IT Investment Allocation and Organizational Performance: A Study of Information Technology Investment Portfolios in Federal Government Agencies

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Dedication

This study is dedicated to my wife, Susan, who makes all things possible for me and to my parents, Ennis and Novella Whitehead, who have always encouraged me to seek out and complete challenges. Thank you.

Acknowledgements

I would like to thank my advisers, Dr. Tom Mazzuchi and Dr. Shahram Sarkani for providing much needed advice and focus during the writing of his dissertation, and Dr. Tom Holzer, Dr. Tom McCormick, and Dr. Bob Norris for their guidance, support and insight.

I would like to especially thank my wife, Susan Whitehead, probably the smartest and most creative person I have ever known. Each weekend when we ran together, my undeveloped ideas took shape as she questioned and helped me clarify my research, results and presentation. This research endeavor would not have been possible without her.

Abstract of Dissertation

IT investment Allocation and Organizational Performance: A Study of Information Technology Investment Portfolios in Federal Government Agencies

This study examined Federal Government Information Technology (IT) portfolio investments for twenty-seven Federal Government agencies, as provided annually to the Office of Management and Budget (OMB) in their Agency IT Investment Portfolio Reports (Exhibit 53), and divided Federal agency IT investments into four categories: Innovation, Management Support, Process Automation and Infrastructure.

Agency program performance was statistically compared, using the OMB's Program Assessment Rating Tool (PART), to determine the higher and lower performing agencies based on the PART scores of each agency's assessed programs. Agencies with total program performance in the top third of all agencies were considered "higher performing agencies" and those with total program performance in the lowest third of all agencies were considered "lower performing." Agency performance ranking was compared with agency IT investment allocations to answer the following question: Do higher performing Federal Government agencies invest IT assets differently than lower performing agencies?

Evidence pointed to a significant difference in how higher performing and lower performing agencies invest their IT budgets. A causal effect between IT investment and agency performance could not be statistically proven, but distinct differences were found. This research provides a new perspective on IT investment allocation and suggests a

comparative technique by which IT investments in Federal Government agencies can be evaluated.

The research further categorized agencies from mission statement information available on their websites to determine those agencies with missions having either cost or agility as primary foci. A similar question was posed: Do cost-focused Federal Government agencies invest IT assets differently than agility-focused agencies?

Evidence again pointed to a significant difference in how cost-focused and agility-focused agencies invest their IT budgets. This research illustrates an innovative way of looking at IT investment allocations and agency missions.

Additionally, these agency results were compared with cost-focused and agility-focused corporations in the private sector, finding very similar patterns of IT investment.

The results of this research may be useful to agency Chief Information Officers, Chief Financial Officers as well as Sub-agency Directors in considering their IT budget expenditures. These officials can directly compare their organization's IT investment portfolio with the top performing agencies and use that information to help determine whether their investment portfolios should be adjusted. Managers of cost or agility-focused organizations may also use the mission-focused results of this research to examine and consider adjustments to their current portfolio of IT investments.

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Glossary of Terms and Acronyms

Retrieved from General Accountability Office Information Technology Investment Management **(**United States. Government Accountability Office. 1997, May)

Asset: Property, funding, technical knowledge, or other valuable items owned by the organization. Investments typically create assets.

Customer: Individual(s) or organizational entity for whom the product or service is rendered. The customer may also be the end user.

End User: The individual or groups who will operate the system for its intended purpose when it is deployed.

Information System: The organized collection, processing, transmission, and dissemination of information in accordance with defined procedures, whether automated or manual.

Information Technology (IT): The computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources used by an organization to accomplish a function.

IT Investment: The decision by the organization to expend resources or the actual expenditure of resources on selected information technology or IT-related initiatives

with the expectation that the benefits from the expenditure exceed the value of the resources expended.

IT Investment Portfolio: The combination of all IT assets, resources, and investments owned or planned by an organization in order to achieve its strategic goals, objectives, and mission.

IT Management: An approach used by IT project managers to direct, control, administer, and regulate a project team creating an IT asset such that the resultant product meets its requirements upon delivery.

IT Project: An organizational initiative employing or producing IT or IT related assets. Each project has or will incur costs for the initiative, has expected or realized benefits arising from the initiative, has a schedule of project activities and deadlines, and has or will incur risks associated with engaging in this initiative.

Mission: The enduring, chartered, long-term goal(s) of an organization.

Program: An activity or set of activities intended to help achieve a particular outcome for the public.

Stakeholder: An individual or group with an interest in the success of an organization in delivering intended results and maintaining the viability of the

organization's products and services. Stakeholders influence programs, products, and services.

Retrieved from the website of the Office of the Chief Information Officer, Department of Health and Human Services, http://www.hhs.gov/ocio/about/terms/index.html

OMB Circular A-11: Identifies two types of investments, major, and non-major. All investments, major or non-major are represented as an Exhibit 53 line item. OMB requires that major investments provide an Exhibit 300 Business Case.

Exhibit 300: Document describing capital asset plans and business cases for major IT investments;

Exhibit 53: Document describing capital asset plans and business cases for both major and non-major IT investments

Major IT Investment: An IT investment that applies one or more of the following: Has total planned outlays of $10 million or more in the budget year, is for financial management and obligates more than $500,000 annually, is otherwise designated by the Agency CIO as critical to the mission or to the administration of the Agency's programs, finances, property or other resources, has life-cycle costs exceeding $50 million.

The following acronyms were used:

CIO – Chief Information Officers

CISR – Center for Information Systems Research

DoD – Department of Defense

E-gov - electronic government

EPA – Environmental Protection Agency

FDA – Food and Drug Administration

FTC – Federal Trade Commission

FY – Fiscal Year

GAO – Government Accountability Office

GSA – General Services Administration

HHS – Health and Human Services

HUD – Housing and Urban Development

IT – Information Technology

MIT – Massachusetts Institute of Technology

MSPB – Merit Systems Protection Board

NASA – National Aeronautics and Space Administration

OMB – Office of Management and Budget

OPM – Office of Personnel Management

PART – Program Assessment Rating Tool

R & D – Research and Development

SBA – Small Business Administration

SSA – Social Security Administration

USAID – United States Agency for International Development

VA – Veterans Administration

Chapter 1 – Introduction

"The Federal Government has largely missed out on the transformation in the use of IT due to poor management of its technology investments. Government IT projects all too often cost millions of dollars more than they should, take years longer than necessary to deploy, and deliver technologies that are obsolete by the time they are completed." Vivek Kundra, 2010 (United States. Chief Information Officers Council, 2010).

So testified Vivek Kundra, Federal Chief Information Officer, before the House Committee on Oversight and Government Reform, July 1, 2010. The Federal IT budget stands at $78.4 billion for FY 2010, a 10% increase over the FY 2009 enacted budget and 2.5% of the overall Federal budget (United States. Executive Office of the President. IT Dashboard, 2010). Despite the significant amount spent on IT to improve government performance, only 51% of Federal agency programs were rated as "Effective" or "Moderately Effective" in the 2009 Performance Assessment Rating Tool (PART) evaluation of agency program effectiveness (United States. Office of Management and Budget. www.whitehouse.gov/omb/expectmore/faq.html#005).

There is significant pressure for the United States Federal Government to improve agency performance and reduce IT costs, but challenges and questions emerge. Could there be a connection between types of IT investments and agency performance? If so, where should IT funds be spent to be most effective? On improved IT infrastructure with more energy-efficient servers and increased network bandwidth, or on new software to cut costs and increase productivity? Would IT dollars be most effectively used to increase collaboration and management control, or should agencies forecast their stakeholders' future needs and invest more to meet those requirements? This study does

not examine individual IT projects as to their efficacy, but the larger question of whether there is a connection between how agencies invest their information technology dollars and overall agency performance.

With each new administration, laws and programs are created to improve agency performance through improved IT productivity. In 1996 the Clinger-Cohen Act adopted a private sector IT investment approach of performance and results-based management, in 2002 E-government initiatives were begun to bring government services online, and the Government Performance and Results Modernization Act of 2010 increased reporting requirements for successful and unsuccessful programs. As we study IT, if evidence could be found that certain categories of IT investments were associated with higher organizational performance, perhaps agencies could spend IT budget resources more effectively.

Sinan Aral and Peter Weill at the Massachusetts Institute of Technology (MIT) Center for Information Systems Research (CISR) found that corporate performance was influenced by IT asset allocation (Aral and Weill, 2007). Although Federal Government requirements and measures of performance differ significantly from those of the private sector, with agencies focusing on mission accomplishment and responding to political conditions more than market conditions (Holmes, 2001, Ostroff, 2006), this research study examines the similar connection between Federal information technology investments and agency performance.

Federal Government agency IT portfolio investments for twenty-seven Federal Government agencies, as provided annually to the Office of Management and Budget (OMB) in their agency IT Investment Portfolio Reports (Exhibit 53s), were studied and Federal agency IT investments were divided into four categories: Innovation, Management Support, Process Automation and Infrastructure.

Agency overall program performance was statistically compared, using the OMB's Program Assessment Rating Tool (PART), to rank order the agencies based on the PART scores of each agency's assessed programs. Agencies with total program performance in the top third of all agencies were considered "higher performing agencies" and those with total program performance in the lowest third of all agencies were considered "lower performing". Agency performance ranking was compared with agency IT investment allocations to answer the following question:

> Do higher performing Federal Government agencies invest IT assets differently than lower performing agencies?

Evidence pointed to a significant difference in how higher performing and lower performing agencies invest their IT budgets. A causal effect between IT investment and agency performance could not be statistically proven, but distinct differences were found. This research provides a new perspective on IT investment allocation and suggests a comparative technique by which IT investments in Federal Government agencies can be evaluated.

The research further categorized agencies from mission statement information available on their websites to determine those agencies with missions having either cost or agility as primary foci. A similar question was posed:

> Do cost-focused Federal Government agencies invest IT assets differently than agility-focused agencies?

Evidence again pointed to a significant difference in how cost-focused and agility-focused agencies invest their IT budgets. When agency results were compared with cost-focused and agility-focused corporations in the private sector, similar patterns of IT investment were found.

1.1 Context and Approach

Improving mission effectiveness, organizational performance, and cost effectiveness are fundamental goals of government (Arveson, 1999; U.S. GAO 1997). As individual agency missions increase in number and complexity, and as technological innovations increase, IT organizations and IT infrastructures are even more challenged to successfully support agency missions. Brynjolfsson and Hitt (1998) found a positive correlation between IT investment and productivity, customer value and competitive advantage in the private sector. Federal agencies that optimally allocate IT dollars in

order to utilize IT effectively and efficiently may also be able to accomplish more with less in this age of increasing focus on the Federal deficit and debt.

Improved use of IT investments may allow government agencies to be more responsive to and interactive with the public, provide greater accuracy and information security of public data, increase opportunities for a more mobile workforce through improved telecommunications capabilities, improve interagency cooperation, improve military effectiveness with better information management, and take the lead in more environmentally-conscious information technologies.

While the concept of IT investment strategies as a contributing factor to organizational performance has been applied to the private sector, little research has been done correlating the allocation of IT resources in the public sector to public sector performance, and specifically within Federal Government agencies. This research is a critical study of Federal agencies' investment allocations to determine the relationship of IT investment portfolios with organizational performance.

The first part of the study defines key terminology, analyzes the meaning of public sector organizational performance, and considers previous measures used in agency comparison. The second part analyzes IT investment strategies used by the private and public sectors, and different models of IT investment portfolio allocations.

The study then looks at program evaluations from the PART, which quantifies the success of agency mission-centric programs, and identifies the relative higher performing and lower performing agencies according to their PART evaluations. IT investment allocation portfolios of 31 Federal Government agencies are categorically divided using their agency IT Investment Portfolio Reports (Exhibit 53s), which are approved by agency Chief Information Officers (CIOs) and submitted annually to OMB. Performance was then correlated with investment allocations.

This research seeks to determine if (1) there is a difference in IT investment strategies between higher- and lower performing agencies and (2) if cost-focused and agility-focused agencies invest their IT dollars differently.

1.2 Statement of the Problem

Information technology is a key driver for organizational success, with private sector studies linking IT investments and organizational performance (Mahmood and Mann, 1993; Weill and Aral, 2003; Jeffrey and Leliveld, 2004). The principal model of success used in the private sector, economic performance, is not applicable, however, as a primary measure for the public sector. Weill and Ross note that productivity in the public sector is less easily determined because of different productivity definitions and often conflicting directives (Weill and Ross, 2009). Productivity in not-for-profit organizations cannot be justified solely on future sales or profits, but must be justified on legislative or

social merits, integrity and affordability (Holmes, 2001; Chakrabarty, 2007; Weill and Ross, 2009).

We see three reasons that the role of information technology needs to be further studied in Federal Government agencies: (1) IT is becoming more critical to organizational core competencies, (2) IT expenditures are consuming an increasing share of organizational budgets, and (3) there is increasing demand for more accountability in IT spending.

Information technology is increasingly more critical to organizational core competencies in both public and private sectors. In the private sector, IT is expected to improve economic value to stakeholders: customers, employees, suppliers and distributors (Maizlish and Handler, 2005). In the public sector, not only economic, but social value must be demonstrated to taxpayers, as well as to the executive, legislative and judicial branches of government (Ostroff, 2006).

IT expenditures are growing exponentially, both in the private and public sector. Nicholas Carr cited a US Department of Commerce Bureau of Economic Analysis study that noted successive increases in capital expenditures for IT in U.S. companies: in 1965, less than 5% of capital expenditures of US companies went to IT; by the 1980s, 15%; in the early 1990s, 30%; and by 2000, almost 50% of capital expenditures of US companies were for IT (Carr, 2003). Although the Federal Government does not differentiate

between capital and expense outlays, its IT budget has also increased exponentially (United States. Executive Office of the President. IT Dashboard, 2010).

More accountability is demanded for IT spending in the federal government, and laws and procedures have been enacted to improve technology performance. The Clinger-Cohen Act (Information Technology Management Reform Act, 1996) was created to encourage Federal Government agencies to model private sector improvement in acquisition and management of IT, treating IT planning, acquisition and management as a capital investment. As part of the President's budget process, the US Office of Management and Budget has instituted annual agency reporting on IT investments which require agencies to align their budgets with mission needs. Agencies are required to complete an Exhibit 53, which provides individual agency budget estimates for IT projects as well as an Exhibit 300, which identifies major IT investments. Much of the technology spending data was made publicly available online, and as of January 2010, could be found on the IT Dashboard, published by the Executive Branch, http://it.usaspending.gov.

Despite all this attention to IT investments, there are several potential reasons that public sector IT investment research is lacking: private sector spending can be more easily measured and evaluated, more funding is available for private sector studies, public sector data has been difficult to obtain, and public sector agencies are slower to react to information and delayed in their implementations, so studies are perceived as lacking in immediate value. By documenting research which measures organizational performance

for both private and public organizations, examining how IT dollars are utilized, and finding correlations between categories of IT expenditures and successful performance of an organization, this study will contribute to the empirical research on improving performance within Federal agencies, and provide a foundation for further research.

1.3 Research Questions

Evaluating how best to invest government information technology dollars means making choices. Should agencies strengthen IT infrastructure with more energy-efficient servers and increased network bandwidth, purchase software to cut costs and increase internal collaboration, or invest to meet stakeholders' future needs? Is there a connection between the way Federal organizations invest IT dollars and the successful accomplishment of their missions?

In their private sector research, Aral and Weill did not find a statistical correlation between total IT investment and firm performance, but did note that the average firm will see performance benefits from different IT investment assets consistent with the strategic purpose of the asset (Aral and Weill, 2007). Do their results hold true for Federal Government agencies? Three specific questions prompted this research:

How can agency organizational performance be measured?

Do agency IT investment portfolios differ by organizational performance?

Do agency IT investment portfolios differ by mission?

1.4 Hypotheses

Hypothesis 1 – Higher performing Federal agencies invest their IT assets differently than lower performing Federal agencies

Hypothesis 2 – Cost-focused Federal agencies invest their IT assets differently than agility-focused Federal agencies

1.5 Purpose of the Research

The purpose of this study is to further academic research into, and augment the knowledge of, the role that IT investment portfolio allocations play in public sector organizational performance. Peter Weill and the Massachusetts Institute of Technology Center for Information Systems Research (CISR) explored this problem in the private sector, looking at investment categories and examining whether higher investments in one category led to greater profitability for a firm. They only examined a subset of the public sector, looking at a small sample of schools and non-profits, but noted that goals, stakeholders, and methods of measurement are different between public and private sectors (Weill and Ross, 2004). This research has expanded upon their work in an effort

to define a connection between types of IT spending and Federal Government agency performance.

1.6 Significance of the Research

Research which looks at Federal Government agency performance and compares it with categories of IT investment has not been previously pursued. This is also the first time that public sector organization IT investments are considered in terms of cost-focused or agility-focused agencies.

While causal links may not be definitively made, the results of this research may be useful to agency Chief Information Officers, Chief Financial Officers as well as Sub-agency Directors in considering their IT budget expenditures. These officials can directly compare their organization's IT investment portfolio with the top performing agencies and use that information to help determine whether their investment portfolios should be adjusted. If they manage a cost or agility-focused organization, officials may use the results of this research to examine and consider adjustments to their current portfolio of IT investments.

1.7 Scope and Limitation of the Research

This study examined over 7,200 Federal Government IT spending projects for 2008 and 2009 in the IT portfolios of thirty-one Federal Government agencies that reported to the Office of Management and Budget in their filed IT Investment Portfolio Reports (Exhibit 53s). The data submitted to the Federal Government was certified by the agency and required annually by OMB. Four agencies were excluded from the study after examination because they did not have both PART evaluations and Exhibit 53s, or they only had a minimal number of programs evaluated through the PART.

Organizational performance was determined by analyzing agency program performance as determined from the Program Assessment Rating Tool from the 2008 and 2009 reports. Over 1000 program assessments were reviewed and included in this study. The PART programs studied were comprehensive in that they encompassed over 98% of the published Federal budget (United States. Office of Management and Budget. http://www.whitehouse.gov/omb/expectmore/about.html)

The most recent time period was selected for both the IT investment data and the performance data in order to keep the information as current as possible, and a two year time-frame of data was selected, 2008 actual budget spending and 2009 enacted budget spending, in an attempt to lessen the impact of a short-term spike in spending on one project. The PART data included annual updates for previously reviewed programs through 2008, the last year available.

Limitations of the study include the small sample size of agencies that limited the selection of statistical processes and the potential for time lags in performance results and investment allocations. Further research could be conducted on sub-units of agencies to confirm the research results.

1.8 Organization of the Research

This research is organized into five chapters. Chapter 1 defines the context and description of the problem being researched, and the research questions pursued and resulting hypotheses. It further describes the purpose and significance of the study and the scope and the limitations of the research.

Chapter 2 addresses the literature review, beginning with key definitions, published research on organizational performance in the private and public sectors, previous agency comparison studies, and IT investment portfolio research.

Chapter 3 addresses the research methodology, the research plan and data requirements. It then discusses agency selection, data collection procedures, the quantitative analysis process, and reliability of the data.

