A COMPARATIVE ANALYSIS OF THE IMPACT OF NEW TECHNOLOGY IMPLEMENTATION ON ORGANIZATIONAL STRUCTURE AND CORPORATE DECISION-MAKING

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ABSTRACT

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This thesis examined the influence of new technology integration on both structure and decision-making in organizations. The proffered hypothesis maintains that the continuous and rapid flow of new technology opportunities forces identifiable changes in organizations. The influx of technology affects the communication efficiency of organizations, influencing their competitiveness. This study investigated the structures and decision-making constructs of successful Fortune 500 companies focusing on the issues they experience during assimilation of technology and what challenges they have mastered to achieve organizational effectiveness. The results, analyzed using both inferential and descriptive statistics, reveal a strong connection between technology use and changes in Fortune 500 organizations' structure and decision-making methods. These findings targeted specific areas where improvements would facilitate the integration of technology. The particular areas expose weaknesses in organizational planning and highlight directions for future study.

Accepted by: Ahmad Zaryab, Chair

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Chapter I: Introduction

General Area of Concern

In the last decade, much has been written about efforts to restructure organizations through the incorporation of process improvement strategies. Six Sigma, Total Quality Management (TQM), International Organization for Standardization (ISO), and other quality improvement programs integrate statistical analysis and prediction software with organizational strategies to increase profits and shareholder value. However, success remains fleeting for many companies, if it ever exists at all. After the initial flush of energy and enthusiasm, employees' efforts with potentially successful projects fade, not because the programs are faulty, but because the inherently inflexible traditional company structure fails to create an atmosphere where change can occur. Competitiveness between and within departments prevents effective communication, and new technology challenges employees to change the way they make decisions and predict future changes. But, employees, burned out on management's enthusiastic, yet short-term endorsement of the "latest trend" in process improvement, and busy simply trying to do their jobs, turn to passive resistance as a defense mechanism. Inertia causes the programs to

quietly disappear. Lack of follow-through and communication difficulties within and between departments further shortens the lifespan of such programs, where the focus is primarily on production processes and customers.

Current research examines several successful efforts at restructuring the entire organization to create process enterprises, but little is said about the impact of continuous new technology implementation on those processes, specifically decision-making. Since companies are transitioning into lean structures and focusing more on customer service and process reengineering, it is reasonable to assume that technology changes will considerably impact those efforts.

The factor of organizational structure further complicates the issue of success or failure of decision-making. Staying with the trend of doing more with less capital (or improving return on investment (ROI)), successful companies are striving to scale back on hardware expenditures and to place more emphasis on emerging analysis and prediction software, specific technologies that have a more direct impact on increasing profits. This influx of software affects the reeducation and daily work processes of millions of employees who must multi-task at an unprecedented rate. This flood of new technology influences an organization's communication regarding vital decision-making information.

This thesis contains two major parts, the first of which compares the structures of contemporary, successful, and technological organizations with

respect to the effects of the implementation of current and emerging technology on decision-making. From that analysis, a more productive understanding of technological use can be advanced for transition into a more flexible organizational structure. This structure would allow employees to share information vital to effective decision-making, and assume more responsibility and authority, which in effect, would create a network of partnerships to replace ineffective and outdated managerial hierarchies. The second part of this thesis hypothesizes that current problems in decision-making are not merely compounded by complications resulting from the constant influx of new technology, but by faulty structures intrinsic to traditional organizations creating an atmosphere where competition between and within departments prevents valuable communication of analysis results. Objectives of this study were:

1. To identify the organizational structures of Fortune 500 companies along with their current level of technological integration.
2. To identify critical issues present in Fortune 500 companies with regard to technology implementation.
3. To identify the effects of new technology implementation on corporate decision-making.
4. To discover potential link between new technology implementation and emergence of more horizontal strategic decision-making and structure within Fortune 500 companies.

Significance of the Study

The completion of this investigative study provides organizations with a means of improving communication and making better use of the assets they already possess: employees and technology. Deliberate and wide-ranging changes within an organization are necessary for these improvements to occur. This understanding forms the center of this study.

Assumptions made prior to this study involve the labeling of all Fortune 500 companies as generally "successful," according to the criteria determined by Fortune magazine. Also, the researcher assumes that technology has affected these companies in both positive and negative ways. Finally, the presupposition that decision making and structures have also been affected by technology in ways yet to be determined (by this study) forms the basis for the research question of this thesis.

Limitations of the Study

The major limitations of this study are confined to the method of data gathering and analysis procedures. Ideally, the researcher preferred to send multiple, qualified interviewers to the 200 companies and directly interview participants. In that way, rapport that is more direct could have been established with participants, who would then be more likely to be open in discussions concerning company analysis details. A more comprehensive understanding of the effects could then have been acquired through more in-depth interviewing techniques. On the other hand, the benefit of using a

questionnaire is to help eliminate potential tainting of participant responses due to interviewer bias. Also, because only the researcher analyzed the data, the data could not be independently verified. To address this concern, the researcher pilot tested the question items and made use of content analysis techniques, specifically, categorization and coding of responses to enhance reliability and validity and to aid in eliminating selective perception of content by the researcher.

A final limitation of the study concerns the choice of participants. Fortune 500 companies are, by definition, large companies that produce sizable profits. They also possess and require different levels of technological sophistication compared to small companies. Therefore, the findings of this study relate with few exceptions to large organizations.

Definition of Terms

Cross-teaming – a method of communication across and within departments, characterized by shared knowledge and usage of statistical data analysis processes for improved decision-making.

EIS – (Executive Information System) - software that allows executives to view and analyze key factors and performance trends.

ERP – Enterprise Resource Planning; a strategic improvement design that enables an organization to allocate and improve existing resources in order to improve processes.

ISO Standards – ISO stands for International Organization of Standards - a network of technical standards institutes from 146 countries that is able to act as a bridging organization in which a consensus can be reached on solutions that meet both the requirements of business and the broader needs of society.

IS – Information Systems; a term used to describe sets of technology tools and is commonly used to refer to the technology departments within companies.

IT – Information Technology; a term used to describe technological/computing tools used to report, analyze, or predict business needs.

Lean Office – the creation of a process-centered organizational plan that involves four steps: planning, leaning (mapping processes & developing a plan to eliminate waste), implementing, and sustaining.

Process reengineering – the analysis and redesign of workflow within and between enterprises.

Six Sigma – a management philosophy developed by Motorola, Inc. that emphasizes setting extremely high objectives, collecting data, and analyzing results to a fine degree as a way to reduce defects in products and services.

TQM – Total Quality Management; a structured system for satisfying internal and external customers and suppliers by integrating the business environment, continuous improvement, and breakthroughs with development, improvement, and maintenance cycles while changing organizational culture.

Summary

Chapter I introduced the topic of this thesis and a rationale for engaging in this specific meaningful research. A description of the objectives and the significance of the research followed, in addition to both assumptions and limitations of the study. Chapter One ended with definitions of terms used within the thesis.

Chapter II: Review of Literature

Historical Background

During the Industrial Revolution and even most of the 20th century, companies organized themselves according to the premise that the educated and skilled few (executives and managers) make the decisions for the many – generally, the many being uneducated and/or unskilled workers. Management levels gathered information. Communication, selected by management, moved down the chain of command and usually took the form of orders. As the years passed, this hierarchy became the standard due to the financial success of the companies who followed this organization pattern, even as companies became larger and more complex. However, in the latter half of the 20th century, with the development of new technology in the form of rapidly accessible data mining and analysis tools, and with the shifts in marketplace values and products, problems arose in part due to the lack of communication between departments and the lack of integrated common goals. Now, even with the wealth of available information, the difficulties still stem from an inability to communicate that information to maximize the benefits of technological and informational access. As a result, companies are beginning to alter their basic structures to improve production processes as well as communication flow.

Communication Issues

Although many studies exist related to company communication issues and organizational structure and the changes new technology has caused within organizational structure, very little has been investigated regarding the links between communication, recent technological advances, and how that continual influx of technology has affected decision-making within an organization. For example, the silo approach to organizational design emphasizes that different departments funnel work in progress down the organizational chain to create a product. In essence, Harbour (1996) offers that isolated groups work on different aspects of the same product in tandem. Inefficiencies inherent in any of those processes often originate from lack of communication between departments and inevitably impair final output. Decisions made along the production line are hindered by each department's inability to communicate what they are doing and why, or even if what they are doing is necessary at all. Farther up the chain of command, decisions are made based on incomplete or inaccurate information due to the confusion below.

Even in studies that focus on process improvement, little is mentioned about failures in the communication chain that are affected by technological advances, except as they relate to IT departments. The existence of this relatively new IT subculture often evolves into more of a hindrance to decision making than the aid it is intended to be. A recent study of technology (Brown,

2004) in the workplace revealed that "As many as 75% of IT-related projects fail" (p. 1), largely because of conflicts between IT departments and other employees, both management and the "rank and file." These conflicts complicate communication efforts, which in turn create ill will and resentment toward the use of IT. In service fields, this problem is exacerbated because information flow is often critical on a moment-to-moment basis to the decisions that affect the service offered. Harbour (1996) does, however, note that "In too many companies, interdivisional and interdepartmental cooperation falls along a continuum bordering somewhere between resigned tolerance and open hostility!" caused by "company politics, interdivisional rivalries, personal agendas, or management infighting" (p. 36). Harbour recognizes that the human factor often prevents progress and change within an organization, but relegates it to the ambiguous category of "bureaucratic inefficiencies," ignoring another, perhaps just as critical factor – the overwhelming influx of new technology.

A later study echoes Brown's findings by indicating that most IT projects - "between 40 percent and 75 percent" (Griffith, Zammuto, & Aiman-Smith, 1999, p. 30) fail. For example, Washington state's motor vehicles department spent $16 million in acquiring a client/server drivers' license processing system. The set-up was scheduled for 3 years. After 5 years, $40 million had been spent and the system was abandoned (Griffith, Zammuto, & Aiman-Smith, 1999, p. 32).

Organizational Decision-Making Issues

One significant study in the area of IT and organizational change by Wang and Paper (2005) outlines three areas in which problems generally occur: "envisioning change, implementing change, and managing reactions to change" (Case Description section). This case study examines the organizational transformation, in part a result of new IT technology implementation, of a university-owned research center that became a research corporation. According to Wang and Paper, one of the most frequently observed setbacks during technology-driven organizational change occurs due to ignorance or deliberate underestimation of the social issues surrounding the changes. The emphasis on the importance of technology incorporation, or what is commonly called the technology imperative paradigm, neglects to address the human factor.

> Managing reactions to change is probably the most challenging and unpredictable element in a change process. Receptivity, resistance, commitment, cynicism, stress, and related personal reactions must be considered within the framework of planning and implementing an organizational change (Wang & Paper, 2005, Case Description section).

Otherwise, failure of implementation is almost certain to occur. In their particular case study, Wang and Paper discover that lack of communication from the CEO to the rest of the employees, specifically management and IT

specialists, prevents the successful implementation of software designed to simplify and improve existing processes. IT specialists resist the change because they see no added benefit to them and have not been shown any positive impacts, while the CEO refuses to actively endorse the change, rendering the consultants charged with implementing the technology powerless. For the IT specialists, if the technology implementation is successful, much of their power-base will evaporate, due to the more widespread information access and decision-making power the technology offers to other employees. The message this study offers is that these issues need to be addressed *prior* to the technology implementation rather than during or after the changes take place.

Conversely, Harbour, in his earlier workbook on process reengineering (1994), does acknowledge the benefits of technology integration. But, as seen ten years later, his argument to use technology in process improvement mistakenly views technology as solely a waste eliminator or minimizer. Harbour's approach barely grasps the present complexity of this issue. Business intelligence tools range from scorecards, portals, and dashboards, to more complex analytic applications, data marts, database servers, and modeling and predictive tools, just to name a few. The problem for companies is two-fold: 1) what to do with all of this new technology, and 2) how to effectively communicate and interpret the results of this technology to improve processes and decision-making. To complicate the matter further, there are

the questions of which tools are needed and how to justify the cost of this implementation. Ideally, employees from CEO to customer-service representative want to understand the data faster so they can make decisions more quickly and effectively. Underlying the questions identified above is the pervasive and amorphous challenge of communication. The experts in IT, the accounting department, upper-level management, and even the CEO depend on the flow of communication to make decisions that affect every facet of the organization. Flaws in communication regretfully diminish the value of the technology so expensively purchased.

James Watson's 2003 dissertation investigates "attempts to integrate the organizational, environmental, and technological factors to explain how market responsiveness can be improved" (p. 2568) and sheds light on the subject of organizational adaptation to information technologies. Although his study focuses on his assertion that customer relationship management (CRM) technology is integral to a company's success, he also acknowledges that some companies have experienced success while others have failed, in part, due to what he calls "organizational dissonance." Watson (2003) further advocates "formally coordinated cross-functional decision making and prioritization of IT initiatives" (p. 2568), which emphasizes the importance of the marriage of IT and cooperative sharing of information for effective decision-making.

An addendum to the previous study's findings can be found in Wheeler, Chang, and Thomas's early examination of a major steel company's initial failure to successfully implement an Executive Information System (EIS) in 1993. Though the organizational structure itself did not alter significantly, nor did strategic decision-making, the resulting widespread dissemination of vital information via a modification to the EIS system enabled more efficient decision-making by executives. At first, the EIS system, instigated by an executive vice-president, was embraced by the executives of the company due to its ease of information gathering and eye-catching graphics. However, with the departure of the vice-president three years later, the system fell into disuse altogether because the executives did not have ongoing computer literacy training and there emerged a lack of parallel between executive roles and the EIS program capabilities. Lack of communication facility with the IT department further encouraged distancing from the program by executives. In the end, instead of abandoning the system completely, the IT department modified the program to widen the user base to include lower levels of staff who could truly benefit from the information gathered by EIS, which began to stand for 'everybody's information system.' As Wheeler, Chang, and Thomas (1993) describe, "expanding the system to everyone not only justified its cost by spreading its benefits to a wide range of users, but also made the human information suppliers more efficient at servicing senior managers" (p. 182). The problems associated with this particular technology implementation were

caused by misapplication of software due to lack of effective communication between upper management and the IT department regarding a clear understanding of the needs of the various positions within the company.

An additional study found within the search parameters of organizational decision making dates back to 1989, and reveals the interest and concerns of U.S. companies regarding the influx of technology and its affect on decision-making. Clarke's dissertation (1989), studied the retail banking industry at all levels and discovered that "in the U.S.A., the bank is restricted in its expansion by the lack of decision-making at the branch level" (p. 4011). Due to the rigidity of the organizational structure and technology capabilities at that time, the banking industry was hampered in its decision-making abilities. Implied here is that the communicative capacities were hampered by the limitations inherent in the organization structure and technology. Clearly, this triumvirate exists as an interrelated framework, both influenced by each other and capable of influencing in turn, the success of the organization.

