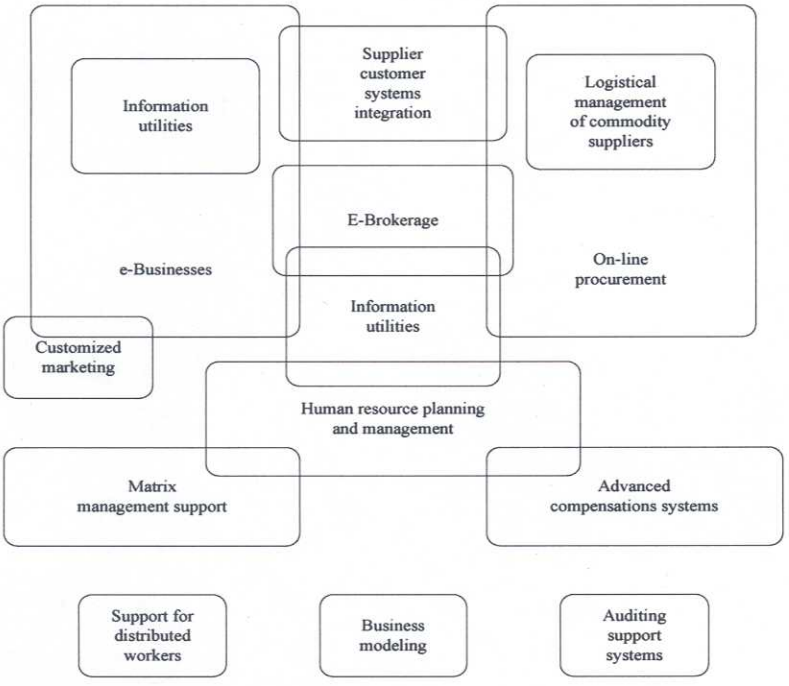


Figure 1 - Overlapping Types of e-Commerce Applications (Carter, 2002:37)

There are several benefits to organizations implementing the principles of e-Procurement. Some of the most often cited benefits include decreased administration and overhead costs; decreased labor hour cost per transaction; more accurate and timely business intelligence; more timely payment; and enhanced cash flow management. There is also the opportunity to "source from a wider range of suppliers at lower prices and to encourage individual employees to conform more closely to corporate procurement policies and practices" (McKie, 2001:97). However, these benefits are hard to measure unless the organization keeps metrics dealing with costs of transactions; time to complete transactions; and abuses of employees in the procurement environment.

E-Procurement provides the benefits in several ways. First, the ability to access online catalogs allows buyers to view a wider spectrum of offerings and prices from several different companies, and through these catalogs, organizations can develop programs that will automatically order when certain criteria are met. Second, an electronic approval cycle negates the need to print several copies of orders or contracts and allows for a more rapid, orderly flow that can be set up even if key people are away. The ability to track where the procurement is in the process, for buyer and seller alike, allows for the instant ability to go right to the point of stoppage, rather than spend time looking for it. Third, the ability to pay electronically ensures prompt payment without all of the invoices and receiving documents that traditionally burdened the process. Finally, an automated interface allows the companies other e-systems to synchronize data with procurement as a "check and balance" and gives managers the information they need

(McKie, 2001:99-100). While these benefits center on the processes e-Procurement enhances, a key benefit arises from the personnel who accomplish the procurement.

Another innovation e-Procurement brings to the table is employee-centered purchasing. This eliminates the need for a purchasing professional to ensure all rules and regulations are being followed. In employee-centered purchasing the people who know what the organization needs can conveniently and effectively order the parts without worrying about breaking rules or policies. E-Procurement systems incorporate the rules and policies of the organization into the system and will not allow personnel to buy outside of the systems rulebook. While this could hinder the purchasing process if a good rulebook is not developed, it allows for most purchasing situations an organization could face. In the end it should "prevent the purchasing department itself from becoming a procurement process bottleneck" (McKie, 2001:105).

E-Procurement provides several benefits to organizations that implement it properly. Even in the current depressed economic market, several firms are continuing implementation of an e-Procurement system despite the large startup costs. The benefits yielded by the system actually help businesses during economic crisis by providing better visibility into where and how procurement dollars are being spent. Yet while businesses have been embracing e-Procurement, government agencies have been slow to move into this arena. Over a decade has passed from the first large push into the e-World and very few agencies have successfully implemented a comprehensive e-Procurement tool.

E-Procurement in the Federal Government

In March of 1993, President Clinton directed Vice President Gore to conduct a study of the federal government that became known as the National Performance Review

(NPR). From the NPR, the development of an e-Commerce system throughout the federal government was seen as a top priority with the goals of streamlining the acquisition process, improving customer service, and lowering costs (Hansen, 1995:I-1). In addition to NPR, two congressional acts, the Federal Acquisition Streamlining Act of 1994 and the Clinger-Cohen Act of 1996, reasserted the government's idea to conduct business through technology. The impetus for these acts was to fix government procurement, which constantly receives scrutiny from Congress, with the emerging technology. While a timeline was set for the project and a lot of emphasis was, and still is, put on the idea of e-Commerce in the government, very few government agencies have a complete e-Procurement system for day-to-day transactions.

Federal sector organizations are implementing, or trying to implement, e-Procurement systems to realize benefits. Federal agencies, however, are finding great difficulty in implementing e-Procurement solutions. Some of the biggest barriers to implementation are federal policies and status quo processes; as well as funding, limited availability of technological capability, training and education, standards, security, fragmented implementation plans, and the wide range of commodity items that are sought by federal government procurement offices (Hansen, 1995:IV-1 to IV-4). In addition to this list of barriers, there is also the fact that each government agency tends to have a unique set of rules and regulations that they feel are unique to their mission. The uniqueness of procurement policies between organizations makes an organization hesitant to commit to any system that is not specifically designed for their organization.

E-Procurement is usually the first area that government organizations look to for their entrance into e-Commerce. The federal government resembles at first glance a B2C

relationship with suppliers, as the government consumes that which it purchases. However, in the big picture sense, the government is a B2B organization that procures items in order to provide its service to the American public. In servicing the American public, with the odd situation of being both a funding source and consumer of government services, the government has a duty to provide the American public with the best service they can for the most reasonable cost. And since e-Procurement usually presents several rapid, short-term, impressive cost savings that show improvement in an organization, it is targeted first.

However, there are dangers involved with blindly implementing e-Procurement without a plan in the federal government, even when done only on an agency basis. First, the Federal Acquisition Regulation (FAR), while continually being updated, does not yet fully support the ideas of e-Procurement. Especially part 53, which prescribes the forms for various actions and leaves little room for innovation. Until these parts are updated, there will be solid ground for those who do not welcome the change of e-Procurement to stand on. The other major obstacle is electronic signatures. While the General Accounting Office has recognized since 1990 that an electronic signature is unique and meets the criteria for a legally binding contract, resistance is still pervasive a decade later. Part of the resistance is due to the lack of security built into the electronic signature system, but a great majority is just institutional fear of change. (Drake, 1992:2-3)

Although little has been accomplished in the federal realm with regards to e-Procurement, there are some agencies that have shown success in implementing and utilizing a system. The Department of the Interior worked with their procurement system and partnered with the provider of their Government Procurement Card (GPC), U.S.

Bank, to provide their buyers with a powerful means of buying items safely on-line and receiving business data to assist them in their procurement analysis. The General Services Administration (GSA) has set up the GSA Advantage website to provide any government agency with the ability to buy items that are found on GSA schedule (a mandatory purchase under the FAR) through the website. Each of these organization's implementations and deployment of their e-Procurement tool is interesting, but this paper focuses on the Air Force's, a branch of the Department of Defense (DoD), needs and the process for their e-Procurement implementation.

E-Procurement in the Department of Defense and the Air Force

The DoD has been a major player in the e-Procurement realm since the NPR mandate was announced in 1994. The DoD closely defined how it as an organization wanted to accomplish the federal government's mandate with the Defense Reform Initiative in November 1997. One of the key concepts to moving toward a defense-wide, integrated system was the development of the Joint Electronic Commerce Program Office (JECPO) to manage the DoD's various branches in their conversion to e-Commerce, and therefore e-Procurement, systems. In addition, the office of Chief Information Officer (CIO) for the DoD was created. While the DoD started off with bold initiatives, it ran into just as many problems as the federal government in implementing e-Procurement. This highlights the problems of implementing electronic ideas in a public sector.

Although the JECPO was created to focus the various branches of the DoD towards implementation of a standard e-Commerce system, a report by the General Accounting Office (GAO) in July 2000 highlighted some of the failings of this office. First, although the JECPO committee had identified various goals and a strategic vision for

implementing e-Commerce, the office never developed a detailed plan on how the service branches were to accomplish the goals and vision. Next, the JECPO failed to create an e-Commerce architecture that would guide the services on how to integrate their different business processes into a cohesive e-Commerce system. Then, although the JECPO was set up to control the integration of e-Commerce into all the services and branches of DoD, its role in DoD was to receive funding and personnel through the Defense Information Systems Agency (DISA) and the Defense Logistics Agency (DLA). In addition to the dual sub-agency interest, the office was supposed to be controlled by the DoD CIO. This aspect provided the JECPO with three separate chains of commands to report to instead of one and raised doubts about the office being independent. Finally, goals to increase security measures for transactions in the electronic environment have not been realized, without which, the beginning of implementing an e-Commerce system would be futile (General Accounting Office, 2000:4). This report condemns the steps that had been taken by the DoD since the JECPO was created.

While the information provided by the GAO looks mainly at the failings of the JECPO, there have been some tremendous initiatives by the office. First, the Central Contractor Registration and DoD Business Opportunities (which eventually became Federal Business Opportunities) homepages have been true success in standardizing payment of contractors and disseminating information on available business. The DoD e-Mall provides a step in the right direction for one stop e-shopping for many commodities, however its price validity and ease of use are issues which have made it less than favorable. Paperless contracting has yet to happen, three years after the goal to go paperless, and the jury is still out on the use of the Standard Procurement System, which

was supposed to provide a DoD wide platform to standardize the whole procurement process. The Prime Vendor program shows promise, although the amount of business that goes through this source is still minimal. The use of Government Purchase Cards and Smart Cards has increased tremendously, but these concepts would be greatly enhanced with a valid e-Procurement system. The JECPO seems to have come to the realization that while the office will continue to work on these systems that will eventually meld into a comprehensive e-Commerce system, the separate service branches at this time should develop their own initiatives.

The Air Force has been attempting to implement an e-Procurement, and other e-Commerce systems. Several pilot programs and test programs have been attempted over the past two to three years. The Air Force is at a crossroads now where the system needs to be chosen and implemented, or the Air Force faces the risk of the program going into a research and development death spiral (the act of continual research on technology that keeps changing by the time any decisions on implementation can be made). The danger that the Air Force faces in this pre-implementation period is wasting time and resources on areas that are not important to ensuring success of an e-Procurement system. While agencies like the Internal Revenue Service, the Department of the Interior, and the General Services Administration have e-Procurement systems that each department uses, the benefits of these systems and lessons learned from implementation were never documented and/or made public. That is why a discriminate analysis of factors common in e-Procurement implementation in public sector organizations would benefit the Air Force in this planning stage before the system is chosen and implemented.

Acquisition Process

The acquisition process provides the driving force behind many aspects of an implementation of any system. The promise of twenty-first century acquisition is an integration of all the processes that go into making a useful and effective system for the customer. While this study deals with the implementation phase of an e-Procurement system acquisition, one phase of any acquisition can never be isolated from either the phases that precede it or the phases that will come after it. The impact of decisions made early on in the process, which is the stage the Air Force is currently in, will affect the rest of the acquisition. Also, although there are several types of process models to use, the spiral model offers the best fit for an acquisition for an e-Procurement system.

Impact of Decisions. The "iceberg effect" (Figure 2) provides a useful illustration of cost visibility in the acquisition process. Most references to costs of a specific program deal with the acquisition costs, the tip of the "iceberg". However, this model illustrates how up to 75% of the costs involved in the life span of a system fall below the "waterline" in system operation, maintenance, effectiveness, and retirement (Blanchard, 1998:4). The problem in viewing the tip of the iceberg is the strong effect the decisions made early in the acquisition process have on all those costs below the "waterline". As Figure 3 illustrates, the farther into the acquisition process a team proceeds, the less opportunity there is to have any significant impact on those hidden life cycle costs. By the time a team is ready for Low Rate Initial Production near the end of the design and development process, the opportunity to impact life cycle costs has decreased by over 60%.

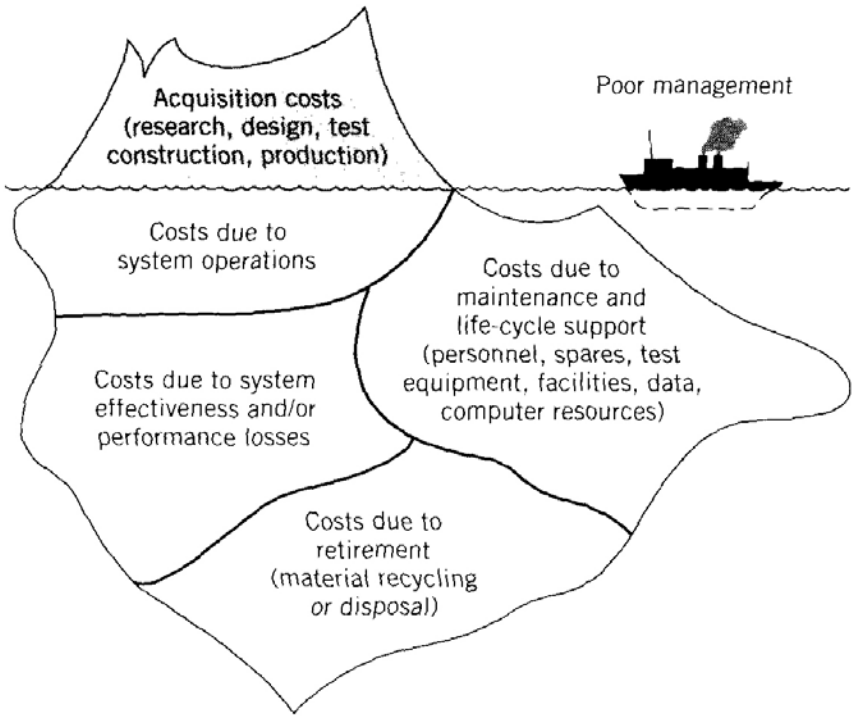


Figure 2 - Life-Cycle Cost Iceberg (Blanchard, 1998:4)

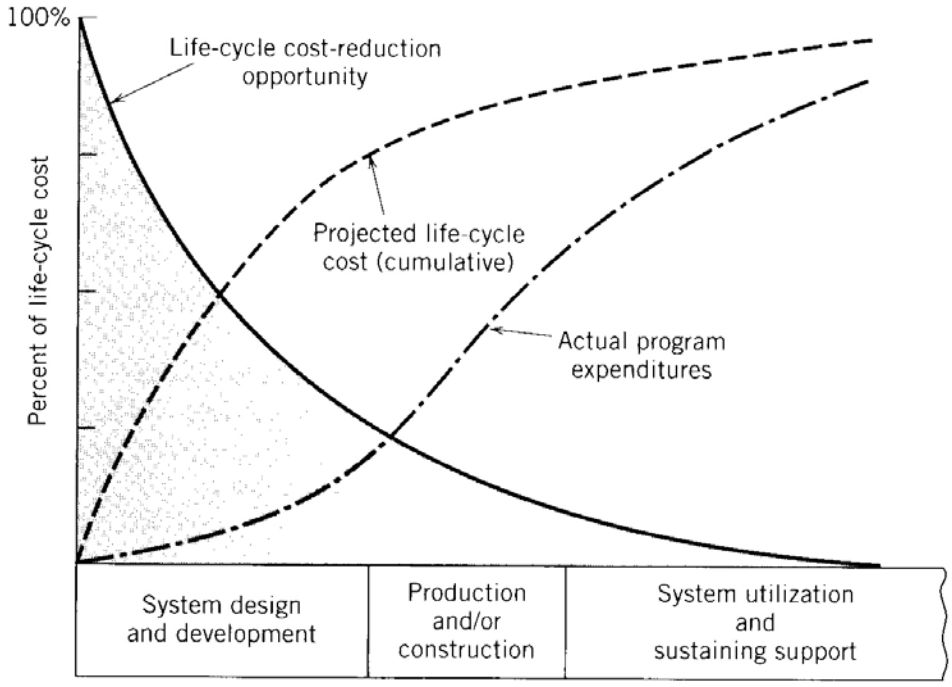


Figure 3 - Commitment of Life-Cycle Cost (Blanchard, 1998:5)

The amount of time spent in pre-design for an e-Procurement system by many federal agencies, including DoD, has led to a state of analysis paralysis. While DoD has taken an active part in e-Procurement since 1994 when the NPR mandated electronic initiatives, neither the DoD nor any of its branches have proceeded past concept designs or small, fragmented systems that have yet to be used service-wide. Although emphasizing the design process of a program allows the program to work out life cycle cost issues, the goal of acquisition is to develop an actual working system for the customer. While there is a law of diminishing returns over time in the design process, constantly incorporating new technology sets the process back as seen in Figure 4. To avert the sudden drop off in improvements when new technology is introduced in the market is a major problem in all software development, not just DoD.