Chapter 4 outlines the quantitative analysis, including the statistical analysis and findings.

Chapter 5 discusses the conclusions of the research and avenues for additional analysis.

A List of Figures, a List of Tables and a Glossary of Terms and Acronyms follow the Table of Contents page. Agency Mission Statements, Program Assessment Rating Tool Categories, and sample Exhibit 53 and PART reports are located in the Appendices.

Chapter 2 – Literature Review

The scope of research for this study of the relationship between IT asset allocation and organizational performance in the Federal Government involves investigation into several areas. First, baseline definitions are required for IT assets and organizational performance. Most previous research has been in the private sector, so this review begins there, later incorporating public sector Federal Government findings. Second, since the study is based on connections between agency performance and the composition of IT assets, a method of determining agency performance needs to be established, and a search for previous comparisons of Federal agency performance in the reference literature was conducted. Third, the role of IT investments in influencing organizational performance was explored, both in the private sector and in the Federal Government, with a brief examination of government efforts to use IT to improve organizational performance. Finally, the evolution of IT portfolio management theories is addressed, concluding with research on correlations between IT portfolio studies and firm performance research from the MIT Center for Information System Research.

2.1 Definitions

2.1.1 Defining Information Technology Assets in the Public and Private Sectors

The term *IT assets* has been defined in the past by the inclusion of different components, depending on the organization and the researcher. The measurements of IT assets can differ as well, sometimes measured directly and sometimes through surrogate (user) reported measurements (Mahmood, 1993). Our study of federal government agency IT investments and performance data will necessitate the use of federal government definitions, but in considering the applicability of private sector studies to those in the public sector, we must understand private sector definitions and the evolution of the terms as well.

Fundamentally, information technology assets are technology resources that help with the management, processing, communication and storage of information. Information is often synonymous with data, but David Ronfeldt notes that there is a dimensional hierarchy to information, and that information can include raw data, patterns of information, and aggregated and processed patterns to include knowledge. An increased amount of data does not always lead to more information, and more information does not always lead to increased knowledge, but processed and available information can lead to increased, actionable knowledge (Ronfeldt, 1991).

Table 1 presents a summary of the scope of different IT investment asset definitions

included with this literature review, and illustrates the disparity in the literature as to what constitutes IT investment assets, with the only consistent elements being hardware and software assets.

Table 1: Summary of the IT Investment Asset Definitions

Variations in Definitions of IT Investment Assets							
	Hardware (computers, networks, servers)	Software applications	Projects, Procurement, Contracts to create new services	Personnel (Salaries, benefits, training)	Operations and Support for existing services	Telecom-munications systems to support personnel	IT Policies
Ronfeldt	x	x				x	
Dos Santos	x	x				x	
Van Over	x	x	x				
Chatterjee	x	x		x			x
Harris	x	x	x	x	x	x	
GAO	x	x	x		x	x	x

IT investment assets have been defined as the purely physical assets of hardware, software, systems, networks and databases (Ronfeldt, 1991), and as hardware, software and telecommunication technologies (Dos Santos, et al, 1993).

David Van Over observes that IT assets can include support mechanisms for the processing of information to sustain business activities. In addition to the hardware and software of computers, printers, servers, telecommunications equipment, and software programs, IT assets include elements such as projects, procurements and contracts that create new assets or capabilities for the organization. Van Over does not include operations and maintenance in support of existing projects as IT investments (Van Over, 2008).

Michael Harris offers a broad definition, which includes not only hardware and software, but IT personnel and professional services to include consulting and temporary staff augmentation, travel and expenses for training, communications, and all supplies consumed by an IT department (M. Harris, 2008).

Debabroto Chatterjee considers IT assets to include the physical assets of hardware and software, the intellectual IT assets of personnel, and the policies and procedures necessary to combine the physical and human components into shared IT services (Chatterjee, et al, 2002).

Jason Dedrick examined fifty previous studies of IT investment and productivity, and noted that many of the studies defined IT investment as not only the hardware, software and services, but also the annualized value of computer investments, including depreciated value of previous investments that are still in service (Dedrick, et al, 2003).

The U.S. Government Accountability Office defines IT assets as "computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources used by an organization to accomplish a function" (United States.GAO, 2000). Some private sector estimates of Federal Government IT expenditures often include personnel costs. The official IT expenditure report approved by the CIOs of each Federal agency and reported to the Office of Management and Budget, known as the Exhibit 53, includes Federal Government spending on applications, network hardware, telecommunications, outsourcing, and services and support, but not government personnel costs, probably due to the difficulty

of disaggregating agency civilian pay budgets into IT and non-IT accounts.

For the purpose of this study, the GAO definition of IT assets used in Exhibit 53, consisting of hardware, software, projects, procurement contracts to create new services, operations and support for existing services, telecommunications systems, and IT policies, but not including government personnel costs, will be used.

2.1.2 Defining Organizational Performance

The definition of the term *organizational performance,* when used across industry and the government, is dependent on the determination of performance indicators relevant to the organization. Private sector performance criteria can be different from those of the public sector, and within sectors, criteria weighting will vary. Thus, performance for shareholders could be a critical measure of organizational performance in a traditional for-profit company; a new business might look at customer satisfaction and the ability to attract employees as a performance goal; a governmental organization might consider satisfying Congressional committees, with improved service to constituents as a primary measure of organizational performance.

Earlier research by Ford and Schellenberg looked at three frameworks to evaluate determinants of organizational performance: 1) Goals, 2) Systems Resources, and 3) Constituency. The *Goals* approach uses measures predicated on achieving either defined

or implied goals of an organization, such as profit or return on equity. *The Systems Resources* approach looks at key resources needed by an organization, e.g. the need for skilled human resources, money, prestige, or technology, and the organization's ability to compete for these resources. The *Constituency* approach envisions organizational performance as a fulfillment of stakeholders' needs, with customer satisfaction being a key measure (Ford and Schellenberg, 1982). To further expand on the system resources approach, Hackler and Saxton also add intangible resources such as intellectual property, organizational networks, and organizational brand and image (Hackler and Saxton, 2007).

Organizational performance can be interdependent and rely on criteria which are constantly changing; therefore organizational performance is itself dynamic (Ford and Schellenberg, 1982). Michael Porter noted that "the productivity frontier is constantly shifting outward as new technologies and management approaches are developed and as new inputs become available" (Porter,1996).

2.1.2.1 Defining Organizational Performance in the Private Sector

Organizational performance in the private sector has been traditionally defined by profit, performance for shareholders, longevity of the firm, productivity, operational success and customer satisfaction. Table 2 outlines the further research in this section.

Table 2: Private Sector Organizational Performance Factors as Determined by Literature Research

Private Sector Organizational Performance Factors	
Financial	Profit Shareholder performance Availability of capital
Operational	Productivity Operations Effectiveness Efficiency Efficacy Ethics Elegance Ability to Manage Risk
Customer Satisfaction	Product Time (to bring to market, order, deliver) Product Quality Product Performance/Service Cost of product Customization and convenience of product
Employee Satisfaction	Ability to attract employees Workforce stability
Firm Advantages	Longevity of firm Competitiveness in marketplace Prestige Availability of resources Product Innovation

Maltz (2003) found that performance traditionally was financially oriented and often short-term, based on the last quarter's financial reports. Jacobsen (2008) contended that both a high level of return on total assets and an increase in shareholder wealth indicated a high-performing organization. Weill and Broadbent examined lagging and leading indicators of organizational performance: profit and return on equity were current performance financial measures that were lagging indicators of what the company had achieved in the past; customer satisfaction and innovative products were medium term measures that were leading indicators of future performance. They noted that these criteria could be traded off and balanced with the strategic mission and the current

economic environment to focus on short term profits or future innovation (Weill and Broadbent, 1998).

Erik Brynjolfsson noted that productivity, i.e., output produced per unit of input, is a measure of performance that can be difficult to quantify. Input should not only include labor hours, but also materials and resources consumed, quantity and quality of equipment used, worker training and education, and amount of "organizational capital" required. Output should be a function of intangible as well as tangible resources, including product quality and variety, timeliness, service, convenience. (Brynjolfsson, 1993).

Jacobsen noted that to successfully perform operationally, organizations must maximize the efficiency of current operations, deal with risks through threat identification and remediation, and increase their "absorptive" capacity, i.e., their capacity to recognize and bring to market new ideas (Jacobsen, 2008).

Richard Heeks noted additional dimensions of organizational performance, and illustrated how Peter Checkland brought an operational approach to organizational performance, expanding the measure of performance to (1) *Effectiveness*, is the right thing being done (2) *Efficacy*, does the method work, and (3) *Efficiency*, is the resource usage minimum. In addition, Checkland added two more measures: *Ethics*, is the transformation morally correct, and *Elegance*, is it aesthetically satisfying (Heeks, 1999).

L. Roebeke added the concept of a hierarchy to Checkland's first three elements, with effectiveness being primary, efficacy as the second element, and last, efficiency, and said that an organization should use several indicators of performance, representing differing organizational goals, with emphasis on time and performance (Roebeke, 1990). Since effectiveness and efficiency are more subjective, the results using these criteria are more qualitative judgments than quantitative measures (Waldo, 2006).

Kaplan and Norton developed their Balanced Scorecard approach to combine measurements of operational performance with financial performance. They measure four perspectives of performance, Financial, Customer, Internal Business, and Innovation/Learning, to balance short-term and long-term goals. They note that even with customer, internal business, and innovation/learning perspectives, the financial measures are still critical to organizational success. The other measures are more objective and predicated on the company's view of its strategic goals (Kaplan and Norton, 1992).

In discussing successful performance from a customer perspective, Kaplan and Norton indicate that customers are interested in four categories: *time* (for existing products, time to deliver an order; for new products, time to deliver the product to market), *quality* (defect level of a product as experienced by the customer), *performance and service* (how the product creates value for the customer), and *cost* (Kaplan and Norton, 1992).

Watson states that "customer satisfaction is the final goal of quality activities and the ultimate enabler of enduring competitiveness" and that there is a distinction between stakeholder value and customer satisfaction. Stakeholder value is compliance or obedience-based, and customer value is achievement-based. He also notes that there are three different dimensions to the way organizations produce value: value for markets and customers, value for shareholders and investors and value for society. The first two are financial determinants, but the third measure, value for society, is difficult to measure in the private or public sector (Watson, 2007).

2.1.2.2 Defining Organizational Performance in the Federal Government

Waldo and Miller cite three reasons for government to measure organizational performance. First, it can evaluate organization or employee quantity or quality of work; second, it can compare agencies and employees statistically; and third, it can quantify the social effects of administrative operations (Waldo and Miller, 2006).

Table 3 below, summarizes the research on Federal Government organizational performance factors in this chapter.

Table 3: Federal Government Agency Organizational Performance Factors as Determined by Literature Research

Federal Government Agency Organizational Performance Factors	
Mission Effectiveness	Program delivery accuracy and expediency Efficacy of programs Accountability of Agency
Cost Accountability	Cost reduction Efficiency Best use of taxpayer dollars
Human Resources Strength	Quality of the workforce and leadership Role and quality of political appointees Employee satisfaction Motivation and Teamwork Availability of trained workforce Training and development programs
Political Stakeholder Approval	Executive and legislative branch support Legislative compliance Stability of administration
Citizen/Taxpayer Approval	Delivery of desired goods or services Accountability to public Integrity Fairness Transparency and openness Positive perception of time, quality, responsiveness, cooperation and communication skills
Operational Effectiveness	Best management practices Improved productivity Economies of scale and standardized technology Modern information management and communication systems Positive climate for research and development Ability to work within politically defined budgets, inflexible personnel and procurement rules

The literature applying to organizational achievement for Federal Government agencies lays out several goals: continuous improvement on mission effectiveness (Popovich, 1998); cost-effective program delivery, accountability to taxpayers, improved productivity, human resources strength including quality of the workforce, and employee satisfaction (Kaplan and Norton, 2005; Keyes, 2005); the approval of political stakeholders and the public perception that they are "doing the right thing" (Holmes, 2001).

Mark Popovich defines high performance governmental organizations as "groups of employees who produce desired goods or services at higher quality with the same or fewer resources. Their productivity and quality improve continuously, from day to day, week to week, and year to year, leading to the achievement of their mission." He specifies that for government agencies, providing "desired goods and services" refer to activities that increase the agency's ability to achieve its mission (Popovich, 1998).

Douglas Holmes notes that the two primary goals of any government entity are to "provide unbiased execution of policy and stability of administration." His determination of the need for the unbiased execution of the agency mission is inherent in achieving public sector policies, but his second point illustrates the need to satisfy differing political stakeholders (Holmes, 2001).

Biswanath Chakrabarty notes that private and public organizations by necessity plan, budget and organize differently because of different methods for decision-making and accountability. Private sector customers also pay for and directly receive the intended product or service, whereas in government, customers (citizens) may not pay directly or proportionally for the service received (Chakrabarty, 2007).

Kaplan and Norton align four elements of organizational performance for the public sector with the four perspectives of Financial, Customer, Internal Business, and Innovation and Learning. Financial success in the public sector necessitates cost-effective program delivery and the maximization of government funding and fiscal

revenue. Customer satisfaction in the public sector involves the delivery of the right program, the best use of taxpayer dollars and accountability for that stewardship, and compliance with legislative mandates. Internal business strength involves improved productivity, appropriate infrastructural facilities, a positive climate for innovation, and community-based decision-making. Lastly, organizational performance in the public sector must include human resource strength, or innovation and learning with a skilled workforce, motivated team, modern information management system, effective communication system, facility for training and development, and a positive climate for research and development (Kaplan and Norton, 2005).

Jessica Keyes looks at measures of these elements of successful organizational performance and notes that for customer service, the customer is the end user of the contract; their satisfaction depends on their perception of time, quality, responsiveness, cooperation and communication skills. The financial perspective measures for the public sector will not be the primary objective, but will emphasize cost efficiency. Public sector measures of human resource strength may include employee satisfaction, employee information availability, and the quality of the workforce and the environment (Keyes, 2005).

Holmes notes that the government's need to be right, rather than expedient, decelerates decision-making. There is less flexibility in budgets and there are more rules to follow. Government agencies are more complex than private companies, must achieve

political support, and must be examples of "integrity, transparency and openness" (Holmes 2001).

Despite these differences, Frank Ostroff sees four similarities between a high performing government organization and a private company: decisive goals, well-designed processes, accountability, and effective leaders. One difference he sees is in agency leaders, who are often political appointees who may have technical expertise or an understanding of policy, but little experience in leading large-scale reform or increasing productivity, and have a limited amount of time as an appointee to effect change. He also sees less flexibility in agencies because of procurement, personnel and budget rules, and legal constraints, which all inhibit innovation, and a culture where the penalties for failure are greater than the rewards for achievement. In addition, pleasing the many constituencies of a Federal Government agency is challenging: the President, cabinet members, Congress, oversight agencies like the Office of Management and Budget, public interest watchdog groups and the media (Ostroff, 2006).

Patrick Wolf surveyed and aggregated forty-four case studies on Federal Government agencies to determine bureaucratic effectiveness, which he defined as "excellence at performing an agency's perceived mission." He uncovered several subjective factors which influence an agency's performance: 1) the age of bureaucracy, 2) the quality of leadership, 3) the institutional design, 4) organizational professionalism, 5) the ability to respond to economic incentives, 6) organizational environment and adaptability, 7) an agency's political environment, whether politically autonomous or

receiving executive (Presidential) support and visibility, and 8) luck, that their characteristics happen to match a changing environment's needs. His evaluation concluded that factors that make a difference in agency performance are quality of leadership, political autonomy and executive support, which protect agencies from volatility, adaptability, and competition from other agencies, providing incentives for achievement (Wolfe, P., 1993).

Hal Rainey and Paula Steinbauer propose that government is often perceived as inefficient, but can be responsive and adaptive to cost constraints. They add that agency effectiveness is improved by the utilization of technology and the development of an agency's human resources (Rainey and Steinbauer, 1999).

Since this public sector study builds upon private sector research, it is instructive to compare the two. Paul Arveson has done this for us, outlining private sector versus public sector comparative factors. He observes that key factors of organizational performance for the private sector are competitiveness, profit, growth, market share, and customer satisfaction. For the public sector, he cites organizational performance as being measured by mission effectiveness, cost reduction and efficiency, and customer satisfaction (Arveson, 1999). In Table 4, we refine Arveson's chart to more specifically consider private sector versus federal government comparative factors.

Table 4: Private Sector vs. Federal Agency Organizational Performance Comparative Factors

Private Sector vs. Federal Agency Organizational Performance Comparative Factors		
	Private Sector	**Federal Agencies**
Strategic Goal	Competitiveness	Mission effectiveness
Financial Goal	Profit; growth; market share	Cost reduction, efficiency
Values	Innovative, creativity, good will, recognition	Accountability to public, integrity, fairness
Desired Outcomes	Customer satisfaction (customer pays for product/service)	Taxpayer and other stakeholder satisfaction (stakeholder may not pay proportionally for service)
Stakeholders	Stockholders, owners, market	Taxpayers; voters, legislative, executive and judicial branches, media, advocacy organizations
Budget Priorities defined by	Customer demand	Leadership, legislators, planners
Justification for Secrecy	Protection of intellectual capital; proprietary knowledge	National security
Key Success Factors	Growth rate, earnings, market share	Best management practices; legislative compliance
	Uniqueness	Sameness; economies of scale
	Advanced technology	Standardized technology

Adapted from Arveson, 1999

2.2 Previous Federal Government Agency Comparisons

We searched the literature for ranking comparisons of federal agencies for our study of agency performance as correlated with categories of IT investments, and found few comparative studies. Waldo and Miller (2006) observe that comparing agencies statistically, both for quality and quantity of work, is a driver for organizational efficiency studies, but our research found few of these comparative analyses. Agencies have unique missions with unique metrics for performance (Arveson, 1999), changing political environments, and politically determined budgets (Ostroff, 2006). As a result, agency ranking comparisons in the federal government are often subjective and agencies

are hesitant to be compared. Nevertheless, existing literature on comparisons of agency performance provided insights into key factors in agency performance. Table 5 illustrates the comparisons studied in this research.

Table 5: Previous Agency Organizational Performance Comparative Studies

Previous Agency Organizational Performance Comparative Studies for Federal Government Agencies	
Author	**Organizational Performance Factors Studied**
Pegnato	Organizational design and management
Simon	Characteristics of President's Quality Award recipients
Hennessey	Leadership and organizational culture
Senate Governmental Affairs Committee	Accuracy and Relevance of GPRA Performance Reports
Brewer and Seldon	Employee judgments of organizational performance
West and Lu	Organizational website technology and effectiveness

The impact of organizational environment, size and design was studied by Joseph Pegnato in thirty-five Federal Government organizations, measuring organizational performance by efficiency and output quality. He found that organizational design had the most influence, with performance decreasing as the levels of management increased and, surprisingly, performance decreased as staff education increased. He also found that a higher proportion of political appointees increased organizational performance (Pegnato, 1993).

