

**What to Buy: the Underexplored Dimension of the  
Smart-buyer Problem**

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**ABSTRACT**

Using one question of Donald Kettl's smart-buyer problem as the basis of investigation, this study empirically examines the relationship between five selected services contract characteristics related to requirements and evaluation ratings of 120 federal information technology investments. The five contract characteristics selected for investigation were: Contract Type, Extent Competed, Performance-Based Acquisition, Integrated Process Team, and Program Manager Qualification. Analysis of these characteristics is relevant because current federal acquisition policy advocates particular contract characteristics as the preferred methods of procurement and others as widely accepted best practices.

The five selected contract characteristics were analyzed for over 200 information technology services contracts using two separate statistical tests and four variants of information technology investment ratings as the dependent variable. Empirical evidence failed to reject the null hypothesis that there is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings. This failure of rejection through multiple tests led to the conclusion that service contract requirements are not better defined in cases when they should be based on selected contract characteristics.

In order to better inform and understand the quantitative findings, interviews were conducted with over 20 senior acquisition and information technology executives representing 11 different federal departments and industry. None of the senior executives interviewed disputed the null finding and nearly 70 percent of subject matter experts interviewed were unsurprised that the selected service contract characteristics did not correlate with investment ratings.

The lack of correlation between selected contract characteristics related to requirements and investment ratings indicates that service contract requirements definition is a significant problem for federal agencies. That conclusion was confirmed by interviews with senior subject matter experts who consistently stated that accurately defining and managing information technology service contract requirements is a genuine challenge facing the federal government today.

Although empirical evidence failed to reject the null hypothesis, subsequent interviews revealed other factors that may have greater bearing on requirements and acquisition program outcomes than the five selected service contract characteristics. They present promising topics that merit further research.

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## LIST OF ABBREVIATIONS

AT&L	Acquisition, Technology, and Logistics
CAO	Chief Acquisition Officer
CAOC	Chief Acquisition Officers Council
CICA	Competition in Contracting Act
CIO	Chief Information Officer
CIOC	Chief Information Officer Council
CO	Contracting Officer
CPAF	Cost Plus Award Fee
CPFF	Cost Plus Fixed Fee
CPIF	Cost Plus Incentive Fee
DAU	Defense Acquisition University
DAWIA	Defense Acquisition Workforce Improvement Act
DOD	Department of Defense
DPAP	Defense Procurement and Acquisition Policy
DSB	Defense Science Board
FAI	Federal Acquisition Institute
FAR	Federal Acquisition Regulation
FFP	Firm-Fixed Price
FPDS-NG	Federal Procurement Data System - Next Generation
GAO	Government Accountability Office (formerly the General Accounting Office)
GSA	General Services Administration
GWAC	Government-wide Acquisition Contract
IDC	Indefinite Delivery Contract
IDIQ	Indefinite-Delivery, Indefinite-Quantity
IT	Information Technology
LH	Labor Hour
NCMA	National Contract Management Association
NDAA	National Defense Authorization Act
NPR	National Performance Review

OFPP	Office of Federal Procurement Policy
OMB	Office of Management and Budget
PBA	Performance-Based Acquisition
PBC	Performance-Based Contracting
PBSA	Performance-Based Service Acquisition
PBSC	Performance-Based Service Contract
PCO	Procurement Contracting Officer
PM	Program Manager
PMA	President's Management Agenda
PSC	Product Service Code
PWS	Performance Work Statement
QASP	Quality Assurance Surveillance Plan
SARA	Services Acquisition Reform Act of 2003
SBA	Small Business Administration
SES	Senior Executive Service
SOO	Statement of Objectives
SOW	Statement of Work
T&M	Time-and-Materials
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics

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## CHAPTER ONE: INTRODUCTION

### I. Importance of Federal Government Services Contracting

Federal contracting is an important management challenge for both public officials and private vendors. As noted by Cooper (2003, 11), "the scope and scale of contracts mean that neither public officials nor citizens can afford to ignore them." Services contracts in particular are ubiquitous and vitally important to federal agencies. Kettl summed it up best when he stated that "Not only is virtually every service imaginable contracted out, but contracting out has become a near-universal phenomenon" (1993, 185).

Services contracts have been integral enablers of effective public management since the earliest days of the United States, and have now become the most pervasive form of public contracting. While they are nothing new, all levels of government are making increased use of services contracts. They have become indispensable for effective and efficient government operations. In general, services contracts have become increasingly common and are a primary means of accomplishing federal government work.