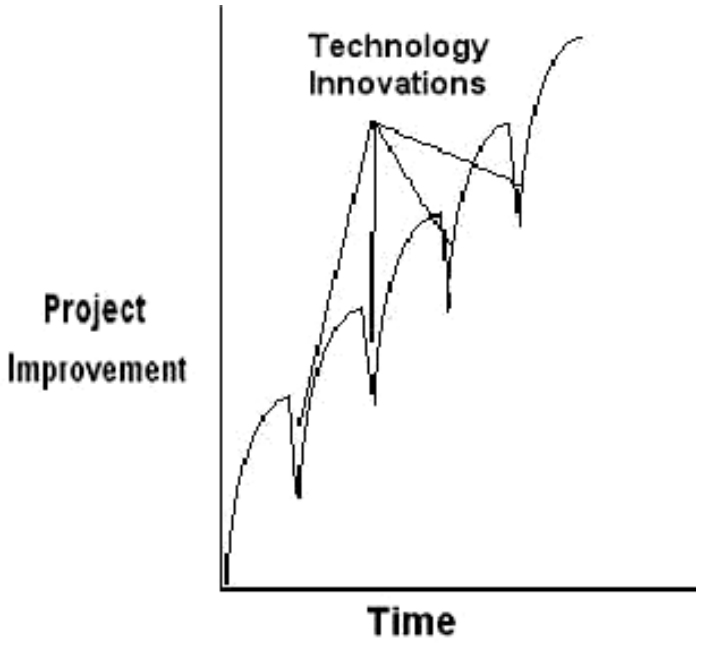


Figure 4 - Declination of Project Improvement

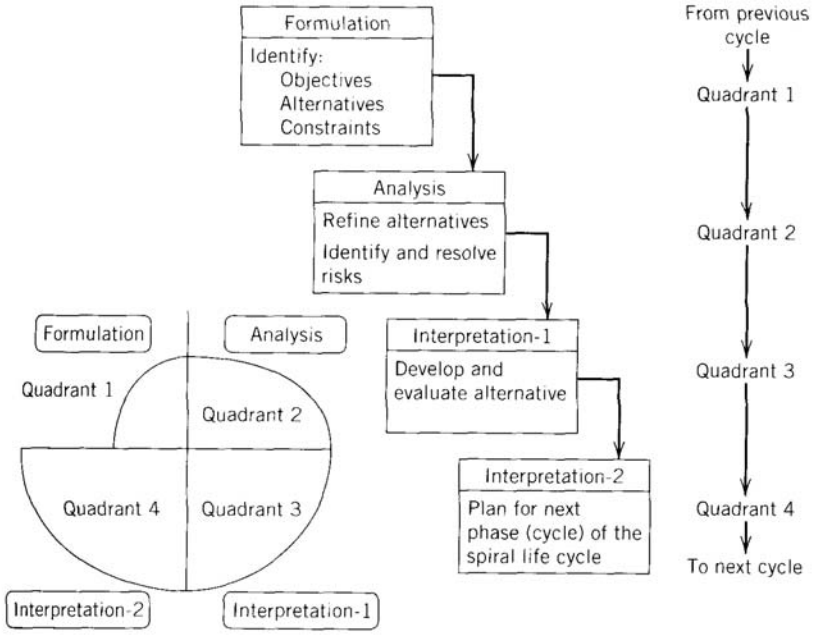
The problem in working on design concepts for almost eight years is that the technology changes so rapidly. Humphrey (1990) discusses this issue when he talks about requirements instability:

> To design, to build, and to test a program the required functions, interfaces, and environments must be stable. While these may change during development, the changes must be temporarily frozen while development proceeds. At planned intervals, batches of changes can be considered and the design adjusted accordingly. If change is not controlled in this way, the development process will become unstable, and productivity and quality will be adversely affected. (Humphrey, 1990:255)

While the human reaction tends to gravitate toward always incorporating the latest and greatest innovations as soon as they come out, to impose this constraint in an already slow acquisition process shackles the acquisition to the design phase. Alleviation of this problem arrives in the form of the spiral model of development, which will be discussed next.

Spiral Design Model. The Spiral Model for design was originally intended for software design. But the model has found applicability in any system acquisition that faces rapid technology shifts and the need to continually incorporate change. Boehm devised the model in response to the failures of the more orderly Waterfall Model, the most widely used framework for software development since 1970. (Humphrey, 1990: 249) The need arose from three main shortcomings of the Waterfall Model: 1) Inadequate address of change. 2) Assumption of relatively uniform and orderly sequence of steps. 3) Does not allow for rapid prototyping. (Humphrey, 1990:249) While not

every acquisition (even software) fits into the spiral development process, it is well suited for complex, multi-year projects.



Flow of activity in spiral life cycle

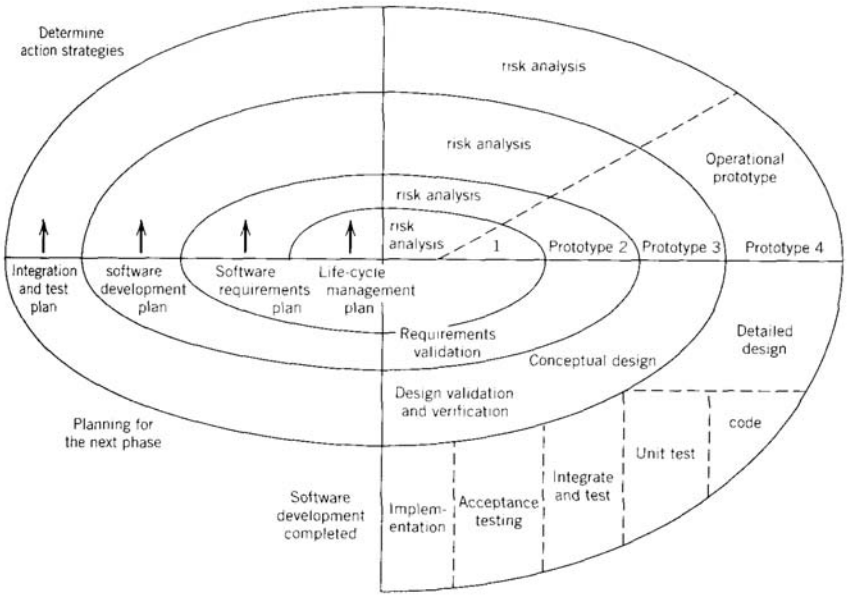


Figure 5 - Spiral Design Model (Blanchard, 1998:21)

As Figure 5 shows, the spiral model is a continuous improvement process on a system. No penalty exists for advancing alternatives early on in the process where the technology may not even exist yet, because the concept will be studied at its proper interval. The initial planners only need to develop a system that is designed for easily accepting upgrades to the system. Also, that emerging technology, which bogs developers down in shifting requirements, easily incorporates into the Quadrant 4 (Interpretation 2) and Quadrant 1 (Formulation) for discussion and testing for the system. The Spiral Model ideally eliminates the drops in project improvement as shown in Figure 4 (Blanchard, 1998:22). The drops disappear because the project is designed for change and the technology will only be incorporated after an iteration where the technology is determined to give more benefit than risk to the project.

At this point, one may wonder if the Spiral Model takes care of so many issues, why isn't it used more? The answer is twofold. First, there is operational user frustration from hearing about all the planned functionality of the end project, yet only getting small pieces of the package at a time. At times the opposition to using a system that may be fully capable, yet still have many future upgrades, may bring criticism to the whole acquisition process and disrupt the phases of the process. Project leaders must be aware of the aspects of change in an organization and be prepared to address them. Secondly, no one can see into the future and technology may not always follow the team's visions for upgrades. Project leaders must be able to handle this contingency and should always have several alternatives to satisfy a future requirement. Unfortunately, these two problems feed off of each other and can create a snowball effect that could disrupt and even destroy the project.

The DoD is no stranger to the Spiral Model. The Standard Procurement System (SPS) has been developed utilizing this model. SPS is an example of how the problems can develop when enough criticism is applied. The first problem SPS created was in announcing what the user would be able to accomplish when the final version of the system arrived. This raised user expectations and led to a large disappointment when the initial version arrived and had substantially less functionality than was stated at the training. Next, the milestones for release were severally delayed partly from underestimating the number of issues that would arise after initial implementation. More importantly, however, criticism swelled from users and the individual branches of the DoD (and sometimes components within a service) were not happy with the compromises being made for one joint system.

In looking ahead to development of an e-Procurement system (presumably as a part of a larger e-Commerce system), there are several issues to address if using the Spiral Model. First and foremost among the issues will be deciding on the phases of the project. While the DoD has over 90,000 vendors, whom must be given a fair and reasonable opportunity to compete for contracts, there definitely needs to be phases in rolling out the necessary equipment and training for both acquisition officials and vendors. Next, training timing represents a major issue in keeping the workforce enthusiastic about the change. If the training is relatively unobtrusive, explains exactly what is expected, and provides resources for follow up help, as well as briefly and concisely explaining the importance of the system, users will not resent the change and may recognize the benefits the organization will gain from the change. Ensuring proper phases and training reaches

back to the first section's discussion of the hidden Life-Cycle Costs, because these improvements fall into system operation and effectiveness.

Factors

E-Procurement (Technology). The comfort level of the organization with their technology culture is seen as a large factor in how successful the implementation of that technology is. There are several indicators that signal an organization that is preparing for a dramatic change in technology that will affect core processes. Mercer Consulting developed a chart (Figure 6) that plots out technological acceptance on four different planes. Each plane may have a value from zero, which equates to a "poor" rating, to a three, which equates to an "excellent" rating, for that particular area. As seen from the example of the second figure below, the bigger the diamond the actual ratings make, the greater the chance for the technologies acceptance (Chaudhuy, 2002:9). For the model to be effective for a company, however, it must be constantly updated as the rapidly changing pace of technology makes the upper boundaries of the model constantly fluctuate.

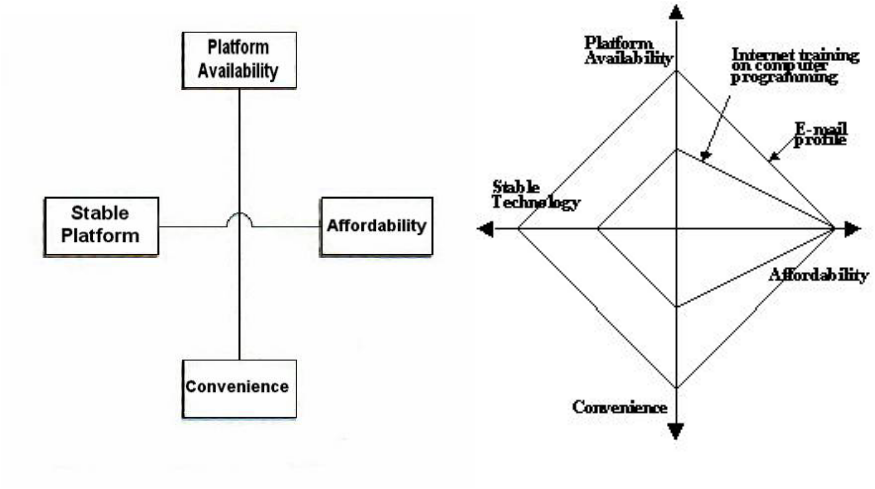


Figure 6 - Technology Acceptance Graph (Chaudhuy, 2002:9)

The different planes of the model allow a company to analyze their e-Procurement options and make a decision on if they are ready to implement a system. First there is the affordability of the system, which rates the cost of the system versus keeping status quo or going to other technologies. Then there is the convenience factor that not only measures the productivity savings from the project, but also how easy it will be to adapt to current policies and the amount of training required for successful implementation. The next factor, stability of the platform, shows the maturity of the platform and how powerful the technology is for the work it will be doing. Finally, availability of a technology shows how widely proliferated that technology is throughout the global marketplace, which increases a company's leverage with suppliers in attempting to integrate with them (Chaudhuy, 2002:9-10).

While technological acceptance helps a company determine if it possesses a viable solution for itself, it still has to choose a variety of options based on what they do. First there are several options for what types of functions a business needs to have for e-Procurement capability. Traditional manufacturing companies led the charge in e-Procurement, thus allowing for more experience in developing the proper support functions for their department. Traditionally, the backbone of manufacturing e-Procurement has been the electronic catalog. One company, Fastenal Co. is on the leading edge of companies that employ electronic catalog technology. Fastenal purports that it only takes three or four days for them to "crank out a catalog on demand with custom pricing for a selection of 100,000 products that's compatible with e-Procurement systems from vendors such as Ariba Inc. and Commerce One Inc. [two leaders in supplying e-Procurement solutions]"(Gilbert, 2001:51). While Fastenal has invested a

large amount into this technology, they feel the benefits realized from the ability to get pricing out and be compatible with a procurement organization's system gives them a competitive advantage in their arena.

In Leibs' article in CFO magazine on services e-Procurement, they state that service companies face a more challenging task than traditional manufacturing companies with the amount of functions necessary for them to succeed in e-Procurement. While a traditional manufacturer may get by with "online catalogs and Web trading exchanges," service companies incorporate, "front-end functions such as the posting of requests for quotes and comparisons of competing bids, intermediate steps such as workflow and approval routing, and back-end chores such as payment and record keeping" (Leibs, 2001:92). While services may be forced into these extra tasks for e-Procurement, the manufacturers will also need this technology. The next generation of e-Procurement capable companies will be interacting up and down the supply chain for both services and manufacturing companies. This type of innovation will lead not only to increased visibility through the continued expansion of the Internet, but also increased business visibility into the supply chain.

One function that may aid in payments in the electronic environment is including the ability to pay by a company's procurement card in the system. For this function to work, the company must partner with the procurement card provider. Lockheed Martin took this step with US Bank Visa to ensure their procurement card was fully integrated with their SAP R/3 ERP system (Avery, 2000:16). By integrating the procurement card, the need for a separate payment module is eliminated and the bill is consolidated into a

monthly payment for the procurement office. Another advantage is that there may be rebates that can be negotiated with the procurement card company based on dollars spent.

When a company decides on the procurement functions it requires to be in place, the technological medium it wants to use must be decided upon. In the beginning of e-Procurement efforts, structures used Electronic Data Interchange (EDI) and Value Added Networks (VAN) in various solutions. These systems were very innovative for their time and were the basic building blocks for the current e-Procurement uprising. However, applications developed for these systems had little standardization and the interface was basically with users holding the same software. While they were very inviting in the early nineties, the advent of the Internet has made for a more efficient means to pass on information.

The medium eXtensible Markup Language (XML) has been gaining wide acceptance over the past two years. While the Internet for years usually utilized Hyper Text Markup Language (HTML), which specified the appearance of the document the user wanted to send, but did not send information such as data fields for programs to interact with and pull information from. With XML, the user can define the structure for many types of data, almost like a database, and through this, programs can recognize the form of the data from other systems that use XML and the same structure for that type of data (Chaudhuy, 2002:268). Denise Donald, business development manager for e-Procurement specialist e:\\volution, says, "A lot of people say that the integration of e-Procurement with existing internal systems like ERP [Enterprise Resource Planning] suites will be a nightmare. But that's not our experience – with XML, dynamic information exchanges and the cross-platform capacity of integration tools, it's often so

easy" (Bland, 2002:25). With XML, not everyone has to utilize the same system in order to continue business relationships; they must simply standardize the data format. And though XML is a young technology, it has gained wide acceptance and therefore makes it a stable platform for future use.

Another option for companies seeking to employ e-Procurement is to employ the use of an Application Service Provider (ASP). An ASP hosts platforms to be used by companies for e-Procurement rather than selling software to companies. Two years ago this market segment of e-Procurement was rapidly growing (Consultants, 2000:79). However, due to a slowing economy, the incentive to start up in this business has declined and some former suppliers have simply gone out of business. However, if the economy regains momentum, this area could do well, as discussions with procurement officials at Honda and NCR Corporation indicated that they prefer not having to host programs within their firewall. This does offer an option for businesses that do not have the current resources to implement an in-house e-Procurement system and have a lot of spending occurring that they would like to have better visibility into.

If a company chooses to buy software and use an internal e-Procurement system, they may choose to either go with an off-the-shelf suite or work with a solution provider to develop software. While buying off-the-shelf lowers cost of development and implementation, they may not support a company's business strategy that may entail more complex B2B transactions (Foust, 2002:44). On the other side, there is the need to work a long time with a solution provider to ensure the system provided is tailored to the company's procurement strategies and needs. There are several levels in between these two extremes that provide a company with what they want. In the Processes section

below, the need to match business strategy to the e-Procurement system will be discussed further.

One problem in implementing an e-Procurement solution is the need to integrate the legacy systems of a company. In companies with long procurement histories and tons of historical data in these legacy systems, there may be hesitation in the move to new programs. One problem with legacy systems is that they hinder the ability of the company to create new systems that will be compatible with suppliers and customers. The procurement history is important for companies trying to accomplish Supply Chain Management, but one option may be a thorough scrubbing of information before implementation to determine the risk distribution of a company's suppliers, as well as the family tree relationship of their suppliers (Consultants, 2000:81). This relates to the affordability factor on the technological acceptance model.

While technology drives e-Procurement, it is by no means the only, or even the most important, factor in implementing an e-Procurement solution. Technology is the enabler of e-Procurement. Technology and business change go hand in hand (innovations such as the car, the typewriter, the computer, etc. all had a profound impact on businesses). But someone has to decide the company's position on technology. A company may develop the most comprehensive e-Procurement plan, have the resources, and the enthusiasm to implement the system, but without high-level support from management, e-Procurement will have a hard time getting off the ground.

Management. Management plays a large role in steering the company during implementation to make the transition as effective as possible. In one of the most highly regarded books on the idea of Business Process Reengineering (BPR) Hammer and

Champy (2001) discuss the role of the leader in BPR. They say a leader "is a senior executive with enough clout to cause an organization to turn itself inside out and upside down and to persuade people to accept the radical disruptions that reengineering brings" (Hammer, 2001:107). The definition of BPR is "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance" (Hammer, 2001:35). Implementing an e-Procurement system in an organization definitely fits Hammer and Champy's criteria.