Studies are few regarding this topic. An investigation into industry concerns via journal articles demonstrates a need for concrete information to facilitate and justify organizational changes. As it stands, organizations now institute changes in processes as a reaction to voiced industry apprehensions. Private companies espouse numerous process reengineering programs such as Six Sigma, Total Quality Management, and Value-Stream

Management that attempt to address the issues of change in organizational structure and process management. The premise intrinsic to all of these methods is that the process must be changed or adapted to meet the needs of the customers. Industry experts, such as Hammer in 1990, believe that massive investments in technology have not yet produced the return on investment predicted because of user errors and the inability to implement technology where needed (p. 2). The traditional top-down hierarchy still fails fifteen years later than Hammer's observation because the framework is outdated and does not meet the needs of today's demand for integration of communication and technology. Hammer comments, "Unless we change these rules, we are merely rearranging the deck chairs on the Titanic" (p. 4). Organizations are beginning to acknowledge the salient need for transformation in the areas of technology usage and structure, though even today, this change is still evolving.

The late 20th through the early 21st century appears to be a time of structural transition for American companies. Innovators within organizations are attempting to initiate IT-driven processes and flatten the traditional hierarchy of decision-making. But, company-wide resistance to change hampers these efforts. Hammer and Stanton (1999) maintain that power in key areas "still resides in vertical units...and those fiefdoms still jealously guard their turf, their people, and their resources" (p. 3). Without shared common goals and clear-cut parameters within integrated processes,

confusion and interdepartmental conflicts arise that prevent any meaningful change or progress across the organization. Hammer and Stanton add, "The horizontal processes pull people in one direction; the traditional vertical management systems pull them in another" (p. 3). Because businesses and industry leaders are slow to change, this problem has yet to be solved, despite enormous opportunities offered by today's technology.

Some companies have, however, taken on the challenge of redesigning their organizations to improve process performance with dramatic results. Industry success stories like that of Duke Power's transition to a process enterprise structure suggest that cooperation drives efficient decision-making and change within a company. Hammer and Stanton (1999) report that "Duke Power's managers, like those of most companies, were not accustomed to a collaborative style" and in the beginning "acted more as rivals than as partners" (p. 5). Later, as Duke Power evolved into a process-centered organization, these managers learned that "Unit heads have to negotiate with the process owners to ensure that the process designs are sound, the process goals reasonable, and the resource allocations fair. The split in authority makes cooperation unavoidable" (p. 5). Proof of the company's ability to become more efficient because of this changeover can be seen in their dramatic improvements in building-contractor commitments. "In 1996, Duke Power was meeting only 30% to 50% of its commitments to building-contractors on time. By 1999, the company met 98% of its

construction commitments" (p. 4). Though this study unmistakably connects communication and decision-making, no mention is made of the influence of new technology opportunities on the process improvement process or on communication efforts.

Technological advances in the area of information gathering and analysis has grown rapidly in the last ten years. Computers first began helping organizations by enabling the reporting of business transactions and analyzing returns on investments. Then, just a few years ago, OLAP (on-line analysis processing), ERP (enterprise resource planning system), and data mining tools enabled more accurate decision-making. Now, decision-making itself is capable of being automated. Beard (1999) believes that businesses "demand an integrated decision process that pulls together all the relevant data, loads the data into a model of the business domain, constructs and tests scenarios and refines the results to support business action" (para. 4). However, many organizations are still not taking advantage of this capability because of lack of training or lack of communication regarding results or even usage of the software itself. Human beings must still make final decisions, which means that someone must communicate the meaning of the results of analyses. A 1996 study by Fielder, Grover and Teng of IT structure and its relationship to organizational structure affirms, "The taxonomy of IT structure is based on the degree of centralization of computer processing, capability to support communications, and the ability to share resources" (para. 1). In

order for results to enable meaningful decisions, they must be easily communicable.

Advances in electronic communication still do not address the issue of data interpretation. Apparently, changes in organizational structures are a *result* of the increased ability to provide technologically advanced analytical capabilities and Fielder, Grover and Teng (1996) found that "organizations are finding it difficult to capitalize on these new opportunities" (para. 3) and added that "Centralization of major decision making is the extent to which decisions (e.g. capital budgeting, pricing, personnel) are made at the top levels of the organization" (para. 17). Organizations with the most centralized decision making structure have a centralized IT structure and the opposite is true as well. Fielder, Grover, and Teng acknowledge that "It is possible that IT structures that increase communication and resource sharing may also affect the structure of the organization's decision making and change the nature of organizational work" (para. 18). Their research further maintains that, "only those organizations that have been denied the influences of IT-supported communication and data and application sharing will maintain organizational structures that are characterized by extreme decentralized or centralized decision making" (para. 19).

More concerns arise due to IT's influence on departmental relationships and the potential financial considerations regarding budgeting decision making. In an early study, Malone and Rockart (1991), propose "IT

has the potential to alter the nature of organizational work by increasing or decreasing organizational integration" (para. 128). This observation supports Fielder, Grover, and Teng's later notation (1996) that "Organizational integration is the degree to which the firm has interdepartmental cooperation. Interdepartmental cooperation would include the lateral sharing of projects, applications, ideas, and information" (para. 22). This sharing implies horizontal communication efforts that "facilitate firm integration." Interdepartmental sharing affects future funding of resources and increased communication, as executives realize a return on their investiture through centralized processing of information. Fielder, Grover, and Teng (1996) add "For example, a department's individually maintained computer data and application portfolios would reflect their isolated vision and understanding" (para. 22). Changes in organizational structure because of this centralization of resource sharing and analysis will inevitably involve more horizontal decision-making instead of vertical.

Nevertheless, the evolution of decision-making and organizational structure is negatively influenced - unable to capitalize on new technological opportunities - because the influx is so rapid. Fielder, Grover, and Teng (1996) offer the suggestion that "these new technological capabilities may result in new, more collaborative organizational structures" (para. 22). This transformation has already occurred in companies such as Dell, Inc., where Klein suggests that "technical staff, using searchable databases and F

(frequently asked files) files, need not have experts in every aspect of computer technology. One person can solve many different types of problems" (para. 9). This change, called "widening the span of control" (para. 8), performs the dual function of empowering employees and reducing the actual number needed to perform jobs, while transforming the organization's structure. IT innovations further reduce the necessity for employees to work in centralized locations, making even difficult problems solvable through the facilitation of asynchronous communication (i.e. email). Klein goes farther to submit "companies that use computer-based technology, then, can eliminate middle management, allowing them to widen the span of control of managers and thereby flatten the organizational structure" (1996, para. 8).

More recent research reiterates the importance of knowledge sharing to maintain competitive advantage. Kearns and Lederer reveal, "only one-third of IT investments made by CEO's and IT executives aimed at gaining a competitive advantage were actually profitable" (2003, para.1). Kearns and Lederer propose a more direct IT alignment with upper management decision making in light of the IT department's potential for increasing organizational performance. Their study adds, "CEO understanding of IT opportunities within the firm and awareness of competitors' IT uses may break down the barriers to business-IT collaboration" (2003, para. 25). Therefore, communication and understanding of IT resources is not simply a matter of interdepartmental

sharing and collaboration, but involves the participation of upper management in order to realize its fullest potential.

The main questions, however, persist: What particular effects does the wealth of present-day technological opportunities have on both the organizational structure and interaction within and among departments in companies? How is the decision-making process affected by this influx of new technological implementation? These questions form the central issue concerning this study.

Existing research implies that negative influences affect introduction of new technology within organizations and inhibit productive interaction among employees and departments. IT has a reputation for elimination of jobs, which oftentimes causes employees to greet new technology with apprehension and skepticism. "The massive downsizing of the workforce which has accompanied the introduction of computer-led work has, not surprisingly, resulted in a lack of job security" (Sutherland, 1997, p. 17).

Also, assimilation of process reengineering systems such as ERPs (Enterprise Resource Planning) causes a multitude of difficulties during the implementation process. For example, John Osberg, consultant at Informed Partners in Atlanta understands "Implementing an ERP system is hard, expensive, and it creates turmoil in an organization, but the return on investment is there for putting financial resources together" (Schuerenberg, 2003, para. 9). Variations in ERP software enable a variety of companies to

take advantage of process efficiency improvements and future savings, which may be difficult for employees to foresee during initial implementation. Other obstacles to implementation include "a storm of heavy [initial] investments and multiple data conversions" (Schuerenberg, 2003, para. 8), which cause problems and hidden costs involved in employee training and morale and financial obligations to continuous service production.

Absent from this discussion is how these considerations affect decision-making at multiple levels. Although process reengineering involves changes within and among departments, shifts are inevitable in terms of decision-making effectiveness as well. Clearly, further investigation is necessary to determine the levels of influence both technology and changing structures have on decision-making.

Process Reengineering

Related to this issue is the influence of new technology on business process reengineering. Substantial reengineering of not only organizational structures, but also organizational information systems exists as a difficult yet vital concern to all companies. Business process reengineering (BPR) redirects emphasis "on integrating business web sites with back-end legacy and enterprise systems, as well as organizational databases" (Attaran, 2003, p. 585). New research in this area suggests that redesigning core business processes increases competitiveness and improves resource allocation and efficiency (Attaran, 2003). Additionally, Attaran believes that IT capabilities fall

into three categories or phases that follow the business reengineering process: "before the process is designed, while the process design is underway, and after the design is complete" (2003, p. 586). The first concerns pre-design implementation planning, where the infrastructure is created or altered in order to best manage information that will support the evolving organization. This planning period allows IT to identify and select processes for redesign. But, one significant and new offering of IT is anticipating future needs and changes based on software predictions. Here, research fails to connect the potential of IT with the existing infrastructure changes that will inevitably take place because of the design implementation. The infinite possibilities of IT capabilities and the vast amount of information brought to the process will necessitate an entire educational shift within an organization not only with regard to the software, but also with regard to communication. Process reengineering "enhances employees' ability to make more informed decisions with less reliance on formal vertical information flows" (Attaran, 2003, p. 587); however, it does not create the attitude shifts that must take place with regard to decision-making. That shift must come from changes at all levels of the organization, which justifies the need for further research into this area. Tapping and Shuker observe that information travels freely among multiple paths, especially vertically in both directions (2003) at the beginning of the process of restructuring the organization toward a leaner framework, thus enhancing the commitment to improve.

During the process design phase of reengineering, IT drives the changes that take place under the guidance of management support. The gap in literature suggests the need to investigate where within this process organizations are failing to follow-through. Existing research advances the position that the failure is not due to limitations in IT software, but rather in the limitations of personnel understanding of the need for and willingness to change. IT is an enabler, not a solution in itself. "Many companies ignore IT capabilities until after a process is designed" (Attaran, 2003, p. 587), which implies a lack of perception on the part of management in particular regarding the role IT plays in both the process design and the ways in which technology can enhance decision-making.

Numerous organizational improvement methods focus on processes while others focus on customers, or even the product/service itself. However, most strategies today emphasize the desire for the development of one key characteristic – leanness. Flexibility facilitates the bottom-line savings a company can generate. Flexibility is created by improvements in a company's most important asset – its people. In the end, the employees determine the quality of efficient service and productivity, the "leanness" of the company, and whether or not there is an increase in its profits. But, in so many strategies on the market, mere lip service is given to the implementation of communication and educational changes within an organization during process reengineering, decision-making, and the confluence of these

changes with the relentless assault of new information technology. Truly lean enterprises develop chiefly because the people who work in these organizations possess experience in the industry, knowledge of tools and techniques that enable lean enterprises, and communication skills necessary to successfully implement lean changes. There are five basic tenets of lean thinking:

1) Specify value from the customer's perspective.
2) Create a clear picture of how value is added to products or services.
3) Make products/services flow.
4) Implement synchronous information systems.
5) Eliminate ALL non-value added operations. (Benson & Hutzel, 2004)

Inherently implicit in the above list is the certainty that technology and people must integrate in order for success to occur. The persistent flood of new information technology changes the way employees make decisions, especially in lean companies, where most, if not all employees must function in a variety of capacities. The main reason companies fail in their efforts, despite the massive number of lean strategy offerings is that they ignore this significant factor.

Without a doubt, this new area of research challenges the way we look at how companies communicate and make decisions. Barrie Nault, in her 1998 study of information technology and organizational design notes that,

> One of the most important frontiers of current research is how information technology (IT) affects organization design. Understanding the effects that IT has on individual organization designs and the potential relative advantages IT brings to different organization designs is crucial to making progress. (para. 1)

Nonetheless, she also finds in her study that IT does not automatically favor decentralized decision-making, an idea previously proposed and which warrants further study. Though Nault's study is similar to this researcher's proposed research topic, she does not examine the effect that IT has on basic communication and its attendant issues, and instead, primarily focuses on organizational design. She concludes that of the three basic organizational designs: centralized, decentralized, and market (a mix of the two), the mixed mode causes coordination problems in the collocation of information and decision rights (Nault, 1998). This researcher proposes that communication difficulties, as well as lack of coordinated education and training improvements, prevent efficient sharing of valuable information that is continually changing. In any case, Nault offers valuable insight into the rationale behind organizational design for the purposes of this study.

Most prior research examined in this literature review acknowledges the power of organizational culture in facilitating change. In fact, William Lareau, in his text Office Kaizen (2003), explains, "the failure to deal with the realities of human behavior is responsible for most business problems,

failures, and shortfalls that are controllable by an organization" (p. 52). Organizational culture is not necessarily complicated, but it is difficult to alter due to the power of group reinforcement over time and individual misconceptions and fears concerning change. Lareau's endorsement of the Kaizen process philosophy stems from his belief "to change behaviors, focus must be turned to changing actions first" (2003, p. 53). This conviction is founded on the observation that no matter how novel or exciting a proposed change may appear during a presentation, employees inevitably return to routine processes and behavior that reinforce the status quo. Transformation to leaner organizational structures and the assimilation of new technologies (a topic not addressed by Lareau), challenges employees to change regardless of their basic reinforcing internal or cultural responses, which inevitably create conflict.

Perhaps the most relevant concern here is how information is disseminated. Making competent decisions requires having the requisite information readily available. One particular study analyzes where decisions are made and how IT affects the distribution of information in organizations. Malone (1997) proposes that decentralization is occurring in organizations as a response to the influx of new IT tools and technologies. While other studies support this declaration, Malone goes further to present the challenge that this researcher is attempting to answer,

> Figuring out how to design effective decentralized systems and how to manage the continually shifting balance between empowerment and control will not be easy. Easier to believe that mastering this challenge will be one of the most important differences between organizations that succeed in the next century and those that fail. (1997, Conclusion section, para. 73)

Since the radical decrease in middle managers with leaner companies, employees are finding themselves multitasking and taking on increased responsibilities, as well as making strategic decisions on a daily basis. Certainly, the rising influence of IT plays a crucial role in forcing most of this change.

The Future

The ever-increasing influence of technology will continue to expand and change organizations from the inside out. This phenomenon is exhaustively explored by large companies around the world who search for ways to increase their advantage over competitors. For example, Comergent's yearly e-commerce survey investigates the changes that this particular technology perpetuates within numerous industries. "Conducted in March and April of 2005, the survey provides a window into the current and future e-commerce plans of 124 companies from more than eleven different industries" (2005, Introduction section, para.1). Findings across multiple industries show that a variety of factors presently impel companies to engage

more forcefully in e-commerce, the one area of IT investment that holds the greatest ROI potential. The number one factor influencing companies to initiate e-commerce is to make it easier for customers to do business with the company. Other more predictable outcomes accrue as advantageous side effects of customer satisfaction and include lowering costs, out-performing the competition, and increasing revenues. Even more impressive, 80% of the respondents reported plans to expand their e-commerce offerings to customers, which illustrates the increasing importance of technology in all industries (2005, Key Findings section). Companies will be forced to embrace e-commerce and its attendant technologies or see their profits evaporate as more nimble, streamlined companies sweep up their customer base. Of the 124 companies surveyed, "68 percent . . . enjoy[ed] results they characterize as positive or strongly positive" (2005, Key Findings section, para.1) - proof of the success of e-commerce technology. Most of these same companies also expect e-commerce to increase in significance over the next year, "with 42 percent citing e-commerce as important and 46 percent citing it as very important" (2005, Key Findings section, para. 1).