According to the latest Organization for Economic Co-operation and Development (OECD) report, public procurement in

the United States accounts for over 10 percent of the gross domestic product (OECD, 2011). That percentage has remained fairly constant over the past decade, since Bajari and Tadelis reported the same figure in 2001 for procurement by federal, state and local government in the United States (Bajari & Tadelis, 2001). Especially noteworthy during the current fiscal debates, the acquisition of goods and services from contractors constitutes over 25 percent of all discretionary government spending (GAO, 2007a). Additionally, 62 percent of the entire combined federal workforce (contractors, civil service, and military) are contract employees (Durant, Girth, & Johnston, 2010).

Besides accounting for a large portion of our gross domestic product, over the past several decades the United States has transitioned from a goods-based to a services-based economy. As of 2010, services represent approximately 75 percent of U.S. economic output and 80 percent of U.S. private sector employment. Similarly, U.S. private services exports exceeded \$526 billion with a trade surplus of approximately \$168 billion (Coalition of Services Industries (CSI), 2012). It is no coincidence that services contracting is a large element of our economy and major component of federal government operations.

In terms of federal services contracting expenditures, the Center for Strategic and International Studies reported that it has increased from \$159 billion in 2000 to \$333 billion in 2010, which is an overall growth rate of 109 percent (CSIS, 2011). CSIS further reported that as a share of total federal contract spending, services accounted for 62 percent in 2010. According to the General Accountability Office (GAO, 2011), services contracts account for 80 percent of all money obligated by civilian agencies on contracts. In dollar terms, that translates to federal civilian agencies obligating over \$135 billion in the fiscal year 2010 for services (GAO, 2011).

The amount of money solely obligated by the Department of Defense (DOD) was even greater, since the amount and percentage in 2009 was \$212 billion and 57 percent. According to the Defense Science Board Task Force on Improvements to Services Contracting (Kaminski, 2011), DOD services contracting in 2010 again exceeded \$200 billion and accounted for over 50 percent of the total DOD acquisition budget. That amount is more than double the amount the DOD spent on such services a decade ago (Andrews, Conaway, et. al., 2010). Therefore the total estimated amount of dollars spent on federal services contracts according to the Defense Science Board and GAO exceeded \$335 billion, slightly above the figure reported by CSIS.

In Information technology (IT) investments, which are used as the lens for contract examination in this study, the federal government spent nearly \$80 billion in 2010; it is the single largest purchaser of software code (Balter, 2011). However, according to Balter (2011), end users failed to entirely use nearly 45 percent of the IT features procured and only rarely used another 19 percent of the features. Therefore, only approximately 36 percent of the IT functionality procured is actually used on a routine basis. Even more alarming than the minimal use of features procured, as few as 9 percent of all IT projects are delivered on time and within budget (Balter, 2011). Furthermore, according to the GAO, 48 percent of all IT projects are rebaselined<sup>1</sup> and of those rebaselined projects, 51 percent need to be rebaselined at least a one additional time. It is apparent that the minimal use of features procured, not meeting schedule and cost parameters, and the need for repeated

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<sup>1</sup> An acquisition program baseline reflects cost, schedule, and performance attributes that describe the program over its life cycle (Hagan, 2009, B-5) and baselining is defined as "a process whereby all managers concerned collectively agree on the specific description of the program, requirements, and funding; and make a commitment to manage the program along those guidelines" (Hagan, 2009, B-16). An initial baseline is established and approved for measuring program cost, schedule, and performance progress. Due to a variety of reasons, the initial baseline and subsequent baselines can be changed by rebaselining the program. The result of rebaselining is a formal change to one or more of the program attributes (cost, schedule, and performance).

rebaselining can all be attributable, at least in part, to poorly defined user contract requirements.

## **II. Problem Statement**

"It's the requirements, stupid" (Kelman, 2007, 1). This response received the highest number of votes when Steven Kelman, the former administrator of the Office of Federal Procurement Policy, asked acquisition professionals for ideas that would improve the success rate of large federal IT investments. Similarly, acquisition officials testifying before the Services Acquisition Reform Act (SARA) Acquisition Advisory Panel stated that "it's all about the requirements" (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007, p. 100). Additional testimony before the Panel "overwhelmingly emphasized the importance of requirements definition to successful competition and performance of services contracts."

In addition to the SARA Panel's affirmation, the independent Project on Government Oversight (POGO) recently recognized the importance of properly identifying user needs. Specifically, when commenting on contract design, the government watchdog organization's general counsel stated that "The problem begins with contract formulation and definition of contract requirements" (Amey, 2012, 697).