Cary Simon examined seventy-seven Federal bureaus and compared organizations that had received the President's Quality Award for Management Excellence with those that had not. This award evaluates agencies that apply on overall management, agency-wide performance and innovative practices, including competitive sourcing, E-government, financial practices and human resources management (United States. Office

of Personnel Management. *President's Quality Award program*. http://www.opm.gov/pqa/past_pqa_winners/2008/index.asp). Simon determined that the factors that were present in those agencies that received the award included higher perceived qualities of leadership, information and analysis, strategic planning, human resource development, process management, business results, and customer focus and satisfaction, and that the successful bureaus were significantly more focused on measuring performance (Simon, 1998).

J. Thomas Hennessey studied nine Federal offices in two Federal Government agencies in terms of leadership and organizational culture in both "reinventing government" and organizational performance, and used the measures employed by the organizations to determine organizational performance. If those measures supported organizational goals, they were weighted more heavily, and if there was a low correlation between those measures and mission results, less weight was given. He found that leadership and organizational culture affected organizational performance, and that there were definitive qualitative and quantitative distinctions between high and low performers (Hennessey, 1998).

In 1999, the Senate Governmental Affairs Committee evaluated the FY 1999 Performance Reports of the twenty-four largest federal agencies under the Government Performance and Results Act, to determine how well the Reports reflected agency performance according to their missions. Criteria included the extent by which the Reports demonstrated achievement of mission results, progress in resolving management

challenges and the usefulness of the report. This was a performance ranking, not of agency performance, however, but of Report representation ("Senator Thompson unveils agency performance report", http://www.orau.gov/pbm/grades.pdf).

Brewer and Selden evaluated organizational performance using the Merit Principles Survey to statistically rank Federal agencies according to employee surveys. Their study is based on a random sampling of over 18,000 permanent, full-time employees in the 23 largest Federal Government agencies. Employee opinions are perceptual in nature, but according to Powell (1992), these results show that measures of perceived organizational performance correlate positively with objective measures of organizational performance. Brewer and Selden concluded that the variables which most affect Federal Government organizational performance are efficacy, teamwork, building human capital, structure of task/work, protection of employees, concern for the public interest, and task motivation. In considering why organizations which have done well on other studies may not do as well in the MSPB evaluation, the authors note that organizations may have put more emphasis on business-based goals rather than employee satisfaction (Brewer and Selden, 2000).

West and Lu (2009) ranked 68 corporate, 1,476 state government and 61 Federal Government websites for technology effectiveness, looking at personalization, interactivity, transparency, PDA access, disability access, language translation, number of online services, privacy, security and user feedback. Effective websites allowed customers to get information, more easily do tasks, were customer-needs driven and up-

to-date. Government agency websites often lacked the multimedia, interactivity, and personalization of private sector websites, but had better disability and privacy policies.

Our research found several comparisons of federal government agencies on different criteria, but no existing rank ordering of government agencies on agency program performance. A new analysis of organizational performance for Federal Government agencies was therefore required.

2.3 IT Investments and Organizational Performance

P. Specht notes that benefits achieved through IT investments have four goals for all organizations: 1) *increase productivity*, which can lead to improved quality of service, more timely and accessible information, improved communication, and better operations, 2) *facilitate management*, providing for more rapid decision-making, improved control and increased employee satisfaction, 3) *gain competitive advantage*, which can lower supplier costs, improve service, and improve operating margins relative to competitors, and 4) *provide a solid base for business redesign* (Specht, 2000).

IT investments can increase efficiency by lowering costs, reducing waste and redundancy, reducing errors, and allowing higher output while maintaining costs. They can improve effectiveness by providing better information access and new services and improving or expanding performance capabilities. There are increased risks to IT investments as well: physical risks including equipment theft, viruses, data theft or

alteration; privacy breaches; and managerial risks, including excessive implementation time or cost, and employee resistance resulting in low usage (Specht, 2000).

2.3.1 IT Investments and Organizational Performance in the Private Sector

Private sector awareness of the role of IT investments in organizational performance has evolved into an understanding that investments in IT do increase productivity, and that not only the amount of money invested in IT but the composition of IT investments and the quality of IT governance for these investments can impact private sector organizational performance.

Early private sector research, relying on financial measures of performance, did not always find support for the relationship between IT investment and positive financial performance. Eric Clemons (1991) considered IT investment as a strategy to enable future corporate achievements, where payoffs might not be realized in the current timeframe. Clemons and Row (1991) saw little evidence that information systems conferred a competitive advantage for businesses in most cases, unless the strategic investment was not easily imitated by competitors and gave the business advantages in leveraging resources. In the early 1990s, Brynjolfsson discussed the "productivity paradox", the question of why, with increasing expenditures on computers and IT, metrics for productivity were not also increasing. His four reasons were *measurement* inaccuracies, *time lags* in payoffs of current expenditures/benefits; *redistribution* within

the firm, where IT was positively affecting operations but not increasing total output; and *mismanagement,* where because of the difficulty of measuring the benefits, managers were misallocating and over-consuming technologies (Brynjolfsson, 1993).

By the mid 1990s, however, Brynjolfsson and Saunders note that private sector productivity growth increased from a 1973-1995 average of 1.4% annual growth to a 1996-2000 average of 2.6%, with even greater growth in 2000-2003. They assert that this significant increase in productivity for American companies was caused by a combination of investments in IT and new business management practices, and that there is a delay of three to four years from increased IT investments to increased IT productivity. These business practices included employee incentive programs, improved training and efforts to decentralize decision-making, and an organization's combination of these practices and investments, leading to increased productivity. They also note that productivity in the information age is more difficult to measure; as an example, the intangibles of being able to provide information online at any time to recipients has not yet been quantified in productivity measurements (Brynjolfsson and Saunders, 2009).

Dedrick, Gurbaxani and Kraemer, after evaluating over 50 empirical studies between 1985 and 2002 on IT and productivity, found a definite positive correlation between investment in IT and productivity growth. They noted IT was not only a means of automating business, but could enable organizational change and lead to increased productivity (Dedrick, Gurbaxani & Kraemer, 2003).

Brynjolfsson and Hitt (1998) expanded the concept of corporate impact into the non-financial realm, noting that there was a positive correlation between IT investment and customer value, competitive advantage, and innovation. Sasha Deklava quotes work by Harris and Casonato (2002) predicting that by 2005, over two-thirds of major corporations' IT investment decisions would be based on these non-financial goals, such as improved product design, improved products, improved customer service, employee effectiveness, increased organizational reputation and brand value (Deklava, 2005).

Saberwhal found that IT investment influence on performance had contributing factors of top management support, user attitude, to include training and experience with an IT system, and user participation in the development of the system. Saberwhal noted that Delone and McLean in 1992, Seddon in 1997, and Rai, et al, (1997) developed five constructs to information system success: system quality, information quality, perceived usefulness, user satisfaction, and system use (Saberwhal, 2006).

Jeanne Ross found that IT could create business agility by creating reusable IT-enabled business processes to increase business value and at the same time control cost and risk. A reusable IT foundation allowed an organization to more cost-efficiently use existing assets to launch new products, change and improve business models, and increase flexibility in acquisitions and divestitures (Ross, 2009).

Peter Weill and Jeanne Ross observe that IT is one of six assets that must be governed to create value within an organization: human, financial, physical, intellectual

property, IT, and relationships. In looking at the value of IT contributions to organizational performance, they consider IT governance, i.e., the accountability structure for IT investment, as the single most important predictor of success (Weill and Ross, 2004).

Rachivandran and Lertwongsatien found that specific types of IT investments, made in support of an organization's core competencies, may confer improved firm performance (Rachivandran, 2005), a concept also confirmed by Aral and Weill (2007). Dibrell, et al, in studying small business IT investments, found that strategic and innovative IT investments, as part of a firm emphasis on innovation, allowed managers to improve organizational performance (Ravichandran & Lertwongsatien, 2005).

In summary, research indicates that not only IT investments as a whole can impact organizational performance in the private sector, but that their composition and governance as well can be determining factors on organizational performance. This sets the stage for our further research into the public sector.

2.3.2 Background of Government Efforts to use IT to Improve Organizational Performance

The Federal Government recognized the need for effective acquisition and use of IT assets and enacted over 300 public laws for IT between 1977 and 1990 (Lineer, 1999).

Since 1990, several other key Federal laws were enacted: Chief Financial Officers Act of 1990, Government Performance and Results Act of 1993, Federal Acquisition Streamlining Act of 1994, Paperwork Reduction Act of 1995, the Clinger Cohen Act of 1996, which aimed to use private sector practices to improve IT efficiency and accountability, and the E-government Act of 2002 which encourages use of the Internet to provide better information to citizens at less cost and encourage data sharing between agencies.

The Clinger-Cohen Act, originally named the Information Technology Management Reform Act of 1996, was legislated to bring the private sector ideas of profitability into the public sector, and to help agencies acquire and manage their IT assets. It required Federal agencies to move toward capital planning, performance and results-based management for IT. The goal was to establish and reinforce a connection between IT planning and investment decisions and program missions and goals, and to require standardized IT management policies. This Act put the Office of Management and Budget in charge of an integrated approach to IT management to improve the productivity, efficiency and effectiveness of Federal agencies by linking planning and investment strategies and IT portfolio management to the Federal budget process (Van Over, 2009).

The E-government Act of 2002 established the Federal CIO Council, an inter-departmental forum to improve planning, performance and sharing of Federal Government information resources. The Federal Enterprise Architecture was developed

under the direction of the Federal CIO Council to provide a framework for technology improvement within all agencies of the government, which would centralize information on each agency into a format which would allow the Office of Management and Budget and the Government Accountability Office (GAO) to assess the efficiency of an agency's IT enterprise planning and results (Maizlish and Handler, 2005).

OMB established OMB Circular A-11 (Exhibit 300) to require agencies which are subject to Executive Branch review to develop and implement a capital planning and budgeting process and select investments to support agency missions, demonstrate optimal projected return on investments, monitor performance and establish oversight systems to ensure IT assets are delivering promised results. Exhibit 300 is a reporting mechanism for agencies to evaluate major IT projects, and ensure that they are well-planned and meet cost, schedule and performance goals planned for the investment. The OMB evaluates Exhibit 300s on the following criteria, giving scores from 1-10: support of the President's Management Agenda, project (investment) management, acquisition strategy, performance information, security, privacy, enterprise architecture, alternatives analysis, risk management, and cost/schedule/performance. Projects are placed on a Management Watch List if they receive low scores and must submit remediation plans.

Whereas OMB Exhibit 300 is a listing and evaluation of an agency's major IT investment projects and their performance, OMB Exhibit 53 reports total Federal agency IT investments. Our investigation of IT investments and organizational performance focuses on Exhibit 53 and its six major categories of IT investments: Mission Area

Support; Infrastructure, Office Automation, and Telecommunications; Enterprise Architecture and Planning; Grants Management Systems; Grants to State and Local IT Investments; and National Security Systems IT Investments (Garson, 2003).

As the federal government adopted IT portfolios, it formulated several goals: to optimize the return on taxpayer IT investments, to better control IT costs, to assess and balance risk with different IT investments, to give management more information for decision-making, to better align IT expenditures with organizational goals, and to improve enterprise performance management (Maizlish and Handler, 2005).

The goals of the portfolio approach are to improve response times, reduce duplication and overlap of investments, improve the interoperability of systems, better manage costs, benefits and risks, and improve information security. This optimally requires building an awareness of the IT investment process and formal processes of IT evaluation into the agency, and the agency moves from a project-centric base to a portfolio approach, evaluating investments according to their support of the agency overall mission. High risk, low value, or obsolete IT investments are evaluated and may be de-selected from the portfolio, and through benchmarking IT investments to successful organizational investments, better technologies can be chosen.

Despite the reputations of government agencies as being unable to overcome the bureaucracy and make improvements, examples of Federal Government IT investment portfolios driving efficiency exist. Westerman and Hunter describe a 1996 effort by the

Department of Housing and Urban Development to consolidate business functions. This $35B agency, encompassing three business functions (housing, community development, and public housing), had been established with separate legislative mandates, was regulated by different congressional committees, and operated independently with different IT staffs. In order to combine these staffs, the technology portfolio was first assessed and divided according to lines of business, the core business and support needs for each were identified with IT functions mapped against this, and a streamlined system was developed. The agency then focused on reducing the infrastructure costs, eliminating redundant applications and reducing staff by 25%. Costs were reduced and financial resources were freed up to invest in large application investments. The earlier restructuring allowed new major investments despite a flat HUD budget (Westerman and Hunter, 2007).

2.3.3 IT Investments and Organizational Performance in the Federal Government

The GAO defines IT investments as "the actual expenditure of resources on selected information technology or IT-related initiatives *with the expectation that the benefits from the expenditure exceeds the value of the resources*" (United States. Government Accountability Office, 2000; italics added). IT investments are expected to create value for any organization, private or public sector and, at least for the long-term, to return more than their costs.

The structure and missions of governmental organizations are different from private industry, as noted previously. Of the three dimensions of value produced by organizations, value for markets and customers, value for shareholders and investors, and value for society, governments must primarily be concerned with the value for society Watson (2007). While the private sector invests in IT for competitive advantage, the government invests and shares information and creates systems to ensure public accountability and provide equal access to public services (Kamal, 2006).

Kim Anderson notes that IT has been used in government for data quality and data access for over 30 years, and that 40% of its impact on government capabilities is in quality. Efficiency in government means decreasing expenditures through productivity gains, staff reductions, improved management control of staff and processes, and time savings (Anderson, 2004).

There are several IT challenges that are unique to the government, as well. Federal agencies are high profile, risk-averse, and operate on a huge scale, and must not only deal with frequent technology changes, but with frequent changes in demands due to oversight stakeholders' policy changes. Government agencies are slower to replace outdated legacy databases, hardware and software, have many diverse sources and types of data to consolidate into their systems, and must operate under a procurement bidding system which does not always result in the best and most cost-effective IT product (Longbottom, 2006).

Maizlish and Handler note other challenges for the Federal Government in implementing IT projects. First, there are few common standards or historical bases for evaluating IT investments. Second, IT investments are not liquid, and it is difficult to disentangle an IT investment that is not working well from the systems and databases used by an organization. It is also difficult to retire IT investments without other systems being affected. Other existing challenges include scalability, availability, functionality, reusability, interoperability, maintainability and portability for IT investments (Maizlish and Handler, 2005).

G. David Garson asserts that traditionally IT investments in government were made on a project basis, which led to a conservative policy whereby riskier projects went unfunded. Portfolio management allows balancing less risky/lower payoff projects with higher risk/higher payoff projects, justifying some large non-traditional E-government projects (Garson, 2003).

Not only are structures and missions of government agencies different from the private sector, their IT investments have different goals, measures and challenges. Nevertheless, an IT investment and performance investigative approach for the public sector can take advantage of private sector IT investment and productivity research and illustrate increases in productivity, if not in short term financial measures, then in increased customer satisfaction, improved operations, innovation and cultural change.

2.4 IT Portfolio Management

2.4.1 IT Portfolio Management Definitions

IT portfolio management is a continuous process to manage IT assets in order to maximize portfolio benefits, minimize risk and cost, and ensure alignment with organizational strategy in a long-term time frame. IT Portfolio Management was developed in the private sector and has been adapted by the Federal government as a means to improve the acquisition and management of IT assets. Kumar defines three asset classes of portfolios: projects, applications, and infrastructure, similar to financial investment portfolios of stocks, bonds and cash assets (Kumar, 2008).

IT portfolio management is described by Jeffrey Kaplan as a comprehensive way to govern IT investments across an organization, and manage those investments for value. In order to manage a portfolio, the portfolio must be segmented into measurable components, several of which may encompass the same project. IT Portfolio management evaluates IT investments as assets, rather than costs to an organization, and allows the categorization, elimination of redundancy, and evaluation according to benefits, risk and return. Portfolio management is not stagnant, but uses a continuous process of evaluation, improvement, and adaptation. The definition of IT projects varies among organizations, changes over time within the same organization, and can include major or minor IT needs to include a specific help desk request, a major network

reconfiguration, new equipment or the acquisition of new software. Kaplan notes the only requirement should be that IT projects have explicit goals (J. Kaplan, 2009).

The GAO defines an IT Investment Portfolio as "the combination of all IT assets, resources, and investments owned or planned by an organization in order to achieve its strategic goals, objectives and mission" (GAO, 2000).

There are several methods of IT investment management in use in the federal government. The GAO's IT Investment Management Framework (ITIM) uses five stages of maturity to help an agency build an IT investment portfolio and manage its IT investments. The IT Infrastructure Library (ITIL) is a set of best practices for monitoring and servicing IT investments throughout their lifecycle. The Federal Business Reference Model (BRM) is a part of the Federal Enterprise Architecture (FEA) which helps an agency identify ways to simplify processes, align work across several Federal agencies, and reuse Federal IT investments (NASCIO, 2005).

2.4.2 Theories of IT Portfolio Management

IT portfolio management is rooted in H. Markowitz' Modern Portfolio Theory for investments, where diversification of financial assets (stocks, bonds and cash) is balanced by expected returns and risk (Markowitz, 1952). Warren McFarlan used the work of Markowitz to apply the principles of investment and risk to information systems investment, noting that IT project and portfolio risk alone were neither positive or

negative, but must be seen in the context of the degree of risk and potential reward (McFarlan, 1981). IT portfolio risk requires examining current and future projects, constantly evaluating projects to determine effectiveness, and investing and divesting as necessary (Van Over, 2009).

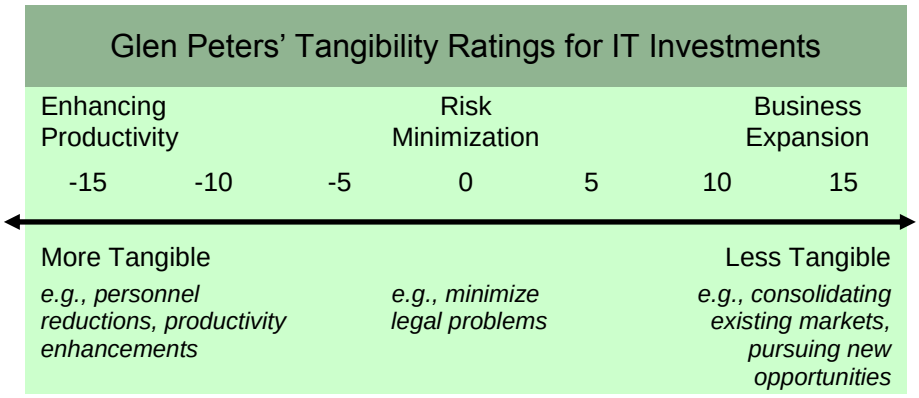
Early research by McFarlan noted that IT projects were often unsuccessful because an organization failed to assess the individual project risk or the aggregate risk of the portfolio of projects, and that an organization often failed to evaluate the specific needs of a project. Project risk can be related to managerial approach, project size, experience with the technology, and the structure of the project (McFarlan 1981).

Several IT investment portfolio allocation methods have been proposed over the years as outlined in diagrammed descriptions below. Glen Peters (1988) and John Ward (1990) both divided IT investments into functional categories. Targett, et al (1999) used a grid with weighted circles to present functional investments according to financial investments needed, Maizlish and Handler (2005) developed a functional pyramid approach, Andriole (2009) centralized the human factor within the functional categories, and Weill and Aral (2003) refined the functional pyramid investment portfolio through extensive private sector company research.