While e-commerce may be the most influential technology, without internal change, companies will be unable to take advantage of its considerable benefits. Antiquated business processes, are incompatible with innovative technologies like e-commerce and predictive analytical software. The reason? Managers and those they hire are not able to take advantage of

new technology because the processes hinder them. A very recent poll from CIO Tech in June 2005 reports "When asked about the biggest barrier to implementing IT at their companies, the No. 1 answer. . . 41.2%. . . was that firms are unwilling to change business processes to take advantage of new and more powerful technology" ("IT Spending Projections Drop Sharply in May," Special Questions section).

Summary

By whatever name it is called, process reengineering possesses far-reaching influence in organizational structuring today. The combination of structural changes, new IT capabilities, and a leaner employee base force new and different decision-making strategies that will forever transform organizations. Future success in companies will depend on the successful and rapid ability of companies to integrate valuable information and make decisions without the present confusion and transitions prevalent in traditional hierarchies. Managers and CEO's must relinquish a micromanagement approach and offer an environment where employee empowerment creates a climate where mission statements mean more than the paper on which they are printed and the success of the company is of central interest to everyone, not just shareholders. The hypothesis of this study emphasized the importance of communication in the face of a constant influx of new technological opportunities and the changes they will force in decision-making. Current research indicates a need for further investigation into how

current companies prioritize these three issues and how their decision-making is affected by new IT opportunities. Since competitiveness relies on the ability of employees to make fast and reliable decisions, this study questions how effective current practices have been in the face of new technology and the budgets allocated for educational and communicative strategies needed to implement software. Finally, this study investigated influences on the integration of the three areas of structure, decision-making, and technology in successful organizations of various sizes.

Chapter II discussed the salient research conducted into the area of technology integration and corporate decision-making and structures within the last 20 years. The prior studies suggest that more information is needed connecting new technology implementation to changes within corporate structures and decision-making paradigms that affect both profits and communication.

Chapter III: Methodology

Definition of Participants

This thesis examines the effects of new technology integration on successful Fortune 500 companies. Therefore, the nature of the information gathered in this study necessitates representation from a particular population of successful organizations. A sampling from Fortune 500 companies ensures that the data acquired by questionnaire is representative of companies in the United States that have achieved "successful" status – "success" meaning the companies are financially stable and profitable. The sample can then be categorized as a probability sample. Fortune 500 companies possess the distinction of meeting the definitive measures of success, which include company revenues, and both private and publicly traded companies are included on the list. The participants from within these Fortune 500 companies are the CIO's (Chief Information Officers). These upper management employees generally possess authority and knowledge concerning the company as a whole. And, according to Gartner analyst, John Kost (2003), these leaders own the following attributes: "1) an understanding of the business issues of the enterprise, 2) the ability to translate between business needs and technology solutions, and 3) strong leadership in the areas of business and technology" (p. 4), making them ideal participants for this study. At the same time, the researcher acknowledged the variability in

job descriptions and duties of a CIO and included the caveat that the participants be the CIO's equivalent in terms of decision-making capability.

Criteria for Sampling Design

The study itself required a minimum sample size of 100 of the total 500 companies due to the descriptive and correlational nature of the study. The sampling size was determined by using a sampling table for survey research (see Appendix B), assuming a probability of 50/50 on a dichotomous research question (positive/negative effects), and no sub-population (Sullivan and Rassel, 2002). Accuracy required is +/- 10 margin of error, with a confidence level of 90%, resulting in a sample population of 96. For purposes of proportion, the researcher rounded up to 100 total sample organizations/participants for the initial survey population. Due to the questionable response rate of Fortune 500 Chief Information Officers, phone contact was attempted with participants prior to the administration of the questionnaire to increase the probability of an acceptable response. Therefore, the number of companies chosen to participate in the study was in part based on prior agreement with participants. To compensate for lack of response after the administration of the survey, the researcher first sent a second letter of inquiry along with a second copy of the questionnaire, followed by a phone call to ascertain the reason(s) for non-response. The acceptable response rate for the 100 participants was 50 responses, which was achieved after repeated attempts to make contact.

The independent variable in this study is the influx of new IT tools into an organization's decision-making structure. The organizational structure itself and the decision-making process are both dependent variables, influenced by the degree of new technology implemented in the organization. The measurement was the degree of change present in the dependent variables, measured in terms of value-added and structural difference from traditional hierarchy, as well as defined communication difficulties by company representatives. Data gathering is classified as discrete and one-group, and while the variables at first appear to be univariate, the volatile nature of the dependent variables will be analyzed, making the data more multivariate.

The researcher's role was to create a questionnaire to be administered by postal mail to representatives from the 100 companies. The researcher then collated findings and interpreted the results. The study took place during a six-month period during the spring of 2005. The data collection and analysis was simultaneous rather than sequential and data representation took the form of description, tables, and charts for interpretive purposes.

The researcher used a constant comparative approach, whereby the results from each question were compared to the prior relative questions to form a holistic representation of changes within successful companies' structures and decision making because of new technology integration. Data

was stored at the researcher's home for the duration of the study until analyzed and published.

Development of Instrument

The best method to acquire the answers to the research question is through a written questionnaire, sent to companies' CIO's (Chief Information Officer) or the equivalent in terms of decision-making responsibilities (See Appendix A). The traditional definition of 'questionnaire' describes the term as "a set of questions for obtaining statistically useful or personal information from individuals" (Merriam-Webster, 1999, p. 958) and is chosen for the purposes of inquiry here due to practical concerns relating to time management and distance. It is not cost effective for the researcher to travel to 100 distant cities. However, the researcher incurred the cost of 100 phone calls to inquire into participation agreement by potential corporate CFO's. A 50 percent agreement rate was sought with regard to the 100 inquiries so that a +/-10 margin of error at 95% confidence rate could be achieved by a total sample size of 96. In addition, the questionnaire provided participants with an opportunity to extemporize on comments in a more anonymous way, separate from any potential biases incurred during an interview process.

Question Design

Since the composition of the questions is designed to inquire into the influence of technology on structure and decision-making capabilities within a successful organization, the result is to create a more comprehensive

understanding of the rapid changes that are taking place within successful high-tech companies. New or transitioning organizations can then analyze their own decision-making systems and structures for efficiency, and incorporate the results into their own reengineering processes. The questions themselves were designed to address the objectives listed in Chapter I. Objective #1 called for identification of the organizational structures of Fortune 500 companies, along with their current level of technological integration. Questions 2, 5, and 20 address the structure part of this objective, while Questions 1, 6, 17, and 19 focus on levels of technological integration. Objective #2 states the intent of the study to identify critical issues present in Fortune 500 companies with regard to technology implementation. Questions 2, 8-16, and 20 address this objective. Objective #3 requires the survey to identify the effects of new technology implementation on corporate decision-making. The survey questions associated with this objective relate to budget allocation and decisions regarding new technology importance in the workplace and overlap with other objectives. Questions 6, 15, 16, 18, and 20 acquire this information. The final objective, #4, refers to the intent to discover a link between new technology implementation and the emergence of more horizontal strategic decision-making and the structures of these Fortune 500 companies. Again, Questions 2, 3, 15, 18, and 20 were designed to attain this data. Also, questions were designed to garner background information from the organizations, specifically questions 5, 7, 17, and 19.

Method of Information Analysis

To investigate the questions related to the four objectives formulated for this study, the researcher carried out regression analysis, as well as descriptive analysis of the findings. Multiple types of questions were chosen to obtain both quantitative and qualitative data concerning technology's effects on Fortune 500 companies. Fourteen question were created using the Likert method, requiring respondents to choose from (5) Strongly Agree, (4) Agree, (3) Neither Agree Nor Disagree, (2) Disagree, or (1) Strongly Disagree as possible responses. This enabled the researcher to complete inferential regression analysis to determine statistical significance and relationships among question responses. One ranking question and several identification questions concerning tools, budget data, and background information were included to provide descriptive analysis capability. The descriptive questions were analyzed using percentages and means.

Because the hypothesis indicates a potential causal relationship between the dependent variables and the independent variable, causal analysis was the statistical method used to discover the exact extent of the relationships examined in the study. Correlation tests were used, along with *t*-tests to determine the relationships between 1) technology implementation and organizational structure changes, 2) technology implementation and decision-making changes, and 3) effects of new technology on Fortune 500 organizations. Since there was no attempt to manipulate the variables, but

simply study the subjects, the ex post facto design was used through the examination of the responses on the questionnaire. Controlling for compound variables necessitated the inclusion of open-ended questions regarding other influencing factors and the addition of "Other" as a choice in checklist questions. To obtain more definitive analytical information, regression analysis was used.

Analysis results were cross-tabulated because the study involves categorical variables. However, the use of percentages to describe data results simplified the data and converted it into a standard recognizable form (pie charts) with a base of 100 for comparison purposes. The data gathered through regression calculation was displayed using tables. The statistical program MINITAB was used to create the tables to illustrate the results. Standardization of the raw data using percentages helped to eliminate potential errors and to reveal shifts in the data. Finally, the calculation of the mean concerning questions designed to reveal effects of technology implementation was used to discover patterns of specific issues that occur.

Pilot Testing of Questionnaire

Before the questionnaire was sent to the sample Fortune 500 organizations, the questions were pilot-tested by 10 chosen companies within the total original population that are considered profitable and high-tech. In this way, the reliability and validity of the questions could be analyzed and revised. It was not necessary for either the 10 pilot test participants or the

actual sample participants to be randomly chosen due to the specific nature of the participants' qualifications. The pilot test with a 40 percent response rate enabled the researcher to determine reliability and validity of test items and language. The accepted response rate was 40% for the pilot test.

Chapter IV: Findings

Introduction

A discussion of the results of this study begins with a reiteration of the objectives developed prior to the study. However, the first noteworthy observation based on the findings warrants inclusion here. That observation is that every company participant except one reported involvement in process improvement strategies. What this suggests is that Fortune 500 companies are actively aggressive in searching for ways to remain competitive. This observation is also significant in light of the rest of this study's findings because it highlights a large gap in initiating change vs. undergoing considerable change. Most successful Fortune 500 companies are in the early to mid stages of reengineering their structures, but the changes themselves are extensive. Technology continues to spur this reengineering, with varying degrees of success. Areas of concern rising from the results of this study are discussed in the Chapter V: Conclusions section, but also are outlined here in Chapter IV as the findings are interpreted and analyzed in connection with the research objectives. The concerns for organizations include budget allocation for IT, change in corporate structure relative to use of technology, and long-term commitment to continual integration of new technology and assessment of that technology's use in increasing productivity. This chapter elucidates the results of the questionnaire, analyzes and explains the findings, and specifies what problems occurred throughout

the process. Interpretation of data is based on both inferential and descriptive methods of analysis.

Results

Results for Objective #1.

The survey is constructed of 20 questions grouped here into categories relative to the objectives for initial analysis purposes. The first category consists of questions that define the organizational structures of Fortune 500 companies and their current level of technological integration (Objective #1). Analysis of Questions 2 (Tech Structure) and 20 (Org. Structure) centered on decision-making and structural changes within companies. Initial analysis comprised comparisons of the mean using MINITAB software (2.72 for Question 2 and 2.60 for Question 20 on a scale of 1-5, with the range of choices from Strongly Agree (5) to Strongly Disagree (1)). Early examination showed that with a Confidence Interval of 95%, there is correlation between significant changes in organizational structure as a direct result of technology implementation. None of the respondents chose 5 for either question, indicating a reluctance to show extreme change; however, with means close to 3 in the absence of any 5s, indicates that technology is a factor in the change of Fortune 500 organizations with regard to both structure and the decentralization. In fact, with regard to Question 2, slightly more respondents agreed that their organization's structure had changed significantly as a result of new technology implementation, although fewer indicated a definite

decentralization. Both Figures 1 and 2 outline the results for both Question 2 and Question 20 and indicate the range of answers in histogram form with the mean indicated with an X-bar sign along with a 95% *t*-confidence interval.

Figure 1. MINITAB Histogram of results for Question 2 concerning Structural Change.

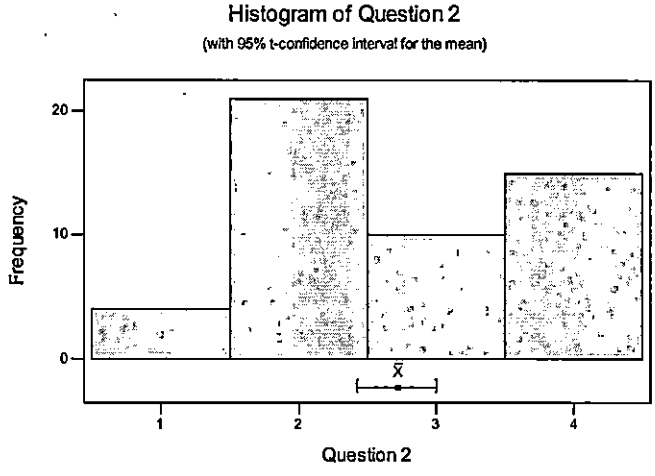
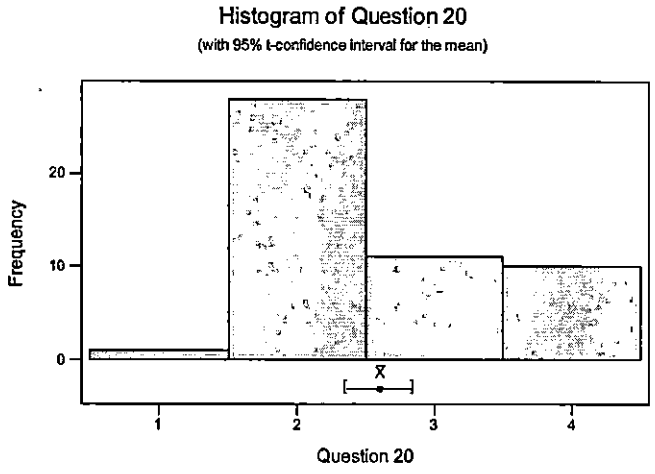


Figure 2. MINITAB Histogram of results for Question 20 concerning Decentralization of Structure.



Another test indicates a correlation between the responses for Question 2 and 20. Using MINITAB's Correlation function, the results indicated a positive correlation between the two, with a Pearson's coefficient (or *p*-value) of .019. The only inference that could be made is that there exists a small correlational significance between organizational structure and technology increase. However, more investigation needed to be completed in order to determine with more statistical certainty that the correlation reveals a true relationship between organizational structure and the influence of technology on that structure. Therefore, regression analysis was undertaken regarding the two variables. Table 1 illustrates the results of that regression.