In Lockheed Martin's efforts to move to a more comprehensive e-Commerce environment, then company president Jim Berry supported the effort fully. While Lockheed's manager for sourcing and business development, Bobby Proffitt, led the development of the plan, he did not want to go forward without high-level support. Mr. Berry reviewed the proposal and eventually put his enthusiastic support behind Mr. Proffitt. This allowed Mr. Proffitt to implement process and technology changes using the authority of the company president. This freed Mr. Proffitt of the burden of attempting to convince all of Lockheed's business divisions on how the proposed system would benefit them (Avery, 2000:14).

In the government sector, there is also an impetus for having high-level involvement in the efforts of implementing e-Procurement. Virginia's former Governor James Gilmore, a national leader in promoting e-Commerce activities and an advisor during current President George W. Bush's campaign on information technology matters, appointed a Cabinet-level Secretary of Technology during his tenure in Virginia. With this high level position and Governor Gilmore's idea to change Virginia from the "Old Dominion" to the "Digital Dominion" has allowed Virginia to lead e-Commerce

programs among the states (Gottlieb, 2001:24). The goal of state governments seeking to implement "e" systems is to ease the burden of residents and ensure state money is spent as effectively as possible. While Virginia is not the only state implementing these initiatives, Governor Gilmore has created high visibility for these programs among the state governments.

One of the problems with not having a specific, high-level official overseeing programs is illustrated by DoD's early attempts at implementing an agency wide e-Commerce system. DoD started strong in the e-Commerce realm by creating the Chief Information Officer (CIO) position and implementing the Joint Electronic Commerce Program Office (JECPO) to oversee the development and implementation of efforts throughout the DoD. However, while the JECPO reports to the Secretary of Defense through the CIO, they are also controlled by two other sub-agencies, the Defense Logistics Agency (DLA) and the Defense Information Systems Agency (DISA). DLA and DISA provide both funding and personnel for the JECPO, which means the commanders of DLA and DISA want to be kept in the loop and have a say in what the JECPO does (GAO, 2000:6). This fragmented leadership style has led to the failure of the DoD to implement an agency wide system in the timeframe originally defined. One key abuse cited of the DoD is that they did not adequately assess their processes in determining a plan for implementation.

Processes. Processes are the key to any implementation. In order to utilize e-Procurement, an organization must have good business practices. The risk associated with implementing an e-Procurement system on top of bad procurement processes resides not only in the cost to acquire the e-Procurement system, but also the accelerated costs

the company occurs from abuses in the system. These actions may put the company in a death spiral by making their procurement reactionary and incapable of dealing with the problems that arise in the system. That is why so many companies that have implemented or that are an expert at providing solutions recommend reviewing business processes first.

One of the reasons that companies get into trouble during implementation is that they do not have the IT experience necessary to develop a system and have to rely on outside consultants or providers (Bland, 2002:25). In relying on outside companies there is the possibility that the outside corporation may not understand the business processes in place in the company. The outside parties may attempt to force an organization into procurement processes based on the software available or previous practices. While e-Procurement activities are important, organizations must realize that they are the experts in their own businesses and they shouldn't be forced into processes that make them uncomfortable just to implement e-Procurement. They may either wait until the technology to fit their needs becomes available or attempt to find a provider who will work with them.

One of the first steps in implementing e-Procurement should be having a third party analyze the organizations existing purchasing system (Bland, 2002:26). One e-business project manager eloquently stated that, "You need a procurement strategy and procedures in place before you introduce e-Procurement, otherwise you're just introducing more complexities on top of a mess" (Hayward, 2001:5). IBM, a leader in the e-Procurement revolution, believes that solutions that rely on a "unique procurement tool" fail because they "cannot fit into real business process" (Hannon, 2002:36). KPMG

makes the point, “Leading companies in e-Procurement aren’t just selling software. Rather, they’re building an infrastructure” (Consultant, 2000:84). Even if the procurement process is sound, it may pay to ask if the process is at the top of the industry.

To ensure leading edge procurement before implementation of an e-Procurement system, an organization should ensure strategic sourcing processes are in place. One e-Procurement provider from Integrated Strategies feels that few companies stop to “consider what percentage of the potential savings they might achieve by simply applying best sourcing practices” (Consultants, 2000:79). This could involve strategic alliances, supplier reduction, or other steps to decrease both management and procurement costs. Alan Daniel, the e-Procurement manager for Texas Instruments, agrees that by first ensuring the procurement process is on par with leaders in the industry, “the savings you realize will be the result of what you have done internally with your processes and strategies” (Atkinson, 2001:24). New technology and new business fads can never substitute for good business practices.

State and federal government business processes are largely regulated by very strict policies. These policies are largely in place due to the public’s suspicion in the 1950s and 1960s that the government engaged in questionable and illegal business practices like kickbacks and insider information (Gottlieb, 2001:28). These policies have traditionally served to ensure these abuses are mitigated and the public trust is served. However in moving to e-Procurement, there are examples of some agencies attempting to redesign the processes and trust the increased visibility to take care of the problems. The Air Force recently cut down the pages in its FAR supplement from over one hundred to twenty-five. The state of Massachusetts reduced its procurement regulation from one

hundred pages to twelve pages of "value-based regulations" (Mitchell, 2000:22). These are two examples of how the government is attempting to change its processes to favor the implementation of electronic business systems.

In the government, not cleaning up business processes and developing an implementation plan also hamper the implementation of e-Procurement. While the benefits of e-Procurement include increased visibility and decreased rogue spending, if the processes that allowed these problems are not eliminated, the problems will still be around. The Space and Naval Warfare Systems Command (SPAWAR) Systems Center underwent Congressional investigation of procurement card abuses and tried to point to e-Procurement development efforts in their plan for recovery. However, the congressional finding was that, "Although the new system has the stated capability to address the weaknesses we identified in the purchase card program, until it is effectively implemented and individuals comply with purchase card policies and procedures, SPAWAR Systems Center has little assurance that the weaknesses we previously identified will be corrected or mitigated" (Kutz, 2002:14). SPAWAR thought e-Procurement would solve their problems without realizing that it is the processes, not the technology, which creates problems.

The other large part of changing the businesses processes is training personnel. A big step in the implementation process is getting the eventual users of the system to not only know, but also believe in the new processes. While equating e-Procurement with BPR, the image of laying off many workers after implementation is a concern of employees. However, while a goal of implementing e-Procurement is decreasing the number of personnel needed to manage the procurement activities, there is the need to

move some workers into a strategic sourcing department to manage the new system. Whatever is done, their needs to be a definite change in the attitudes of procurement personnel.

The procurement-supplier relationship has traditionally been adversarial. While Ford did not implement e-Procurement fully, in its BPR shift to strategic sourcing, they found that they needed to train their personnel to view their suppliers as partners (Hammer, 2001:226). In federal agencies, the procurement policies discussed above cement the adversarial relationship in our procurement processes. While these policies are on the road to reform, the significant change does not automatically assure the government that users of the new system will be more efficient. Users in the government are not only shifting from an adversarial to a partnership mindset, but also from a specific rule for every possible decision to the necessity to use sound business judgment in day-to-day procurement decisions (Hansen, 1995:IV-2). While training may help, there may be a generational gap to get the old mindset out of the organization.

Suppliers. "What if we set up an e-Procurement system, and no suppliers came?"(Atkinson, 2001:23) The re-phrase of the popular 1960s saying highlights the fact that the implementation of an e-Procurement system is definitely a two-sided beast. Too often the procuring organization sees the flash of savings promised through e-Procurement. They may even have a top rated procurement system currently in place, but fail to realize that unless suppliers buy into the system, it will be a cart without a horse. So the next key factor in implementation is to get suppliers to buy-in during implementation planning.

Some industries have suppliers that are ready to work with procuring organizations in implementing an e-Procurement system. However, other industries have suppliers who will gain little benefit from working electronically. As a supplier, they not only have to worry about interfacing with the organization that wants to enter the electronic buying arena with them, they have to worry about investing a lot of money and also whether the system will be able to interface with all of their customers (Hannon, 2001:10-11). Providers of e-Procurement and ERP solutions have realized this and are trying to ensure that systems can by compatible across a wide spectrum. This is possible through the XML technology and standardizing data format.

Lockheed provides an excellent example of how to work with suppliers in order to ensure e-Procurement implementation with suppliers is successful. Lockheed developed an e-Commerce tool called ipTeam that acts to develop and manage supplier data. Lockheed provides this software to its suppliers in order to ensure the data formats work and they can still do business with minimal disruption. Through working with their office supply providers, about 28% of Lockheed's office supplies are purchased through their e-Procurement system. In 2000 this was definitely a significant achievement for a large corporation's e-Procurement system (Avery, 2000:17).

One option for companies seeking e-Procurement solutions to get their suppliers, and other suppliers in their industry, on-line for e-Procurement is through the use of aggregators. Aggregators are companies that take a company's electronic catalogs and place them in a database with several other suppliers' catalogs (Gilbert, 2001:52). This provides the supplier with a cheap way of getting their information out to those who are looking to do business with them in the electronic realm. It also gives the procuring

organization the ability to identify which suppliers in their industry are "e" capable and also provides a great marketing tool to leverage pricing. Aggregators are mainly in service for manufacturers right now, but only time will tell if services will be added to their service.

Sometimes, the procuring organization may need to coerce suppliers into using electronic methods. Cessna launched an EDI system in 1998 and found that many small suppliers simply did not use the system to the full extent because they did not understand it, which negated many of the visibility benefits Cessna hoped to receive. So Cessna developed a Web-based tool to provide to suppliers who were not comfortable with EDI. They paid the cost to install the program, but after implementation no longer accepted orders or information from phone or fax transmissions that could be done in the system (Morgan, 2000:105). Cessna wanted to realize the savings and to do this they let their suppliers know that either they complied with their buying policy, or they would no longer be used as a supplier.

The preferred approach to supplier involvement is to show them how the system benefits them. John Sharman, a procurement practice executive for IBM, says, "Customers need to better define the supplier value proposition" (Atkinson, 2001:25). The supplier can realize many of the same benefits the procuring agency realizes as well. The supplier will get increased visibility into their sales and decreased administrative costs and hopefully time to payment. This can be particularly beneficial to small businesses that have rudimentary accounting systems. The goal is not for someone to win the game of e-Procurement; it is for everyone to work together to gain more return.

In the government, the need to manage suppliers becomes a monumental task. The government is required to give any supplier a fair and reasonable chance at any procurement opportunity. Therefore, any supplier in America (and to some extent, the world) could bid and would need the ability to interact with the government system. While large suppliers may have the capability to implement what the government dictates, a concern about small businesses' ability to utilize the Internet remains. For small businesses to be able to compete there may need to be a program to offer the supply-order tool and a low-end personal computer (Mitchell, 2000:25).

Benefits. The benefits an e-Procurement system offers several challenges in measurement and meaning. There are three main benefits that are mentioned throughout the literature. First, e-Procurement offers administrative cost savings by decreasing the labor and repetitious paperwork that has traditionally gone into the procurement process. Next, through visibility of spend data, the procuring organization can leverage their procurement decisions to realize better prices on purchases. Finally, there should be decreased time in the procurement process, leading to better efficiency.

While some companies have complained that the promises of e-Procurement are misleading, a recent study by the Aberdeen Group found the following benefits realized from e-Procurement:

- Lowered prices paid for goods and services (via leveraged negotiations and contracts) by 5% to 10%
- Reduced administrative costs by 73%
- Shortened acquisition cycle time by 70% to 80%
- Reduced off-contract (maverick) spending by 51%

- Reduced inventory costs by 25% to 50% and
- Improved expenditure data-gathering and reporting (Atkinson, 2001:23)

While some of these benefits may be attributable to improving the organization's procurement processes, the tremendous decline in administrative costs and inventory costs can be attributed to e-Procurement speed and business intelligence. So while not every company may realize exactly these savings, this study shows there is information to support the benefits of e-Procurement.

The administrative cost reduction and decreased procurement time go hand in hand. The National Association of Purchasing Management (NAPM) found that a single purchase of $500 might cost the organization up to $150 just to process (Mitchell, 2000:22). At Clear Communications, the first year of their e-Procurement system allowed them to decrease their cost per order from $100 to $64 and decrease the number of orders from 3000 to 1000. They did this through consolidating purchases and eliminating having to fill out information in multiple places by having the system fill out standard data automatically (Bland, 2002:24). Lockheed Martin has almost reached its goal of decreasing its acquisition time from sixteen days to three days (Avery, 2000:17). These are great benefits, but too often these savings go away quickly.

Companies are quick to grab at the benefits to be realized from the administrative and productivity efficiencies. However, the consultant Booz Allen and Hamilton feel that companies, "many struggle to extract the full benefit of the information and scale they can now muster to realize savings across the enterprise" (Consultant, 2000:82). The cost savings realized from administrative and productivity are often immediately visible and breathtaking. However, in the long run they will disappear because it is hard and

expensive to keep reengineering processes to cut more fat out of them. The true sustainable costs come from leveraging and the visibility the system provides.

Leverage can occur because of the tremendous amount of a company's dollars going to procurement and the consolidation of requirements. At Lockheed, they estimated 70% of their sales dollars went to procurement (Avery, 2000:15). This percentage is fairly typical for organizations. Regions Financial Corp. has an e-Procurement system for just over a year, but already they have realized a 15% decrease in cost of goods through leveraging. The director of procurement for Regions Financial points out that prior to the e-Procurement system, 68% of procurement was done outside the procurement system, but the use of e-Procurement has cut that number down to 32%. The more goods that can be put through a procurement system, the better leverage a company will be able to realize.

While there are many examples of savings in the manufacturing arena, there are other industries that have not yet been analyzed at length. Leveraging the service arena is an area that is showing great promise. While the acquisition of services traditionally is more complex than manufactured goods, there is a strong support for this type of system. Companies spend a large percentage of their labor dollars on temporary and contingent workers. Scott Wilkerson, manager of solution strategies at Commerce One, says the benefits to be realized by utilizing e-Procurement on contingent workers may be anywhere from 5 to 25 percent (Leibs, 2001:93).

Conclusion

In accomplishing a thorough review of public and private sector organizations' e-Procurement efforts, it is supposed that the general applicability of the success factors

and lessons learned will become more relevant. The review attempts to validate the likelihood of success able to be attributed to implementing key principles. Additionally, I hope to reassess the degree of benefit that can be attributed to previously identified key success factors. The final resulting factors can then be used as foundational principles for any government organization desiring to begin an e-Procurement program.

III. Methodology

Research Question

This research focuses on the following research question:

- **What are factors that can enhance the probability of successful implementation of an e-Procurement system in the public sector?**

The Air Force currently funds projects chartered with studying and developing an e-procurement solution. These projects deal mainly with the functionality the Air Force requires for an e-Procurement system based on the rules and policies that are in place. The projects have not looked into the different aspects of implementing a system so that the full benefit of the system may be realized. A review and analysis of various e-Procurement projects (i.e. public and private sector) should identify factors that contribute to successful e-Procurement implementation. This process of identification should: 1) improve pre-implementation planning, 2) improve spend decisions, and 3) decrease implementation time by eliminating unnecessary steps as well as add the benefits of e-Procurement mentioned earlier to the organization.

This thesis covers e-Procurement, whether implemented alone or as part of a larger e-Business system. The model development will concern primarily federal organizations, and specifically the Air Force. Although the process is relatively new, the concept of e-Procurement has grown rapidly in the past decade, and more specifically in the past four years. The novelty of the idea makes for minimal literature on successful e-Procurement implementations in peer-reviewed journals, although many articles on e-Procurement are currently being reviewed as seen in the Academy of Management's

pending paper database. However, many trade journals from both the computer and purchasing professions provide insight into the emerging world of e-Procurement.

Research Design

The first part of the research took place during the literature review. By analyzing the, albeit minimal, data on companies that have had success with implementing an e-Procurement system, some of the important factors for success were deduced. The second part of the research was developing the survey tool and administering it to the population. The population was chosen as the fifty state Chief Information Officers to analyze one group that resembles the federal government. Gathering the data from them allowed us to perform a discriminate analysis of the data.

The discriminate analysis of data allows for comparing the success of organizations in implementing the entrepreneurial mindset. Through surveying organizations and analyzing their responses on what was important in their organization's implementation of e-procurement, a statistical model for success can hopefully be developed. This model will allow the most important factors of e-Procurement implementation to guide an organization's decisions through pre-implementation planning, implementation, and also areas of post implementation such as training and updating.

Data collection

Sample. The sample of organizations I will study will be the population of the United States state governments. The state director for acquisition or, preferably if one exists, the head of the office responsible for e-initiatives will be surveyed to gather the necessary data regarding the importance of the factors of e-procurement implementation.

In attempting to find organizations whose purchasing practices mirror DoD as closely as possible, the state governments emerged as likely candidates. Reasons for choosing state governments include factors such as their need to purchase parts for a logistics supply chain that is fairly complex, size and reach of the organization, high number of suppliers, a fairly structured acquisition environment with multiple rules and regulations, and varied types of products purchased. While not all state governments currently utilize e-Procurement, the number of them that have implemented should provide good data that will be more applicable to the federal government than trying to compare it with a private industry.

Interview Questions

In reviewing the existing literature I have identified fourteen constructs that could be possible factors influencing companies successful implementation of an e-procurement network. From these constructs I have chosen a measure to operationalize each construct. Five quantitative variables and nine qualitative variables reside among them. To ensure a common understanding of the definitions of the measures, I used the most prevalent definition found in the existing literature as the basis for the interview question.

For a response variable for the model I gathered data on three additional constructs, perceived administrative cost-savings, perceived procurement cost-savings, and perceived time-savings from e-procurement initiatives. I then made a composite response variable of the three that I call the e-Procurement Satisfaction variable.