Glen Peters developed an investment mapping methodology in 1988 to graphically identify and manage the benefits of IT investments, shown in Figure 1. He mapped investments linearly as to tangibility ratings of -15 to +15, with more tangible

investments enhancing productivity, neutral investments minimizing risk, and less tangible investments expanding the business (Peters, 1988).

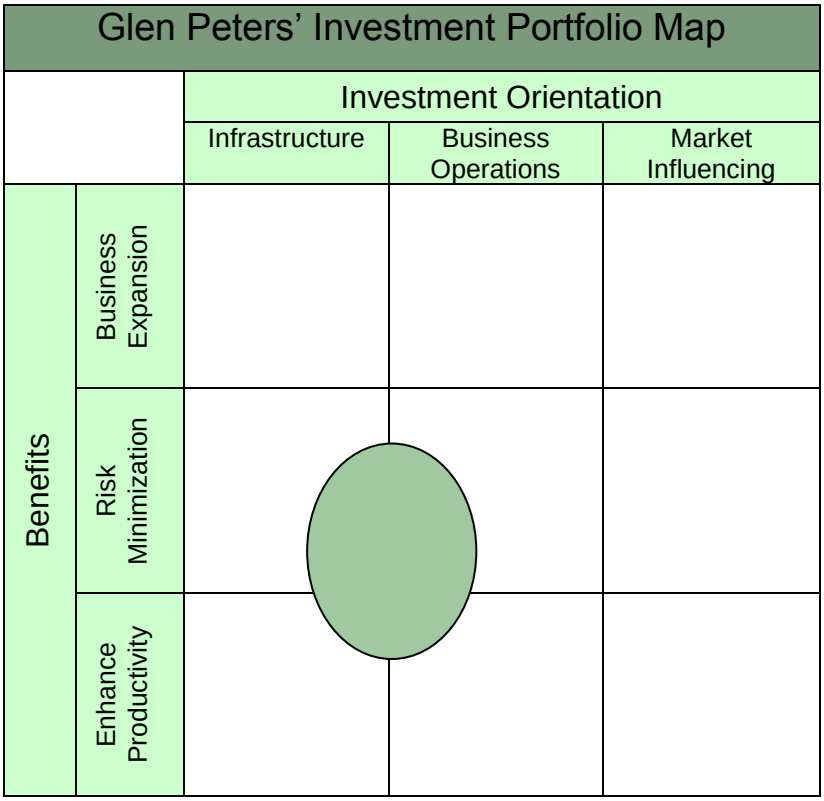
Figure 1: Glen Peters' Tangibility Ratings for IT Investments



Based on Peters (1989) type benefits continuum (Schneiderjans and Hamaker, 2004)

Peters then mapped three categories of investments shown in Figure 2 on a grid: 1) supporting technical infrastructure, 2) performing routine business operations, and 3) influencing the market, and developed a cost/benefit hierarchy for any selected investment (Schneiderjans and Hamaker, 2004).

Figure 2: Glen Peters' Investment Portfolio Map



Based on Glen Peters' Investment Portfolio Map (Schniederjans and Hamaker, 2004)

Ward's Portfolio methodology (1990) notes that an organization should follow a consistent evaluation approach for IT investments, using four functional categories: 1) *strategic*, which may cause change within the organization and convey competitive advantage and future success of the organization, 2) *high potential*, which are often high-risk/high reward research and development investments using a new technology or new business objective, 3) *factory* (operational), which improve current effectiveness and efficiency of organization, and 4) *support*, which often improve productivity of support functions of organization, but are not critical to success (Schneiderjans and Hamaker, 2004).

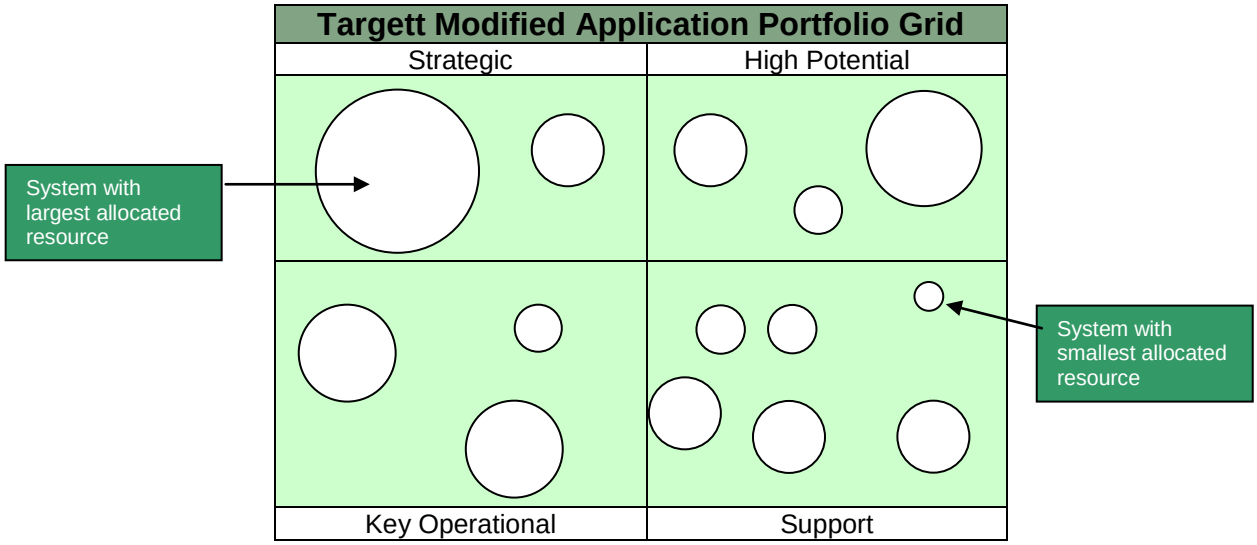
Table 6: Ward's Portfolio Approach

Ward's Portfolio Approach				
Four Categories	**Strategic**	**High potential**	**Factory (Operational)**	**Support**
Purpose	May cause change within the organization and convey competitive advantage and future success of the organization	Often are R & D investments due to a new technology or new business objective, are riskier but may impact future organizational success,	Improve current effectiveness and efficiency of organization	Often improve productivity of support functions of organization; not critical to success
How to evaluate	Quantify some direct costs and benefits	Develop quickly and inexpensively	Feasibility study - technical, economic and operational) and Cost/benefit analysis may be used to evaluate	Cost/benefit analysis
Who decides	Management	Often championed by someone	Management	Decision-making group or department
Priority for decision	Choose investment that best contributes to business objectives with the use of the least resources	Choose investments with highest value of Critical Success Factors and champion factor	Highest scoring investments in economic, critical success factors, risk and infrastructure improvement, with fewest resources	Choose investments with greatest economic benefit and least amount of resources
How to manage	Consider with other business issues	May become factory or supporting investments, or be rejected after prototype	Standardized, centralized approach to all factory investments	

Created from information in Schniederjans and Hamaker, 2004.

Targett, et al, (1999) recommend a modified application portfolio grid, shown in Figure 5, where investments are categorized into *Strategic*, *High Performing*, *Key Operational* and *Support*. They further enhance the investment grid by adding a weight for human or financial resources needed, represented as the size of circles. This gives a better representation of where an organization's IT spending is allocated (Targett, et al, 1999).

Figure 3: Targett Modified Application Portfolio Grid

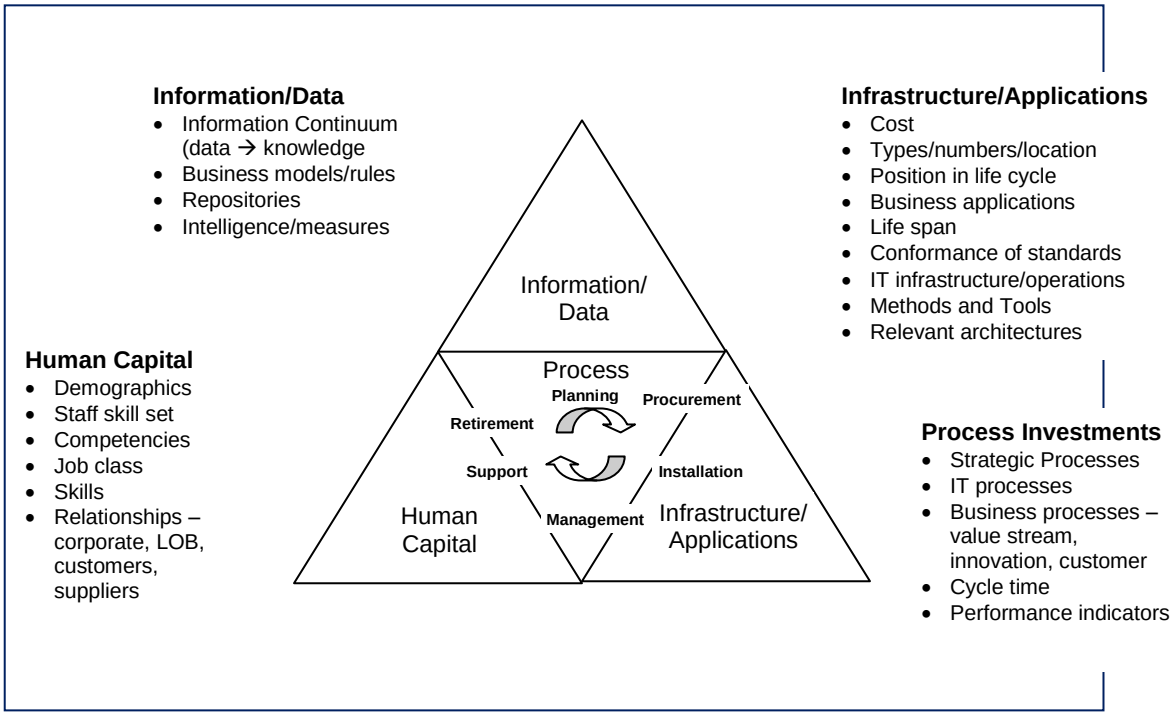


Based on Targett, et al, 1999, and Schniederjans and Hamaker, 2004

Maizlish and Handler's IT portfolio uses a pyramid structure and divides asset portfolios into four elements, *Information and Data*, *Infrastructure and Applications*, *Human Capital*, and *Processes*, with Processes as the central function, as shown in Figure 4.

Maizlish and Handler noted that in the Federal Government there are extra challenges to successfully designing an IT asset portfolio: few common standards or historical bases are available for evaluating IT investments, IT investments are difficult to retire without other agency systems and databases being affected, investments and their component interdependencies must be monitored, adjusted and disposed of for their full life cycle, and IT projects must be evaluated not only as to performance goals, risk management, and life-cycle cost formulation, but also for security and privacy, and support of the President's management agenda (Maizlish and Handler 2005).

Figure 4: Maizlish and Handler's IT Asset Portfolio



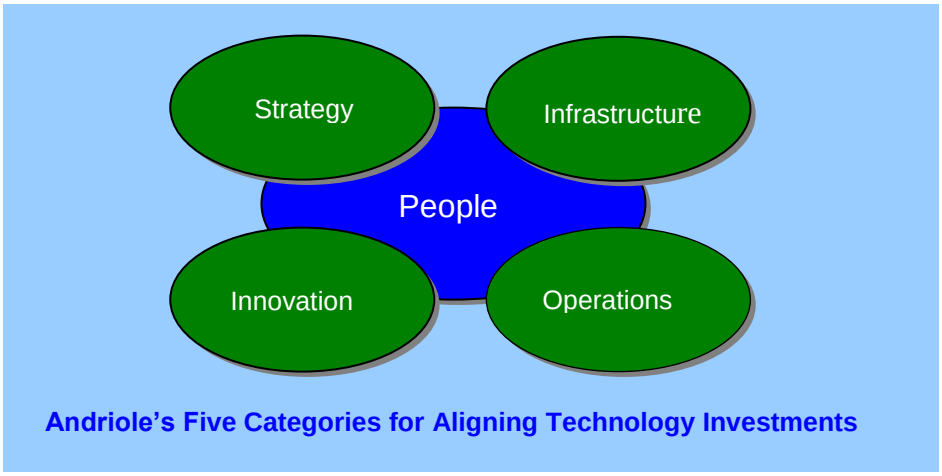
Maizlish and Handler, 2005

Stephen Andriole developed five categories for aligning technology investments in an organization: *Strategic*, *Infrastructure*, *Operational*, *Innovation* and *People*, as shown in figure 5. *Strategic* investments include technology investments that are consistent with organizational strategy. *Infrastructure* investments are concerned with maximizing efficiency, reliability and security. *Operational* investments concentrate on flexibility, adaptation and agility, and focus on servicing existing products and services. *Innovation* investments include new products and services, and have significant allocation to research and development (Andriole, 2009).

People alignment is key to each of the above allocations, and requires getting the right people with the requisite training, in the right place. Each category demands people with different skills: *strategic* alignment needs strategic thinkers, with an understanding

of how technology fits in this big picture. *Infrastructure* alignment requires detail-oriented people who understand the architecture as well as cost-effectiveness, reliability and security. *Operational* alignment needs flexible people with skills in delivery and support functions. *Innovation* alignment requires creativity and an ability to step back from the everyday issues. *People* alignment requires an ability to see the skill gaps in personnel, and fill those gaps through transfers and hiring, so that the right people are in the right place. If the right people are not there, an organizational alignment strategy can fail (Andriole, 2009).

Figure 5: Andriole's Five Categories for Aligning Technology Investments



Adapted from Andriole's Investment Categories (Andriole, 2009)

In summary, these theories led to the development of IT portfolio management in private industry and the Federal Government. G. David Garson notes that traditionally IT investments in government were made on a project basis, which led to a conservative policy whereby riskier projects went unfunded. Portfolio management allows balancing less risky/lower payoff projects with higher risk/higher payoff projects, justifying some large non-traditional E-government projects (Garson, 2003).

2.4.3 IT Portfolio Development Process

There are several approaches to IT portfolio development, along a spectrum from focusing solely on the IT budget and ignoring the existence of a portfolio, to establishing formal processes for IT investment allocations and carefully planning matches of IT investments to organizational strategy and goals. As we see in the existing literature, most organizations do not actively develop and manage their IT portfolios, but IT portfolio development can improve internal communications, efficiency and agility of an organization, (Maizlish and Handler, 2005) and lead to improved productivity and lower IT costs (Fitzpatrick 2005). Noted below are methodologies and benefits of IT portfolio development found in our literature research.

Bryan Maizlish and Robert Handler researched IT portfolio management, and found that despite IT consuming from 7- 20% of an organization's revenues, over 80% of organizations do not have an active IT portfolio management structure. IT portfolio management is a continuous process and improves the coordination between the IT and business sides of an organization. It improves communications and agility, eliminates redundancy and maximizes reuse, manages risk, improves personnel scheduling, and monitors and measures IT investments throughout their lifespan.

They recommend the development of an accurate model of current IT investments and their architectures in comparison with desired future goals. They categorize low risk-medium reward IT investments ("run-the-business") as equivalent to cash in a financial

portfolio, a no-risk and liquid investment that enable current functioning of operations, replacement of legacy systems, and mission-critical software. "Grow-the-business" components, equivalent to bonds in a financial investment portfolio, would be safe and stable IT investments that might expand IT products and services within current business operations, perhaps an expansion of accounting software, and "transform-the-business" components, equivalent to stocks in a financial investment portfolio, often involve moving into new markets, and have potential risks to revenues. They note that IT portfolio management is similar to financial portfolio management in many ways, but also dissimilar: IT portfolios are more complex, have high exit costs, low salvage value, less securitization, and are more intertwined within the organization and more difficult to unravel (Maizlish and Handler, 2005).

Many organizations pursue IT technology investments in the wrong order, developing IT budgets before evaluating organizational plans. The result is that the organizational strategy is not the driver of IT decisions, requiring IT to be aligned later at a lower level of management. For optimal alignment, an IT strategy should be in partnership with business decisions, and an IT portfolio should guide how IT investments are aligned (J. Kaplan, 2009).

According to Brown and Yarberry, IT portfolios should be managed by matching assets to strategy, and be managed similarly to mutual funds. The organization should: 1) maintain a list of current and past investments with total cost, maintenance expenses, business issues, and return on investment, 2) review effectiveness annually or

semiannually, 3) balance the portfolio based on risk, where expected value equals probability of success times the cost, and 4) identify redundant projects Brown and Yarberry (2009).

G. David Garson found that traditional IT investments were made too conservatively, neglecting riskier projects. Portfolio management allows higher risk/higher payoff projects to be balanced with less risky/lower payoff projects, justifying some large non-traditional systems (e.g., the E-government initiative).

An awareness of the IT investment process must be built into the agency, so that formal processes of IT evaluation are adopted and the agency moves from a project-centric base to a portfolio approach, evaluating investments according to their support of the agency overall mission. High risk, low value, or obsolete IT investments are assessed and may be de-selected from the portfolio, and through benchmarking IT investments to successful organizational results, better technologies can be chosen (Garson, 2003). Ideally, an agency reaches the stage where IT is truly aligned with business strategy, and the organization measures lifecycle value, eliminates underperforming projects, assesses both *project* risks, to include costs overruns, delays, strategic misalignment, and end user acceptance, and *portfolio* risks, where the combination of assets does not achieve the correct blend of assets to achieve business goals (Jeffrey and Lileveld, 2004).

Fitzpatrick quoted a 2004 AMR Research report showed that by focusing first on high business value projects and initially avoiding high risk, low return, overlapping or

duplicative investments, IT productivity could improve 24-50%, and 10% to 15% of the IT budget could be shifted into projects that improved competitiveness, and overall IT costs could be cut by up to 30%. According to Fitzpatrick, "While implementation can be challenging, it is almost impossible to find an IT portfolio management initiative that has been called a failure" (Fitzpatrick 2005).

2.4.4 CISR Portfolio Management Research

Peter Weill and other researchers from the MIT CISR, whose research prompted this study, have published extensive research on private company and industry IT investment portfolios. Using survey data from Chief Information Officers or their representatives from 1508 companies in 60 countries over a ten-year period, and statistically controlling for industry, firm size, advertising expense, and research and development, they divided IT expenditures into four asset classes, *Infrastructure*, *Transactional*, *Informational* and *Strategic* (Figure 6). Weill looked at total IT investment, both insourced and outsourced, which included all IT expenses, depreciated capital, personnel dedicated to IT services and management. From this data, CISR established patterns within industries, evaluated business strategies, and defined measures for companies to take to evaluate their current IT expenditures and improve organizational performance. Weill and Aral in 2003 and 2008, and Weill and Ross in 2004 found that:

(1) *Strategic* investments are designed to gain competitive advantage in the marketplace and to develop new business products and services and consumed on average 13% of private sector IT investments in 2007. These investments are higher risk, have a longer lead-time, and often involve very new technologies. The failure rate for strategic IT investments can be as high as 50%. Weill noted that strategic investments in the small sample of public sector organizations he studied (charities, private schools, local government), led to greater innovation, increased interaction with customers, and enabled major changes and easier facilitation within the organization.