Table 1

Regression analysis of Organizational Structure vs. Tech. Structure

Regression Analysis: Org Structure versus Tech Structure

The regression equation is
Org Structure = 1.84 + 0.279 Tech Structure

Predictor	Coef	SE Coef	T	P
Constant	1.8419	0.3311	5.56	0.000
Tech Structure	0.2787	0.1145	2.43	0.019

S = 0.794059 R-Sq = 11.0% R-Sq(adj) = 9.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	3.7346	3.7346	5.92	0.019
Residual Error	48	30.2654	0.6305		
Total	49	34.0000			

Unusual Observations

Obs	Tech Structure	Org Structure	Fit	SE Fit	Residual	St Resid
20	2.00	4.000	2.399	0.139	1.601	2.05R
25	2.00	4.000	2.399	0.139	1.601	2.05R
35	2.00	4.000	2.399	0.139	1.601	2.05R

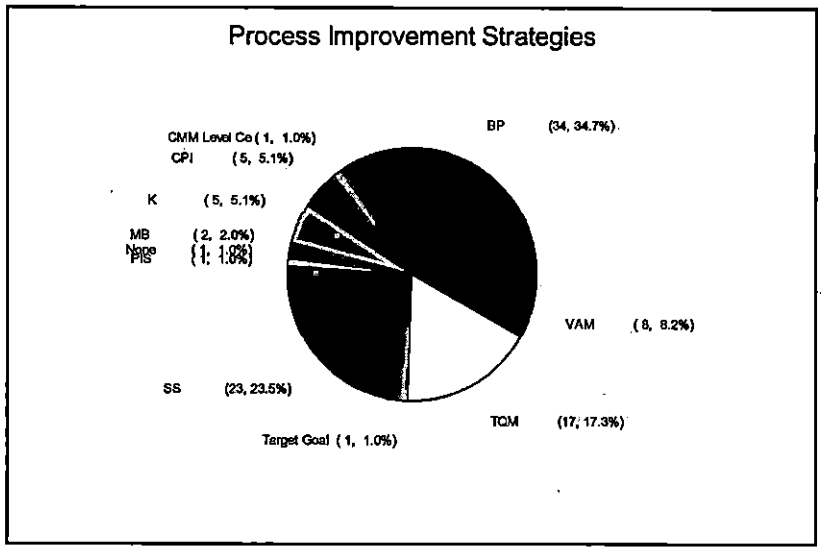
R denotes an observation with a large standardized residual.

Using the regression model $Y = \beta_0 + \beta_1 X$, when X = Tech Structure and Y = Organizational Structure, the findings indicate for every 1 unit increase in change due to technology, there is a corresponding change in organizational structure of 0.279. Therefore, a positive relationship exists between the influence of technology on structure and organizational structure decentralization. The relationship is also significant because the p-value of

$0.019 < \alpha = .10$, or 90% confidence level, shows a significant relationship. This regression analysis also addresses the main issue of Objective #4, wherein a link between new technology integration and emergence of more horizontal structure was discovered. Later discussion of findings relates to the second part of Objective #4 relating to decision-making.

The current levels of technology integration (the second part of Objective #1) was found using descriptive statistical inference from analysis of the mean and percentages from Questions 1, 6, 17, and 19. The results of Question 1 shed light on a reason for the relative decline in vertical structures. Question 1 asks respondents to check any process improvement strategies that they currently use. All but one of the respondents checked at least one of the offerings and most checked more than one for a total of 98 choices. Of those responses, 34 organizations use Best Practices (BP), with Six Sigma (SS) a close second with 23. Total Quality Management (TQM) comes in third with 17 responses. Five respondents chose the "Other" category listed in the question and cited Continuous Process Improvement (CPI) as their current improvement strategy, while one chose Target Driven Goal and another CMM Level Certification Process. Kaizen with 5, Value Added Management (VAM) with 8, and Malcolm Baldridge (MB) with 2 represent the other three categories. A summary of the findings by percentage is shown in Figure 3.

Figure 3. MINITAB Pie Chart for Process Improvement Strategies.



The prolific response rate concerning process improvement strategies suggests that Fortune 500 companies take seriously the intent to change and improve the methods they use to interact with customers as well as interact internally. This result, along with the increase in organizations with both management and employee decision-making shows intent to become more effective in action as well as rhetoric.

Question 6 data reports on the level of technology tool (software) integration within Fortune 500 companies. This question asked respondents to rank the technology tools they use from most important to least important, on a scale from 1-10 (with one being most important to the organization). To prevent the systematic bias or halo effect common to ranking scales, the tools were clearly defined. Also, this type of question prevented the transitivity problem that risks preferences. The respondents were asked to rank the tools

the organization finds most important. However, the risk of using more than five items, which often creates carelessness in ranking, was offset by the simplicity and familiarity to Fortune 500 CIO's of the items listed. The results are summarized in Table 2.

Table 2.

Data Summary of Mean and Rank Order of Technology Tools in order of importance to organization.

Data Display

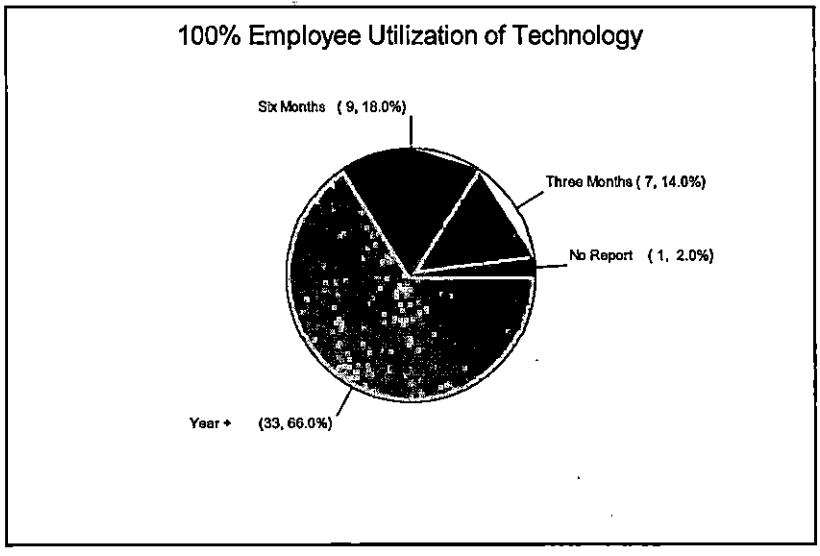
Mean of Q6 - Items 1-10	Rank Order of Technology Tools by Importance
(1) 2.86	1 Reporting/Scheduling
(2) 4.12	2 Fraud detection/Security
(3) 5.58	3 Analysis
(4) 4.68	4 Predictive Analysis
(5) 4.06	5 Budgeting/Financial
(6) 5.25	6 Data Mining
(7) 5.23	7 Demand Planning
(8) 9.10 Processes	8 BPM (business strategy)
(9) 6.15	9 Web services
(10) 7.41	10 Video-conferencing
	11 OTHER: Inventory/Supply Chain Mgmt. & Transaction Processing

An important finding is that fraud detection and security is high on the list, supporting earlier research on the subject of technology trends. One interesting discovery relates to the choice of Reporting/Scheduling as first,

while general Analysis and Predictive Analysis falls third and fourth. The generation of reports and scheduling seems to be more important than the integration of more complex technological capabilities. Why? One possible answer may be found in analyses of the rest of the questions (8, 10 – 13, 15 - 18), which explore the effects and critical issues of new technology in successful Fortune 500 companies. Analyses of these questions specifically concern Objectives #2 and #3, and will be discussed at the conclusion of Objective #1 analysis.

In Question 17, companies report that it takes all employees a year or more to implement and use new technology. For this reason alone, it is not surprising that they resist taking on new technology (See findings on Question 10 Employee Resistance, Figure 8), since it takes them so long to incorporate it into their everyday duties.

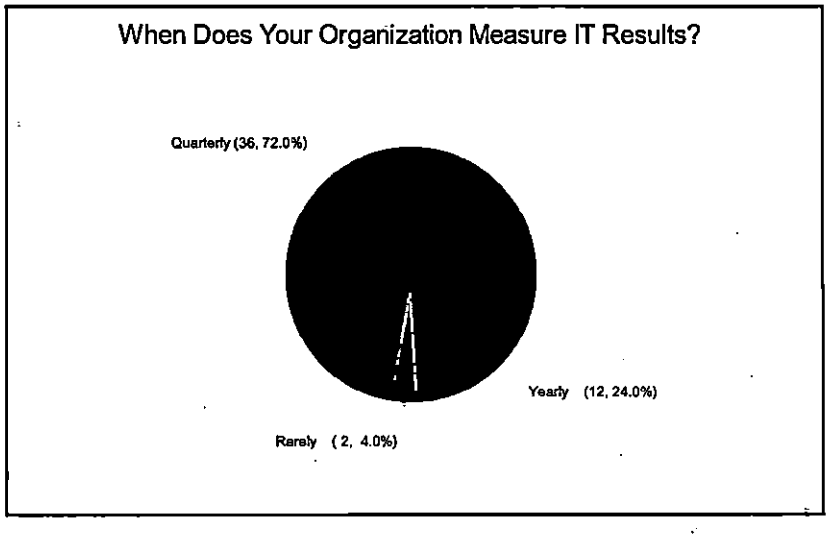
Figure 3. MINITAB Pie Chart of 100% Employee Utilization of New Technology.



Furthermore, new technology is being added to companies much more frequently than yearly, so employees are continually attempting to learn new technology, making their jobs more difficult. The implication for Objective #1 is that the level of technology integration in organizations cannot keep up with current trends due to the length of time it is taking employees to incorporate the technology. By the time they integrate last year's technology, it is already out of date in many cases. In addition, the sophistication of technology is lower than optimal.

Question 19 is a background question, and as such, adds tangential information to the study. The findings provide financial information of IT in Fortune 500 companies, asking participants to state when their organization measures IT results. Figure 4 shows the vast majority of participants 72% measure IT quarterly, while 24% measure yearly, with only 4% (2 respondents) measuring rarely.

Figure 4. Time Frame for Measurement of IT Results.



This response indicates that for most Fortune 500 companies, IT results are measured frequently, along with other important financial investments and disbursements within the organization. Not only are most successful companies watching their investment in IT closely, they are realizing positive returns on that investment as seen from the later analysis of findings from the background Question 7, relating to predicted return on investment in technology.

Results for Objective #2

Continuing with the structure of discussing findings connected to the Objectives listed in Chapter I, the researcher turns next to Objective #2. Objective #2 states that the study will identify critical issues present in Fortune 500 companies with regard to technology implementation. Since a discussion and analysis of Questions 2 and 20 has already taken place previously, a repetition of the detailed findings will be omitted at this time. Again, less sophisticated analysis is followed by the regression analysis for particular questions. To reiterate, the p-value of 0.019 indicated a positive causal relationship between technology integration and changes in organizational structure, identifying change in structure as a critical issue.

Question 8 used the standard Likert style, asking respondents to rate their agreement with the statement "In the last five years, new technology implementation has resulted in problems or special issues within or between departments." As both Figures 5 and 6 show, a considerable number of

participants, 12, or 24%, declined to respond either in the negative or positive, the mean calculated at 3.16. Sixteen respondents disagreed with the statement, 2 of whom did so strongly, while 22 agreed, 5 of whom did so strongly.

Figure 5. MINITAB Histogram of results for Question 8 concerning problems or special issues within or between departments regarding technology implementation.

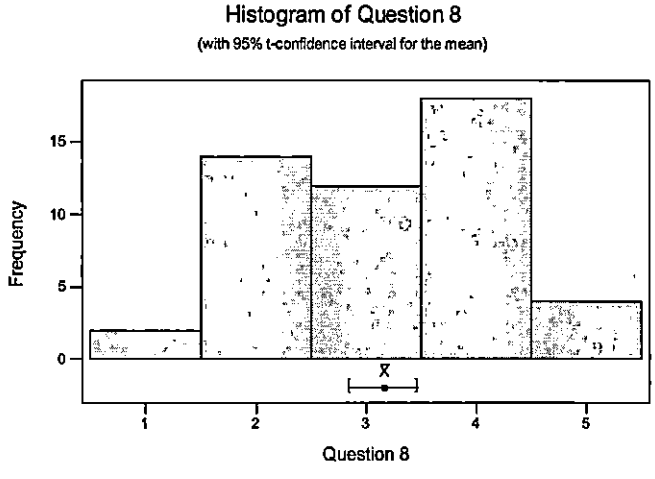
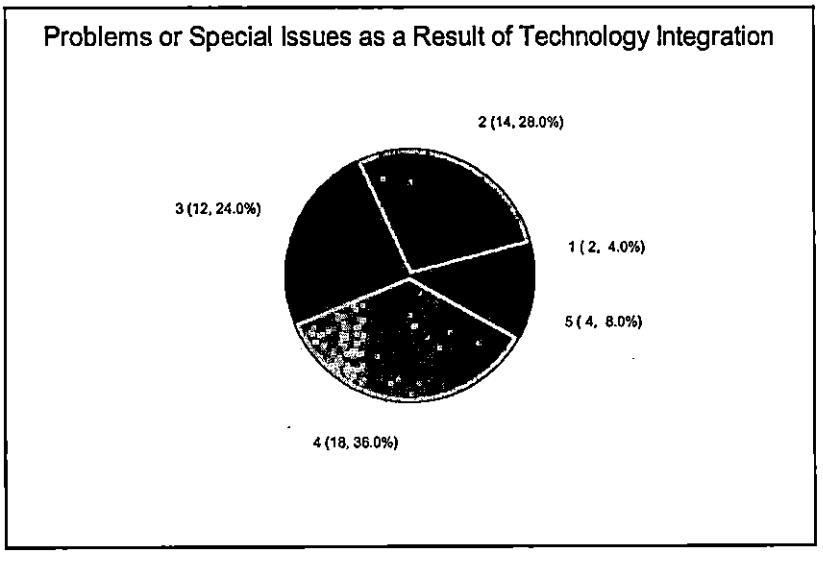


Figure 6. Percentages for Question 8.



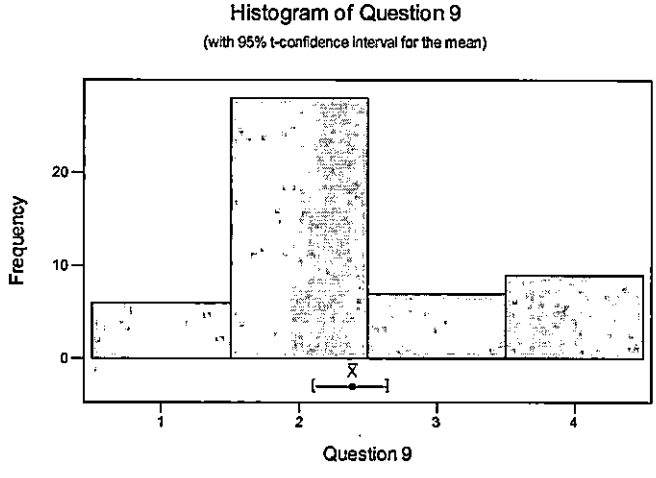
This result strongly suggests that many companies are experiencing problems during new technology implementation.