Reliability/Validity. Reliability and validity concerns arise in this study for a number of reasons, however, steps have been taken to try and mitigate the concerns.

Reliability of the gathered data was assessed in the statistical analysis. However, reliability concerns were taken into account in development of the survey questions. David Dooley, in his book Social Research Methods, states that three ways to improve reliability include ensuring questions are reliable, standardization, and examining the sample.

First, to ensure reliable questions, the questions' wording was developed from the most common definitions of the construct and measure found in the existing literature. For the more ambiguous questions, such as time and cost savings, the definition was thoroughly detailed in the questionnaire to ensure a standard response to this question that could be interpreted in many different ways. Finally, although the sample for this research is the state governments, the questionnaire was developed to try and be generalizable to any organization. Should future research desire to check different organizations, including for profit organizations, the questionnaire was developed to only be specific to e-procurement, not business type. This reason for the planning is to attempt to ensure that future researchers can use the same questionnaire and achieve similar understanding and coding of responses which are non rater dependent.

Validity issues arise by checking to see if the variable chosen actually represents the construct it seeks to measure. The most important type of validity for this study will be the predictive validity of the factors. Predictive validity occurs, "If we measure with the new test before the criterion"(Dooley, 2001:89). Thus since the factors for e-procurement success have already been chosen, the goal is that some of them will be valid predictors of the model. Construct validity has been addressed in this case through many of the methods mentioned above in the reliability section. By defining the

constructs and their applicable measures, utilizing the existing literature, and providing a thorough definition in the questionnaire to ensure the measures desired for the constructs are the ones gathered in the interview, the measures are valid for the constructs.

Data Analysis

A discriminate analysis of the data provides a method for looking at the amount of significance each factor contributes to explaining the variance in the cost/time savings response variable, the factor that represents success in e-Procurement initiatives. To perform the analysis, I used the SAS Institute's JMP 4.0.4 statistical software program. I used a multiple, step-wise, regression tool to perform the actual analysis.

Standards

The only standard that needs to be defined for this study is the response variable for the survey, e-Procurement success. The researcher narrowed the choices to two:

1) Cost/Productivity Savings – a quantitative measure (made so by standardizing a formula for computing each type of savings) to assess the impact of e-Procurement on the organization.
2) General Success – a qualitative measure based on a Liekert scale which asks the state government's director of electronic initiatives to rate the impact of the e-Procurement system.

In the end it was determined that since different organizations tend to measure cost and productivity savings in very different methods, the general success response variable would be more applicable. It would be developed based on the average Liekert (5 point scale) responses of three questions. The three questions deal with how much the

organization feels it has saved in terms or administrative costs, procured goods costs, and time.

Assumptions

The research assumptions of this thesis are attributable due to the lack of knowledge on federal organizations implementation of e-Procurement systems and the small number of federal organizations that have attempted to implement. The assumptions I use in this thesis are:

- An e-Procurement system will be implemented in the Air Force and it will reflect current procurement policies.
- State organizations are viable samples for the study of e-Procurement implementation in the public sector.
- Public organization procurement strategies are similar enough due to regulation to allow common factors that will enhance implementation.
- Factors of implementation found in the literature on private organizations can be transferred to federal projects.

These four assumptions allow for the study to develop a model of probable factors that enhance e-Procurement implementation that can apply to current Air Force efforts as well as other federal organizations.

IV. Results and Analysis

Introduction

This chapter details the results collected and analyzes the data collected as described in the previous chapter. It begins with a discussion of the questionnaire response and how the rate of response limits the application of the data. Then there will be a discussion of each of the different factors using descriptive statistics. Next, the discriminate analysis process will highlight what I have deduced about each of the factors and their ability to influence overall e-Procurement implementation success. Finally, the chapter will close with a discussion of the final model and how it fits with the data.

Survey Response

Due to the initially poor response rate from the web-based survey (6 responses of which only one was a user of an e-Procurement system), the option of telephone interviews was utilized to enhance the number of respondents. In accomplishing this option, there is the risk of non-standard response with the web-based survey respondents due to the interviewer being present to explain the intent of questions. Although the interviewer tried as much as possible to keep the telephone conversations strictly on the lines of the survey and avoid elaboration until the end of the survey, many of the subjects elaborated on their positions. In addition, at times during the interviews, the interviewer was left to classify the actual answer to the survey question after an elaboration on the particular State's description of their system or processes which may lead to interviewer bias being introduced into the answers decided upon. However, due to the fairly narrow

interpretation of the questions, it is likely that the respondent would have arrived at the same conclusion if they had taken the survey on their own.

Another problem is one that is recognized by the American Statistical Association as one of the main sources of survey error: noninterviews (McClave, 2001:328). This is the nonresponse to either the web-survey or repeated telephone calls. Below shows a formula that depicts what the sample size would needed to have been to gather a 90% confidence interval (where α is the level of significance, p is the population proportion, q is (1-p), $z.5\alpha$ is the z score for a two tailed significance level, and N is the total population):

$$\alpha := .1 \quad p := .5 \quad q := .5 \quad z_{.5\alpha} := 1.64 \quad N := 50$$

$$n := \frac{N \cdot z_{.5\alpha}{}^2 \cdot p \cdot q}{\left[\left(\frac{\alpha}{2}\right)^2 \cdot (N-1)\right] + \left(z_{.5\alpha}{}^2 \cdot p \cdot q\right)}$$

$$n = 42.295$$

So a sample of 43 states would have given the sample a 90% confidence interval. However, only 35 states actually responded or were able to be contacted. This only yields a 71% confidence interval for the sample.

In addition to the low confidence interval, only 9 of the 35 states actually employed an e-Procurement system in their organizations. While the lack of organizations utilizing e-Procurement makes the application of any model very limited, it does represent the number of the total population (state governments) that utilize e-Procurement. This study does not address any factors of those states that do not have an e-Procurement system, and therefore the 26 non-users yield no value to any quantitative

analysis other than seeing that only 26% of the respondents actually had a system in place. However, from the phone contacts, several pertinent facts arose from the non-users that will be discussed in Chapter 5 since they are qualitative and not part of the original study.

Descriptive Statistics

This section will attempt to explain the results found in each of the areas measured. The unformatted results are found in Appendix B and have explanations of the coding for each measurement. Histograms, means, standard deviations, and confidence intervals for each response are in Appendix C. Many of the factors were coded as dummy variable (i.e. either a one or a zero depending on if the factor was utilized) and the frequency distributions of these variables will provide us with a good idea of what the states that have implemented e-Procurement viewed as important when implementing. Unfortunately, because of the many dummy variables coded in the study, a correlation table provided no useful information as to how the variables interacted with on another.

Technology. In the technology questions, the study attempted to ascertain the level of technology that the organization was both familiar and competent with. The first question dealt with the level of customization the organization utilized in their e-Procurement system. As seen from the results, the states with e-Procurement systems were divided 5 to 4 respectively with utilizing COTS applications with some customization and having a consultant analyze their process and recommend a COTS application. These results indicate that although an organization wants some

customization in the product they implement, the lower development costs of the COTS software is more appealing and something the organization is willing to trade off.

Next, the types of e-Procurement tools that the organization utilizes showed a key bit of information. Namely while most of the states utilized their e-Procurement software for research and buying, electronic catalogs, and a procurement portal, only 1 of the 9 utilized the reverse auction function. Further, that sole state's representative informed me in the telephone interview that the reverse auction was not utilized much. This fits with some of the literature on the subject because although reverse auctions provide immediately visible savings for procurement, it does not particularly foster an attitude of cooperation with suppliers. Thus, for those organizations trying to develop a procurement system that assists in their supply chain management, reverse auctioning may hinder those efforts.

Finally, the information on management and worker acceptance of IT for use in their day-to-day jobs was interesting. The results were that for all states except one, the management was believed to have a better acceptance of IT in their jobs than workers (in the one case the scores were tied). Although the results may be slightly skewed as most interviewees and respondents were management level, they should not be discounted as it is the managers job to know how effective their people are with the tools of their job. If an organization that desires to implement an e-Procurement system knows that their workforce lacks comfort in IT tools, the returns they expect to get in productivity and cost savings may be severely tempered by this factor and their dollars may be better spent on more training for their people first.

Management. The management section dealt with the authority of the person in charge of the organizations IT resources and their background. All but one of the directors' positions were one level below the governor in the state organizational charts. The one state that had three levels of management to the governor did not have an office for IT, but instead used a working group format for the state's IT needs. This confirmed the assumption that technological matters have gained sufficient weight to be a top level concern in any organization. This also was shown by the background of those in charge of IT, where five of the nine directors had background in IT (as coded by the "Other" category as it was not one of the listed backgrounds).

Processes. As for the reviews accomplished prior to implementation, the results were not surprising. The two reviews that most states accomplished (4 out of 9 and 8 out of 9 respectively) were the review of information technology assets and the life-cycle cost of the system and an internal review of procured items to facilitate their transition to an e-Procurement environment. The other two reviews, amount of savings that could be realized through strategic sourcing alone and the third party review of processes, are the most potent reviews, but require more resources and contain more recent developments which may contribute to fewer states accomplishing them. These reviews that deal with strategic sourcing and reengineering contain the potential to save the organization from wasting limited resources on a system that may not be right for their situation.

Whether the e-Procurement support was in-house or contracted out was almost split in half (5 in-house and 4 contracted out). This factor would have been more useful if more budgetary information could have been gathered in later questions. Telephone interviews seemed to indicate that the in-house support usually came with lower dollar,

basic systems. However with the lack of response to the budget questions, there is no way to make a numerical correlation to this indication.

Training also supplied a good indication of implementation success. As suspected, the majority of states trained users either prior to or during implementation of the e-Procurement system. However, the majority of state representatives interviewed via phone interviews stated the importance of a good follow-on training program with a good training library. This acts to ensure quick and efficient training of new personnel, transfers, or workers that have not used a particular system tool in a long time and require a refresher. The effect of training on e-Procurement implementation success will be discussed further in the discriminate analysis.

Suppliers. The question on percentage of suppliers that have full interface capability with the organizations e-Procurement system was answered on five of the nine surveys. The responses had a range of eighty-five percent to one hundred percent. The mean was 92.8% and the standard deviation was 5.4%. The interviews in this case also yielded most of the results, which came from the interviewer being able to explain the concept. The interviews also revealed that the systems that yielded these high percentages were mainly web-based, requiring suppliers to only have web access and a registration with the state. Therefore, although this has a quantitative looking response, the data is really qualitative in nature.

Budget. The budgetary responses were too random and varied to be of any use to this research. The few states that actually had the information seemed to have different interpretations and therefore the results are unusable. As discussed earlier, this information would have been nice to compare against several of the factors and could

have provided a better understanding of potential correlations among the variables. However, this set of responses will not be included in the final analysis.

Benefits. The three areas of benefits that went into the response variable revealed some interesting results. Two of the benefits, decreased administrative cost and decreased procurement time, scored high by all respondents (a mean of 4.44 for administrative cost and a mean of 4.55 on time savings). However, the third response variable, decrease in amount paid for goods, did not receive as favorable results (a mean of 3.44). This seems counterintuitive as one of the main goals of e-Procurement is to increase visibility into business intelligence to provide leverage in the procurement of goods. If the literature is correct, this area should be where most of the savings are realized, but most respondents do not feel this way.

Factor Results

This discriminate analysis of these results presented a challenge. While the methodology called for a stepwise regression to determine which of the factors were most significant in the model, the low response rate (n=9) made this option impossible to perform with sufficient statistical power. While it will be performed, the more accurate results arise from the standard least squares regression of each of the independent variables, against the response variable. A personal bias that there should be ten responses for each factor used in the final equation leads to this preference for the single variable regression.

The Stepwise Regression. The stepwise regression is a systematic approach to building a model with a large number of independent variables (McClave, 2001:626). As stated above though, a stepwise regression with so few responses has a high probability

of error. The large number of t-tests conducted by the software package on such a small sample make the probability that one or more Type I or Type II errors have been committed. However, it is interesting to see the results as shown in Appendix D.

The stepwise regression was performed with an entrance criteria of .15 and an exit criteria of .05 which allows the program to decide at what point the combined t-tests have exceeded the specified limit and will not allow anymore factors to be accepted. After running the program the equation for the model the process led us to was as follows:

LOC = Level of Customization of the e-Procurement system
RA = Utilization of the Reverse Auction Capability
DB = Director of IT Background
LCC = Life Cycle Cost Review performed
WT = When the user was trained on the system
EP = E-Procurement Success

$$EP = 3.873 - .322(LOC) - .318(RA) - .243(DB) + 1.689(LCC) + .643(WT)$$

As you can see in Appendix D, the multiple coefficient of determination, R^2, is very large, .99. And even the adjusted R^2, which takes sample size into account, only goes down to .97. When $R^2=1$ that implies a perfect fit with the model passing through every data point. And while this seems to be a good model based on the R^2, the reservations stated earlier about using this method should not be ignored. Also the F statistic is very large, 71.78. The F Ratio is a measure of how much of the total variability is accounted for in the model (McClave, 2001:557). The information to take from this model is to see what factors the analysis picks up and perhaps use them as a starting point on future research. In the single variable, standard least squares regressions below, only some of the variables identified by the stepwise regression also appear as good single variable models.

Standard Least Squares. Appendix E shows single variable, standard least squares regressions. In looking at which single variable models would be good predictors (explain the most variance) for the model, the level of significance was set at .1. With this criterion, only Director Background and Life Cycle Cost Review met the cutoff. Their Analysis Of Variance (ANOVA) tables are shown below for the two acceptable variables (the rest can be found in Appendix E):

Analysis of Variance (Director Background)

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.1927705	1.19277	6.5415
Error	7	1.2763653	0.18234	Prob > F
C. Total	8	2.4691358		0.0377

Analysis of Variance (Life Cycle Cost Review)

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.3635802	1.36358	8.6337
Error	7	1.1055556	0.15794	Prob > F
C. Total	8	2.4691358		0.0218

While the other factors incorporated into the stepwise regression above all received high R2 values, which means they explained a great deal of the variance, their t-test scores were outside the acceptable limits. As seen, each of these variables also entered the stepwise regression. This implies that the stepwise model may not be as faulty as initially thought, but caution should still be used in applying it. And if the stepwise model is utilized, it should be remembered that this model is for state government e-Procurement implementation and as tempting as it is to directly apply the model to federal government or other similar organizations, the factors may be similar, but the coefficients may be completely different.

Summary

This chapter addressed the results and analysis of the data from the e-Procurement success survey. It started by discussing the survey response rate and the limitations the response rate put on any generalizations about the research. This was followed by an descriptive statistical analysis of each of the variable responses. The factor analysis, both with the stepwise regression and the standard least squares regression, identified the most important variables in the study. Finally the results of the two types of analysis allowed us to identify why some of the factors in the stepwise regression may be faulty without further analysis.

V. Discussion

Application of Results

This research contributes to the existing literature by providing a limited foundation to analyze the implementation of e-Procurement in organizations. While the results of this study cannot be generalized to any organization other than the sample population, the model and the questionnaire can be used as a starting point for future research into successful implementation of e-Procurement systems. If a larger body of data is gathered, the results found in this study could also be used as a benchmark to test for differences in organizations and gain better estimates of the factor coefficients for the model. As for its application to the Air Force, I foresee two possible uses for the findings.

The application of the model equation developed in this research should not be used for Air Force application yet. It is a good starting point and the evidence points to the significance of the factors, but the sample is not exactly the same. In refining the model for Air Force use, I feel that surveying organizations during the rollout of some of the systems the Air Force is putting on-line will allow for a steep learning curve by continuously adding data and improving the model. By learning during the rollout, the Air Force can potentially save money in implementation costs by eliminating no-value-added actions in deployment, but more importantly it should shorten implementation time that is more valuable in money in the fast-paced world of technology. Finally, it will allow us to implement it correctly, with a proper strategic purchasing focus, and not just as a tool to process paperwork faster.

The second application to the Air Force would be in prescreening areas for implementation. Even if the actual model is not applied, knowing the important factors that influence the successful implementation, as found in the standard least squares regressions, allows the analysis of a potential area for rollout. This analysis can point out weak areas that may be of concern during implementation and allow organizations to take corrective action before implementation begins instead of finding out during the implementation.

Areas of Concern

As discussed earlier, the main area of concern about this study is the lack of adequate samples. However, in any fairly new area of study, there has to be a starting point for the gathering of data and research. While there were only nine responses, I feel that is representative of the proportion of organizations in my overall population that have e-Procurement systems. In hindsight, the inclusion of gathering some information on states that are still in the planning stages or have scrapped systems in the past would have added to the research and allowed for a larger number of respondents with analyzable data.

Future Research

The issues brought forward in this thesis are applicable to more in-depth research on many different areas. Even the survey presented in this thesis only addressed one area that has implemented e-Procurement systems in their organizations. The results discussed in this survey should lend themselves to future research. With the rapid change in technology, business practices, and the economy there are many different ways to look at the realm of e-Procurement.

A topic that arose in the research, the lower degree of comfort that workers experience with IT, and particularly e-Procurement systems, in the workplace, is an excellent topic for further research. First, the workers utilize a lot more of the functional tools in IT systems and therefore more time should be spent to make sure they know what to do and when to do it. Also, the data a worker enters, especially in a procurement environment, often affects several different parts of an organization and if the worker is not comfortable with the system, the chance for error greatly increases. It would be interesting to combine this with research on innovation to see if factors such as education, position, job type, or other factors influence a person's level of comfort. This could be done with a large survey where all responses could be analyzed as a whole to make a model, and then test the means between the worker group and the management group.