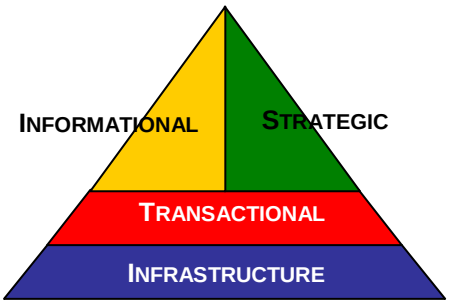
(2) *Informational* investments provide internal information (e.g., for accounting, and communication) and are designed to reduce costs and add potential profitability improvements in the future. In 2007, these investments consumed on average 13% of annual firm IT costs.

(3) *Transactional* investments often automate existing operations and may result in immediate cost reductions. In 2007, the average private sector organization studied by Weill apportioned 27% of annual IT investment to transactional investments. Private sector companies that invest more heavily in transactional systems than their competitors had higher productivity (sales per dollar of assets) and lower costs. Weill estimates transactional investments return 25-40% per IT dollar invested.

(4) *Infrastructure* costs allow an organization to either reduce IT costs via consolidation or to establish a flexible, reusable base for future business needs. Infrastructure investments typically have high initial costs and lower short-term profitability, but higher operational performance and profitability over the long run. In 2007, the average firm in the CISR study allocated 47% of IT investment to infrastructure (Weill and Aral, 2003; Weill and Ross, 2004; Weill and Aral, 2008).

These asset classes are represented in a pyramid form with Infrastructure serving as the base and as a shared resource for other investments. Transactional investments, concerned with cutting costs and automating procedures, rely on the infrastructure, and help to support both Informational and Strategic investments. Both Informational and Strategic investments use Transactional and Infrastructure investments as a foundation.

Figure 6: Weill's IT Investment Portfolio



From Weill and Aral, 2003

Projects are examined and measured in terms of these four categories of investment, but can span several of these asset classes, change over time, and vary by industry and

objective. An organization would allocate its proposed IT investment dollars into the above categories, examine its business goals, compare its allocation and size with others in the industry, and then evaluate its strategy to determine if its allocations deliver the desired results.

One important consideration for government organizations is their high legacy system costs. When Weill, Woerner and Rubin looked at *sustaining* IT investments which maintain and update current systems, and *new* investments which encompass major initiatives and changes to systems, they found that in 2007, the average firm spent 66% of IT investments on sustaining investments, and one-third of the firms studied by the CISR spent over 75% of their IT dollars to run existing systems. With so much of IT assets spent supporting existing complex and often redundant systems, portfolio assets are not freed up to support new IT systems. Weill found that organizations allocating more to new investments rather than sustaining investments had greater revenue growth, and by that measure, were higher performing in their industry. An IT governance system could improve further on IT usage by adding an approval gate at the business case stage to try to prevent redundancy and employ reusability of business processes (Weill, Woerner and Rubin, 2008).

Weill learned that each asset class has different risk-return profiles, and the optimal results occurred when a portfolio was balanced to align with organizational business strategy and the desired combination of short and long-term payoffs. They found several trends occurred on IT asset spending:

Firms investing more intensively in *Strategic* IT, to position the firm for growth, were adopting a high risk/high return strategy with a failure rate of about 50%, but their successes could put the company several years ahead of competitors. Strategic IT investments were lower risk if they were enhancements or modified existing products.

Firms investing more heavily in *Informational* systems had higher quality information and higher margins.

Companies which invest more heavily in *Transactional* systems than their competitors had higher productivity (sales per dollar of assets) and lower costs. Weill estimates transactional investments return 25-40% per IT dollar.

IT *Infrastructure* investments were often more extensive and costly, and would lead to lower profitability in the year of investment. Infrastructure investments could reduce long-term firm expenses through standardization, providing a platform for delivering firm-wide initiatives and enabling future IT initiatives, and could reduce time to market for new business initiatives (Weill and Aral, 2004).

Weill and Broadbent found that there were four views of IT Infrastructure, and that most organizations used different views at different times: 1) no firm-wide infrastructure where each unit operates independently, 2) the Utility view, where infrastructure spending is for clear cost savings, 3) the Dependent view, where Infrastructure spending

is driven by the current business strategy, such as customer service (this view was predominant, and applied to 40% of firms), and 4) the Enabling view, where Infrastructure is a core competence in the organization and increases strategic options (Weill and Broadbent, 1998).

The CISR studies also found that top performers in each industry spent 4% more on IT, but had similar portfolios (Weill and Aral, 2004). Organizations with superior IT governance, a system with defined decision rights and accountability for IT, earned at least 20% higher profits than organizations with poor governance (Weill and Ross, 2004).

Other characteristics found for top performers were a high use of IT for communication (e.g., email, intranet, wireless), a high degree of digitalization of repetitive transactions (sales, customer interaction and purchasing), an extensive use of the Internet (for sales force management, employee performance measurement, training, post-sales customer support), high IT skills in the staff and an adequate market supply of highly skilled IT personnel, and business management involvement with senior staff commitment and a partnership between business units and IT staff. IT savvy firms achieved higher performance in all four asset classes; so IT management skills and attention may be a key factor in organizational success (Weill and Aral, 2004).

As much as IT portfolio management appears to be mathematically-based, Weill and Ross assert that it must rely on the human factor. If key stakeholders are not

identified and convinced of the personal benefits to them of the portfolio approach, the process will not be successful (Weill and Ross, 2004).

The true power of IT infrastructure, according to Weill and Broadbent, is its "reach and range." Reach is the physical connectivity of the IT platform (the locations and people that the infrastructure can connect) and Range is the functionality of what business operations can be shared automatically and seamlessly across each level of reach (Weill and Broadbent, 1998).

Although the majority of the 1508 organizations studied were private sector firms, 74 were from nonprofit organizations, which included charities, private schools, and local, state or Federal Government organizations. For nonprofits, Weill and Ross (2004) noted that IT consumed an average of 8.4% of annual budgets, a number which was similar to for-profit firms. Nonprofits, which must deal with different stakeholders, have different measures of success and different cultures than private sector firms and have worse governance performance, probably because their strategic objectives are more complex. In government organizations, which are often information-based with IT as a key infrastructure, political stakeholders provide resources and oversight. There are also different definitions of performance in achieving an organizational mission and providing public value, and the culture includes more use of committees, the need for transparency, and acceptance of longer timeframes between communication and implementation of new procedures. In addition, the largest organizational units get the most attention and have most influence on decisions (Weill and Ross, 2004).

Weill also looked at cost-focused and agility-focused firms to compare their IT portfolio investments. Weill and Aral noted that cost-focused firms spent less than average on Strategic, Informational, and Infrastructure, and significantly more on Transactional investments. Agility-focused firms spent more on Strategic, less on Informational and Transactional, and slightly more on Infrastructure investments, as shown in Table 7 (Weill and Aral, 2003).

Table 7: IT Investment Averages for Private Companies by Mission

IT Investment Averages for Private Companies by Cost-focused and Agility-focused Missions			
Four Categories of IT Investments	**Average Agency**	**Cost Focused**	**Agility Focused**
Innovation	13%	5%	17%
Management Support	20%	13%	14%
Process Automation	13%	40%	11%
Infrastructure	54%	42%	58%
IT Dollars as a Percentage of Overall Agency Budget	Average	10-20% Lower than Average	10-25% Higher than Average

Source: P. Weill & S. Aral, "managing the IT Funding (Update Circa 2003)", Center for Information Systems Research, MIT Sloan School of Management, March 2003.

After looking at the previous research into IT portfolio management and its relationship with organizational performance, our study will next focus on extending Peter Weill's private industry research into the Federal Government.

Chapter 3 – Research Methodology

3.1 Methodology and Research Plan

This research was designed to improve understanding of the connection between Federal Government agency IT investment strategies and agency performance. It adapts a private sector research model on organizational performance and IT investment portfolios developed by the Massachusetts Institute of Technology Center for Information Systems Research (MIT CISR) to U.S. Federal Government agencies. Adaptations were made in nomenclature and definitions of investment categories due to disparities between private sector (financial) and public sector (mission achievement) primary goals and measures of performance.

Quantitative analysis was used to define relationships in two categories: (1) for agency performance and IT investments in the selected agencies as a whole, and (2) for agency mission and IT investments in cost-focused and agility-focused agencies. Agency mission categorizations were established from agency website mission statements. The two mission foci of cost and agility were selected to enable further comparison with private sector results determined from MIT CISR empirical studies of cost-focused and agility-focused corporations in the private sector.

The background research initially involved the exploration into the concept of organizational performance in the private and public sector. Origins, constraints and decision makers were examined and compared in both sectors and research was

specifically sought for Federal Government agency performance. Next, research was conducted on IT investment strategies for both the private and public sectors. This exploration included an examination of the origins and expansion of portfolio theory, from Markowitz' investment portfolio, to McFarlan's application of investment portfolios to IT investments, and progressive iterations of IT investment portfolio research. IT portfolio research conducted at the Massachusetts Institute of Technology Center for Information Systems Research was analyzed and IT investment allocation and organizational success as they relate to a company's strategic goals within their industry was studied. Peter Weill, from the MIT CISR, noted that there could be parallels between the public sector and the financial industry in their IT asset allocation portfolios (Weill and Aral, 2003), which prompted this research.

Data from the OMB Program Assessment Rating Tool (PART) and IT Investment Portfolio Reports (Exhibit 53) was used in this study. The PART was submitted each year by agencies to the President, Congress, and the public with audited financial information and an assessment of program results achieved through 2008. Information from the PART shows agency key mission-focused programs and their performance ratings, which allowed the ranking of agencies into "higher performing" and "lower performing" tiers, according to their quantified results in achieving successful programs. The nine highest performing agencies and the nine lowest performing agencies were compared in terms of their IT investment allocations. Over 1000 programs were analyzed from the PART data, with these programs representing 98% of the Federal Government's budget (United States. Office of Management and Budget.

http://www.whitehouse.gov/omb/expectmore/about.html). The most current year the PART data was reported was 2009, showing program budgets for fiscal years 2008 and 2009.

For the Exhibit 53s, over 7,200 IT investments were analyzed for thirty-one agencies. IT investments were allocated into the four categories of Infrastructure, Process Automation, Management Support and Innovation according to agency descriptions and categorization. Agency IT investment allocation percentages in each category were compared with the higher performing and lower performing agencies determined from the PART. IT investment data for agencies with a cost focus, such as the General Services Administration or an agility focus, such as the Department of Defense, were also disaggregated and compared within each focus, to develop and confirm trends. In order to account for IT project investment spikes as well as possible lag time in returns, the analysis looked at two-years of data from fiscal years 2008 and 2009.

All the Federal Government agencies that had publicly available PART data (agency program assessment submissions) and publicly available Exhibit 53 data (official IT expenditure reports on all information technology investments) were selected as part of this study. The Office of Management and Budget agency PART data was not available, with only two reporting lines in their Exhibit 53, and OMB data was therefore discarded from the study. Similarly, the Social Security Administration and the Smithsonian each had only two programs assessed through the PART process and the

National Archives and Records Administration only had three, leaving twenty-seven Federal Government agencies in the study with sufficient PART and Exhibit 53 results.

3.2 Data Requirements

Five data requirements were established for this research: data must be available, accurate and reliable, consistent, current, and comprehensive.

The first requirement was that data must be available and in the public domain. Agencies such as the National Security Agency, which do not publish this information publicly for national security reasons, were not included in this study.

Second, data must be accurate and reliable. This research used information that was mandated annually by the OMB and certified by either the CIO or a representative of the CIO for each agency.

Third, data must result from consistent criteria among all the agencies. For program evaluation in the PART, agencies selected their largest programs to be evaluated, and all were evaluated using the same measuring processes directed and applied by the OMB. For IT investments in Exhibit 53, agencies listed all their IT investments, and categorized them systematically and numerically according to OMB guidelines.

Fourth, data must be current. The most recent available evaluations, which were published in 2009 based on 2008 data, were used for the PART data, and the Exhibit 53 included fiscal years 2008 and 2009, also published in 2009.

Fifth, data must be comprehensive. The PART program data on Federal Government agency performance covers 98% of the published Federal budget (United States. Office of Management and Budget. Expectmore.gov website. http://www.whitehouse.gov/omb/expectmore/about.html). Exhibit 53 data includes all of the IT investments of the thirty-one agencies studied as certified by their Chief Information Officers, with the exception of any classified national security data.

3.3 Agency Selection

Federal Government agencies in this study were selected for comparative purposes if both publicly available performance data and IT investment data were available. Twenty-seven agencies were found that met these criteria, and are listed alphabetically in Table 8. The cost and agility-focused agencies were selected based on their missions as presented on their websites. See Appendix 1 for a listing of agency mission statements.

Table 8: Agencies Evaluated for this Study

Twenty-seven Agencies Evaluated in this Study	
Department of Agriculture Department of the Air Force Department of the Army Department of Commerce Department of Defense - Other Department of Education Department of Energy Department of Health and Human Services Department of Homeland Security Department of Housing and Urban Development Department of the Interior Department of Justice Department of Labor Department of the Navy	Department of State Department of the Treasury Department of Transportation Department of Veterans Affairs Environmental Protection Agency General Services Administration National Aeronautics and Space Administration National Science Foundation Nuclear Regulatory Commission Office of Personnel Management Small Business Administration US Agency for International Development US Army Corps of Engineers – Civil Work

3.4 Data Collection Procedures

Data was collected through publicly available archival data retrieved through Internet research. Program performance data was comprehensively available for the PART through the Office of Management and Budget Executive Branch website, and selectively confirmed at agency websites. Exhibit 53 information for agency IT investments was found through the Office of Management and Budget website for Circular Number A-11. Budget information was obtained from the Government Printing Office budget website. US Government website availability and content is fluid, and currently IT investment data can be found through the IT dashboard site, http://it.usaspending.gov/ which was established in early 2010.

3.4.1 Data for Agency Performance

The private sector quantitatively determines organizational performance by measuring profit, increase in market valuation, and productivity, all measures which allow comparisons among organizations. Comparative and objective public sector Federal Government information is limited. Agencies perceive themselves as unique in mission and resources, both of which are dictated by Congress with changing political environments and politically determined budgets, and are reluctant to be part of intra-agency comparisons.

In 1993, Congress passed the Government Performance and Results Act (GPRA) to establish a framework for department and agency performance reporting. It required Federal agencies to identify goals on both annual and long-term bases, collect performance data and use this data to justify budget requests. The OMB has responsibility to annually review government performance. In January 2011, the President signed into law the GPRA Modernization Act of 2010 requiring more thorough and frequent agency reports (United States. Library of Congress. GPRA Modernization Act of 2010).

The Program Assessment Rating Tool (PART) was developed in 2004 as an annual agency report which evaluates each agency's key programs as to their purpose, performance, measurement and results across a common matrix. The PART is a questionnaire-based assessment tool to provide accountability and improve the

performance of Federal Government agencies and their programs. The government definition of a program is "an activity or set of activities intended to help achieve an outcome that benefits the public" (http://www.whitehouse.gov/omb/expectmore/faq.html#005). Note that agency programs reflect activity across the agency, and not exclusively IT programs.

By design, the PART has historic agency data on listed programs that reflect the latest evaluations, including any reassessments. It was initiated in 2004 with approximately one-fifth of agency programs rated each year until the PART reflected all 1017 programs in 2008.

The PART questionnaire aims to objectively and uniformly evaluate the purpose and design of programs and measure their performance to improve program effectiveness. It attempts to identify program strengths and weaknesses and provide decision-makers with information to help in legislative, funding and management decisions. The PART requires data-supported conclusions, derived from a consistent series of analytical questions which "allows programs to show improvement over time, and allows comparisons between similar programs" (United States. Office of Personnel Management. Annual Performance Report Fiscal Year 2008). Approximately one-fifth of the programs were initially evaluated every year and added to the database. Although the PART can give guidance on budget considerations, funding decisions for programs that do not demonstrate effectiveness depend on several factors, including national security needs.

There are seven PART categories: Direct Federal, Competitive Grant, Block/Formula Grant, Regulatory, Capital Assets and Service Acquisition, Credit, and Research and Development. These Categories are further explained in Appendix 2.

The PART questionnaire asks twenty-five questions specific to the category of each program, and must be documented with certified data. Agencies have some flexibility in choosing methods of evaluation, which must be approved by the OMB. Sample questions from the OMB website include:

> Is the program designed to have a significant impact in addressing the intended interest, problem, or need?
>
> Are Federal managers and program partners (including grantees, sub-grantees, and contractors) held accountable for cost, schedule, and performance results?
>
> Has the program taken meaningful steps to address its management deficiencies?
>
> Does the program have a limited number of specific, ambitious long-term performance goals that focus on outcomes and meaningfully reflect the purpose of the program?
>
> Does the program (including program partners) achieve its annual performance goals?

There are four areas of assessment: Purpose and Design (legitimacy and clarity of the program's purpose and design), Strategic Planning (validity of annual and long-term goals for program), Management (financial oversight and efforts to improve programs) and Results and Accountability (accuracy and accountability). A numeric score is derived from each of the four areas of assessment, ranging from 0-100, with 100 being the best. These numbers determine one of four qualitative ratings: Effective (85-100), Moderately Effective (70-84), Adequate (50-69), or Ineffective (0-49). If a program is not measured by acceptable performance measures or does not yet have performance data, a rating of Results Not Demonstrated is given. Programs may be reassessed after corrective actions are completed to improve their ratings (United States Government. OMB. http://www.whitehouse.gov/omb/expectmore/faq.html#005)

Of over 1000 programs rated, the 2009 cumulative distribution of scores included: Effective (19%); Moderately Effective (32%); Adequate (29%); Ineffective (3%); Results Not Demonstrated (17%) (www.whitehouse.gov/omb/expectmore/faq.html#005).

The following table shows the PART rating system, taken from the whitehouse.gov website:

Table 9: PART Rating System

PART Rating System	
Effective	This is the highest rating a program can achieve. Programs rated Effective set ambitious goals, achieve results, are well-managed and improve efficiency.
Moderately Effective	In general, a program rated Moderately Effective has set ambitious goals and is well-managed. Moderately Effective programs likely need to improve their efficiency or address other problems in the programs' design or management in order to achieve better results.
Adequate	This rating describes a program that needs to set more ambitious goals, achieve better results, improve accountability or strengthen its management practices.
Not Performing	Programs categorized as Not Performing have ratings of Ineffective or Results Not Demonstrated. 20 percent of assessed programs are Not Performing.
Ineffective	Programs receiving this rating are not using your tax dollars effectively. Ineffective programs have been unable to achieve results due to a lack of clarity regarding the program's purpose or goals, poor management, or some other significant weakness.
Results Not Demonstrated	A rating of Results Not Demonstrated (RND) indicates that a program has not been able to develop acceptable performance goals or collect data to determine whether it is performing.