Question 9 asked respondents to rate their agreement to the statement "Our organization has experienced interdepartmental rivalry due to new technology implementation" on a Likert scale from 1-5 with 1 = Strongly Disagree, 2 = Disagree, 3 Neither Agree Nor Disagree, 4 = Agree, and 5 = Strongly Agree. In the subcategory of decision-making, this question is intended to discover if departments are vying for power or experiencing any interdepartmental management issues because of new technology implementation. The response tested with a *t*-test, shows that with 95% confidence that the mean 2.38 indicates that interdepartmental rivalry is not a major issue with regard to new technology, a finding that disagrees with the theory proposed in the review of literature.

The raw data shows that large number of respondents disagreed with the statement, which indicates a split on the issue. Twenty-eight of the 50 respondents believe that there does not exist interdepartmental rivalry, with an additional 6 strongly disagreeing, leaving 7 to neither agree nor disagree and 9 to agree with the statement. No inference can be made with regard to the 7 who chose not to agree or disagree, except that they either chose not to reveal rivalry or they simply did not feel qualified to make a definitive response. Therefore, interdepartmental rivalry seems to be a small issue with

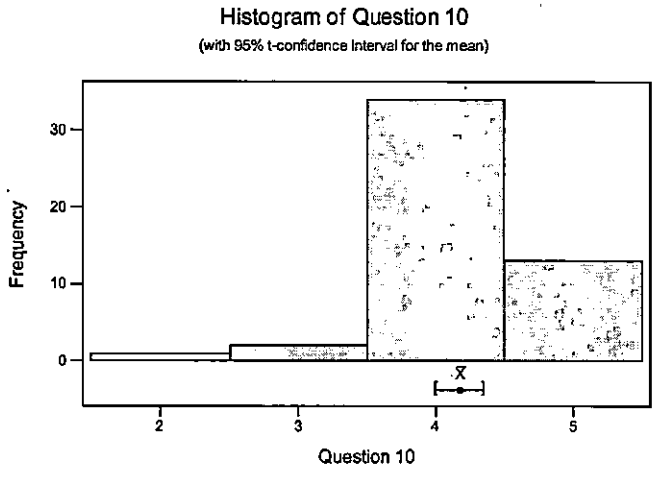
only 18% of respondents believing their organization possesses this problem as a result of new technology integration (See Figure 7).

Figure 7. MINITAB results for Question 8 concerning interdepartmental rivalry as a concern.



But, what kinds of problems are they experiencing? Question 10 sheds light on one problem even successful companies on the Fortune 500 list cannot seem to avoid: employee resistance. As the chart in Figure 8 shows, almost all companies agree that employee resistance often occurs during new technology implementation.

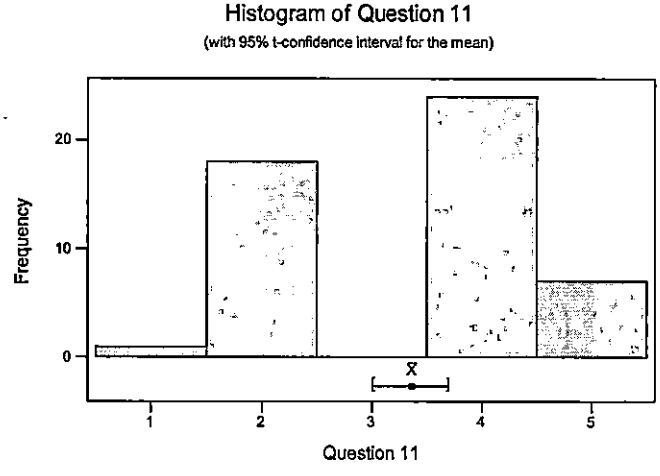
Figure 8. MINITAB results for Question 10 concerning employee resistance to new technology.



The mean of 4.18, wherein most companies agree that employees do resist new technology implementation, coincides with the lengthy period of time employees are taking to utilize new technology 100%.

Questions 11, 12, and 13 investigate other potential problems within organizations due to technology. In Question 11, 62%, or thirty-one participants, stated that lack of employee training opportunities frequently causes difficulties in technology implementation. The chart in Figure 9 shows the results for Question 11, which reveals an apparent polarization on this issue. Only 19 respondents indicated a disagreement with the statement for a mean of 3.36.

Figure 9. MINITAB results for Question 11 concerning lack of training opportunities for employees.

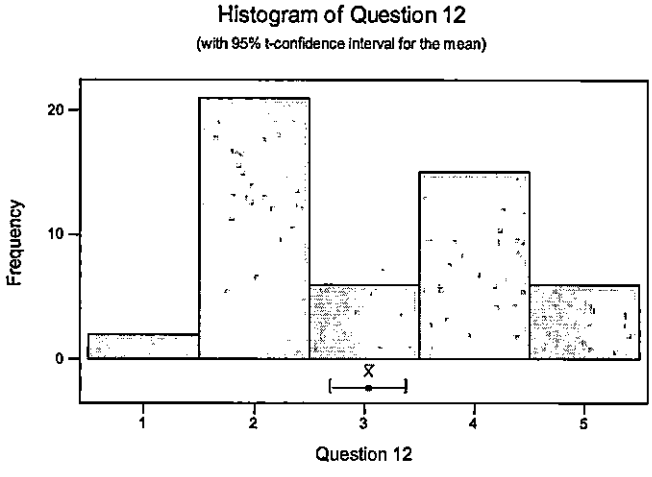


This result coincides with the previous results for Question 17 concerning length of time to utilize technology and the inference can be made that employees find it difficult to implement new technology since it takes them largely a year or more to do so, due, in part, to the lack of training opportunities.

However, respondents are evenly divided over the issue of management lack of commitment to technology implementation, as seen in the graph below. Twenty-three respondents report that their management is committed to a long-term technology integration strategy, while 21 reported that management does have a problem committing to long-term projects. Six respondents declined to answer "yes" or "no," but instead chose the "Neither

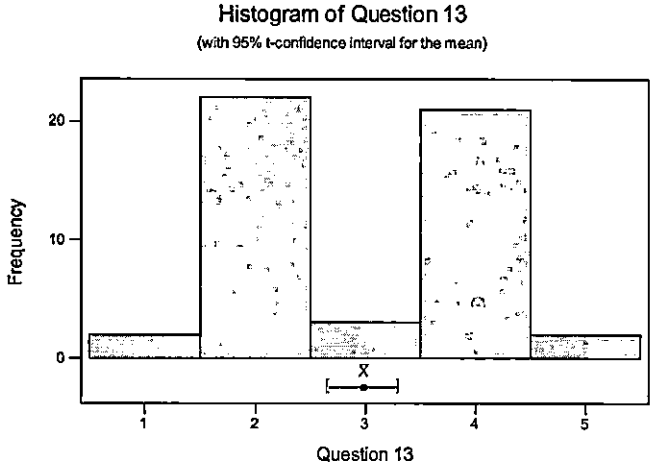
Agree Nor Disagree" option. The mean, 3.04, shown in Figure 10, provides evidence that respondents are evenly split on this issue.

Figure 10. MINITAB results for Question 12 concerning management lack of commitment to technology implementation.



Finally, Question 13 results illustrate yet another almost even divide for organizations. The question asks participants to rate their agreement with the statement, "Lack of a prior implementation strategy has caused difficulties in implementing new technology." The results in Figure 11 show that slightly more respondents disagreed with the statement, yet there remains a strong positive response as well. In fact, 24 participants disagreed, while 23 agreed, with 3 remaining neutral on the issue.

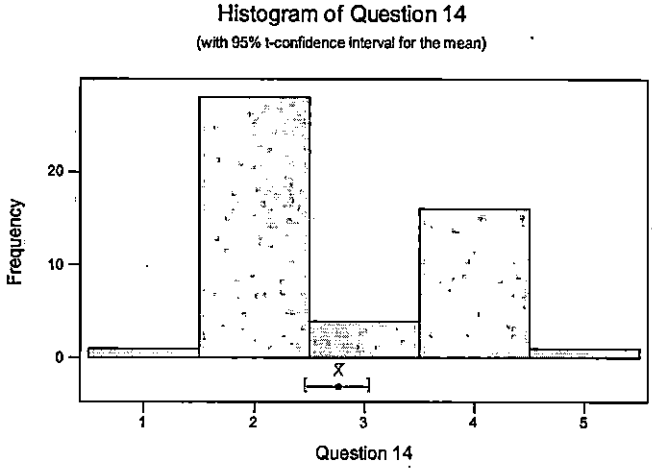
Figure 11. MINITAB results for Question 13 concerning lack of prior implementation strategy for technology implementation.



The results appear remarkably similar to the results for Questions 11 and 12, leading the researcher to infer that these problems exist in enough numbers to be statistically significant for organizations in general.

Further description of critical issues that also relates to Objective #3 – effects of new technology on decision-making - within Fortune 500 companies is seen in the analysis of Question 14 (see Figure 12), wherein respondents were asked if budget concerns preventing successful implementation of technology. The mean of 2.76 illustrates some concern for budgetary problems created as a result of new technology – a count of 17 responses or 34% report budgetary problems preventing implementation of new technology. However, 29 or 58% report not having this problem.

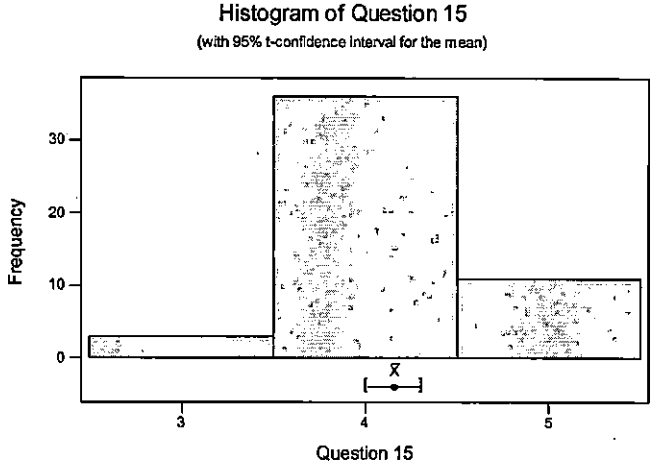
Figure 12. MINITAB results for Question 14 concerning budget anxieties regarding new technology implementation.



What can be inferred is that successful companies are budgeting for technology, clearly foreseeing the necessity of keeping up with new developments, even if they are not keeping up in practice.

Further information relative to critical issues AND effects of new technology on decision-making (another reference to Objective #3) can be found in the response to Question 15, where respondents were asked to rate their agreement or disagreement with the statement "New technology integration has improved communication within our organization for strategic decision makers." The results (see Figure 13) reveal a strong positive response for communication improvements for decision makers due to technology integration. In fact, 47 of the total 50 respondents (94%) agree or strongly agree with the statement.

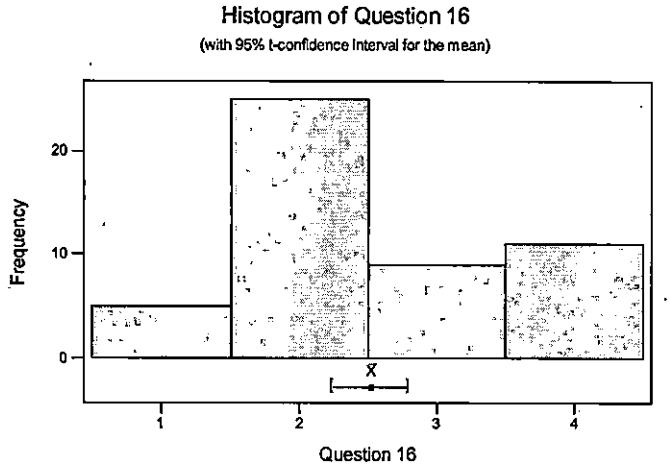
Figure 13. MINITAB results for Question 15 concerning improved communication for decision-makers due to new technology implementation.



A reasonable assumption at this time is that other causes also appreciably influence any changes that take place.

On a positive note, however, companies are reporting that there is little loss of productivity (Question 16). Results of 95% confidence interval for the mean illustrated in the histogram below reveal that people are working harder to incorporate the technology, even if it is taking a long time to efficiently implement.

Figure 14. MINITAB results for Question 16 concerning loss of employee or process productivity as a result of new technology implementation.



Thirty participants, or 60%, disagreed with the statement "New technology implementation has produced loss of productive employee time or loss of process productivity." The mean is 2.52, considerably less than the previous set of results for questions 11, 12, and 13, showing that loss of productivity for employees or processes is not a major factor for most organizations. The remaining 40% is divided with 22% agreeing and 18% declining to commit to either a positive or negative response.

To return to two questions concerning the effects of technology implementation on structure and employee resistance to technology integration, the regression analysis in Table 3 offers definitive statistical data on what is NOT happening. The p-value of 0.724 shows with $\alpha = .10$ that the relationship is not statistically conclusive.

Table 3

Regression Analysis of Effects of Technology Implementation on Structure and Employee Resistance to Technology Integration

Regression Analysis

The regression equation is
Employee Resistance = 4.26 - 0.0308 Tech Structure

Predictor	Coef	StDev	T	P
Constant	4.2637	0.2506	17.02	0.000
Tech Str	-0.03078	0.08667	-0.36	0.724

S = 0.6009 R-Sq = 0.3% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.0456	0.0456	0.13	0.724
Residual Error	48	17.3344	0.3611		
Total	49	17.3800			

Unusual Observations

Obs	Tech Str	Employee	Fit	StDev Fit	Residual	St Resid
6	2.00	2.0000	4.2022	0.1054	-2.2022	-3.72R

R denotes an observation with a large standardized residual

As indicated prior to the analysis of the above questions relating to Objective #2, more sophisticated analysis is necessary to determine with statistical significance that the above results contain useful implications. The questions available for regression analysis relative to Objective #2 are 2 (Tech Structure), 10 (Employee Resistance), 15 (Communication), 16 (Productivity Loss), 18 (Info Flow), and 20 (Organizational Structure). Since a regression test has already been completed for Tech Structure and Org.

Structure, analysis here will begin with Tech Structure and Employee Resistance. There is not significant causal relationship between changes in structure due to technology and employee resistance. A negative correlation was found, but the p-value is greater than the risk of error, indicating little chance that employee resistance is related to organizational change.

The next regression analyzes a potential relationship between Tech Structure and Communication (communication improvements for decision-makers) (see Table 4).

Table 4

Regression Analysis of Communication vs. Tech. Structure

Regression Analysis

The regression equation is
Communication = 4.26 - 0.0366 Tech Structure

Predictor	Coef	StDev	T	P
Constant	4.2596	0.2141	19.89	0.000
Tech Str	-0.03661	0.07405	-0.49	0.623

S = 0.5135 R-Sq = 0.5% R-Sq(adj) = 0.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.0644	0.0644	0.24	0.623
Residual Error	48	12.6556	0.2637		
Total	49	12.7200			

Unusual Observations

Obs	Tech Str	Communic	Fit	StDev Fit	Residual	St Resid
3	4.00	3.0000	4.1131	0.1194	-1.1131	-2.23R
7	3.00	3.0000	4.1498	0.0755	-1.1498	-2.26R
50	3.00	3.0000	4.1498	0.0755	-1.1498	-2.26R

R denotes an observation with a large standardized residual

There appears to be a slightly negative relationship between these two variables, though the Pearson coefficient is high (.623), the equation shows that for every 1 unit change in Tech Structure, communication improvements for decision-makers decreases by 0.0366. However, the high p-value is greater than $\alpha = .10$, indicating lack of significant relationship.