One possible area of research would be to test the survey out among different sectors of business. In this case, the researcher could study how different sectors have implemented e-Procurement and test for differences in models from the results. The models could be used to determine where emphasis should be placed during implementation in the different sectors. The ever increasing sample numbers could even possibly create a model that is generalizable across a broader range of organizations.

Another area of research could be assessing the life-cycle costs of e-Procurement systems. With rapidly changing technology, it would be interesting to see what the best way to contract the system out is, how long the system can be expected to be viable, and if the expected cost and productivity savings really justify the amount spent on the system. Many of the states that were interviewed but did not have e-Procurement systems in place, stated that they had a program in place at one time, but it was low

priority and was put on the chopping block during budget cuts. However, I wonder how this explanation holds up in the face of the great savings that e-Procurement promises. As discussed earlier, it may not only be a technology shift that has made it hard for people to implement e-Procurement properly, it may be the paradigm shift to strategic purchasing that organizations have not caught up to yet.

In looking at the recent reports on DoD e-Procurement, another beneficial area that might be sponsored by the JECPO, would be an assessment of all DoD e-Procurement programs currently in place. The goal should be to try and get back to the ideals that were set forth when the JECPO was created. By doing case studies of the efforts throughout the DoD and tying them in with the goals of the JECPO, it should give a clear picture of what DoD needs to do to get their e-Procurement initiatives back to the Joint level. In bringing DoD procurement back to a Joint Service level, the amount of savings that could be realized from the business intelligence received alone could be staggering.

As discussed in the thesis, one problem implementers of e-Procurement systems face is getting suppliers to work with them. This is particularly true of small businesses that may not have the technological means to interface with some of the technology. A study of how many suppliers feel they are set for e-Procurement and what their impressions of e-Procurement are could set up buyers for a better experience. This would also possibly set up the ability to see if there may be other areas we can focus on to ensure we don't exclude those suppliers that we would have a desire to partner with.

Conclusion

E-Procurement will be a fact of life within the next decade. The Air Force and the rest of the military has to decide what e-Procurement will mean to them in the coming years. The procurement realm is the birthplace for the means to conduct our missions and continue to be the superior force in the world. Even prior to Sun Tzu, military commanders have known that the surest way to defeat an enemy is to disrupt their ability to get supplies. Conversely, a military that can be supplied anytime, anywhere with reliability is a lethal force. E-Procurement gives us this type of advantage. Anyone with a weapon may be able to defend himself or herself, but when you train someone the subtleties of the operation of the weapon, to ensure the most efficient use, you have a professional airman, soldier, or seaman. That is why implementation of e-Procurement is so important. We don't want just a substitute for paper, we want a strategic purchasing system that can integrate seamlessly with our supply and logistics systems anywhere in the world, at any time.

Appendix A: E-Procurement Success Questionnaire for Public Sector

1. Technology

a. Does your organization have an electronic procurement system and policy in place?

1) If **YES**, please continue the survey.

2) If **NO**, please circle this, discontinue survey, and mail back in enclosed stamped envelope.

b. On the scale below please mark how much of your e-Procurement system is Commercial Off The Shelf (COTS) product vs. how much was designed specifically for your organization.

1	2	3	4	5	6	7

All COTS — Equal COTS & Customization — All Customization

c. What type(s) of e-Procurement system(s) are being utilized in your organization? **Circle all that apply.**

1) Utilize Internet alone for research and buying
2) Reverse Auctioning
3) Electronic Catalogs
4) Procurement Portal
5) Other:_____

d. How would you rate your organization's (e.g., management, workers) acceptance of IT in completing their day-to-day jobs?

1	2	3	4	5	6	7

Not Accepting — Neutral — Very Accepting

2. Management

a. How many vertical layers are between the Director for IT (i.e. e-Business, e-Commerce, e-Procurement) programs and the CEO (e.g. governor, mayor, etc.)? **Express as a whole number.**

____

b. What is the background of the Director for IT (i.e. e-Business, e-Commerce, e-Procurement) programs? **Circle one.**

1) Purchasing
2) Sales
3) Operations
4) Logistics
5) Other: _____

3. Processes

a. How comprehensive a review of your procurement process did your organization accomplish prior to the decision to implement an e-Procurement solution?

1	2	3	4	5	6	7

No Review — Comprehensive Review

b. Is the e-Procurement system supported in-house or is support contracted out?

1) In-house
2) Contracted out

c. Have users of the e-Procurement system been trained on the system?

1) Yes (go to question c.)
2) No (go to question d.)

d. When were users trained?

1) Prior to implementation
2) During implementation
3) Post implementation

e. Why were users not trained?

---

4. Suppliers

a. What percent of your suppliers have full interface (the ability to receive and acknowledge orders electronically) capability with your e-Procurement system? **Express as a percentage.**

_____

5. Budget

a. What was the organization's budget for FY02? **Express as whole dollars rounded to the nearest hundred thousand (i.e. $468,500,000).**

_____

b. What percent of the budget was allocated for Information Technology in support of electronic commerce in FY02? **Express as a percentage**

_____

c. What percentage of your procurement dollars goes through your e-Procurement system (vs. traditional methods of procurement)? **Express as a percentage.**

_____

6. Benefits

a. The administrative cost to procure goods and services has decreased as use of e-Procurement has increased.

_____
| | | |
1 2 3 4
Strongly Disagree Disagree Agree Strongly Agree

b. The price your organization pays for goods and services has decreased as use of e-Procurement has increased.

_____
| | | |
1 2 3 4
Strongly Disagree Disagree Agree Strongly Agree

c. The time it takes to process an order, from requirement identification to payment, has decreased as use of e-Procurement has increased.

_____
| | | |
1 2 3 4
Strongly Disagree Disagree Agree Strongly Agree

Appendix B: Tables and Coding

LOC	RB	RA	EC	PP	OU	MA	WA	LD	DB	SS	TPP
2	1	0	1	1	0	5	4	1	5	0	0
2	1	0	1	0	0	7	6	1	1	0	1
2	1	0	0	1	0	6	5	1	5	0	0
3	1	0	1	1	0	6	5	1	5	0	0
3	1	0	1	1	0	5	3	1	2	0	0
2	1	0	0	0	0	6	4	1	3	0	0
2	1	1	1	1	0	7	6	1	5	1	1
3	1	0	1	1	0	6	6	1	5	0	0
3	1	0	0	1	0	4	4	3	1	0	0

LCC	PI	ES	UT	WT	FI	DS	AC	PG	TS	ES	
1	1	0	1	1			5	3	5	4.33	
0	0	1	1	1	.95		4	2	5	3.66	
0	1	1	1	3	.99	1	4	4	4	4	
1	1	0	1	2			5	4	5	4.66	
0	1	0	1	1	.9		3	3	3	3	
0	1	0	1	3			5	3	5	4.33	
1	1	1	1	2	.95		5	4	5	4.66	
1	1	1	1	2			5	4	5	4.66	
0	1	1	1	2	.85	.85	4	4	4	4	

Level of Customization (LOC):
1 = Purchased Commercial Off the Shelf software with no customization
2 = Purchased COTS software that allowed for some customization based on your processes
3 = Consultant assessed procurement processes and recommended COTS products to fit your procurement need
4 = Consultant assessed procurement processes and developed system for org
5 = Your org specified the requirements for the system and oversaw development

Research and Buying (RB):
1 = Utilizes Internet for Research and Buying
0 = Does not utilize Internet for Research and Buying

Reverse Auction (RA):
1 = Utilizes Reverse Auctions
0 = Does not Reverse Auctions

Electronic Catalogs (EC):
1 = Utilizes Electronic Catalogs
0 = Does not utilize Electronic Catalogs

Procurement Portal (PP):
1 = Utilizes Procurement Portal
0 = Does not utilize Procurement Portal

Other Utilization (OU):
1 = Utilizes electronic means for other procurement activities
0 = Does not utilize electronic means for other procurement activities

Management Acceptance (MA):
1 = Not accepting
2 =
3 =
4 = Neutral
5 =
6 =
7 = Very Accepting

Worker Acceptance (WA):
1 = Not accepting
2 =
3 =
4 = Neutral
5 =
6 =
7 = Very Accepting

Level of Director (LD):
Whole number value of how many levels the director is away from the governor (i.e. 1 equals someone who works directly for the governor and 2 would have one layer of management between them and the governor)

Director Background (DB):
1 = Purchasing
2 = Sales
3 = Operations
4 = Logistics
5 = Other

Strategic Sourcing (SS):
1 = Utilized a review of strategic sourcing opportunities prior to implementation
0 = Did not utilize a review of strategic sourcing opportunities prior to implementation

Third Party Procurement (TPP):
1 = Utilized a third party to assess procurement processes
0 = Did not utilize a third party to assess procurement processes

LCC Reviews (LCC):
1 = Performed a Life Cycle Cost review for the e-Procurement system
0 = Did not perform a Life Cycle Cost review for the e-Procurement system

Procured Items (PI):
1 = Performed an analysis of procured items and how they would work in the system
0 = Did not perform an analysis of procured items and how they would work in the system

E-Procurement Support (ES):
1 = In house e-Procurement Support
0 = Contracted Out e-Procurement Support

Users Trained (UT):
1 = Yes
0 = No

When Trained (WT):
1 = Prior to Implementation
2 = During Implementation
3 = Post Implementation

Full Interface % (FI):
Percentage of Suppliers that are able to fully interface with the e-Procurement system

% Proc $'s thru E-System (DS):
Percentage of Procurement Dollars that go thru the e-Procurement system

Administrative Cost (AC):
1 = Strongly Disagree that Administrative Costs have been reduced by implementation
2 = Disagree that Administrative Costs have been reduced by implementation
3 = Neutral
4 = Agree that Administrative Costs have been reduced by implementation
5 = Strongly Agree that Administrative Costs have been reduced by implementation

Cost of Goods (CG):
1 = Strongly Disagree that Cost of Goods have been reduced by implementation
2 = Disagree that Cost of Goods have been reduced by implementation
3 = Neutral
4 = Agree that Cost of Goods have been reduced by implementation

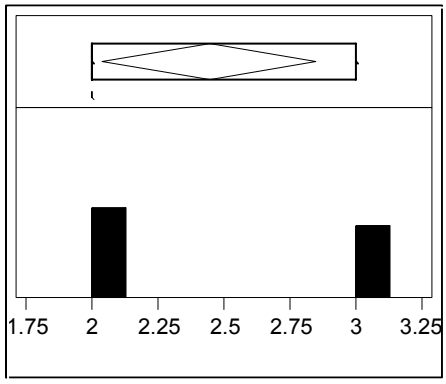
5 = Strongly Agree that Cost of Goods have been reduced by implementation

Time (TS):
1 = Strongly Disagree that Time to procure goods has been reduced
2 = Disagree that Time to procure goods has been reduced
3 = Neutral
4 = Agree that Time to procure goods has been reduced
5 = Strongly Agree that Time to procure goods has been reduced

E-Procurement Success (ES):
Average of the Administrative Cost, Cost of Goods, and Times responses to give an overall satisfaction rating.

Appendix C: Descriptive Statistics

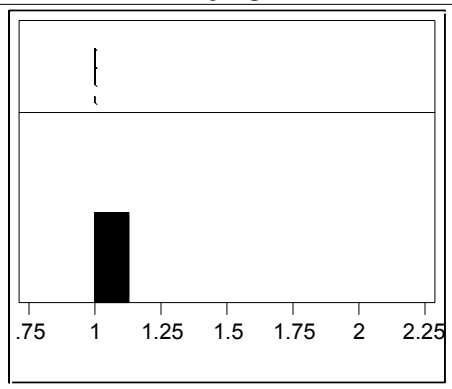
Level of Customization



Quantiles		
100.0%	maximum	3.0000
99.5%		3.0000
97.5%		3.0000
90.0%		3.0000
75.0%	quartile	3.0000
50.0%	median	2.0000
25.0%	quartile	2.0000
10.0%		2.0000
2.5%		2.0000
0.5%		2.0000
0.0%	minimum	2.0000

Moments	
Mean	2.4444444
Std Dev	0.5270463
Std Err Mean	0.1756821
upper 95% Mean	2.8495681
lower 95% Mean	2.0393208
N	9

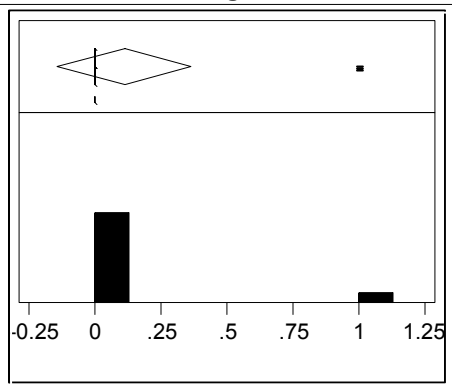
Research and Buying



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	1.0000
10.0%		1.0000
2.5%		1.0000
0.5%		1.0000
0.0%	minimum	1.0000

Moments	
Mean	1
Std Dev	0
Std Err Mean	0
upper 95% Mean	1
lower 95% Mean	1
N	9

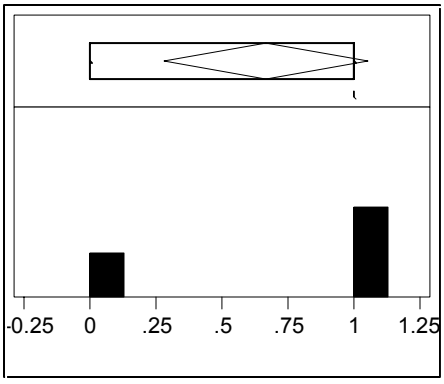
Reverse Auctioning



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	0.0000
50.0%	median	0.0000
25.0%	quartile	0.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.1111111
Std Dev	0.3333333
Std Err Mean	0.1111111
upper 95% Mean	0.3673338
lower 95% Mean	-0.145112
N	9

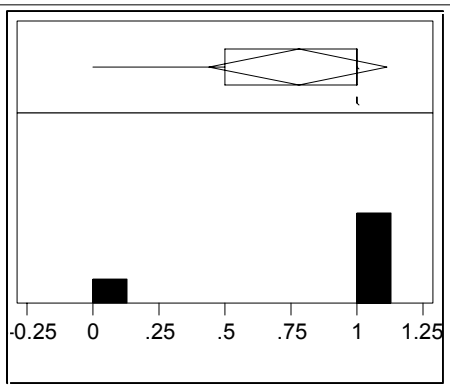
Electronic Catalogs



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	0.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.6666667
Std Dev	0.5
Std Err Mean	0.1666667
upper 95% Mean	1.0510007
lower 95% Mean	0.2823326
N	9

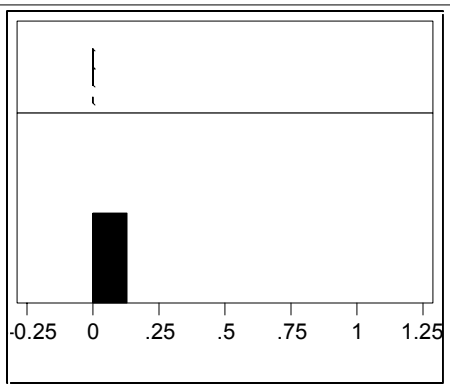
Procurement Portal



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	0.5000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.7777778
Std Dev	0.4409586
Std Err Mean	0.1469862
upper 95% Mean	1.1167285
lower 95% Mean	0.438827
N	9

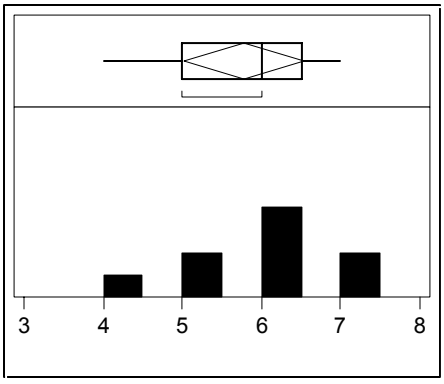
Other Utilization



Quantiles		
100.0%	maximum	0
99.5%		0
97.5%		0
90.0%		0
75.0%	quartile	0
50.0%	median	0
25.0%	quartile	0
10.0%		0
2.5%		0
0.5%		0
0.0%	minimum	0

Moments	
Mean	0
Std Dev	0
Std Err Mean	0
upper 95% Mean	0
lower 95% Mean	0
N	9

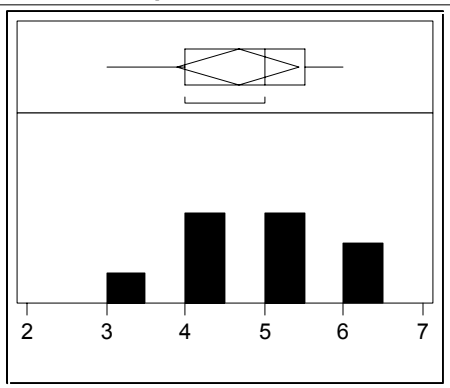
Management Acceptance



Quantiles		
100.0%	maximum	7.0000
99.5%		7.0000
97.5%		7.0000
90.0%		7.0000
75.0%	quartile	6.5000
50.0%	median	6.0000
25.0%	quartile	5.0000
10.0%		4.0000
2.5%		4.0000
0.5%		4.0000
0.0%	minimum	4.0000

Moments	
Mean	5.7777778
Std Dev	0.9718253
Std Err Mean	0.3239418
upper 95% Mean	6.5247888
lower 95% Mean	5.0307667
N	9