From www.whitehouse.gov/omb/expectmore/faq.html#005

Programs are measured on outcome, output and efficiency measures. *Outcome* refers to external results which affect the public or other beneficiaries, and reflects the program's goal. An *output* is internally focused, such as product or a service delivered, and reflects how the program is achieving its goal. *Efficiency measures* reflect how well a program achieves results, relative to an input such as cost. Many of the programs measure outputs, such as number of people served, versus outcomes, or results of the program. Although results are what the government attempts to measure, not all programs can collect this information on an annual basis.

Agencies are given flexibility in determining evaluation techniques on the effectiveness of their programs, with randomized controlled trials being recommended where appropriate.

An example of a published PART form is shown in Appendix 3.

This study evaluated Federal Government agencies using the 2008 PART, which includes data on 1017 programs which have been assessed and updated since the initial PART in 2004, representing 98 percent of the published Federal budget (United States. OMB. "The FY 2008 Performance Report", 2009). The 2008 reporting year was selected in order to be able to evaluate the maximum number of programs, and the two-year mean was used to establish weighted scores for program size in each agency. Using these numbers, agencies could be rank ordered as to the effectiveness of the programs they self-described as most important to their agency mission, using cluster analysis in performance categories of "higher performing" (top third of grouped agencies) and "lower performing" (bottom third of grouped agencies).

The scores given Program Purpose and Design (20%), Planning (10%), Management (20%) and Results (50%) (www.whitehouse.gov/omb/expectmore/faq.html#005) for each program were added with their corresponding weights to determine the overall PART score for the program. Although this same overall program score was generated for each program by OMB, it was not published on the public website and had to be recalculated.

3.4.2 Data for IT Investment Allocations

The 1996 Information Technology Management Reform Act, known as the Clinger-Cohen Act, required agencies to improve the productivity, efficiency and effectiveness of

Federal agencies by linking planning and investment strategies and IT portfolio management to the Federal budget process. Each agency is required to create capital IT asset portfolios and review them to determine if a project is well-planned and meets cost, schedule and performance goals planned for the investment, is still attainable, and has a high benefit/cost ratio compared with other investments in the portfolio. Exhibit 300 describes capital asset plans and business cases specifically for major investments, including the planning, budgeting, acquisition, and management of capital assets. Exhibit 53 provides details for both major and non-major investments. Because of its comprehensiveness, Exhibit 53 was chosen as a source to evaluate all IT investments, both major and non-major, and can be used to compare IT information from different agencies using the same standards.

Exhibit 53 is designed to assist agencies in selecting investments to improve the management of all IT programs, understand the amount spent on IT modernization and support of legacy systems, and encourage inter-agency cooperation to eliminate redundant and non-productive IT investments. It encourages agencies to focus IT spending on high priority modernization initiatives, manage major IT investments within 10% of cost, schedule and performance objectives, and protect the security of information systems (United States. Office of Management and Budget. Section 53, 2008). Exhibit 53 information is required annually, certified by the Chief Information Officer (CIO) of each agency, is reported within concurrent time frames, and is published as part of the Federal budget.

IT investment allocation data for this research was taken from the 2008 IT Investment Portfolio Report (Exhibit 53), which included the 2008 budget and 2009 projected budget. The study used the mean of two reporting years to better accommodate any spikes in one type of investment in a given year and to mediate the effects of front-loading IT investment costs. Over 7200 17-digit coded investments in a total of 31 Federal Government agencies were allocated, based on project descriptions and codes, according to the four investment allocation categories of Innovation, Management Support, Process Automation, and Infrastructure, as defined in Table 11. These categories are similar to Weill's categories of Strategic, Informational, Transactional, and Infrastructure, but adapted to better describe Exhibit 53 categories in terms of government requirements.

The Exhibit 53 coding process begins with a breakdown of IT investments by agency and department. Investments are categorized in six major categories: Mission Area Support; Infrastructure, Office Automation and Telecommunications; Enterprise Architecture and Planning; Grants Management Systems; Grants to State and Local IT Investments; and National Security Systems. Next, investments are divided by agency-specific mission areas, and then by type of IT investments: major, non-major, migration investments and joint investments with other agencies. Then they are disaggregated into specific IT investments, and finally labeled with other attributes, such as whether the investment is a total investment, the first time an agency is reporting this investment, or an e-gov project, and includes the funding source, risk level, or specific initiative.

Table 10 explains the numerical coding system for Exhibit 53, and a sample of the Exhibit 53 is located in Appendix 4.

Table 10: Exhibit 53 Numerical Coding System

The coding in Columns 1 and 2 for Exhibit 53 use a 17 digit system in the form of

xxx-xx-xx-xx-xx-xxxx-xx

In analyzing IT investments, this code is a good starting point, along with the investment title in Column 3 and the Investment Description in column 4. A brief explanation of what these codes mean, taken from the OMB Circular No. A-11 (2008), follows:

The first three digits refer to the agency, and the second two digits to the bureau or department. The next set of two digits refer to categories of IT investment represented in the exhibit:

01 = Mission Area Support
02=Infrastructure, Office Automation, Telecommunications
03=Enterprise Architecture and Planning
04=Grants Management Systems
05=State and Local Grants
06=National Security Systems (Defense Only)

The third set of two digits refers to agency-specific mission areas.
The fourth set of two digits represent the type of IT investment:

01= Major
02=Non-major
03=IT migration investment portion of a larger asset which already has an existing business case.
04=Joint IT investment with partner agency

The four digit number identifies a specific IT investment.
The last two digits indicate the investment category:

00=used for total investment, or the first time an agency is reporting this investment
24= refers to E-Gov initiatives
04= Funding source or appropriation
07=High-Risk project as part of a larger investment
09=Any subtotal

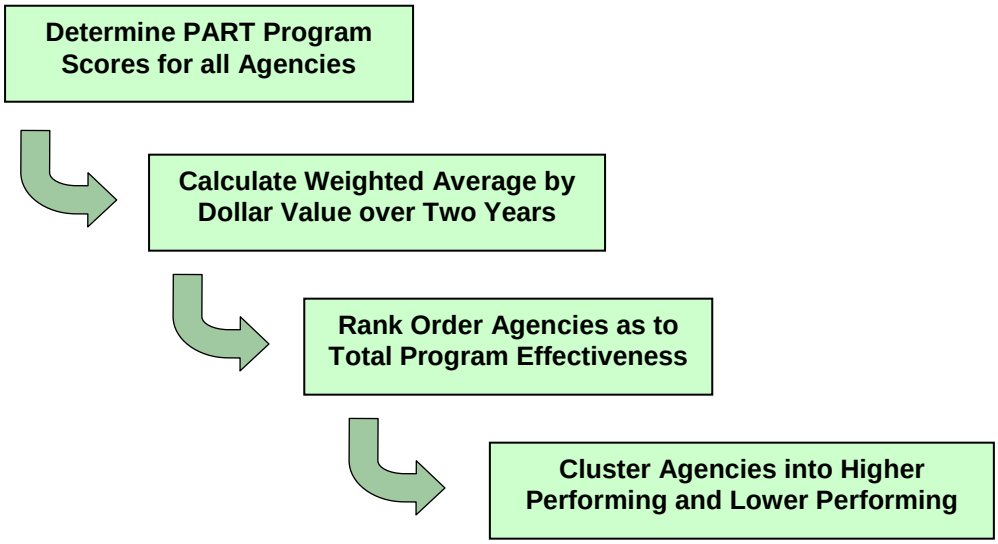
From OMB, Section 53 – Information Technology and E-government

3.5 Quantitative Analysis Process

3.5.1 Quantitative Analysis Process for Organizational Performance

The quantitative analysis process for organizational performance involved evaluation and classification of agencies into three performance categories as determined by PART scores. Each of the 958 programs in the twenty-seven agencies received a score by OMB from 0 to 100%. Hierarchy indexing weighting procedures were used, similar to those employed by Oh and Pinsonneault (2007) in their study of the strategic value of information technologies. The weighted average of the size of the programs as measured by the average of the dollar value of the programs over two fiscal years was used. For example, if a program was worth $100 million per year on average for the two years and the entire agency's budget for all evaluated programs averaged $1 billion per year over the two years, the score for that program was worth 10% of the agency's total performance score. If a program for the same agency was only worth $10 million per year over the two years, it would only be worth 1% of the agency's performance score. Figure 7 illustrates the Quantitative Analysis Process used for evaluating organizational performance.

Figure 7: Quantitative Analysis Process for Organizational Performance



Agencies were evaluated as to their PART program scores on the effectiveness of the programs they self-described as most important to their agency mission. Each of the 958 programs in the final 27 agencies studied received a score by the OMB. Using the two-year mean to establish weighted scores for program size, agencies were rank ordered, using cluster analysis, into performance categories of "higher performing" (top third of grouped agencies) and "lower performing" (bottom third of grouped agencies).

3.5.2 Quantitative Analysis Process for IT Investments

The quantitative analysis process for IT investments involved evaluation and classification of investments according to their descriptions in Exhibit 53. Evaluation and classification can be problematic, but previous studies have dealt with IT data

classification successfully. Weill and Aral (2003) classified investments from 147 firms into the four categories of Informational, Strategic, Transactional and Infrastructure; Dehning, et al (2003) classified over 350 investment announcements into three categories of Automate, Informate and Transform, and Pinsonneault and Kraemer (1997) categorized over 500 IT applications into three classifications of control, coordination and efficiency.

Paralleling Peter Weill's work with the MIT CISR, IT investment categories were determined, with adjustments made for Federal Government and public sector requirements. As an example, strategic investments in Weill's model were designed to develop new business products and gain competitive advantage in the private sector. For the public sector, an investment was classified as innovative if it provided a new service or major innovation that impacted external stakeholders. The IT investment categories used in this analysis are listed in Table 11, below, along with a definition and examples. In reality, individual investments often span two or more of these categories, and can change over time, as Infrastructure investments are retired and Innovation investments become accepted as mainstream. A decision to put an investment into a particular category was based on the weight of two factors, the investment description and how the CIOs certified their categorization, according to their investment codes. Table 11 illustrates the four categories of IT investments, along with specific examples for each category.

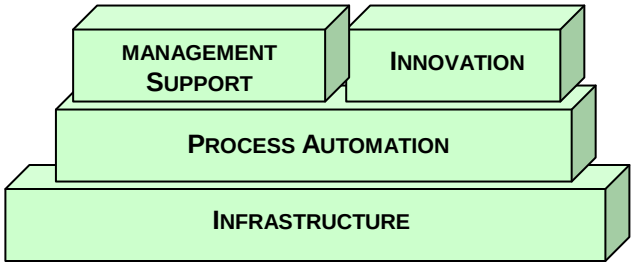
Table 11: Federal Government Agency IT Investment Categories

Federal Government Agency IT Investment Categories	
Innovation	**Innovation** investments provide a new service or major innovation that impacts external stakeholders. Examples include the e-Grants portal, giving citizens one central location from which to access Federal Government grant information; the Veterans Administration E-Gov Benefits program, providing a single point of access for citizens to locate and determine potential eligibility for government benefits; and the Army's Force XXI Battle Command, Brigade and Below information system, a new graphical information system to report battlefield vehicle locations more quickly and accurately than previous reporting methods.
Management Support	**Management Support** investments provide information to employees to improve accounting, management, reporting, communication, collaboration, or analysis. This would include the DoD's Defense Enterprise Accounting and Management System, a financial management system designed to modernize internal accounting systems, and the Department of State's Treaty Information Management System which makes treaty data more accessible to employees.
Process Automation	**Process Automation** investments cut costs or increase throughput for the same cost in organizational operations, often through automating existing operations. Examples include the National Institute of Health Electronic Research Administration System which automates formerly paper-based functions in grant administration, the Department of Labor PeoplePower system which integrates all human resources processes to one system, and the Defense Travel System which automates travel authorization and vouchering, previously a manual, labor-intensive process.
Infrastructure	**Infrastructure** investments are shared resources used by multiple applications (e.g., servers, networks, desktop computers and customer databases), and comprise a substantial proportion of IT investments.

In Figure 8, these investment categories are illustrated as interdependent Building Blocks of IT. Infrastructure is at the base and provides support for all other IT investments. At the next level, Process Automation investments, which often automate existing procedures for cost-cutting purposes, rely on a solid base of Infrastructure, but also symbiotically relate to both Management Support and Innovation investments. Management Support investments improve communications and operations within an agency, and rely both on a solid Infrastructure base and Process Automation investments. Innovation investments, the high risk/high potential investments providing new services

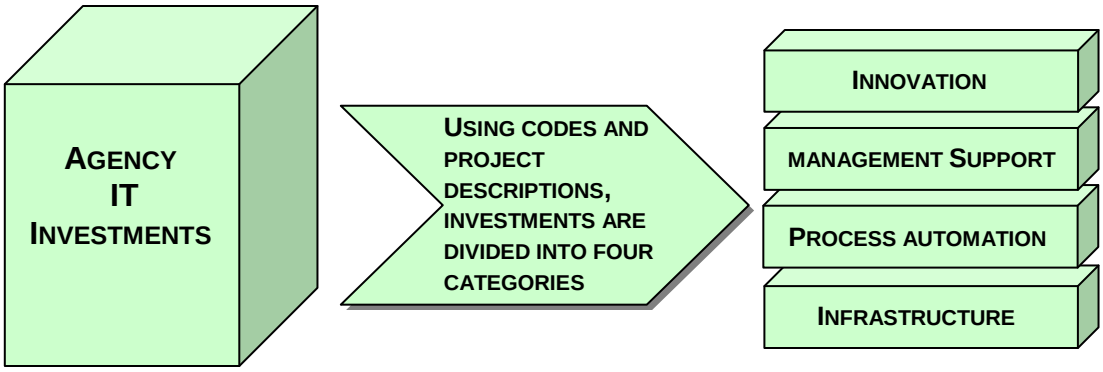
for stakeholders, rely both on Infrastructure as a shared base, and Process Automation investments to improve cost effectiveness.

Figure 8: Interdependent Building Blocks of IT Investments



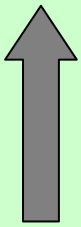
The following diagram explains the process used to disaggregate data on IT investments in each agency into the study's established categories of Innovation, Management Support, Process Automation and Infrastructure.

Figure 9: IT investment Categories



IT portfolio investments have been compared to financial portfolios in their allocation and risk level (Maizlish and Handler, 2005). The following table illustrates our four investment categories, related risks and returns, and a parallel to financial portfolios.

Table 12: IT Portfolio Risk and Return Summary

IT Portfolio Risk and Return Summary			
Greater Risk  Less Risk	**IT Investments**	**Risk and Return Elements**	**Parallels to Personal Financial Statement**
	Innovation	Highest risk	Emerging Markets
	Infrastructure	Some risk because of high upfront costs, long life, and technical outdating	Real estate
	Management Support	Some risk because of difficulty turning information into financial gain	S & P stocks
	Process Automation	Low risk – usually correlates to lower operational costs	Bonds or cash

Adapted from Maizlish and Handler, 2005

3.5.3 Quantitative Analysis Goals

Below is a description of each study hypothesis and related analysis performed.

Table 13: Hypotheses and Analysis Performed

Hypotheses and Analysis Performed	
Hypothesis	**Analysis Performed**
Hypothesis 1 – Higher performing Federal agencies invest their IT assets differently than lower performing Federal agencies	Higher performing and lower performing agencies were statistically compared as to their IT asset allocations in an attempt to prove the null hypothesis: Higher performing Federal agencies invest their IT assets the same as lower performing Federal agencies.
Hypothesis 2 – Cost-focused Federal agencies invest their IT assets differently than agility-focused Federal agencies	Cost-focused and agility-focused agencies were statistically compared as to their IT investment allocations in an attempt to prove the null hypothesis: Cost-focused Federal agencies invest their IT assets the same as agility-focused Federal agencies.

3.5.4 Analysis Procedures

To prove the first hypothesis, that higher performing Federal agencies have different IT investment strategies than lower performing agencies, the data was first analyzed to determine whether the distributions were normal. This evaluated data comprised the percentage allocations of the IT investments into the four IT investment categories, Innovation, Management Support, Process Automation and Infrastructure, for the nine higher performing Federal agencies and the nine lower performing agencies. Data was analyzed using the statistical software Minitab 15. Since normality could not be proven for Innovation, Management Support and Process Automation investments for either the higher performing agencies or the lower performing agencies, the nonparametric Mann-Whitney test was used for further analysis. Infrastructure investments were found to have a normal distribution, so they were evaluated using the two-sample T-test.

The two-sample Mann-Whitney test, also called two-sample rank or two-sample Wilcoxon rank sum, makes inferences about the difference between two population medians based on data from two independent, random samples. The three assumptions of the Mann-Whitney test are that the two samples are randomly and independently drawn, the dependent variable is intrinsically continuous, capable of producing measures carried out to the nth decimal place and that the measures within the two samples have the properties of at least an ordinal scale of measurement, meaning the data can be rank ordered (Minitab 15 Tutorial, 2007). The Mann-Whitney test is a nonparametric alternative to the two-sample T-test. A 95% confidence interval was used.

To prove the second hypothesis that cost-focused Federal agencies have different IT investment strategies than agility-focused agencies, the data was again analyzed in Minitab 15 to determine whether the distributions were normal. The data included the percentage allocations of the IT investments into the four IT investment categories, Innovation, Management Support, Process Automation and Infrastructure, for the six cost-focused Federal agencies and the nine agility-focused agencies. Since normality could be proven for Innovation investments in both groups, the two-sample T-test was used in comparing Innovation investments. The two-sample Mann-Whitney test was used to compare the other investments, because their normality could not be proven for both higher and lower performing agencies.

The results of all statistical testing are listed in Chapter 4, Results.

3.6 Reliability and Limits of the Data

Data from both the PART and the Exhibit 53 were obtained from official public U.S. Government reports. Each agency's report is required by law annually and must be verified by agency leadership. The statistical results were limited to 27 Federal agencies. This research found trends which were consistent throughout each of the Federal Government agency categorical comparisons studied and were similar to trends Weill found in the private sector.

It can be argued that two years of data from Exhibit 53s is not enough, since the effects of IT investments may lag behind implementation, and therefore need a longer time frame. Rai, Patnayakuni and Patnayakuni, however, note that IT investments may have less of a lag effect than capital investments due to the accelerated rate of IT obsolescence. They further note that more than 80% of an organization's IT expenditures are for current operations, and the depreciation of new hardware further dilutes any investments which would impact any lag time for current performance (Rai, et al, 1997).

There have been complaints that the PART does not accurately measure the focus of the programs, allow flexibility as to the program's mandates, or give credit for any programs that cannot be currently quantified and therefore are awarded a "Results Not Demonstrated" classification (Gueorguieva, et al, 2009). The PART is not a flawless interagency program evaluation tool, but it has advantages for this study in its public availability, verified data, consistent criteria among agencies, multi-year timeframe, allowance for rescoring and updating of programs, and coverage of 98% of the published Federal budget (United States. Office of Management and Budget. Expectmore.gov website. http://www.whitehouse.gov/omb/expectmore/about.html).