The next regression analysis looks for a relationship between Communication for decision-makers and Information Flow for employees. Table 5 does indicate a significant relationship between the two forms of communication improvement within Fortune 500 organizations. The inference that can be made is that technology implementation causes improved communication and more rapid information flow within companies, but not by much. This is important in the sense that this improvement is the key change for companies, not increased sophistication. For every 1 unit increase in Information Flow for employees, Communication for strategic decision-makers increases by 0.394. However, the p-value is extremely small, less than $\alpha = .10$, suggesting that there is a highly significant relationship. Therefore, the researcher can say that there is a highly causal relationship or a meaningful correlation between the two variables. The $t = 2.88$ is larger than the critical value of the $t_{0.025,48} = 1.99$. Even though the coefficient of determination ($r^2 = 14.78\%$) indicates a weak fit for sample data to the least

square line for this sample, the consistently low r^2 values such as that in this study are not uncommon when dealing with cross-sectional data.

Table 5

Regression Analysis of Communication vs. Information Flow

Regression Analysis

The regression equation is
Communication = 2.47 + 0.394 Information Flow

Predictor	Coef	StDev	T	P
Constant	2.4735	0.5892	4.20	0.000
Informat	0.3940	0.1368	2.88	0.006

S = 0.4753 R-Sq = 14.7% R-Sq(adj) = 13.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1.8756	1.8756	8.30	0.006
Residual Error	48	10.8444	0.2259		
Total	49	12.7200			

Unusual Observations

Obs	Informat	Communic	Fit	StDev Fit	Residual	St Resid
3	4.00	3.0000	4.0497	0.0774	-1.0497	-2.24R
7	4.00	3.0000	4.0497	0.0774	-1.0497	-2.24R
10	3.00	4.0000	3.6556	0.1875	0.3444	0.79 X
13	4.00	5.0000	4.0497	0.0774	0.9503	2.03R
34	4.00	5.0000	4.0497	0.0774	0.9503	2.03R
39	4.00	5.0000	4.0497	0.0774	0.9503	2.03R
43	4.00	5.0000	4.0497	0.0774	0.9503	2.03R
50	4.00	3.0000	4.0497	0.0774	-1.0497	-2.24R

R denotes an observation with a large standardized residual

Yet, another negative linear relationship is found by the regression analysis of Information Flow vs. Tech. Structure. As indicated by the table below, the p-value (0.077) is less than $\alpha = .10$ and as Tech Structure

increases (or more explicitly, as technology affects organizational structure) Information Flow decreases by 0.126, revealing a negative relationship between the two, as well as a statistically significant one. While the researcher allows that there is a linearly significant relationship, there is not enough evidence to suggest a ***causal*** relationship based on the statistical support in this example alone. Nevertheless, this evidence, taken together with the previous regression analysis strongly suggests that, with a confidence level of 90%, the changes in structure due to technology integration do impact the information flow within organizations, becoming then a critical issue for organizations.

Table 6

Regression Analysis of Information Flow vs. Tech. Structure

Regression Analysis

The regression equation is
Info Flow = 4.62 - 0.126 Tech Structure

Predictor	Coef	SE Coef	T	P
Constant	4.6240	0.2024	22.84	0.000
Tech Structure	-0.12646	0.07001	-1.81	0.077

S = 0.485437 R-Sq = 6.4% R-Sq(adj) = 4.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.7689	0.7689	3.26	0.077
Residual Error	48	11.3111	0.2356		
Total	49	12.0800			

Unusual Observations

Obs	Tech Structure	Info Flow	Fit	SE Fit	Residual	St Resid
10	3.00	3.0000	4.2446	0.0714	-1.2446	-2.59R

R denotes an observation with a large standardized residual.

The next regression analysis concerns Tech Structure vs. Productivity Loss. There does appear not to be a significant causal relationship between the two, though earlier results conflicted with this finding. The regression is shown in Table 7.

Table 7

Regression Analysis of Tech. Structure vs. Productivity Loss

Regression Analysis

The regression equation is
Productivity Loss = 2.00 + 0.193 Tech Structure

Predictor	Coef	StDev	T	P
Constant	1.9950	0.3932	5.07	0.000
Tech Str	0.1930	0.1360	1.42	0.162

S = 0.9431 R-Sq = 4.0% R-Sq(adj) = 2.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1.7911	1.7911	2.01	0.162
Residual Error	48	42.6889	0.8894		
Total	49	44.4800			

For every change in organizational structure because of technology, a corresponding change in production occurs. More specifically, for each 1 unit change in Tech Structure, organizations experience a corresponding productivity loss of 0.193 a small, and statistically insignificant change. The p

value of 0.162 is much greater than $\alpha = .10$, therein negating any chance of significant causal relationship.

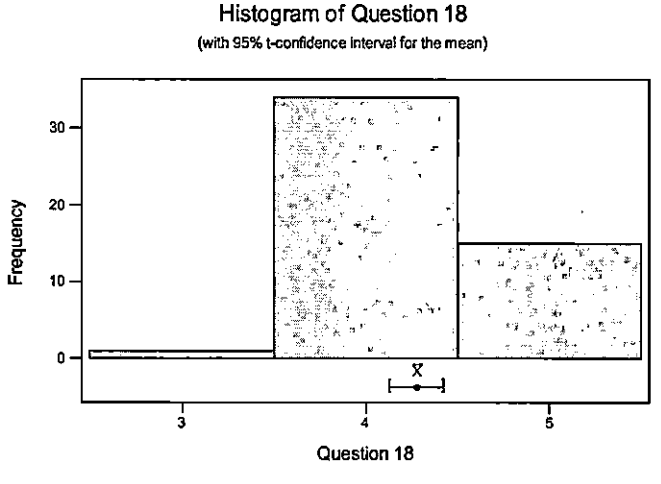
Results for Objective #3

Data on the effects of new technology implementation on corporate decision-making was gathered from Questions 6, 15, 16, 18, and 20. Question 6, already analyzed previously in the discussion of Objective #1, illustrates the choices that decision-makers are making concerning technology usage in their organization. The data reveals simple reporting and scheduling tools are considered the most important technology in companies, while more complex BPM processes and Web services tools are ranked less important. To briefly reiterate the data outlined in Figure 5, fraud detection/security was second, analysis and predictive analysis were third and fourth respectively, budgeting/financial tools were fifth, data mining was sixth, demand planning was seventh, BPM processes, Web services, and video-conferencing round out the top ten. The data suggests less complex tools are more easily incorporated into the organization and are seen as most useful.

Data from Questions 15, 16, 18 and 20 have also been analyzed earlier in the findings section for both Objectives #1 and #2, but it is significant what the findings suggest about decision-making. Questions 15 and 18 both concern improvements in communication and the data sets for both show that

communication for decision-makers and employees has been facilitated by technology. The effects of new technology implementation, therefore, on decision-making is that it is making it easier for both management and employees as a whole to access information and make decisions based on that information. Question 18 illustrates one of the true benefits of new technology implementation for employees, mirroring the results for Question 15, with a strong positive response. Question 18 asked participants to rate their agreement with the statement "The implementation of technology in our organization has resulted in more rapid information flow among employees." Clearly, as seen in the following chart, technology improvements have made it possible for faster information flow, which in turn, allows for more rapid decision-making.

Figure 14. MINITAB Histogram of Question 18 concerning faster information flow as a result of technology implementation.



The implications for making a connection to decentralization then are strengthened by this finding because decisions of all employees can be made faster. Outcomes from the analysis of the mean and tally of data for Question 16 imply a positive effect of new technology on decision-making. Because the results indicate little loss of productivity, the researcher conducted a regression analysis test to further determine if there was a causal relationship between Employee Resistance (to new technology) and any loss of productivity. The results verified the earlier finding and show a significant relationship between the two. (See Table 8).

Table 8

Regression Analysis of Productivity Loss vs. Employee Resistance

Regression Analysis

The regression equation is
Productivity Loss = 0.759 + 0.421 Employee Resistance

Predictor	Coef	StDev	T	P
Constant	0.7595	0.9404	0.81	0.423
Employee	0.4212	0.2228	1.89	0.065

S = 0.9287 R-Sq = 6.9% R-Sq(adj) = 5.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	3.0830	3.0830	3.57	0.065
Residual Error	48	41.3970	0.8624		
Total	49	44.4800			

Unusual Observations

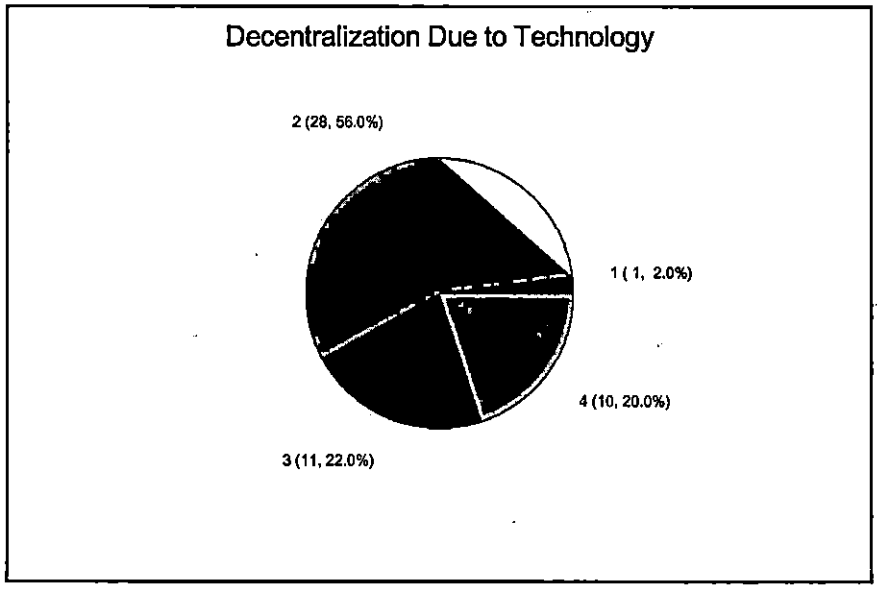
Obs	Employee	Producti	Fit	StDev Fit	Residual	St Resid
5	5.00	1.000	2.865	0.225	-1.865	-2.07R
6	2.00	1.000	1.602	0.503	-0.602	-0.77 X

R denotes an observation with a large standardized residual
X denotes an observation whose X value gives it large influence.

The resultant finding with regard to Objective #3 is that Employee Resistance to new technology is a potential cause of loss of productivity. The p-value of 0.065 is less than the $\alpha = .10$ and links the two variables together conclusively relative to technology implementation.

Question 20 directly relates to Objective #3 in that it examines the effects new technology has had on the organizational structure, which is the decision-making structure of an organization. The mean of Question 20 is 2.6, suggesting that most CIO's disagree that decentralization is occurring due to new technology, a direct refutation of the Review of Literature. A clearer picture of the results for this question can be shown in the pie chart in Figure 15.

Figure 15. MINITAB pie chart concerning decentralization due to technology implementation.



The question is a Likert-style question with (5) Strongly Agree not even chosen by respondents, 20% choosing (4) Agree, 22% choosing (3) Neither Agree Nor Disagree, 56% choosing (2) Disagree, and only 2% choosing (1) Strongly Disagree. However, the 11 participants who chose (3) show a lack of commitment due to unknown factors. This discovery is a direct rebuttal of the existing literature, which draws a strong connection between new technology implementation and decentralization. However, the data shows a considerable number of respondents (42% non-committal or agreeing, forcing the researcher to report a finding of inconclusive with regard to this issue. The unusual finding offers the inference that organizations lack a solid understanding of how decentralization occurs and technology's role in affecting this change within companies.

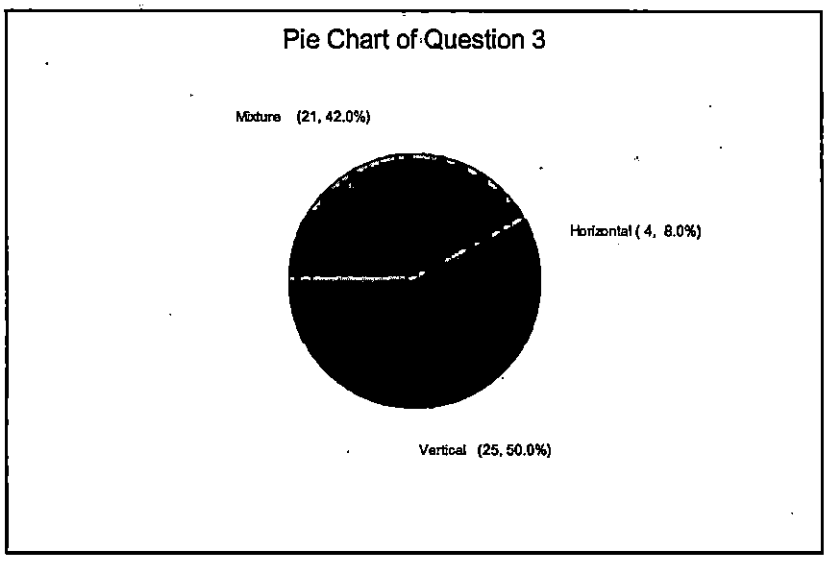
Results for Objective #4

Turning to Objective #4, the discovery of a potential link between new technology implementation and the emergence of a more horizontal decision-making and organizational structure within Fortune 500 companies, can be found in Questions 3, 15, 18, and 20. Questions 15, 18, and 20 have already been analyzed with regard to the effects of technology, and the findings have suggested that most companies do not experience decentralization due to new technology. This inference creates a dilemma regarding interpretation because these same CIO's see their organization, as seen in the following pie chart, as a mixture between vertical decision-making and horizontal. If

technology is not a major factor, then the question left for this researcher is what other factors DO influence this transformation based on the evidence presented in the study?

Figure 16 illustrates the delineation of organizational structures within Fortune 500 companies. The percentage of organizations with a vertical decision-making structure is 50%, with 42% reporting a mixture of both managerial and employee decision-making, a higher percentage than reported in earlier studies. This increase indicates a trend toward change in decision-making from the traditional vertical method. Only 8% report a fully horizontal decision-making structure.

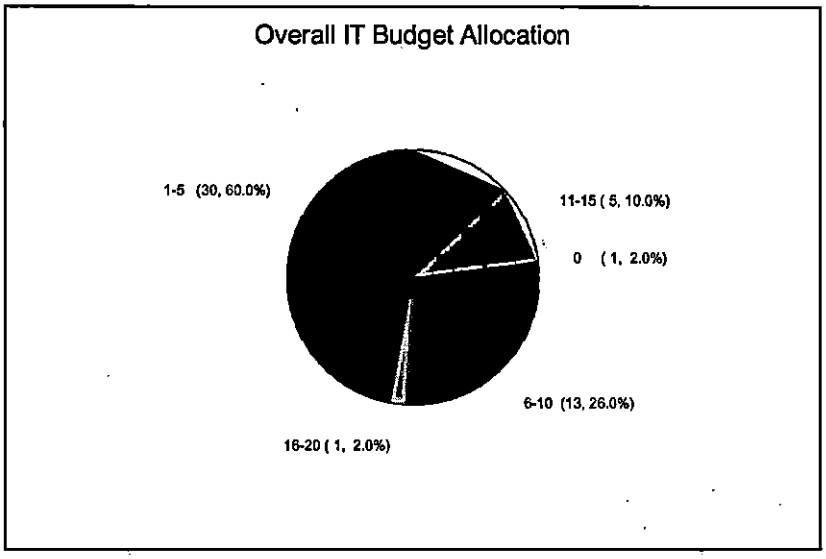
Figure 16. MINITAB pie chart concerning organizational structure in Fortune 500 companies.