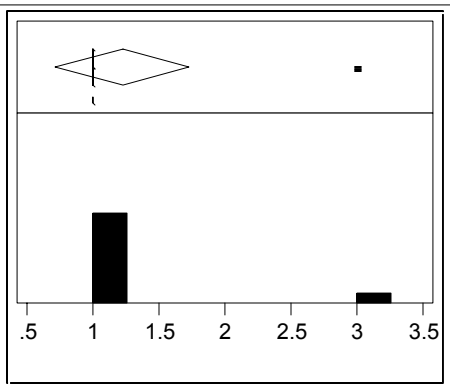
Worker Acceptance



Quantiles		
100.0%	maximum	6.0000
99.5%		6.0000
97.5%		6.0000
90.0%		6.0000
75.0%	quartile	5.5000
50.0%	median	5.0000
25.0%	quartile	4.0000
10.0%		3.0000
2.5%		3.0000
0.5%		3.0000
0.0%	minimum	3.0000

Moments	
Mean	4.6666667
Std Dev	1
Std Err Mean	0.3333333
upper 95% Mean	5.4353347
lower 95% Mean	3.8979986
N	9

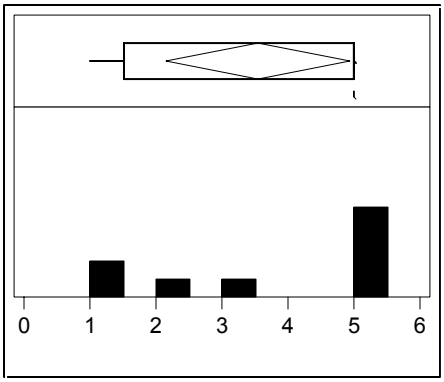
Level of Director



Quantiles		
100.0%	maximum	3.0000
99.5%		3.0000
97.5%		3.0000
90.0%		3.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	1.0000
10.0%		1.0000
2.5%		1.0000
0.5%		1.0000
0.0%	minimum	1.0000

Moments	
Mean	1.2222222
Std Dev	0.6666667
Std Err Mean	0.2222222
upper 95% Mean	1.7346676
lower 95% Mean	0.7097769
N	9

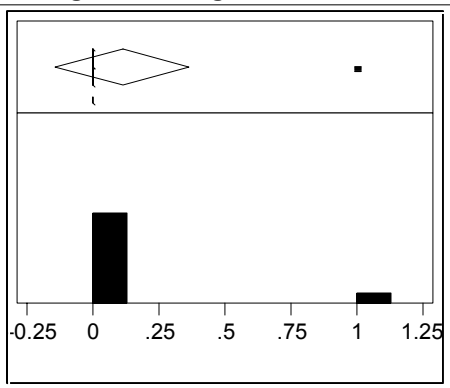
Director Background



Quantiles		
100.0%	maximum	5.0000
99.5%		5.0000
97.5%		5.0000
90.0%		5.0000
75.0%	quartile	5.0000
50.0%	median	5.0000
25.0%	quartile	1.5000
10.0%		1.0000
2.5%		1.0000
0.5%		1.0000
0.0%	minimum	1.0000

Moments	
Mean	3.5555556
Std Dev	1.8104634
Std Err Mean	0.6034878
upper 95% Mean	4.9472009
lower 95% Mean	2.1639102
N	9

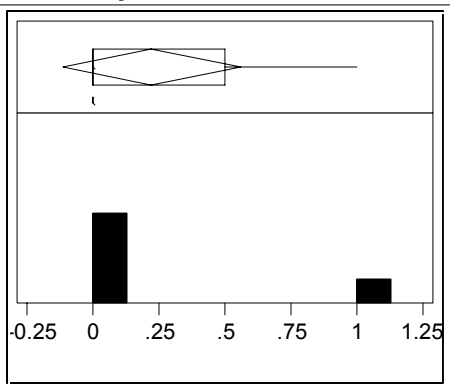
Strategic Sourcing Review



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	0.0000
50.0%	median	0.0000
25.0%	quartile	0.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.1111111
Std Dev	0.3333333
Std Err Mean	0.1111111
upper 95% Mean	0.3673338
lower 95% Mean	-0.145112
N	9

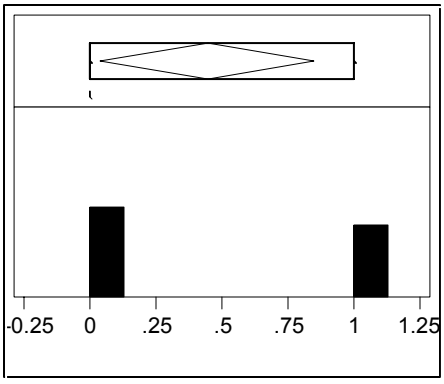
Third Party Procurement Review



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	0.5000
50.0%	median	0.0000
25.0%	quartile	0.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.2222222
Std Dev	0.4409586
Std Err Mean	0.1469862
upper 95% Mean	0.561173
lower 95% Mean	-0.116729
N	9

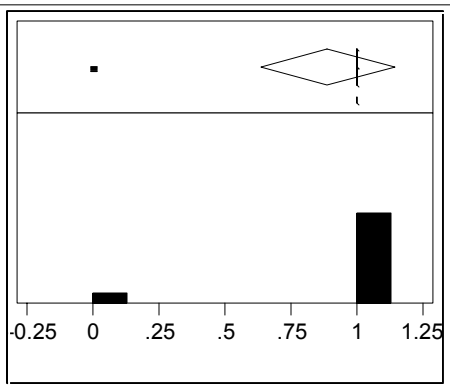
Life Cycle Cost Review



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	0.0000
25.0%	quartile	0.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.4444444
Std Dev	0.5270463
Std Err Mean	0.1756821
upper 95% Mean	0.8495681
lower 95% Mean	0.0393208
N	9

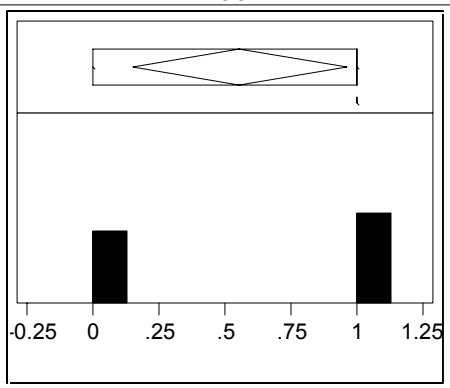
Procured Items Review



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	1.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.8888889
Std Dev	0.3333333
Std Err Mean	0.1111111
upper 95% Mean	1.1451116
lower 95% Mean	0.6326662
N	9

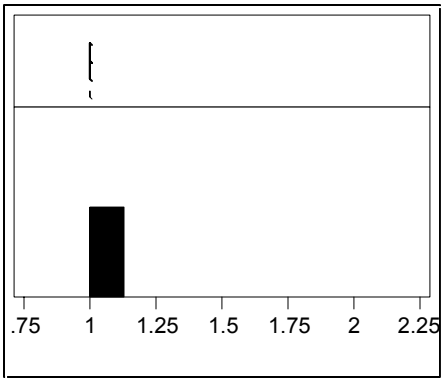
E-Procurement Support



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	0.0000
10.0%		0.0000
2.5%		0.0000
0.5%		0.0000
0.0%	minimum	0.0000

Moments	
Mean	0.5555556
Std Dev	0.5270463
Std Err Mean	0.1756821
upper 95% Mean	0.9606792
lower 95% Mean	0.1504319
N	9

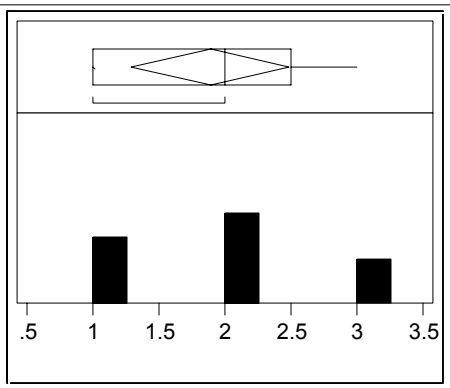
Users Trained



Quantiles		
100.0%	maximum	1.0000
99.5%		1.0000
97.5%		1.0000
90.0%		1.0000
75.0%	quartile	1.0000
50.0%	median	1.0000
25.0%	quartile	1.0000
10.0%		1.0000
2.5%		1.0000
0.5%		1.0000
0.0%	minimum	1.0000

Moments	
Mean	1
Std Dev	0
Std Err Mean	0
upper 95% Mean	1
lower 95% Mean	1
N	9

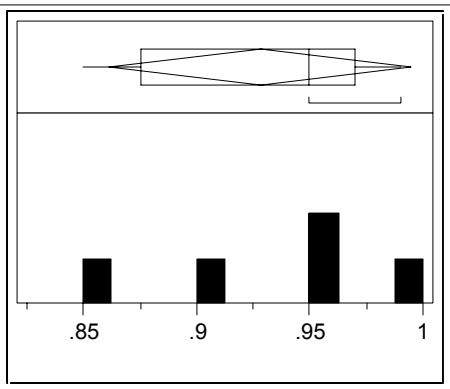
When were users Trained



Quantiles		
100.0%	maximum	3.0000
99.5%		3.0000
97.5%		3.0000
90.0%		3.0000
75.0%	quartile	2.5000
50.0%	median	2.0000
25.0%	quartile	1.0000
10.0%		1.0000
2.5%		1.0000
0.5%		1.0000
0.0%	minimum	1.0000

Moments	
Mean	1.8888889
Std Dev	0.781736
Std Err Mean	0.2605787
upper 95% Mean	2.4897843
lower 95% Mean	1.2879934
N	9

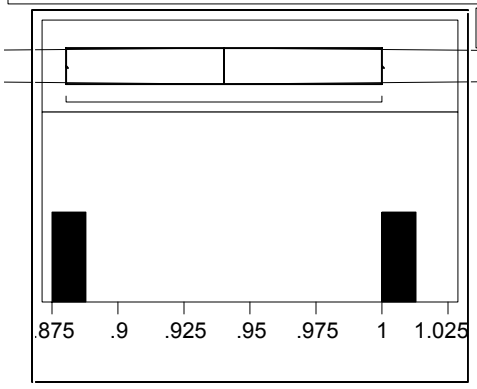
Full Interface %



Quantiles		
100.0%	maximum	0.99000
99.5%		0.99000
97.5%		0.99000
90.0%		0.99000
75.0%	quartile	0.97000
50.0%	median	0.95000
25.0%	quartile	0.87500
10.0%		0.85000
2.5%		0.85000
0.5%		0.85000
0.0%	minimum	0.85000

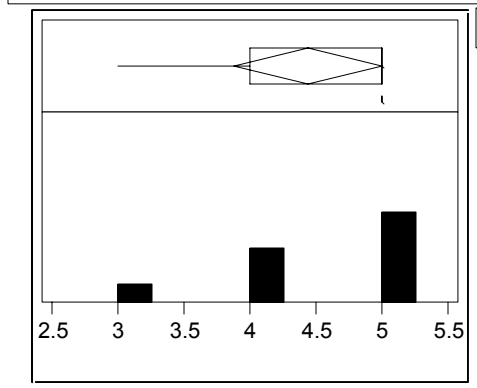
Moments	
Mean	0.928
Std Dev	0.054037
Std Err Mean	0.0241661
upper 95% Mean	0.9950958
lower 95% Mean	0.8609042
N	5

% Proc $'s that go thru e-system



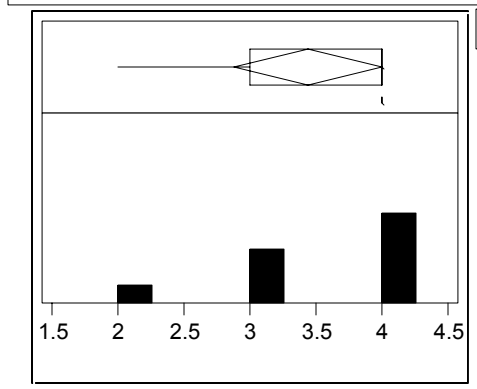
Quantiles			Moments	
100.0%	maximum	1.0000	Mean	0.94
99.5%		1.0000	Std Dev	0.0848528
97.5%		1.0000	Std Err Mean	0.06
90.0%		1.0000	upper 95% Mean	1.7023723
75.0%	quartile	1.0000	lower 95% Mean	0.1776277
50.0%	median	0.9400	N	2
25.0%	quartile	0.8800		
10.0%		0.8800		
2.5%		0.8800		
0.5%		0.8800		
0.0%	minimum	0.8800		

Administrative Cost



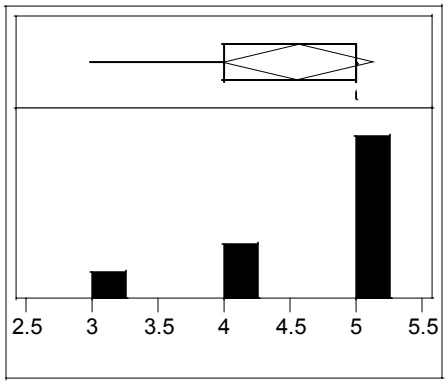
Quantiles			Moments	
100.0%	maximum	5.0000	Mean	4.4444444
99.5%		5.0000	Std Dev	0.7264832
97.5%		5.0000	Std Err Mean	0.2421611
90.0%		5.0000	upper 95% Mean	5.0028688
75.0%	quartile	5.0000	lower 95% Mean	3.8860201
50.0%	median	5.0000	N	9
25.0%	quartile	4.0000		
10.0%		3.0000		
2.5%		3.0000		
0.5%		3.0000		
0.0%	minimum	3.0000		

Price of Goods



Quantiles			Moments	
100.0%	maximum	4.0000	Mean	3.4444444
99.5%		4.0000	Std Dev	0.7264832
97.5%		4.0000	Std Err Mean	0.2421611
90.0%		4.0000	upper 95% Mean	4.0028688
75.0%	quartile	4.0000	lower 95% Mean	2.8860201
50.0%	median	4.0000	N	9
25.0%	quartile	3.0000		
10.0%		2.0000		
2.5%		2.0000		
0.5%		2.0000		
0.0%	minimum	2.0000		

Time



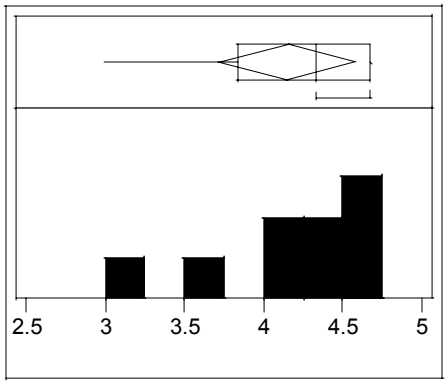
Quantiles

100.0%	maximum	5.0000
99.5%		5.0000
97.5%		5.0000
90.0%		5.0000
75.0%	quartile	5.0000
50.0%	median	5.0000
25.0%	quartile	4.0000
10.0%		3.0000
2.5%		3.0000
0.5%		3.0000
0.0%	minimum	3.0000

Moments

Mean	4.5555556
Std Dev	0.7264832
Std Err Mean	0.2421611
upper 95% Mean	5.1139799
lower 95% Mean	3.9971312
N	9

E-Procurement Success



Quantiles

100.0%	maximum	4.6667
99.5%		4.6667
97.5%		4.6667
90.0%		4.6667
75.0%	quartile	4.6667
50.0%	median	4.3333
25.0%	quartile	3.8333
10.0%		3.0000
2.5%		3.0000
0.5%		3.0000
0.0%	minimum	3.0000

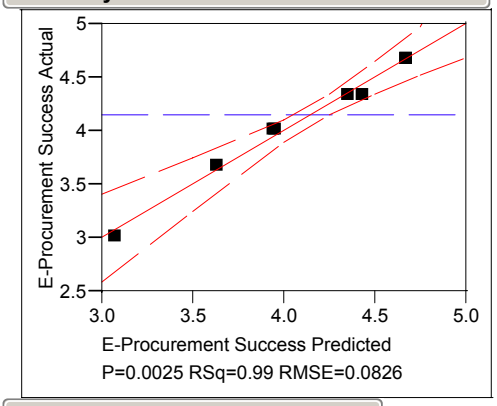
Moments

Mean	4.1481481
Std Dev	0.5555556
Std Err Mean	0.1851852
upper 95% Mean	4.575186
lower 95% Mean	3.7211103
N	9

Appendix D: Stepwise Regression Results

Response E-Procurement Success

Actual by Predicted Plot



Summary of Fit

RSquare	0.991711
RSquare Adj	0.977895
Root Mean Square Error	0.082599
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	5	2.4486680	0.489734	71.7810
Error	3	0.0204678	0.006823	Prob > F
C. Total	8	2.4691358		0.0025

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	2	0.02046784	0.010234	.
Pure Error	1	0.00000000	0.000000	Prob > F
Total Error	3	0.02046784		.
				Max RSq
				1.0000

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.872807	0.19613	19.75	0.0003
Level of Custom.	-0.322368	0.067746	-4.76	0.0176
Reverse Auctioning	-0.317982	0.108908	-2.92	0.0615
Dir Bckgrnd	-0.243421	0.038047	-6.40	0.0077
LCC Review	1.6885965	0.135492	12.46	0.0011
When Trained	0.6425439	0.054531	11.78	0.0013

Effect Tests

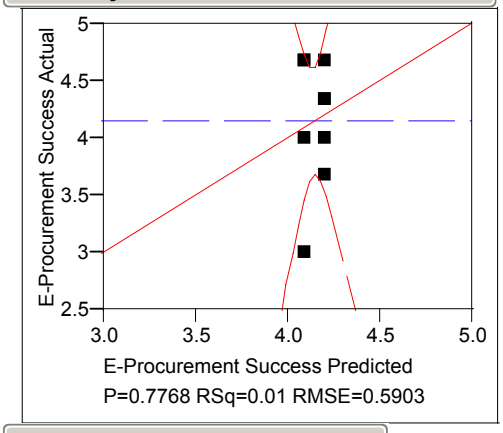
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Level of Custom.	1	1	0.1544846	22.6430	0.0176
Reverse Auctioning	1	1	0.0581614	8.5248	0.0615
Dir Bckgrnd	1	1	0.2792738	40.9336	0.0077
LCC Review	1	1	1.0596734	155.3178	0.0011
When Trained	1	1	0.9472470	138.8394	0.0013

Appendix E: Single Variable SLR Results

Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.01225
RSquare Adj	-0.12886
Root Mean Square Error	0.590265
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

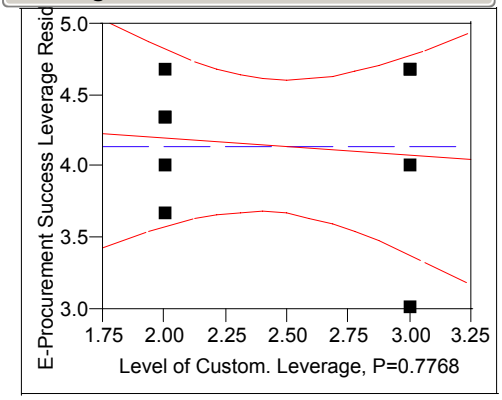
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.0302469	0.030247	0.0868
Error	7	2.4388889	0.348413	Prob > F
C. Total	8	2.4691358		0.7768

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.4333333	0.987702	4.49	0.0028
Level of Custom.	-0.116667	0.395962	-0.29	0.7768

Level of Custom.