Donald Moynihan noted other problems with the PART: 1) OMB examiners may interpret data in different ways, 2) there is ambiguous wording in the assessment, such as "unnecessarily" or "excessively", 3) scores are sometimes dependent on how well an agency can argue with the OMB if they disagree with the rating, 4) the PART can be politically biased towards programs the OMB likes, 5) the rating scale is too simplistic

and does not take into account the complexity of some programs, 6) the PART favors programs with simple, easily-achievable goals, 7) programs providing grants are less successful than other programs, possibly because they have a harder time coming up with easily measurable goals for success, and 8) the PART causes more expense for agencies (Moynihan, 2008).

These are all valid concerns, but Moynihan also states that the OMB defends the PART, saying that it enhances evidence-based dialog by 1) its objectivity being a third party review with definitive measures of program success, 2) the increased emphasis within agencies on performance, 3) its standard of proof for positive evidence versus the absence of failure, where programs are not given benefit of the doubt, 4) the burden of proof is on the agencies, and 5) programs must be evaluated on a regular basis, which keeps the focus on program success (Moynihan, 2008).

3.7 Construct Validity

Since most of the Federal agency IT investment data being evaluated for both hypotheses could not be proven to be normal, the Mann-Whitney test was selected to address the first hypothesis because it is a well-known and accepted nonparametric test for the significance of the difference between the distributions of two independent samples. The three assumptions of the Mann-Whitney test are that the two samples are randomly and independently drawn, the dependent variable is intrinsically continuous,

capable of producing measures carried out to the nth decimal place and that the measures within the two samples have the properties of at least an ordinal scale of measurement (Minitab 15 Tutorial, 2007). The agencies and their dependent variable IT investment data used to address the first hypothesis meet all three assumptions.

Because the Innovation investments for the agility and cost-focused agencies could be shown to be normal, the more widely used two-sample T-test was applied. This test assesses the significance of the difference between the means of two samples, providing that the two samples are randomly drawn from normally distributed populations and that the measures of the two samples are equal-interval. The agencies and their dependent variable IT investment data used to address the second hypothesis meet both requirements.

Chapter 4 – Results

Hypothesis 1 –Higher performing Federal agencies invest their IT assets differently than lower performing Federal agencies

To prove the first hypothesis that higher performing Federal Agencies have different IT investment strategies than lower performing Agencies, the IT investment data was first analyzed to determine whether the distributions were normal. Using the Anderson-Darling normality test in Minitab 15, it was determined that the data could not be shown to be normal for both the higher performing and lower performing agency IT investment variables, Management Support and Process Automation, within a 90% confidence interval. The smaller confidence interval was used because the null hypothesis is that the data is normal. This Anderson-Darling normality test evaluates the null hypothesis (H0) that the data follow a normal distribution. If the p-value for the test is less than the chosen a-level of .10, then H0 must be rejected and conclude that the data do not follow a normal distribution. The Innovation data and Infrastructure data for higher performing agencies, and the Process Automation, Management Support and Infrastructure data for lower performing agencies were shown to be normal with a P value of greater than .10, as indicated in Figures 10 and 11.

Figure 10: Probability Plots of the Higher Performing Agencies

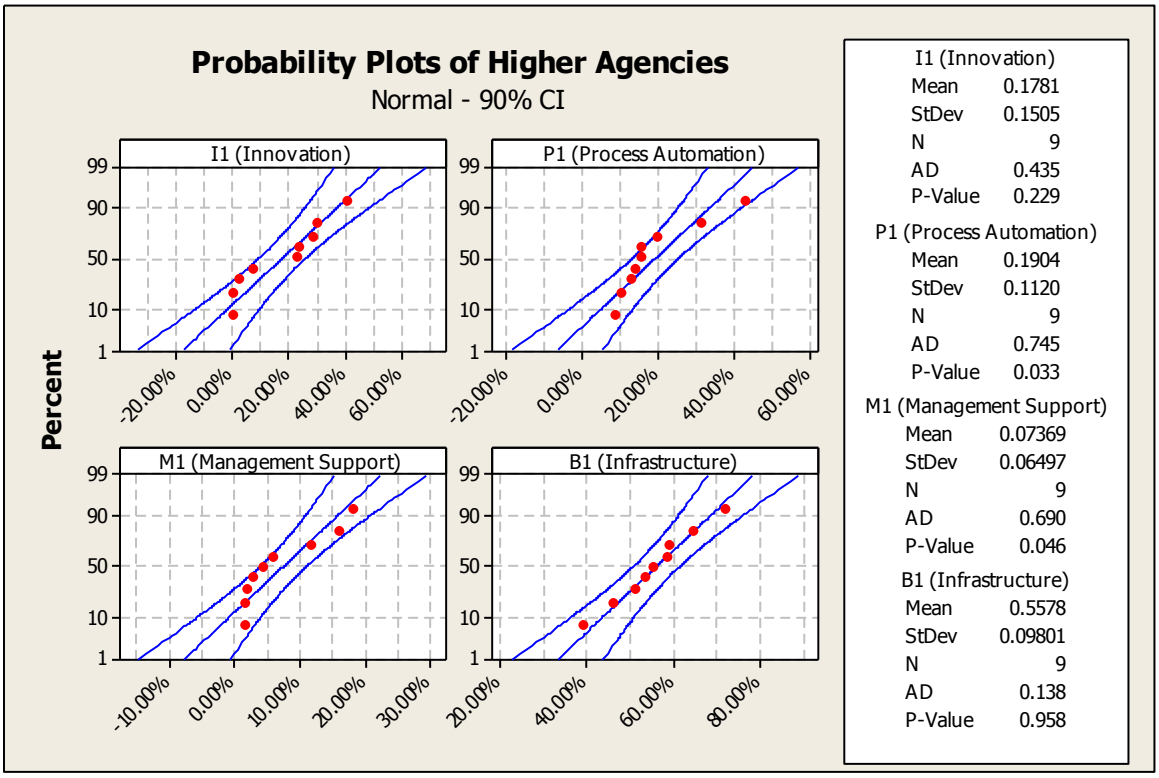
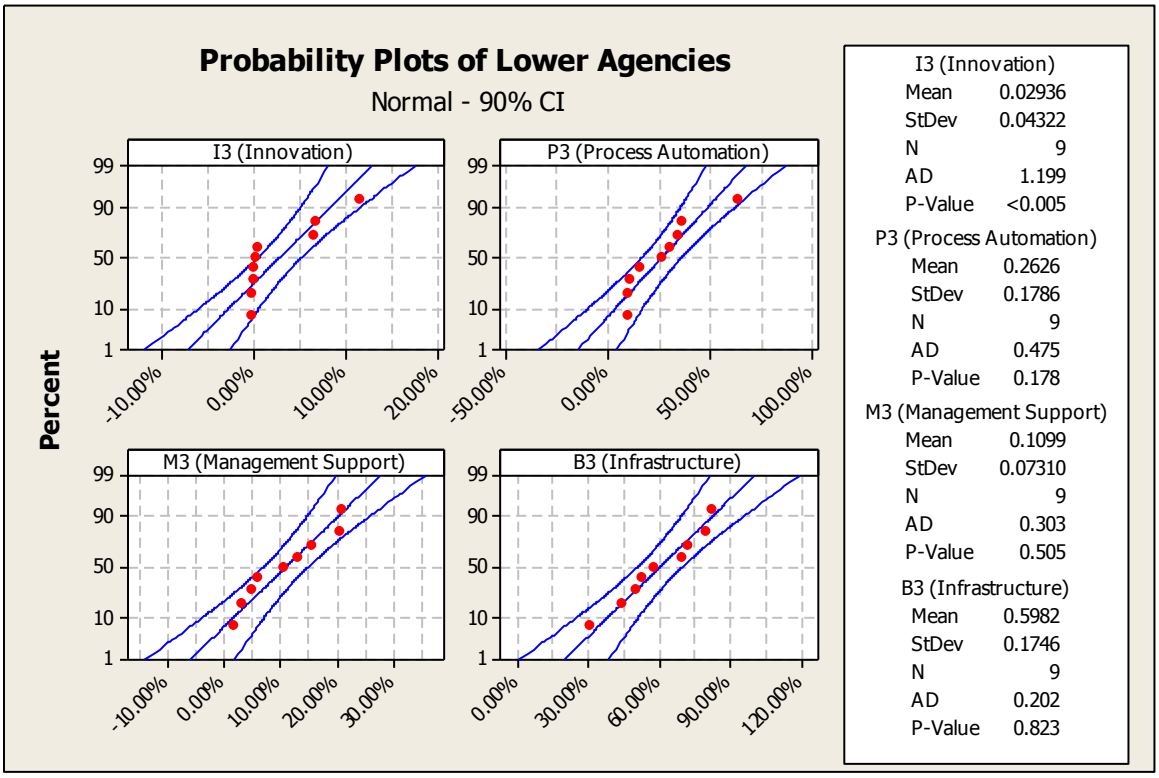


Figure 11: Probability Plots of the Lower Performing Agencies



Since the data could not be shown to be normal for both groups of agencies, except for the Infrastructure data, non-parametric tools were used to test the null hypothesis, that higher performing Federal Agencies have the same IT investment strategies as lower performing Agencies.

Using the Mann-Whitney test from Minitab 15, it was shown that within a 95% confidence interval, Innovation investments are different for the higher and lower performing agencies. Since the Innovation investments are different, the overall portfolios of investments are different. When the Innovation investment data from both the higher and lower performing agencies were compared through the Mann-Whitney nonparametric Test, the resulting P value was .0081, less than the alpha level of .05,

which means the null hypothesis is not supported, and therefore, the nine higher performing agencies invest their Innovation IT assets differently than the nine lower performing agencies. Since the Innovation investments are different, the overall portfolios of investments are different.

Mann-Whitney Test and Confidence Interval: I1 (Innovation), I3 (Innovation)

```
                   N  Median
I1 (Innovation)    9  0.2318
I3 (Innovation)    9  0.0036


Point estimate for ETA1-ETA2 is 0.1723
95.8 Percent CI for ETA1-ETA2 is (0.0061,0.2869)
W = 116.0
Test of ETA1 = ETA2 vs. ETA1 not = ETA2 is significant at 0.0081
```

In summary, using the Mann-Whitney non-parametric test, Hypothesis 1 is proven, higher performing Federal agencies invest their IT assets differently than lower performing Federal agencies. Causal statistical correlations could not be proven, but this research shows relationships between aggregate performance and the IT investment categories.

The study looked at the IT investment breakdown for the means of the nine higher performing and nine lower performing agencies and the mean of all agencies as listed in Table 14. Higher performing agencies spent twice as much as the average agencies and more than six times that of lower performing agencies for Innovation investments and less than average and lower agencies for Management Support and Process Automation systems. Infrastructure investments were slightly higher for lower performing agencies than average. Higher performing agencies invested almost two and a half times more on

IT as a percentage of their overall budget than the agency average and almost three times more than lower performing agencies.

Table 14: IT Investment Means for Agencies by Performance

Mean IT Investments for Agencies by Performance[1]			
Four Categories of IT Investments[2]	**Lower Performing Agencies**	**Average of All Agencies**	**Higher Performing Agencies**
Innovation	3%	8%	18%
Management Support	11%	10%	7%
Process Automation	26%	25%	19%
Infrastructure	60%	56%	56%
IT Spending as a Percentage of Overall Agency Budget[3]	1.87%	2.19%	5.36%

[1]*Performance determined by ranking of PART scores over a two-year period.*
[2]*Agency category distribution determined by Exhibit 53s.*
[3]*Total Agency Budget information for 2008-2009 taken from United States. 2008 and 2009 Budget Numbers from Treasury Table 3*

Hypothesis 2 – Cost-focused agencies invest their IT assets differently than agility-focused agencies

The study next classified cost-focused and agility-focused agencies according to agency mission statements and evaluated their IT investment allocations. Cost-focused agencies (e.g., the General Services Administration) are committed to providing optimum value for taxpayers, while agility-focused agencies (e.g., the Department of Defense and Homeland Security) have a primary objective to meet their changing missions, sometimes regardless of cost.

To prove the second hypothesis, that cost-focused agencies invest their IT assets differently than agility-focused agencies, the appropriate IT investment data was first analyzed to determine whether the distributions were normal. Using the Anderson-Darling normality test in Minitab 15, it was determined that the data could be shown to be normal for both the cost-focused and agility-focused agency IT investment variables, Innovation and Infrastructure, within a 90% confidence interval. The smaller confidence interval was used because the null hypothesis is that the data is normal. This Anderson-Darling normality test evaluates the null hypothesis (H0) that the data follow a normal distribution. If the p-value for the test is less than the chosen alpha-level of .10, then H0 must be rejected and we conclude that the data does not follow a normal distribution. The Innovation and Infrastructure data for cost-focused agencies, and the Innovation, Process Automation, Management Support and Infrastructure data for agility-focused agencies were shown to be normal with a P value of greater than .10, as indicated in Figures 12 and 13.

Figure 12: Probability Plots of Cost-Focused Agencies

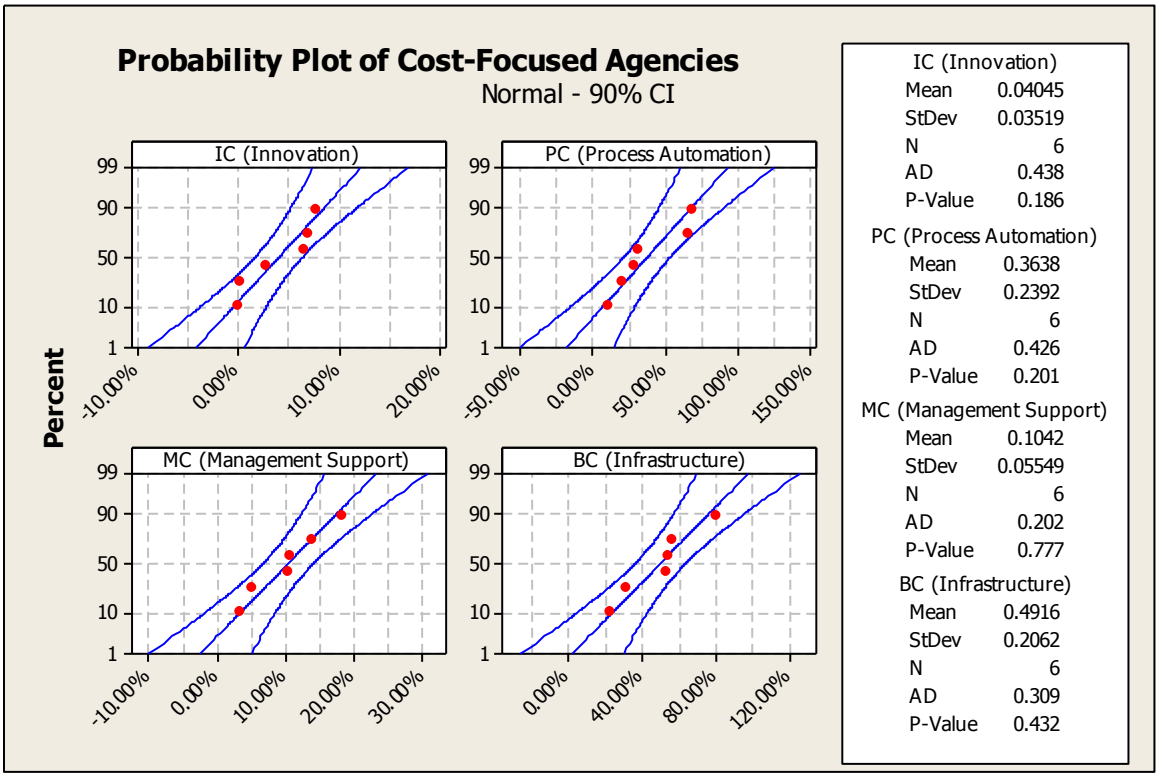
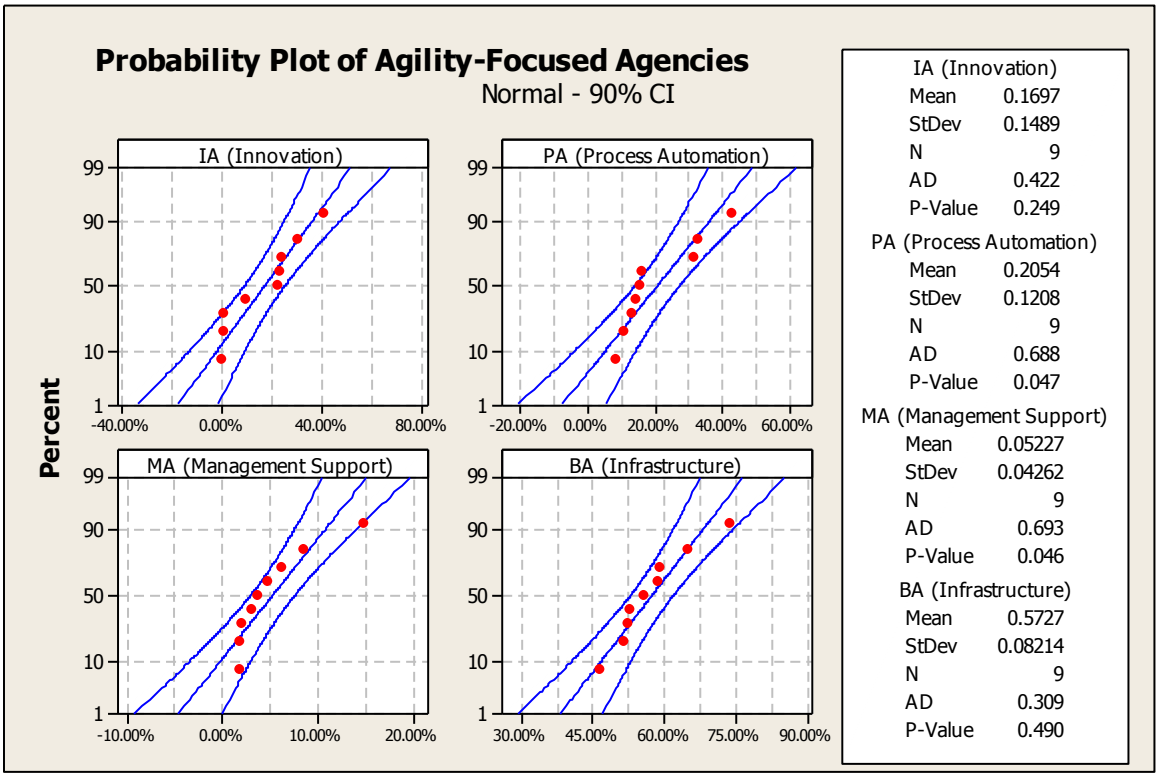


Figure 13: Probability Plots of Agility-Focused Agencies



Since the data was shown to be normal for the Innovation and Infrastructure data, the Two Sample T-Test was used to prove the null hypothesis, that cost-focused Federal Agencies have the same IT investment strategies as agility-focused Agencies.

Using the Two Sample T-Test in Minitab 15, it was shown that within a 95% confidence interval, the null hypothesis could not be proven and Innovation investments are different for cost-focused and agility-focused agencies. Since the Innovation investments are different, the overall portfolios of investments are different. When the Innovation investment data from both the cost-focused and agility-focused agencies were compared through the Two Sample T-Test, the resulting P value was .034, less than the

alpha of .05. The null hypothesis is not supported, and therefore, the six cost-focused agencies invest their IT assets differently than the nine agility-focused agencies.