Beyond Kelman's candid quotes, the SARA Panel testimony stressing the importance of defining contract requirements up front, and POGO's recognition of the importance of defining requirements, the 2010 House Armed Services Committee Panel on Defense Acquisition Reform found that challenges with the contract requirements process are a major factor in poor acquisition outcomes. The acquisition of services, the largest category of acquisition, was considered to be a critical weakness in the Department of Defense (DOD). Furthermore, the Panel noted with concern that "in contrast to the formal, even rigid, contract requirements process for weapons systems acquisition, the requirements process for services contracting is almost entirely ad hoc" (Andrews, Conaway, et al., 2010, p. 13).

The size of contracts and the types of services procured are quite varied, which makes these contracts heterogeneous and challenging to examine holistically. As noted in the recent House Armed Services Committee Panel on Defense Acquisition Reform Findings and Recommendations, "the variety of types of services provided - along with the variety of the types of service contracts awarded - leads to challenges in describing contract requirements, establishing measurable and performance-based outcomes, and overseeing contractor performance" (Andrews, Conaway, et. al., 2010, 11).

As a result of poorly written service contract requirements, the House Panel found that the government was either unable to obtain what it actually needed, unable to hold contractors accountable for poor performance, or both. According to their final report, "the Panel heard at almost every hearing held, regardless of the primary content focus of the hearing, that obtaining consistent, realistic requirements as a basis for the acquisition process is a critical problem in the defense acquisition system" (DAR Final Report, 2010, 22).

Given the critical nature of services contracts and the central importance of contract requirements, this study endeavors to better illuminate our understanding by empirically identifying correlations between federal services contract characteristics and acquisition program success. In doing so, this analysis investigates the correlation between five (5) specific contract characteristics related to requirements (Contract Type, Extent Competed, Performance-Based Acquisition, Integrated Process Team, and Program Manager Qualification) to federal information technology (IT) investment ratings.

While there are many additional contract characteristics, as shown in Appendix A, these particular characteristics were selected based on their connection to policy, best practices, and contract requirements. That is to say, analyzing these five contract characteristics is especially important since current

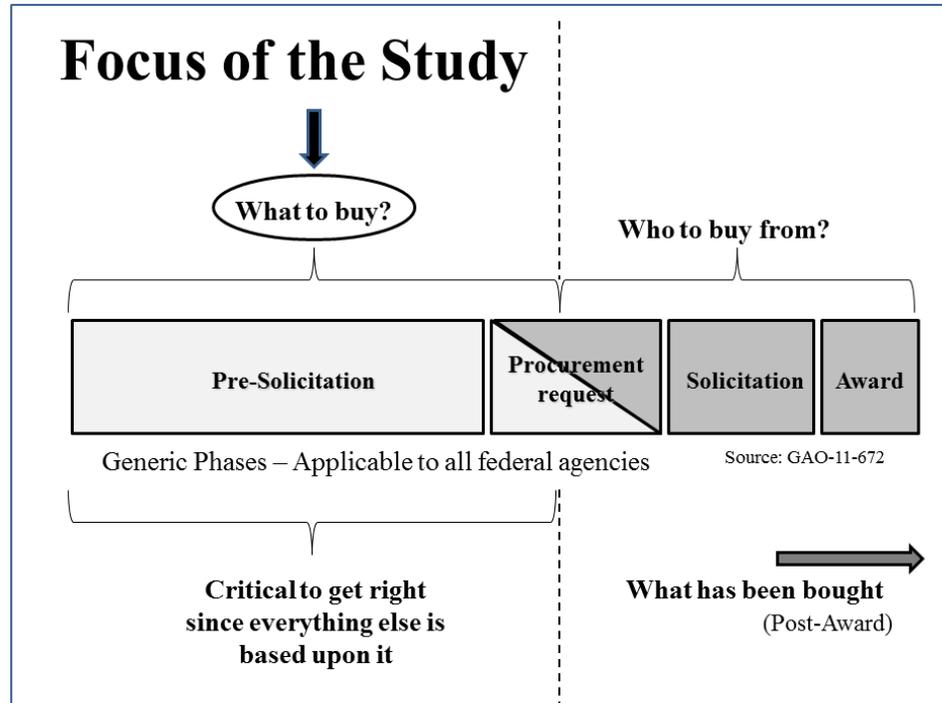
acquisition policy advocates preferred methods of procurement, such as firm-fixed price, performance-based, and competitively awarded contracts. Additionally, the use of integrated process teams and qualified program managers are based in policy and widely accepted as best practices. The linkage between the five selected contract characteristics and policy, practice, and contract requirements will be described in greater detail in subsequent chapters.