Background Information Results

Background responses from Questions 4 and 5 support the above analysis. Question 4 asks respondents to agree or disagree with the following statement "Our company's IT budget has increased in the last five years." The mean of Question 4 is 3.8400 for 50 responses and indicates that on the average, most companies agreed with this statement. Furthermore, Question 5, in asking respondents to disclose their company's IT budget, the overwhelming majority of respondents, 60%, rated their budget between 1-5%, while a smaller percentage, 26%, reported their budget between 6-10% (see Figure 17).

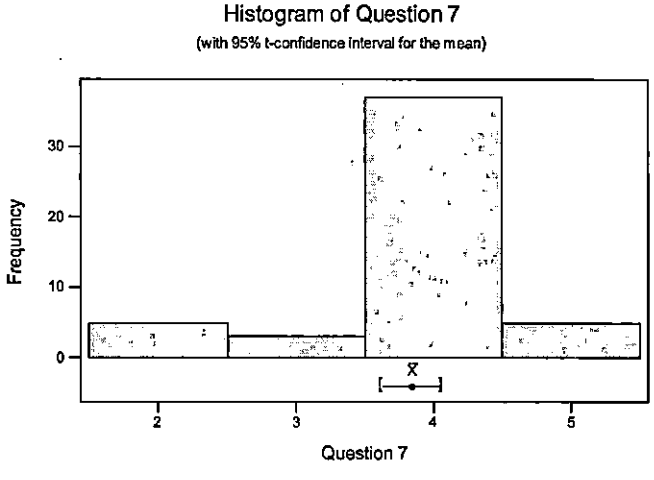
Figure 17. MINITAB pie chart of budget allocation for technology.



This second group response echoes the previous Question 3 results that show a growing number of companies transforming from a vertical to a mixture of decision-making structures where more of the regular employees

are making daily critical decisions. As the budget for technology grows, decisions are being made at various levels of the company structure. Finally, the background question 7, in which respondents were asked to disclose whether their company has achieved the predicted return on investment on IT disbursement, illustrates an overwhelming positive response (see Figure 18). Forty-two of the 50 respondents reported a favorable return on their investments in technology, 5 of which reported a strong return. Clearly, investments in technology are seen by management to pay off.

Figure 18. MINITAB Histogram of Question 7 concerning predicted ROI for IT disbursement.



The results of Question 7 provide background information related to financial information relative to new technology. Question 7 asks CIO's to respond (Likert-style) to the statement "In the last five years, our company has achieved the predicted return on investment (ROI) on our financial

disbursement in IT" on a scale from 1-5, with the range of answers from Strongly Disagree (1) to Strongly Agree (5). The mean of Question 7, 3.84, listed in Table , confirms the earlier conclusion that organizations are realizing the need for new technology and making decisions to fund improvements for their employees. They also believe that their predicted investment in IT is being returned, which shows a confidence in their analysis of IT needs.

Table 9

Means of Respondent Answers to Likert Questions in Questionnaire

Likert Questions	*Question Topic*	*Mean*
Question 2	**Organizational Structure Change**	**2.72**
Question 4	**IT Budget Increase**	**3.84**
Question 7	**Achieved ROI on IT**	**3.84**
Question 8	**Problems/Issues of Tech. Integration**	**3.16**
Question 9	**Interdepartmental Rivalry**	**2.38**
Question 10	**Employee Resistance**	**4.18**
Question 11	**Lack of Training Opportunities**	**3.36**
Question 12	**Management Lack of Commitment**	**3.04**
Question 13	**Lack of Implementation Strategy**	**2.98**
Question 14	**Budgeting Concerns**	**2.76**
Question 15	**Improved Com. for Decision-Makers**	**4.16**
Question 16	**Loss of Employee Productivity**	**2.52**

Question 18	**Rapid Info. Flow for Employees**	**4.28**
Question 20	**Structure Decentralization**	**2.60**

Although Question 17 has also been discussed earlier, it is worth mentioning the results again to demonstrate its contribution to background information. A high percentage (66%) of CIO's reports their employees are taking a year or more to fully incorporate new technology. Yet, another background question, Question 19, also gives information that provides more in-depth understanding of the Fortune 500 organizations. The measurement of IT results occurs most often every quarter (see Figure 4). As the chart indicates, most companies measure results for technology every quarter, which enables them to make more accurate predictions on financial disbursement as well as show how effective new implementation tools have been over the measurement period.

Chapter V: Summary, Conclusions, and Recommendations

Summary

Chapter I revealed an area of concern particular to organizations engaged in finding ways to stay ahead of the competition through the implementation of new technology, a perpetual phenomenon in today's society. The research question arose from this concern, asking how successful and technologically competitive Fortune 500 companies' decision-making and structure are affected by the continuous influx of new technology capabilities. Chapter II outlined the relevant and available literature, both research and popular, relevant to the research question, finding that little research exists connecting the two variables of the research study – decision-making and organizational structure. Much literature existed already concerning one or the other of the variables, but the addition of new technology to the equation showed that this topic is a relatively new line of inquiry that organizations are struggling to address. From that conclusion, the researcher compiled a list of questions relative to the research question and formed a survey, which was then sent to 100 Fortune 500 companies and is detailed in Chapter III. The actual survey can be found in Appendix A. After several modes of inquiry, including phone requests as well as written requests over the course of two months, 50 responses were amassed and analyzed. The findings were reported in Chapter IV and generalizations of

those findings are included in the following section – Conclusions. The problems and limitations that occurred during the course of the study, along with recommendations for future inquiry can be found in the Recommendations section, which ends the body of the study.

Conclusions

Examination of the results of this survey explain the current trend toward decentralization of organizations as expressed by Hammer and Stanton, for example, who detailed Duke Power's transformation to a more horizontal structure due to new technological advances and process improvement strategies. The proven success of Fortune 500 companies make them excellent subjects for this study, with the added benefit that they are also technologically savvy to an extent. This proved true when, during the study, the participants were asked what process improvement strategies and technology tools they use and to rank the tools. All of the respondents except one are engaged in at least one process improvement strategy, and many use several popular strategic designs: Six Sigma and Best Practices the top two. Process improvement strategies qualify as technological advances because of the improvements gained in practice.

However, analysis of the specific software tools these organization report using suggests that they are not making the most sophisticated use of the advances that exist. The tool seen as most important to the organization is reporting and scheduling, which is extremely simplistic compared to

complex analysis tools also listed. Fraud detection and security technology is reported second, which given the security issues prevalent in organizations today, makes sense. But the use of less sophisticated technology tools points to a gap in technology advances vs. effective use within even these technologically perceptive companies. One inference the researcher made regarding this observation arises as a result of the participants' response to the organization question concerning decentralization. Most companies still possess a vertical organizational structure, with management continuing to micromanage the organizational decision-making. It seems that companies are in the process of changing toward more decentralized structures, but the giving up of power within the organization is slow. As stated by Harbour earlier, decision-makers are still making decisions based on inaccurate or incomplete information even though information appears to be moving faster within the organization. Why? The findings of this study show that in general, companies are focusing on reporting and scheduling information more often rather than predictive analytic or BPM (business strategy) processes. So, the quality of the information and the vertical movement of that information affect the quality of the decision-making within the organization. CIO's seem to agree in general that information is flowing faster and that more training opportunities need to be offered, the latter of which agrees with the finding that organizations are not making the best use of the technology available. This supports the existing research evidenced in the recent CIO Tech poll

results released in June 2005. In that same survey, CIO's reported believing "by 19%" that their business leaders lack understanding of IT ("IT Spending Projections Drop Sharply in May, Special Questions Section). Clearly, more training opportunities for decision-makers would ameliorate this situation.

The trend toward decentralization echoes the findings in the literature review, showing that Fortune 500 companies are moving in that direction due to the ability to process and analyze information faster, but it is again a slow process. Budgets for technology in general and IT specifically are increasing and Fortune 500 organizations are reporting favorable ROI's on their predicted investments in IT. Interdepartmental rivalry due to IT was not supported by the findings in the literature, though employee resistance to new technology remains high, prompting the researcher to again conclude that more training opportunities would decrease the resistance and improve performance. However, the researcher questions the finding that interdepartmental rivalry is not a significant issue. Participants report a positive correlation between technology implementation and problems and special issues within and between departments. It remains unclear what those problems are since they also report ease of communication. One clue that may in part answer this question can be seen in the results for Question 17, which indicates time issues in implementation of technology. Since most organizations' employees appear to be taking a year or more to implement technology successfully, it can be inferred that on a daily basis, they are

struggling with implementation issues. The finding that lack of training opportunities is also a problem for Fortune 500 companies supports this inference.

The regression analyses conducted revealed several noteworthy outcomes regarding the influence of technology integration on organizational elements. Technology implementation was found to be a significant factor in the change of vertical structures to more horizontal structures, implying also that the decision-making is becoming more widespread within these transforming organizations as communication is facilitated. Another prominent and useful finding is that productivity loss can be statistically linked to employee resistance to new technology, prompting new questions relative to how this phenomenon can be resolved. However, there is no sign that this productivity loss is related to the changes in organizational structure due to new technology integration.

Finally, the researcher concludes that although Fortune 500 companies appear technologically sophisticated and are indeed successful, they are in a transformation period, evolving incrementally from the traditionally vertical "manufacturing" model of organization to a more flexible and modern form. Technological issues remain at the forefront, shaping the competitive edge of each organization individually. While communication has improved, sophisticated use of technology remains problematical at best.

However, organizations are continually evolving and improving their processes making technology a priority.

Recommendations for Companies

Specific recommendations for organizations that arise from the results of this study support the information gathered in Chapter II, the Review of Literature, but also target areas of improvement. For example, even though complex analytical tools have been developed and made available to corporate organizations, lack of thorough training opportunities and management, along with predictable employee resistance, prevent successful and, more importantly, innovative incorporation of new technological advances. This study echoes Griffith's earlier findings that employees are taking too long to fully integrate technology, since CIO's in this study report a year or more as standard. Overcoming employee resistance is still a major problem and must be overcome. Individual companies must discover the specific source(s) of opposition and address employee fears and mistrust with workable solutions. Instead of imposing change, prior investigation into employee realities would ultimately be cost effective and help prevent conflict before it has a chance to fester and create larger problems – like, for example, loss of productivity or productive time.

Recommendations for Further Research

A major recommendation arising from the conclusions of this study is for a detailed investigation and development of a model for organizations to

follow that specifically addresses the place technology has as a driving force in initiating change.

Investigation of why Fortune 500 companies are not investing more time and effort into sponsoring research into the areas of technology influences and how technology affects organizational change is imperative. The major difficulty of this research was the reluctance and refusal of organizations to take part in the study. Although the researcher recognizes the problems inherent in addressing every study that is presented to Fortune 500 companies, the need for relevant research is clear. This research in particular outlines problem areas and targets trends in organizational structure and decision-making regarding technology.

This researcher further recommends a more in-depth study and evaluation of levels of efficiency and flexibility in decision-making, a limitation of this study. Also, while recognizing that all organizations are unique and separate entities, a general recommendation for budget allocation for IT would be helpful for organizations in planning and execution of technology. These recommendations exist for IT departments, but not for organizations as a whole.

One anomalous finding in light of the existing research is the claim by CIO's that interdepartmental rivalries are not a large problem because of new technology integration. Brown's 2004 study of IT subculture demonstrates a strong correlation between IT project failure and interdepartmental conflicts.

This researcher questions whether this incongruity occurs because the Fortune 500 companies that participated in this study are more successful at implementing IT projects or whether there is reluctance to report conflict. The recommendation of this researcher is to investigate this discrepancy between the literature and the findings of this study.

There exists a parallel between changes in decision-making and organizational structural changes, which is illustrated also in implementation of new technology. Organizational structure changes form as companies integrate process improvement strategies and new hardware and software – ALL key technological advances. These transformations nearly unanimously move in a more horizontal direction, indicating decision-making transformation as well. Decision-making at the management level generally involves prioritizing, in addition to enabling employees technologically, which forces change in the quality of employee decision-making and the direction of decision-making as well. Inevitably, power shifts occur in a horizontal direction, but responsibility shifts as well, giving all employees a sense of ownership in the company. The positive result of this sense of ownership is increasing employee loyalty and morale, two aspects of organizations that have decreased dramatically in the last decade.

The final recommendation of this study relates to the finding that Web services do not appear to be a priority in Fortune 500 companies when compared to other business tools. While Comergent's 2005 study shows both

profits and experience, along with overall significance in e-commerce, growing, the participants of this study ranked Web services next to last on a scale of 1-10. The researcher connects this finding to the realization that employees are taking a year or more to fully implement new technology AND the technology they are using does not take advantage of the sophisticated and powerful advances that exist. The recommendation here is to create an improvement strategy for organization that incorporates a means for ***consistent and ongoing*** technology training for employees so that they can catch up to present advances and ***continually*** take advantage of optimal services in order to maintain and even increase the company's competitive edge. This recommendation has a further benefit and that is increasing employees' sense of ownership in the company's future by bolstering their sense of teamwork. In the end, managers who realize and address the people challenges associated with new technology integration will enjoy less conflict and more productivity.

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Appendix A

Michelle L. McCleese
Department of Industrial and Engineering Technology
Home Phone: 740-574-4250
Cell Phone: 740-935-3612
IET Department Contact: Dr. Ahmad Zargari, Chair
606-783-2425

Morehead State University

October 31, 2005

Dear Sir or Madam:

One of the greatest obstacles to organizational success is the lack of current and reliable research results that focuses on WHY new technology integration efforts so often fail. I am currently completing a Master of Science degree in Industrial Technology and am researching the effects of new technology implementation on organizational structure and decision-making, focusing specifically on changes in communication and structure that have occurred due to technology integration. In order for my research to be meaningful and valid, I request that you spend approximately 6 minutes completing a questionnaire concerning information about your company.

The population of this study consists solely of Fortune 500 companies because these companies are best suited to reporting data concerning the challenges they address in order to become successful organizations. As you are aware, the continual outpouring of new technology forces companies to consistently adapt or find their practices obsolete. I hope to discover what those problems in implementation are and create a means through which these obstacles can be overcome.

I understand your time is valuable and I sincerely appreciate your contribution. In order to make the research results significant for you, I will send you a copy of my thesis upon its completion in June. Just check the appropriate box at the end of the survey if you wish a free copy. Again, thank you for your help.

Respectfully,

Michelle L. McCleese

Enc. Questionnaire

Appendix B

Questionnaire

Please answer the following short questions to the best of your ability. Thank you for participating in this significant study.

Note: Please include any additional comments in the return email.

DIRECTIONS: Click/Check each box that applies to your company. Add any comments where necessary.