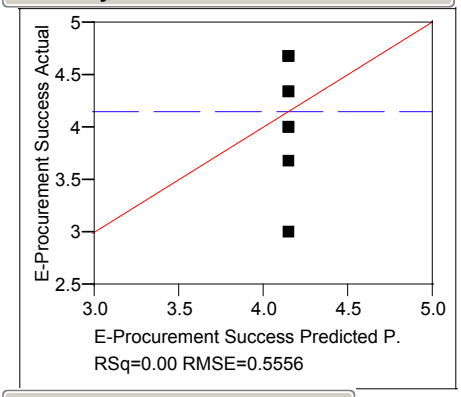
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0
RSquare Adj	-1.2e-14
Root Mean Square Error	0.555556
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

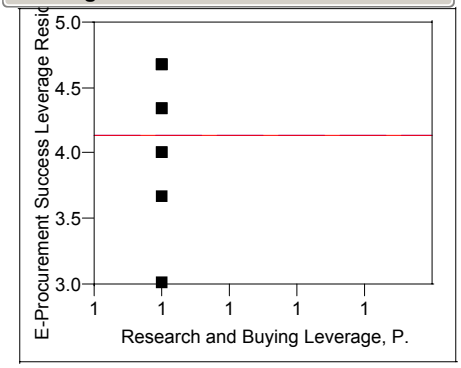
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	0	0.0000000	0.000000	.
Error	8	2.4691358	0.308642	Prob > F
C. Total	8	2.4691358		.

Parameter Estimates

Term		Estimate	Std Error	t Ratio	Prob>|t|
Intercept	Biased	4.1481481	0.185185	22.40	<.0001
Research and Buying	Zeroed	0	0	.	.

Research and Buying

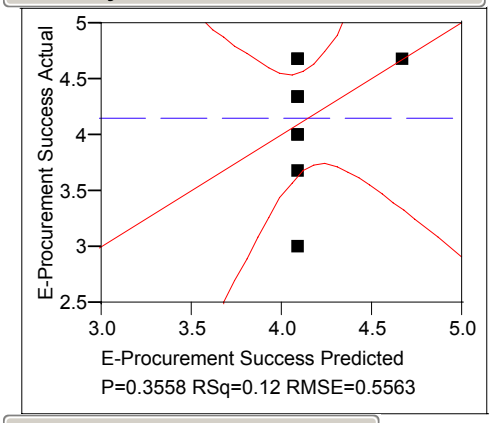
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.1225
RSquare Adj	-0.00286
Root Mean Square Error	0.556349
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

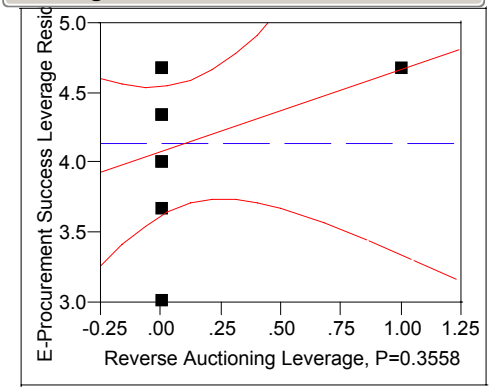
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.3024691	0.302469	0.9772
Error	7	2.1666667	0.309524	Prob > F
C. Total	8	2.4691358		0.3558

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.0833333	0.196699	20.76	<.0001
Reverse Auctioning	0.5833333	0.590097	0.99	0.3558

Reverse Auctioning

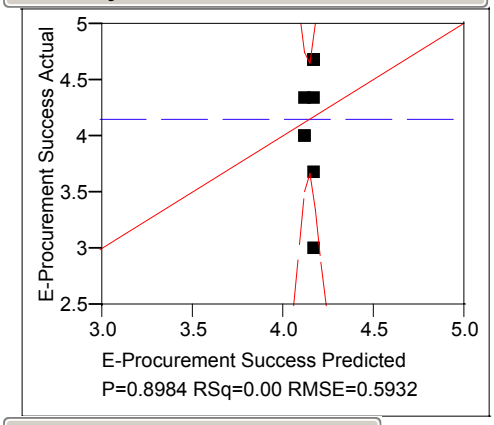
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.0025
RSquare Adj	-0.14
Root Mean Square Error	0.593171
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

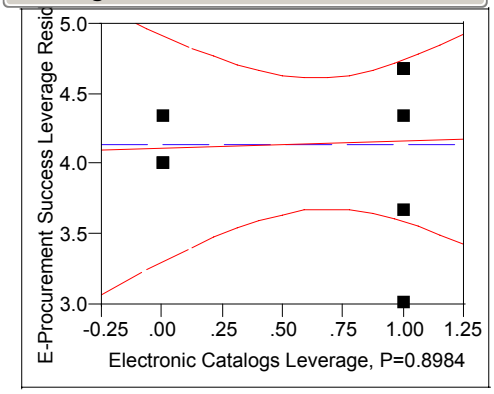
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.0061728	0.006173	0.0175
Error	7	2.4629630	0.351852	Prob > F
C. Total	8	2.4691358		0.8984

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.1111111	0.342467	12.00	<.0001
Electronic Catalogs	0.0555556	0.419435	0.13	0.8984

Electronic Catalogs

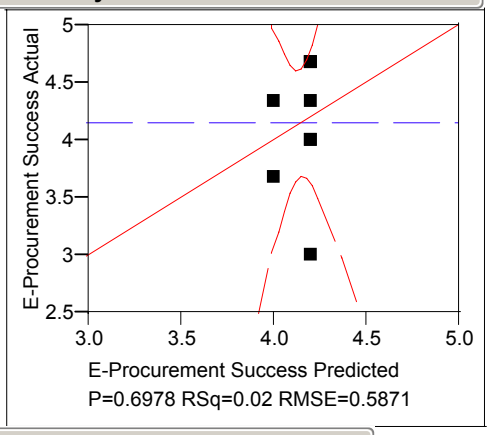
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.022857
RSquare Adj	-0.11673
Root Mean Square Error	0.587087
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

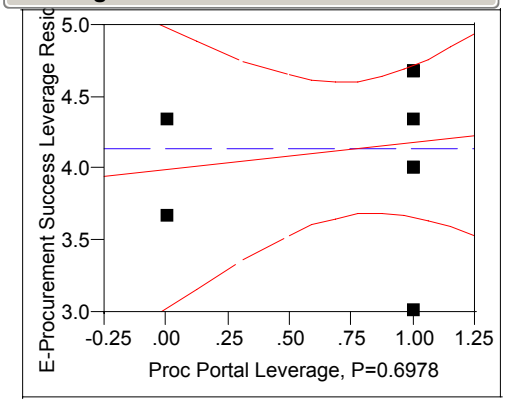
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.0564374	0.056437	0.1637
Error	7	2.4126984	0.344671	Prob > F
C. Total	8	2.4691358		0.6978

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4	0.415133	9.64	<.0001
Proc Portal	0.1904762	0.470717	0.40	0.6978

Proc Portal

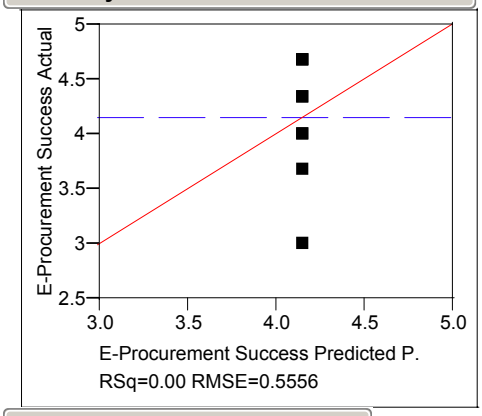
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0
RSquare Adj	-1.2e-14
Root Mean Square Error	0.555556
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

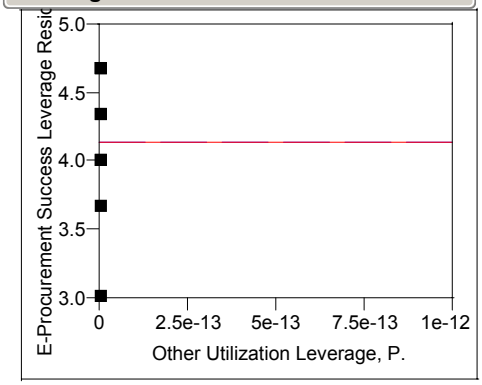
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	0	0.0000000	0.000000	.
Error	8	2.4691358	0.308642	Prob > F
C. Total	8	2.4691358		.

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.1481481	0.185185	22.40	<.0001
Other Utilization Zeroed	0	0	.	.

Other Utilization

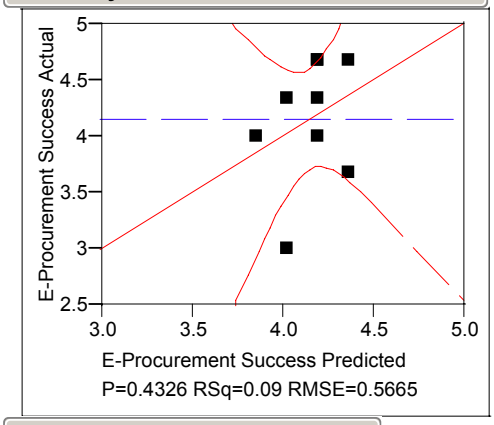
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.090074
RSquare Adj	-0.03992
Root Mean Square Error	0.566535
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.2224038	0.222404	0.6929
Error	7	2.2467320	0.320962	Prob > F
C. Total	8	2.4691358		0.4326

Lack Of Fit

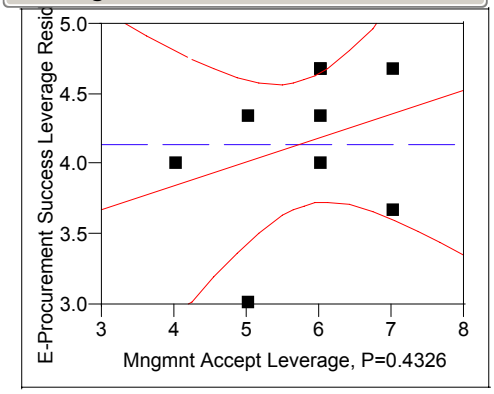
Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	2	0.5522876	0.276144	0.8149
Pure Error	5	1.6944444	0.338889	Prob > F
Total Error	7	2.2467320		0.4940
				Max RSq
				0.3137

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.1568627	1.205723	2.62	0.0345
Mngmnt Accept	0.1715686	0.206107	0.83	0.4326

Mngmnt Accept

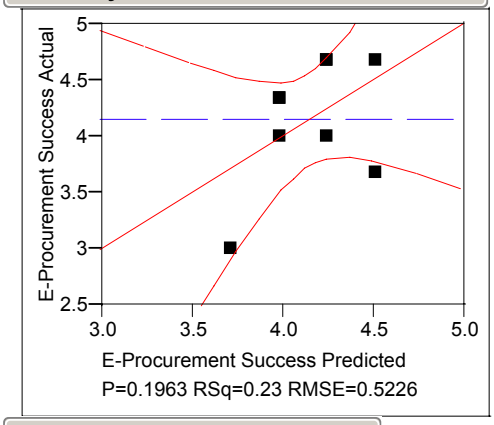
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.225625
RSquare Adj	0.115
Root Mean Square Error	0.522636
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.5570988	0.557099	2.0395
Error	7	1.9120370	0.273148	Prob > F
C. Total	8	2.4691358		0.1963

Lack Of Fit

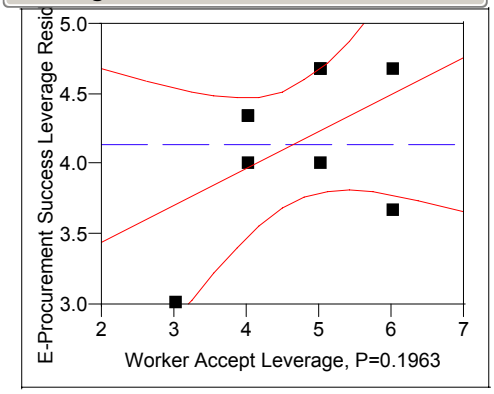
Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	2	1.0416667	0.520833	2.9920
Pure Error	5	0.8703704	0.174074	Prob > F
Total Error	7	1.9120370		0.1398
				Max RSq
				0.6475

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	2.9166667	0.879727	3.32	0.0128
Worker Accept	0.2638889	0.18478	1.43	0.1963

Worker Accept

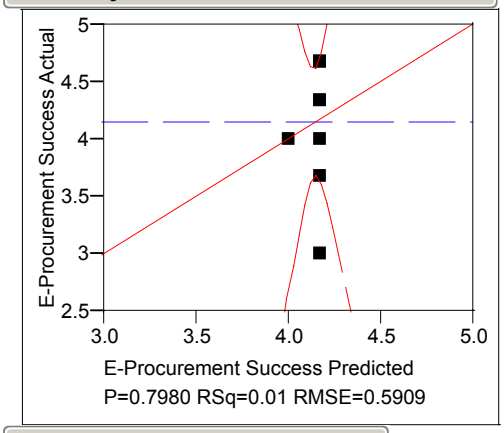
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.01
RSquare Adj	-0.13143
Root Mean Square Error	0.590937
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

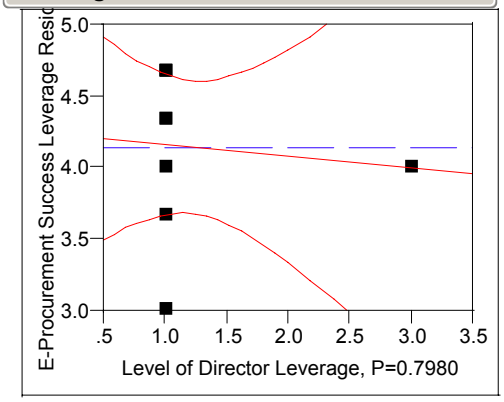
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.0246914	0.024691	0.0707
Error	7	2.4444444	0.349206	Prob > F
C. Total	8	2.4691358		0.7980

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.25	0.430716	9.87	<.0001
Level of Director	-0.083333	0.313392	-0.27	0.7980

Level of Director

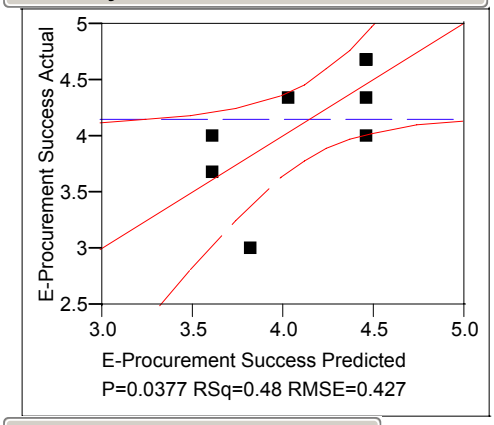
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.483072
RSquare Adj	0.409225
Root Mean Square Error	0.42701
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.1927705	1.19277	6.5415
Error	7	1.2763653	0.18234	Prob > F
C. Total	8	2.4691358		0.0377

Lack Of Fit

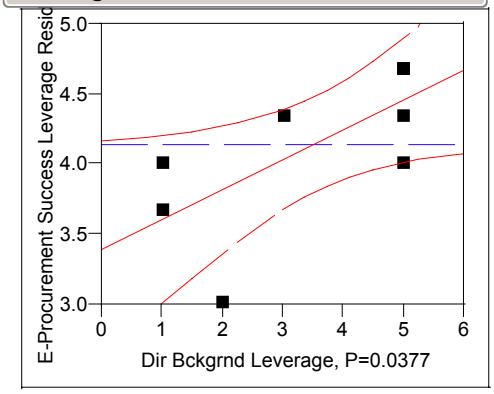
Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	2	0.8652542	0.432627	5.2617
Pure Error	5	0.4111111	0.082222	Prob > F
Total Error	7	1.2763653		0.0589
				Max RSq
				0.8335

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.3898305	0.328887	10.31	<.0001
Dir Bckgrnd	0.2132768	0.083388	2.56	0.0377