### **III. Research Question**

Despite the prevalence and scope of federal services contracting, Donald Kettl (1993) asserted that, while accepting the market-based potential of contracting, governments have failed to develop the capacity to cope with the most basic contracting questions: *what to buy, who to buy from, and what has been bought*. The smart-buyer question that is the focus of this study directly links to contract requirements: *what to buy?* Using this question as the basis of investigation, this study empirically investigates the relationship between the five selected federal services contract characteristics related to requirements and acquisition program success.

As depicted in Figure 1.1, the focus of this study is on the early or pre-solicitation stage of an acquisition investment.

Figure 1.1: Focus of the Study



It is the decision of “what to buy” that forms the basis upon which the acquisition process is conducted. It is the key question that determines how the other stages will be conducted in order to meet the identified user requirements.

Therefore, determining whether there is significant correlation between selected services contract characteristics related to contract requirements and information technology (IT)

investment ratings is the research question of this study. Answering the research question and gaining insights from elite interviews with senior acquisition and information technology experts provides a means to better understand whether services contract requirements are a major factor in poor acquisition outcomes.

Rather than using a multitude of different terms to describe what is being analyzed, for consistency and clarity, this study uses the phrase contract characteristics. This is consistent with the terminology used by Rendon, Apte, and Apte (2012) to describe what they examined in their analysis of Department of Defense (DOD) service contracts. However, the three aspects of contract characteristics that they examined were degree of competition, type of contract, and contract incentives.

To answer the research question, this study utilizes a quantitative dominant, sequential, mixed-methods research design (Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie, & Turner, 2007; Doyle, Brady, & Byrne, 2009; Creswell, 2009), which has two phases. The primary, or dominant, phase is quantitative and looks in detail at contract characteristics and information technology (IT) investment ratings as documented in the Office of Management and Budget (OMB) federal IT dashboard. The secondary phase is qualitative and consists of conducting a

number of semi-structured interviews with subject matter experts to garner reactions and better inform the quantitative findings.

#### **IV. Contribution to Research and Practice**

This study fills a significant gap in public management literature. It examines services contracts, which are predominately used by all federal government agencies, and provides needed insights to the relationship between contract characteristics and program effectiveness. Despite its critical importance to the contracting and acquisition process, up to this point services contract requirements have not received critical examination as a subject of inquiry by public management scholars. In fact, there has been limited empirical research on different aspects of the contracting and acquisition process (Bretschneider & Ni, 2007; Amirkhanyan, 2008; Kelman, 2008).

As previously discussed, contract requirements are formulated based upon identified needs during the pre-solicitation phase of acquisition planning and are a particularly important aspect of the entire procurement process. Contracting officers procure services on behalf of a user (contract requirements generator) for a particular purpose; therefore, the user needs to establish the basis upon which contracts are written, awarded, executed, and evaluated.

Without clear and complete contract requirements, contracting officers are not able to write and award accurate contracts. Similarly, contract requirements form the basis upon which vendor performance and contract fulfillment is measured. Without measurable criteria derived from accurate contract requirements, vendor performance measurement and contract monitoring is problematic.

Therefore, this study serves both research and practical purposes. For the researcher, it examines an overlooked, but critical, aspect of the contracting process: services contract requirements ("*what to buy?*") are usually viewed as a given and are not fundamentally questioned. However, correctly identifying services to be performed is the foundation upon which the entire contracting process is executed. For the public manager, it provides a basis for responding to recent criticism that the requirements process for the acquisition of services is a weakness. Furthermore, it ultimately provides a means for acquisition professionals to better understand the linkage and correlation between services contract characteristics and acquisition program success.

## **V. Limitations of the Study**

This study, which is focused on U.S. federal government services contracts, does not address the "make-or-buy" decision, since the decision to contract has already been determined. Deciding whether to "make-or-buy" is the question of whether or not the particular service should be performed organically by government personnel or outsourced to a non-government provider. It is frequently looked at in the context of transaction cost economics, as the decision is made as to whether it is more advantageous - given capacity constraints - to perform the service directly. Although some observers, such as Kelman (2002a), associate the "make-or-buy" decision with Kettl's "what to buy" question, for purposes of this analysis it is assumed that the "make-or-buy" decision has been made and the "what to buy" question applies to contract requirements.