Two-Sample T-Test and Confidence Interval: IA (Innovation), IC (Innovation)

Two-sample T for IA (Innovation) vs. IC (Innovation)

	N	Mean	St Dev	SE Mean
IA (Innovation)	9	0.170	0.149	0.050
IC (Innovation)	6	0.0405	0.0352	0.014

Difference = mu (IA (Innovation)) - mu (IC (Innovation))
Estimate for difference: 0.1292
95% CI for difference: (0.0124, 0.2461)
T-Test of difference = 0 (vs. not =): T-Value = 2.50 P-Value = 0.034 DF = 9

In summary, using the Two Sample T-Test, Hypothesis 2 is supported; cost-focused agencies invest their IT assets differently than agility-focused agencies. Causal statistical correlations could not be proven, but this research shows relationships between mission focus and the IT investment categories.

The study also looked at the IT investment breakdown for the means of the cost-focused and agility-focused agencies and the mean of all agencies as listed in Table 15. Cost-focused agencies spent less than average on Innovation and Infrastructure as a percentage of overall investment and more than the average for Process Automation. Agility-focused agencies spent greater than twice the average on Innovation investments and less than average for Management Support and Process Automation systems. Agility-focused agencies invested two and a half times as much on IT as a percentage of their overall budget than the agency average and six times as much as cost-focused

agencies, while cost-focused agencies spent less than half of the agency average, again as a percentage of their overall budgets.

Table 15: IT Investment Means for Agencies by Mission

Mean IT Investments for Agencies by Cost-focused and Agility-focused Missions[1]			
Four Categories of IT Investments[2]	**Average Agency**	**Cost Focused**	**Agility Focused**
Innovation	8%	4%	17%
Management Support	10%	10%	5%
Process Automation	25%	36%	21%
Infrastructure	56%	49%	57%
IT Dollars as a Percentage of Overall Agency Budget[3]	2.19%	0.94%	5.64%

[1] *Mission determined from agency websites.*
[2] *Agency category distribution determined by Exhibit 53s*
[3] *Total Agency Budget information for 2008-2009 taken from United States. 2008 and 2009 Budget Numbers from Treasury Table 3*

These results are consistent with those found in private sector studies. Weill and Aral noted that cost-focused firms spent less than average on Strategic (similar to Innovation) investments, Informational (similar to Management Support), and Infrastructure, and significantly more on Transactional (Process Automation) investments. Agility-focused firms spent more on Strategic, less on Informational and Transactional, and slightly more on Infrastructure investments, as shown in Table 7 (Weill and Aral, 2003).

Chapter 5 – Significance and Conclusions

5.1 Significance of the Study

This study uses the theoretical model of IT asset allocation correlated with organizational performance proposed by Weill and Aral (2003). While this model has been used by the MIT Center for Information System Research (CISR) for the private sector and for very limited public sector organizations, its adaptation to the public sector, and specifically to the Federal Government, has not previously been studied. To date there has been limited research for Federal Government performance as compared to corporate performance. This study adds to the research on public sector IT investment portfolio management and organizational performance, and mission orientation and IT asset allocation.

Practical contributions of this study include improved understanding of the role of IT asset allocation in organizational performance in U.S. Federal Government agencies. The motivations behind this study were to improve understanding of Federal Government IT investment strategies using private sector methods. CIOs and other managers can examine the IT asset allocations of their agencies and sub-agency organizations and compare them with higher performing agencies or agencies with similar missions or focus, and evaluate IT investment strategies to determine potential adjustments in their own portfolios. In addition to prescriptive recommendations for agency investments, organizations can use this evaluative tool to assess future investments and better

understand the connection between their investments and organizational performance or mission.

5.1.1 Conclusions with Respect to IT Investments and Performance

This research determines that Federal Government agencies that are most successful in program performance have a different IT portfolio of investments than lower performing agencies. As indicated previously in Table 14, higher performing agencies invest more in Innovation and less in Management Support and Process Automation as a percentage of their total portfolios. This result may be because Innovation investments can set the stage for new services or major agency improvements, or signal that improved IT governance has allowed more of an agency focus on modernization. Higher performing agencies may not place top priorities on simply reducing costs, and therefore not channel their resources into Management Support and Process Automation. Higher performing agencies also invest more in IT as a percentage of their budgets than lower performing or average agencies, possibly indicating a greater management focus on IT as a way to improve agency performance.

5.1.2 Conclusions with Respect to IT Investments and Mission

For cost-focused and agility-focused agencies, the research found, as indicated in Table 15, that cost-focused agencies invest higher than average in Process Automation, lower than average in Innovation and Infrastructure, and lower in IT as a percentage of their overall budget. This is completely consistent with private sector results as summarized in Table 7. Process Automation investments bring immediate cost savings while Innovation and Infrastructure investments increase costs in the short term and may never lead to lower costs long-term. (Weill and Aral, 2003)

Agility-focused agencies have higher than average investments in Innovation, lower in Management Support, and higher IT investments as a percentage of their overall budget. Again, these results are very consistent with the private sector results found in the CISR research (Weill and Aral, 2003). Agility-focused Federal agencies and private firms will invest more in Innovation IT that brings new services to stakeholders and less on Management Support that brings them future cost savings and future profitability.

Table 16: IT Investment Averages for Private Companies/Federal Agencies by Cost-focused and Agility-focused Missions

IT Investment Averages for Private Companies/Federal Agencies by Cost-focused and Agility-focused Missions							
	Private Sector				Federal Agencies		
Four Categories of IT Investments	Average Company	Cost Focused	Agility Focused		Average Agency	Cost Focused	Agility Focused
Innovation	13%	5%	17%		8%	4%	17%
Management Support	20%	13%	14%		10%	10%	5%
Process Automation	13%	40%	11%		25%	36%	21%
Infrastructure	54%	42%	58%		56%	49%	57%
IT Dollars as a Percentage of Overall Budget	Average	10-20% Lower than Average	10-25% Higher than Average		2.9%	.94%	5.64%

Source for Private Sector Data: P. Weill & S. Aral, "Managing the IT Funding (Update Circa 2003)", Center for Information Systems Research, MIT Sloan School of Management, March 2003.

5.2 Conclusions with Respect to Improving Agency Performance

IT investments can be disaggregated, evaluated, refocused, augmented, and discontinued as an appropriate mix of investments is sought. IT investments are as inherently predisposed to change as information technology has changed since Moore's Law proposed the doubling of chip capacity every year. What is innovative at one time, offering the latest in service to taxpayers, soon becomes commoditized and expected, and will be replaced with an improved version. IT investments are by nature dynamic, and headed toward commoditization or replacement.

Some of Weill, Woerner and McDonald's latest private sector research found that Infrastructure spending percentages in the private sector were declining. They proposed several reasons for this: some companies have reduced IT investments due to the economic downturn, there has been more infrastructure consolidation (consolidation of servers, virtual "cloud" storage), greater IT outsourcing, an increase in IT power per dollar (an extension of Moore's Law), and more business outsourcing, where technology to support those services is no longer needed within the company (Weill, Woerner and McDonald, 2009). IT Infrastructure has become a commodity, and Carr notes that "IT is, first of all, a transport mechanism – it carries digital information just as railroads carry goods and power grids carry electricity. And like any transport mechanism, it is far more valuable when shared than when used in isolation" (Carr, 2003).

The future of increased agency performance may well be in sharing more Infrastructure resources, realigning assets and organizational capabilities for greater flexibility and innovation, and reducing technical and security risks.

5.3 Future Considerations

Weill, Woerner and McDonald examined private sector IT investments in the light of the 2008 financial crisis to document how businesses were adapting. They found that private sector IT investments were adjusted in 2009 by the top performing firms, as evaluated by private sector financial standards, and outlined the firm goals and actions

being taken to achieve these goals. This information is edited and included here in Table 17.

Table 17: 2009 IT Investment Adjustments by Top-Performing Private Sector Firms

2009 IT Investment Adjustments by Top-Performing Private Sector Firms	
Goal	Action
To consolidate business operations or have more information for decision-making	They increased Management Support-type of investments
To improve workforce effectiveness	They invested less in Innovative investments and more in Infrastructure
To increase business-IT alignment	They invested more in Innovative investments
To expand the use of information and intelligence	They invested more in Management Support-type of investments and less in Infrastructure
To improve data protection and privacy	They invested less in Automation-type of investments and more in Infrastructure
To implement IT process improvement	They invested less in Innovative investments and more in Infrastructure
To invest more of their IT budget for new business initiatives	They invested more in Innovative and Management Support-type of investments, and less in Automation and Infrastructure

Adapted from Weill, Woerner and McDonald, 2009

The Federal Government is facing a similar economic downturn as Congress pushes to rein in the Federal deficit. Not only should this study be expanded to include sub-agency organizations to see if a larger sample size has an impact on results, but to see if agencies and sub-agency organizations are reacting to the expected funding restrictions in a similar fashion to the highest performing private sector organizations.

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Appendix 1: Agency Mission Statements

Agency mission statements, retrieved from their websites, were used to determine cost and agility focused agencies. The three services, the Departments of the Army, Navy and Air Force support the DoD mission, so their mission statements are not separately listed.

Agency	Mission Statements (taken from websites)
Department of Agriculture	To provide leadership on food, agriculture, natural resources, and related issues based on sound public policy, the best available science, and efficient management. http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?parentnav=ABOUT_USDA&navid=MISSION_STATEMENT&navtype=RT
Department of Commerce	To foster, promote, and develop the foreign and domestic commerce of the United States. http://dms.osec.doc.gov/Cgi/bin/doit.cgi?204:112:f23c40e440fd58af1c94886c8dafe2a0115c34e0e318d0b74b9aa67fc54ea5be:288
Department of Defense	To provide the military forces needed to deter war and to protect the security of our country. http://www.dod.mil/admin/about.html
Department of Education	To establish policy for, administer, and coordinate Federal assistance to education. http://www.ed.gov/about/overview/focus/what.html#whatis
Department of Energy	To advance the national, economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the environmental cleanup of the national nuclear weapons complex. http://www.energy.gov/about/index.htm
Department of Health and Human Services	To protect the health of all Americans and provide essential human services, especially for those who are least able to help themselves http://www.hhs.gov/about/whatwedo.html
Department of Homeland Security	To lead the unified national effort to secure the country and preserve our freedoms. http://www.dhs.gov/xabout/strategicplan/
Department of Housing and Urban Development	To increase homeownership, support community development and increase access to affordable housing free from discrimination. http://portal.hud.gov/portal/page/portal/HUD/about/mission
Department of Interior	To protect and manage the Nation's natural resources and cultural heritage; provide scientific and other information about those resources; and honor its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities. http://www.doi.gov/secretary/mission.html
Department of Justice	To enforce the law and defend the interests of the United States according to the law; to ensure public safety against threats foreign and domestic; to provide Federal leadership in preventing and controlling crime; to seek just punishment for those guilty of unlawful behavior; and to ensure fair and impartial administration of justice for all Americans. http://www.usdoj.gov/02organizations/
Department of Labor	To foster and promote the welfare of the job seekers, wage earners, and retirees of the United States by improving their working conditions, advancing their opportunities for profitable employment, protecting their retirement and health care benefits, helping employers find workers, strengthening free collective bargaining, and tracking changes in employment, prices, and other national economic measurements. http://www.dol.gov/opa/aboutdol/mission.htm
Department of State	To create a more secure, democratic, and prosperous world for the benefit of the American people and the international community. http://www.state.gov/s/d/rm/rls/dosstrat/2004/23503.htm

Agency	Mission Statements (taken from websites)
USAID	To further America's foreign policy interests in expanding democracy and free markets while improving the lives of the citizens of the developing world. http://www.usaid.gov/about_usaid/
Department of Transportation	To serve the United States by ensuring a fast, safe, efficient, accessible and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future. http://www.dot.gov/mission.htm
Department of Treasury	To serve the American people and strengthen national security by managing the U.S. Government's finances effectively, promoting economic growth and stability, and ensuring the safety, soundness, and security of the U.S. and international financial systems. http://www.ustreas.gov/education/duties/
Department of Veterans Affairs	To provide veterans the world-class benefits and services they have earned – and to do so by adhering to the highest standards of compassion, commitment, excellence, professionalism, integrity, accountability, and stewardship. http://www.va.gov/about_va/mission.asp
US Army Corps of Engineers	To provide vital public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters. http://www.usace.army.mil/about/pages/mission.aspx
Environmental Protection Agency	To protect human health and to safeguard the natural environment—air, water, and land—upon which life depends. http://www.epa.gov/history/
General Services Administration	To leverage the buying power of the Federal Government to acquire best value for taxpayers and our Federal customers. http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentId=9789&contentType=GSA_BASIC
NASA	To pioneer the future in space exploration, scientific discovery and aeronautics research. http://www.nasa.gov/about/highlights/what_does_nasa_do.html
National Science Foundation	To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense. http://www.nsf.gov/about/glance.jsp
Nuclear Regulatory Commission	To regulate the nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. http://www.nrc.gov/about-nrc.html
Office of Personnel Management	To build a high quality and diverse Federal workforce, based on merit system principles, that America needs to guarantee freedom, promote prosperity, and ensure the security of this great nation. http://www.opm.gov/gpra/opmgpra/sp2002/mission.asp
Small Business Administration	To aid, counsel, assist and protect the interests of small business concerns, to preserve free competitive enterprise and to maintain and strengthen the overall economy of our nation. http://www.sba.gov/aboutsba/index.html

Appendix 2: Program Assessment Rating Tool Categories

Program Assessment Rating Tool Categories	
Direct Federal	Programs where services are provided primarily by employees of the Federal Government, such as the State Department's Visa and Consular Services program
Competitive Grant	Programs that provide funds to State, local and tribal governments, organizations, individuals and other entities through a competitive process, such as Health Centers at the Department of Health and Human Services (HHS).
Block/Formula Grant	Programs that provide funds to State, local and tribal governments and other entities by formula or block grant, such as Department of Energy's (DOE) Weatherization Assistance program and HHS' Ryan White HIV/AIDS program.
Regulatory	Programs that accomplish their mission through Federal rules that implement, interpret or prescribe law or policy, or describe procedure or practice requirements, such as the U.S. Environmental Protection Agency's Mobile Source Air Pollution Standards and Certification program.
Capital Assets and Service Acquisition	Programs that achieve their goals through development and acquisition of capital assets (such as land, structures, equipment, and intellectual property) or the purchase of services (like maintenance and information technology). Program examples include Navy Shipbuilding and the Bonneville Power Administration.
Credit	Programs that provide support through loans, loan guarantees and direct credit, such as the Export Import Bank's Long Term Guarantees program.
Research and Development	Programs that focus on knowledge creation or its application to the creation of systems, methods, materials, or technologies, such as DOE's Solar Energy and NASA's Solar System Exploration programs.

From http://www.whitehouse.gov/omb/expectmore/faq.html#005)

Appendix 3: Program Assessment Rating Tool (PART) Partial Sample Results

Program Assessment Rating Tool (PART)							
FY 2009 Budget, Spring Update							
Agency Name	PART Program Name	Last Year Assessed	Section 1	Section 2	Section 3	Section 4	Rating
Department of Agriculture	Agricultural Commodity Grading and Certification Programs	2004	80%	88%	100%	40%	Adequate
Department of Agriculture	Agricultural Credit Insurance Fund - Guaranteed Loans	2008	80%	50%	100%	60%	Moderately Effective
Department of Agriculture	Agricultural Credit Insurance Fund Direct Loans	2004	100%	75%	89%	53%	Moderately Effective
Department of Agriculture	Agricultural Crops Counter Cyclical Payments	2004	80%	86%	71%	60%	Adequate
Department of Agriculture	Agricultural Export Credit Guarantee Programs	2004	80%	63%	100%	67%	Moderately Effective
Department of Agriculture	Agricultural Marketing Loan Payments	2007	60%	75%	57%	47%	Adequate
Department of Agriculture	Agriculture Marketing Service - Research and Promotion Programs	2006	80%	63%	100%	33%	Adequate
Department of Agriculture	Animal Welfare	2007	100%	78%	100%	45%	Moderately Effective
Department of Agriculture	Cochran Fellowship Program	2008	100%	75%	100%	40%	Adequate
Department of Agriculture	Commodity Purchase Services (Section 32)	2006	40%	0%	43%	13%	Results Not Demonstrated
Department of Agriculture	Commodity Supplemental Food Program	2004	40%	0%	67%	7%	Results Not Demonstrated

From http://www.ExpectMore.gov

Appendix 4: Partial Sample of an Exhibit 53

UPI	Investment Title	Description	PY	CY	BY	LoB	SubFunc.	DME PY	DME CY	DME BY	Agency BY
IT Spending Categ											
USDA											
005-03-01-01-01-1000-00	Corporate Property Automated Information System (CPAIS)	Provides an integrated asset managemnet soultion that will enable USDA to effectively manage it real and personal property assests department-wide.	2.078	4.684	4.78	402-Financial Management	124-Accounting	1.147	2.684	2.61	2378.854
005-03-01-01-01-1020-00	Corporate Financial Management Systems (CFMS)	USDA Corporate finanical information sytems serves as the intitiative for the OCFO to achieve compliance with the CFO Act of 1990 and provides the functionality to implement the US standard General Ledger.	53.554	58.638	59.681	402-Financial Management	124-Accounting	0	0	0	2378.854
005-03-01-01-01-1102-00	Financial Management Modernization Initiative (FMMI)	The FMMI investment will improve financial management performance by providing USDA agencies with a modern core financial management system that complies with Federal accounting and systems standards and provides maximum support to the USDA mission.	24.747	40.237	50.108	402-Financial Management	124-Accounting	24.747	35.437	34.573	2378.854
005-03-01-01-01-1256-24	Human Resources Line of Business: Service Center	This business case addresses the implementation of a HRLOB Shared Service Center (SSC) by the NFC that offers standardized HR services on a Federal Government-wide level.	37.686	60.47	59.648	403-Human Resource Management	253-Compensation Management	7.754	26.737	24.423	2378.854
005-49-01-01-01-0106-00	Consolidated Financial Management Information Systems (CFMIS) #106	Consolidation of FSA Financial Mgmt Investments: CORE Accting Sys, Auto Records Mgmt of Producer Claims, Financial Mgmt Info Sys, Subsidiary Accting Sys, Centralized Disbursemt Sys, Producer Prog Reporting Sys & Financial, Accting, Info Reporting Sys.	8.171	7.437	7.521	402-Financial Management	129-Reporting and Information	0	0	0	2378.854
005-49-01-01-01-0107-00	Consolidated General Sales Manager (CGSM) #107	Consolidation of FSA Financial Mgmt Investments New General Sales Manager Guarantee System & APLUS, supports CCC Export Credit Guarantee Programs & tracks agreements between U.S. exporters, U.S. financial institutions, foreign banks, & foreign importers.	2.471	1.825	1.574	114-International Affairs and Commerce	043-Global Trade	0	0	0	2378.854

From Office of Management and Budget website for Circular Number A-11