Dir Bckgrnd

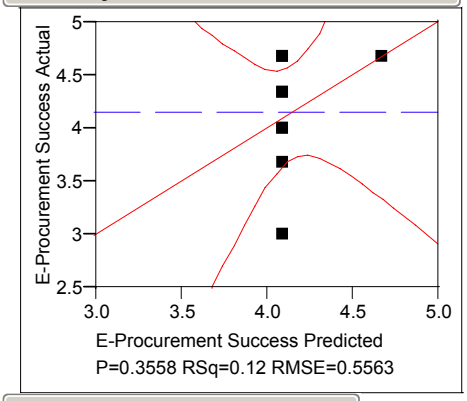
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.1225
RSquare Adj	-0.00286
Root Mean Square Error	0.556349
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

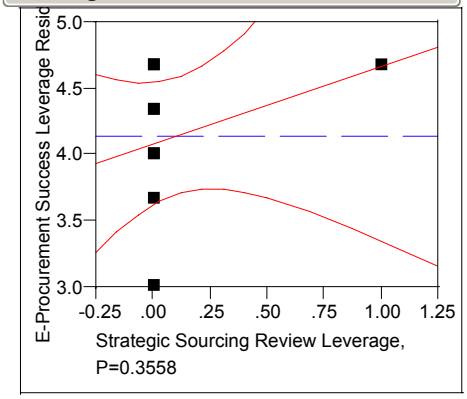
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.3024691	0.302469	0.9772
Error	7	2.1666667	0.309524	Prob > F
C. Total	8	2.4691358		0.3558

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.0833333	0.196699	20.76	<.0001
Strategic Sourcing Review	0.5833333	0.590097	0.99	0.3558

Strategic Sourcing Review

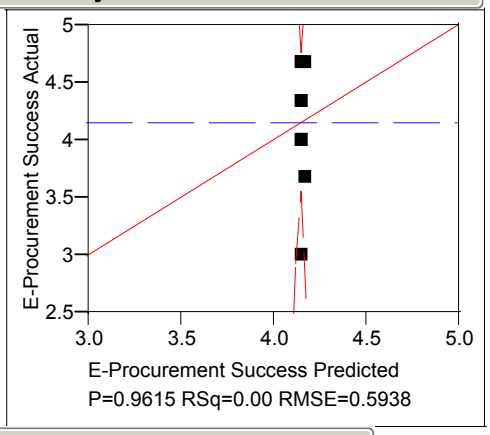
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.000357
RSquare Adj	-0.14245
Root Mean Square Error	0.593808
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

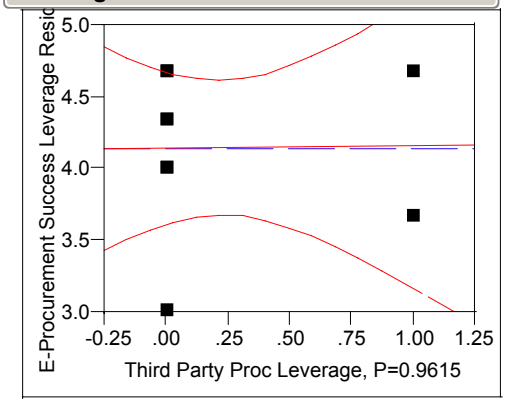
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.0008818	0.000882	0.0025
Error	7	2.4682540	0.352608	Prob > F
C. Total	8	2.4691358		0.9615

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.1428571	0.224438	18.46	<.0001
Third Party Proc	0.0238095	0.476105	0.05	0.9615

Third Party Proc

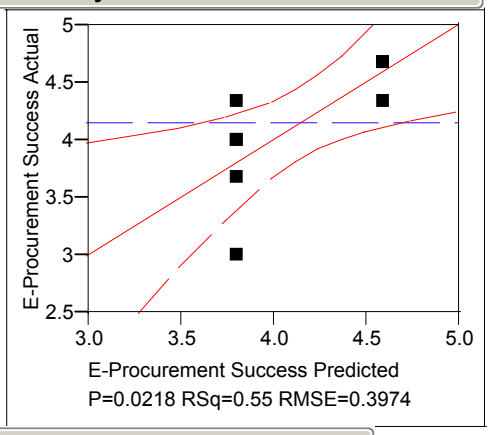
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.55225
RSquare Adj	0.488286
Root Mean Square Error	0.397412
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

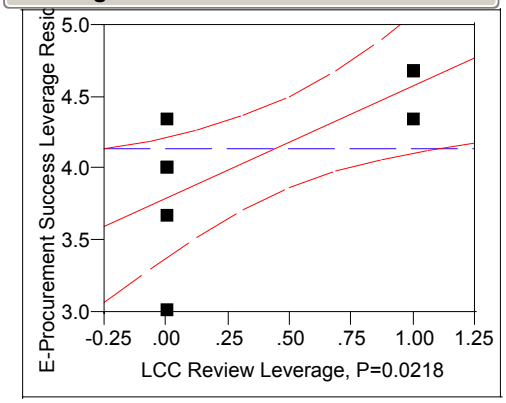
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.3635802	1.36358	8.6337
Error	7	1.1055556	0.15794	Prob > F
C. Total	8	2.4691358		0.0218

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.8	0.177728	21.38	<.0001
LCC Review	0.7833333	0.266592	2.94	0.0218

LCC Review

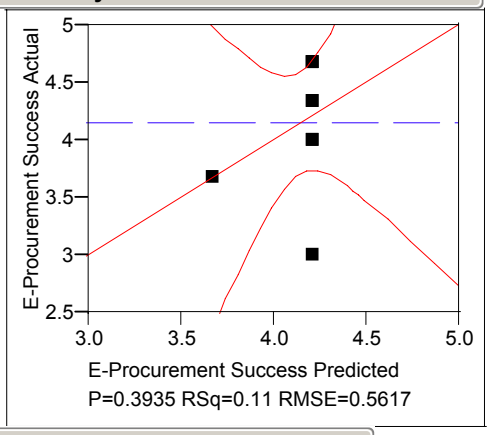
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.105625
RSquare Adj	-0.02214
Root Mean Square Error	0.561673
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

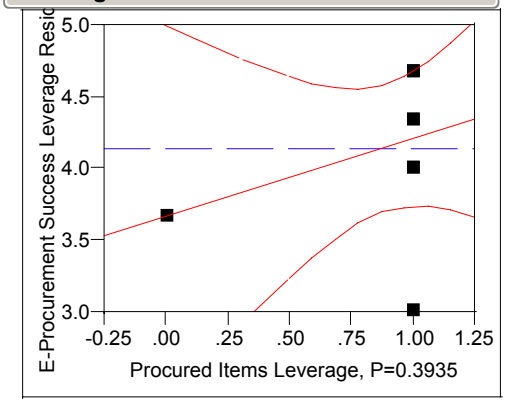
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.2608025	0.260802	0.8267
Error	7	2.2083333	0.315476	Prob > F
C. Total	8	2.4691358		0.3935

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.6666667	0.561673	6.53	0.0003
Procured Items	0.5416667	0.595744	0.91	0.3935

Procured Items

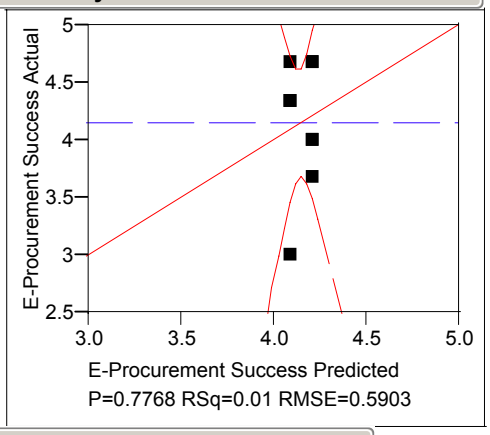
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.01225
RSquare Adj	-0.12886
Root Mean Square Error	0.590265
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

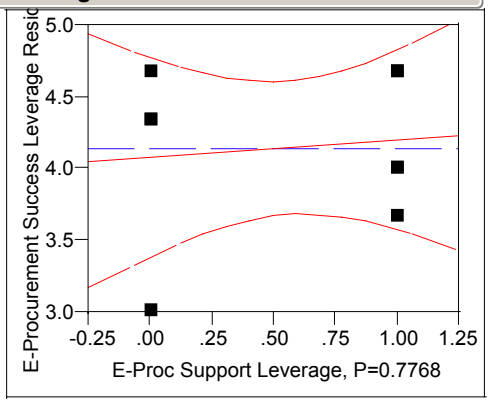
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.0302469	0.030247	0.0868
Error	7	2.4388889	0.348413	Prob > F
C. Total	8	2.4691358		0.7768

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.0833333	0.295132	13.84	<.0001
E-Proc Support	0.1166667	0.395962	0.29	0.7768

E-Proc Support

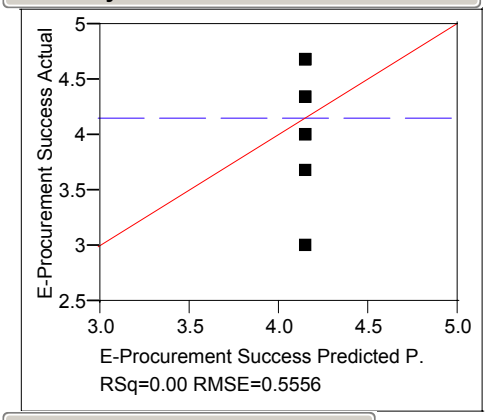
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0
RSquare Adj	-1.2e-14
Root Mean Square Error	0.555556
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

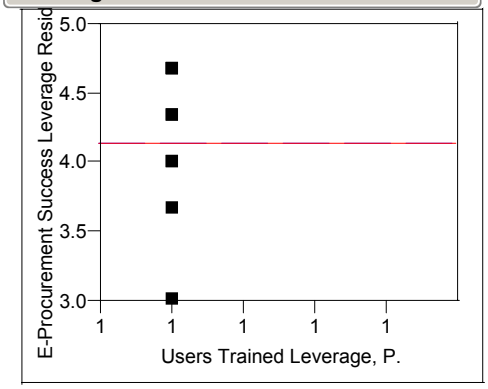
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	0	0.0000000	0.000000	.
Error	8	2.4691358	0.308642	Prob > F
C. Total	8	2.4691358		.

Parameter Estimates

Term		Estimate	Std Error	t Ratio	Prob>|t|
Intercept	Biased	4.1481481	0.185185	22.40	<.0001
Users Trained	Zeroed	0	0	.	.

Users Trained

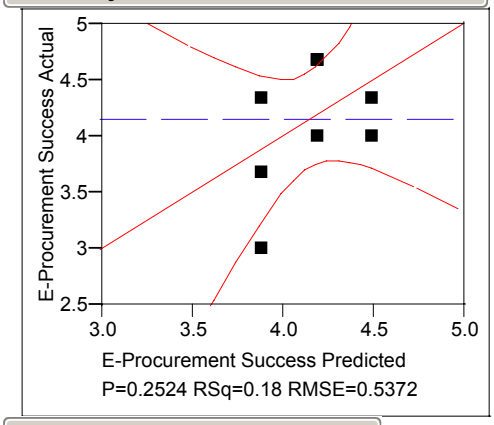
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.181818
RSquare Adj	0.064935
Root Mean Square Error	0.537215
Mean of Response	4.148148
Observations (or Sum Wgts)	9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.4489338	0.448934	1.5556
Error	7	2.0202020	0.288600	Prob > F
C. Total	8	2.4691358		0.2524

Lack Of Fit

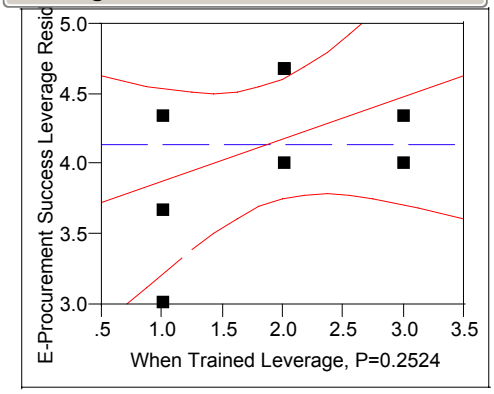
Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	1	0.7424242	0.742424	3.4862
Pure Error	6	1.2777778	0.212963	Prob > F
Total Error	7	2.0202020		0.1111
				Max RSq
				0.4825

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.5757576	0.492632	7.26	0.0002
When Trained	0.3030303	0.242965	1.25	0.2524

When Trained

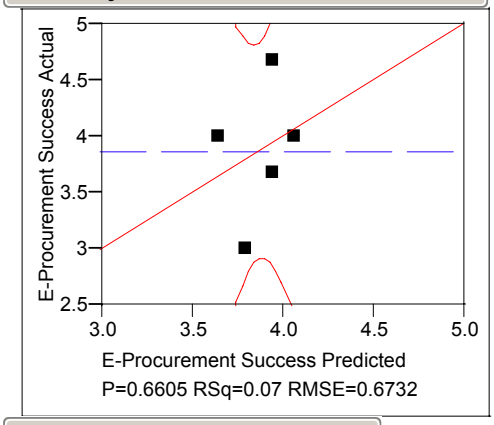
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	0.072878
RSquare Adj	-0.23616
Root Mean Square Error	0.673246
Mean of Response	3.866667
Observations (or Sum Wgts)	5

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.1068874	0.106887	0.2358
Error	3	1.3597793	0.453260	Prob > F
C. Total	4	1.4666667		0.6605

Lack Of Fit

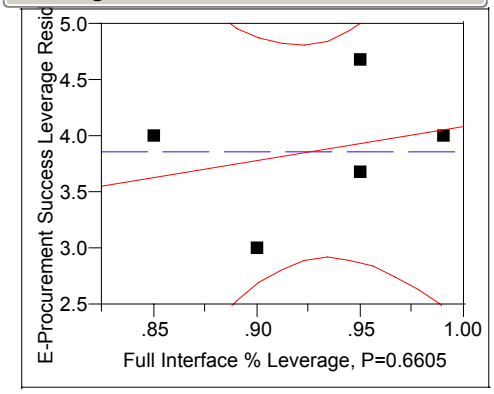
Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	2	0.8597793	0.429890	0.8598
Pure Error	1	0.5000000	0.500000	Prob > F
Total Error	3	1.3597793		0.6064
				Max RSq
				0.6591

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.0593607	5.788798	0.18	0.8665
Full Interface %	3.0251142	6.229485	0.49	0.6605

Full Interface %

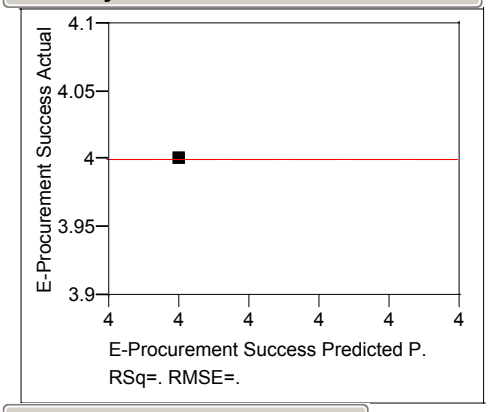
Leverage Plot



Response E-Procurement Success

Whole Model

Actual by Predicted Plot



Summary of Fit

RSquare	.
RSquare Adj	.
Root Mean Square Error	.
Mean of Response	4
Observations (or Sum Wgts)	2

Analysis of Variance

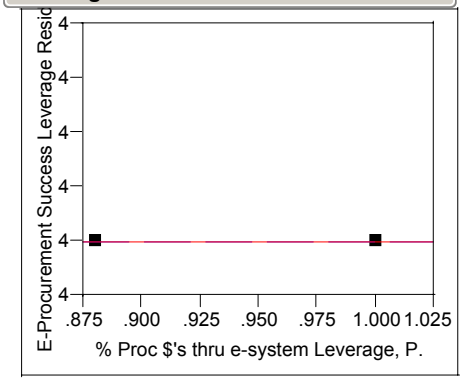
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0	0	.
Error	0	0	.	Prob > F
C. Total	1	0		.

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4	.	.	.
% Proc $'s thru e-system	0	.	.	.

% Proc $'s thru e-system

Leverage Plot



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His first assignment was at Langley AFB, Virginia as a contract manager for the 1st Contracting Squadron. While stationed at Langley, he was eventually assigned to assume flight chief responsibilities for the Plans and Programs section of the 1st Contracting Squadron responsible for Langley's Government Purchase Card Program, quality assurance program, and the computer systems in the contracting squadron. In August 2001, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to the Oklahoma City Air Logistics Center at Tinker AFB, Oklahoma.

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14. ABSTRACT

This research utilized the current literature to identify specific factors important in the e-Procurement implementation process. Once the factors were determined, a survey was developed to measure the factors in organizations with an e-Procurement system. All fifty state governments were contacted to determine if they had implemented e-Procurement systems and, if they responded affirmatively, were surveyed regarding what they have identified as the factors most instrumental in their e-Procurement implementation. The survey results were limited because only nine of the thirty-five states that responded actually had an e-Procurement system in place. By accomplishing a survey of the state governments' e-Procurement efforts, it was understood that the general applicability of the success factors and models developed in this research would be limited to the population of state governments. While the results are not generalizable, the survey can be used in the future to study other populations' e-Procurement efforts. As the survey is refined and expanded into other areas, the final resulting factors can then be used as foundational principles for organizations desiring to begin an e-Procurement program. The Department of Defense and the Air Force can benefit from the research by utilizing the survey to analyze the e-Procurement projects that are coming on-line. While the applicability is limited, the survey was designed to be applicable to any sector and can be used by organizations as a pre-implementation tool to analyze areas of weakness. The more information gathered during the initial phases of rollout can impact when full deployment of the system nears.

15. SUBJECT TERMS
Contracting, e-Procurement, Electronic Procurement

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