1. Is your company currently engaged in any of the following process improvement strategies?

☐ Six Sigma ☐ Total Quality Management

☐ Best Practices ☐ Value Added Management

☐ Kaizen ☐ Malcolm Baldridge

2. In the last five years, our organizational structure has changed significantly as a direct result of new technology influences.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

3. Is the decision-making structure of your organization based more on management decisions (vertical), shared responsibility with departmental employees (horizontal), or a mixture of the two?

☐ Vertical ☐ Horizontal ☐ Mixture

4. Our company's IT budget has increased in the last five years.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

5. The percentage of our company's overall budget allocated for the IT department is:

26% or more	21%-25%	16%-20%	11%-15%	6%-10%	1%-5%
☐	☐	☐	☐	☐	☐

6. Rank the following technology tools in order of importance to your organization, with 1 being the most important.

☐	reporting/scheduling	☐	predictive analytic
☐	analysis	☐	fraud detection/security
☐	demand planning	☐	data mining
☐	budgeting/financial	☐	BPM (business strategy) processes
☐	video-conferencing	☐	Web services

☐ Other (specify): _____

7. In the last five years, our company has achieved the predicted return on investment on our financial disbursement in IT.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

8. In the last five years, new technology implementation has resulted in problems or special issues within or between departments.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

9. Interdepartmental rivalry has developed in our organization because of new technology implementation.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

10. Employee resistance often occurs during new technology implementation.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

11. Lack of employee training opportunities frequently causes difficulties in technology implementation.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

12. Management lack of commitment has at times prevented successful implementation of new technology.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

13. Lack of a prior implementation strategy has caused difficulties in implementing new technology.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)

☐ ☐ ☐ ☐ ☐

14. Budgeting concerns have prevented the implementation of new technology.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

15. New technology integration has improved communication within our organization for strategic decision makers.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

16. New technology integration has produced loss of productive employee time or loss of process productivity.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

17. In general, how quickly would you describe 100% employee utilization of new technology after implementation?

Immediate	Three months	Six months	A year or more
☐	☐	☐	☐

18. The implementation of technology in our organization has resulted in more rapid information flow among employees.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)

☐ ☐ ☐ ☐ ☐

19. Measurement of IT results occurs

Yearly	Biannually	Quarterly	Rarely
☐	☐	☐	☐

20. Overall, our company's organizational structure has become more decentralized due to IT implementation.

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
(5)	(4)	(3)	(2)	(1)
☐	☐	☐	☐	☐

Appendix C

Calculation Summary for Sample Sizes for Survey Research

Accuracy (+/-) (Margin of error)	Confidence Level		
	90%	95%	99%
1	6,765	9,604	16,576
2	1,691	2,401	4,144
3	752	1,067	1,848
4	413	600	1,036
5	271	384	663
10	68	96	166
20	17	24	41

Note. From *Research Methods for Public Administrators* (p. 136), by E. O'Sullivan and G. R. Rassel, 1995, New York: Longman Publishers.

Appendix D

Data Display for Regression Analyses

Row	Tech Structure	Employee Resistance	Communication	Productivity Loss
1	4	4	4	2
2	4	5	4	2
3	4	5	3	2
4	3	3	5	2
5	1	5	4	1
6	2	2	4	1
7	3	4	3	2
8	4	4	5	3
9	1	5	4	3
10	3	4	4	2
11	4	5	4	4
12	4	5	4	4
13	3	5	5	3
14	1	4	4	3
15	2	4	4	1
16	4	4	4	4
17	1	5	4	3
18	4	4	4	2
19	4	4	4	4
20	2	5	4	4
21	2	4	4	2
22	3	4	4	2
23	2	4	4	4
24	4	3	4	3
25	2	4	4	2
26	4	4	4	3
27	3	4	4	4
28	2	4	4	3
29	2	5	4	4
30	3	4	5	2
31	2	5	4	3
32	2	4	5	2
33	4	5	4	2
34	2	4	5	1
35	2	4	4	2
36	2	4	4	2
37	4	4	5	2
38	4	4	4	4
39	2	5	5	2
40	2	4	4	2
41	2	4	4	4
42	2	4	5	2
43	3	4	5	2
44	2	4	4	2
45	4	4	4	2
46	3	4	4	1
47	2	4	4	2
48	2	4	5	2
49	2	4	4	2
50	3	4	3	4

Row	Information Flow	Org. Structure
1	4	2
2	4	2
3	4	2
4	5	3
5	5	3
6	4	3
7	4	3
8	5	4
9	5	1
10	3	2
11	4	2
12	5	2
13	4	2
14	4	2
15	4	2
16	4	4
17	5	2
18	4	2
19	4	4
20	4	4
21	4	2
22	4	2
23	5	2
24	4	4
25	4	4
26	4	3
27	4	2
28	4	2
29	5	2
30	5	3
31	5	3
32	5	2
33	4	4
34	4	2
35	4	4
36	4	2
37	5	4
38	4	2
39	4	2
40	4	2
41	4	2
42	5	2
43	4	3
44	4	2
45	4	4
46	4	3
47	5	3
48	5	3
49	4	2
50	4	2

Appendix E

Data Display for All Questions

Row	Question 2	Question 3	Question 4	Question 5	Question 7	Question 8
1	4	Vertical	5	1-5	5	2
2	4	Mixture	2	1-5	3	4
3	4	Mixture	4	1-5	2	5
4	3	Vertical	4	1-5	2	4
5	1	Mixture	1	1-5	5	1
6	2	Vertical	4	1-5	3	3
7	3	Mixture	4	11-15	4	4
8	4	Vertical	4	6-10	4	3
9	1	Horizontal	5	1-5	4	2
10	3	Mixture	4	1-5	3	4
11	4	Mixture	4	1-5	2	5
12	4	Mixture	5	6-10	5	2
13	3	Vertical	4	6-10	2	5
14	1	Mixture	1	1-5	4	1
15	2	Vertical	4	1-5	4	3
16	4	Horizontal	4	11-15	4	3
17	1	Vertical	4	1-5	4	2
18	4	Mixture	2	1-5	4	4
19	4	Mixture	4	1-5	4	4
20	2	Mixture	4	1-5	4	4
21	2	Vertical	4	1-5	4	4
22	3	Vertical	3	1-5	4	3
23	2	Vertical	4	1-5	4	4
24	4	Mixture	4	11-15	4	3
25	2	Mixture	5	6-10	4	3
26	4	Mixture	4	0	4	4
27	3	Vertical	4	6-10	4	4
28	2	Vertical	4	1-5	4	4
29	2	Vertical	4	6-10	4	4
30	3	Mixture	4	1-5	5	2
31	2	Mixture	4	1-5	4	3
32	2	Vertical	4	6-10	4	2
33	4	Horizontal	4	6-10	4	4
34	2	Vertical	4	6-10	4	2
35	2	Mixture	4	6-10	4	2
36	2	Vertical	4	1-5	4	2
37	4	Horizontal	4	11-15	5	4
38	4	Vertical	4	1-5	4	2
39	2	Vertical	4	1-5	4	2
40	2	Vertical	2	1-5	4	3
41	2	Vertical	4	1-5	4	4
42	2	Vertical	4	1-5	4	2
43	3	Mixture	5	16-20	4	4
44	2	Vertical	4	6-10	4	3
45	4	Mixture	5	6-10	4	4
46	3	Mixture	4	1-5	4	3
47	2	Vertical	5	11-15	4	2
48	2	Vertical	4	1-5	4	2
49	2	Vertical	4	6-10	4	3
50	3	Mixture	2	1-5	2	5

Row	Question 9	Question 10	Question 11	Question 12	Question 13
1	3	4	5	5	2
2	4	5	5	4	4
3	2	5	5	4	5
4	2	3	4	5	4
5	1	5	2	1	1
6	2	2	4	2	2
7	2	4	4	3	4
8	3	4	4	4	4
9	1	5	4	3	2
10	4	4	4	4	4
11	1	5	5	5	4
12	2	5	5	5	3
13	2	5	5	5	5
14	1	4	1	1	1
15	2	4	4	2	2
16	2	4	4	4	4
17	1	5	4	4	2
18	4	4	4	4	4
19	4	4	4	4	4
20	3	5	2	2	4
21	3	4	4	2	2
22	3	4	2	2	2
23	2	4	2	2	2
24	4	3	4	4	4
25	3	4	2	2	3
26	2	4	4	3	4
27	2	4	4	4	4
28	2	4	4	2	2
29	2	5	4	2	2
30	2	4	4	4	2
31	2	5	4	4	4
32	2	4	2	2	2
33	2	5	2	2	4
34	1	4	2	2	2
35	2	4	4	4	4
36	4	4	4	3	4
37	2	4	2	2	2
38	2	4	2	3	2
39	2	5	2	4	4
40	2	4	2	2	2
41	4	4	4	3	4
42	2	4	2	2	4
43	4	4	2	2	4
44	2	4	2	2	3
45	2	4	4	2	2
46	3	4	2	2	2
47	2	4	2	2	2
48	2	4	2	2	2
49	2	4	4	4	2
50	4	4	5	5	2

Row	Question 14	Question 15	Question 16	Question 17	Question 18
1	2	4	2	Year +	4
2	4	4	2	No Report	4
3	4	3	2	Year +	4
4	2	5	2	Year +	5
5	1	4	1	Six Months	5
6	2	4	1	Year +	4
7	2	3	2	Year +	4
8	2	5	3	Six Months	5
9	2	4	3	Three Months	5
10	3	4	2	Year +	3
11	4	4	4	Year +	4
12	2	4	4	Year +	5
13	2	5	3	Year +	4
14	2	4	3	Three Months	4
15	2	4	1	Year +	4
16	4	4	4	Three Months	4
17	4	4	3	Three Months	5
18	4	4	2	Year +	4
19	2	4	4	Year +	4
20	4	4	4	Year +	4
21	4	4	2	Year +	4
22	2	4	2	Year +	4
23	2	4	4	Year +	5
24	4	4	3	Six Months	4
25	2	4	2	Year +	4
26	4	4	3	Six Months	4
27	4	4	4	Year +	4
28	2	4	3	Year +	4
29	4	4	4	Year +	5
30	2	5	2	Six Months	5
31	2	4	3	Year +	5
32	2	5	2	Six Months	5
33	2	4	2	Year +	4
34	3	5	1	Three Months	4
35	4	4	2	Year +	4
36	4	4	2	Year +	4
37	2	5	2	Three Months	5
38	2	4	4	Year +	4
39	2	5	2	Year +	4
40	4	4	2	Year +	4
41	2	4	4	Year +	4
42	2	5	2	Six Months	5
43	2	5	2	Year +	4
44	4	4	2	Year +	4
45	2	4	2	Six Months	4
46	3	4	1	Year +	4
47	2	4	2	Three Months	5
48	3	5	2	Six Months	5
49	2	4	2	Year +	4
50	5	3	4	Year +	4

Row	Question 19	Question 20	Q6 - Item 1	Q6 - Item 2	Q6 - Item 3
1	Quarterly	2	2	3	8
2	Quarterly	2	1	5	8
3	Quarterly	2	1	*	*
4	Quarterly	3	1	4	7
5	Quarterly	3	2	2	4
6	Rarely	3	1	2	5
7	Quarterly	3	1	1	3
8	Quarterly	4	1	*	*
9	Rarely	1	4	2	10
10	Yearly	2	1	3	6
11	Quarterly	2	1	2	1
12	Quarterly	2	3	2	3
13	Quarterly	2	5	3	2
14	Quarterly	2	4	3	6
15	Yearly	2	5	5	6
16	Quarterly	4	0	5	4
17	Quarterly	2	5	4	3
18	Quarterly	2	4	1	4
19	Quarterly	4	1	2	3
20	Quarterly	4	8	2	5
21	Yearly	2	0	5	8
22	Quarterly	2	2	3	6
23	Yearly	2	1	4	5
24	Quarterly	4	1	3	6
25	Quarterly	4	5	1	2
26	Quarterly	3	0	4	3
27	Quarterly	2	2	3	2
28	Yearly	2	1	2	4
29	Quarterly	2	2	7	4
30	Yearly	3	7	4	5
31	Quarterly	3	3	8	5
32	Yearly	2	5	1	2
33	Quarterly	4	8	7	6
34	Yearly	2	2	4	5
35	Quarterly	4	1	9	8
36	Quarterly	2	2	8	7
37	Quarterly	4	9	6	7
38	Quarterly	2	3	2	10
39	Quarterly	2	6	5	8
40	Yearly	2	1	7	10
41	Quarterly	2	2	8	7
42	Quarterly	2	4	2	5
43	Quarterly	3	5	4	9
44	Yearly	2	3	4	10
45	Quarterly	4	2	8	9
46	Yearly	3	1	7	6
47	Quarterly	3	4	6	7
48	Quarterly	3	5	6	8
49	Quarterly	2	3	4	5
50	Yearly	2	2	5	1

Row	Q6 - Item 4	Q6 - Item 5	Q6 - Item 6	Q6 - Item 7	Q6 - Item 8
1	4	6	7	1	9
2	4	3	2	7	10
3	*	*	*	*	*
4	3	10	2	6	8
5	5	3	6	7	9
6	9	7	6	3	10
7	4	6	5	10	9
8	*	*	*	*	*
9	1	9	3	7	11
10	2	4	5	*	*
11	3	6	5	7	10
12	6	4	10	1	7
13	*	*	*	4	*
14	5	1	4	8	9
15	4	2	3	7	8
16	6	7	3	2	10
17	5	6	2	8	9
18	5	3	7	6	10
19	4	5	6	7	8
20	6	3	4	7	9
21	9	4	7	2	6
22	1	5	2	9	7
23	2	3	6	8	9
24	5	8	2	4	9
25	4	6	5	7	9
26	2	7	1	8	10
27	1	7	8	5	10
28	1	7	3	8	9
29	5	3	6	1	10
30	2	1	6	7	9
31	4	1	9	6	10
32	7	3	4	6	10
33	9	2	5	1	10
34	3	1	10	6	9
35	5	4	3	2	10
36	6	3	10	1	9
37	5	2	4	8	10
38	5	4	7	1	6
39	3	1	9	2	10
40	9	8	2	5	6
41	4	1	3	5	10
42	3	1	7	9	10
43	3	2	8	6	10
44	9	5	1	2	8
45	7	5	4	3	10
46	5	4	10	8	9
47	5	1	10	3	9
48	7	1	4	2	10
49	7	2	8	6	10
50	6	4	3	7	9

Row	Q6 - Item 9	Q6 - Item 10
1	5	10
2	6	9
3	*	*
4	1	9
5	8	10
6	8	4
7	8	7
8	*	*
9	4	6
10	*	*
11	9	8
12	8	9
13	*	*
14	7	10
15	9	10
16	8	9
17	7	10
18	8	9
19	9	10
20	8	10
21	10	3
22	8	10
23	7	10
24	7	10
25	8	10
26	6	9
27	6	8
28	6	10
29	3	8
30	8	3
31	7	2
32	8	9
33	3	4
34	8	7
35	7	6
36	5	4
37	3	1
38	8	9
39	4	7
40	4	3
41	6	9
42	6	8
43	7	1
44	6	7
45	1	6
46	2	3
47	2	8
48	3	9
49	1	9
50	10	8