The analysis conducted for this study is based on publically available acquisition program and contract data. Specifically, it uses program data on the Federal Information Technology (IT) investment portfolio that was available through the Office of Management and Budget (OMB) Federal IT Dashboard. Similarly, public data regarding contracts was available through the Federal Procurement Data System - New Generation (FPDS-NG). Therefore, those two databases, along with the individual agency

service contract inventories and agency OMB Exhibit 300 submissions, serve as the primary sources for program and contract data. Restricted data sources, such as the Department of Defense Contractor Performance Assessment Reporting System (CPARS) and Past Performance Information Retrieval System (PPIRS), were not be used in this study since they are not open to the public and cannot be used for independent peer review validation.

This study does not consider wartime contingency contracts, since including them in this analysis could adversely skew the data and lead to distorted results. Given the nature of the combat environment where those contracts are issued, requirements are commonly unstable due to the uncertainty of operating conditions and urgency of need.

In addition to definitive services contracts, the study does include Information Technology (IT) Indefinite Delivery Vehicle (IDV) contracts, which tend to be large omnibus contracts with a more broadly defined scope and requirements. They usually have a set number of pre-qualified vendors that compete for individual orders placed via an indefinite delivery contract. In the IT realm, it has become increasingly popular for federal agencies to use government-wide acquisition contracts (GWACs) as the vehicle for procuring supplies and services. The General Services Administration (GSA) issues and

manages a preponderance of GWACs, which a wide range of federal activities use to satisfy the IT needs. A number of the contracts analyzed in this study are GWACs issued by GSA with task orders placed against them by individual agencies.

## **VI. Organization of the Study**

After providing this brief introduction, attention is initially turned to providing background information regarding contracting, services contracting, and contract requirements. In addition, the five selected contract characteristics are defined and federal policies pertaining to them examined. After completing that foundational discussion, attention is shifted to literature that is germane to this research. Therefore, Chapter 3 reviews contracting literature from historical, theoretical, and contemporary perspectives. Following the review of literature, research design and methodology are addressed; in Chapter 4, the hypotheses, variables, sources of data, sampling methodology, assumptions, and statistical tests applied are all examined. Subsequently, using the research methodology described in Chapter 4, the following chapter discusses the actual quantitative and qualitative analysis conducted for this study and the resulting findings.

Finally, Chapter 6 offers concluding remarks and suggestions for future research. As will be discussed in that chapter, interviews with subject matter experts revealed factors that may have greater bearing on requirements and acquisition program outcomes than the five service contract characteristics selected for this study. They present six topic areas that merit further research: internal processes and agency governance; federal acquisition and information technology workforce competencies; fiscal environment and federal budget cycle; rate of technological change; industry partners and collaboration; and senior leadership involvement.

## CHAPTER TWO: BACKGROUND INFORMATION

### I. Introduction

Contract management is no different than most fields of study: it uses unique terminology and has certain underlying concepts that are generally accepted. In addition, federal government contracting must be conducted in accordance with prescribed regulations and policies in order to adhere to all applicable legal mandates. Therefore, prior to delving too deeply into the issues of interest for this research study, some of the relevant definitions and context that pertain to topics for this exploration are briefly outlined. It is meant to establish a basis of understanding and familiarization with some of the key premises upon which this research study is built. Additionally, since acronyms tend to flourish in the field of government contracting, a list of abbreviations has been appended to facilitate reader comprehension.

The Federal Acquisition Regulations (FAR), which became effective on April 1, 1984, is the primary regulation used by all federal executive agencies in their acquisition of supplies and services with appropriated funds.<sup>2</sup> The current edition of

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<sup>2</sup>The FAR can be accessed at the following website - <http://www.acquisition.gov/far>

the FAR (March 2005), which is over 1,100 pages long, contains specific definitions, procedures, and rules pertaining to the full range of federal acquisition. Nearly all the definitions, concepts, and policies discussed in this chapter are derived from the FAR.

Along with input from all federal agencies, the FAR is issued within applicable laws under the joint authorities of the Administrator of General Services, the Secretary of Defense, and the Administrator for the National Aeronautics and Space Administration under the broad policy guidelines of the Administrator, Office of Federal Procurement Policy (OFPP), Office of Management and Budget (OMB). Although many federal agencies have supplementary regulations (i.e., the Defense Federal Acquisition Regulations (DFAR)), the FAR is the prime federal regulation and supersedes individual agency supplementary guidance.

Besides the FAR, the Defense Acquisition Guidebook (DAG) is extensively used as a source of information for this chapter. In particular, the DAG expands and explains many acquisition policies, regulations, and best practices in detail.<sup>3</sup> While only a 'guidebook' that is not necessarily prescriptive in nature, it is derived from higher level Department of Defense (DOD)

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<sup>3</sup>The DAG is accessible at the Defense Acquisition University (DAU) website - <https://dag.dau.mil/Pages/Default.aspx>

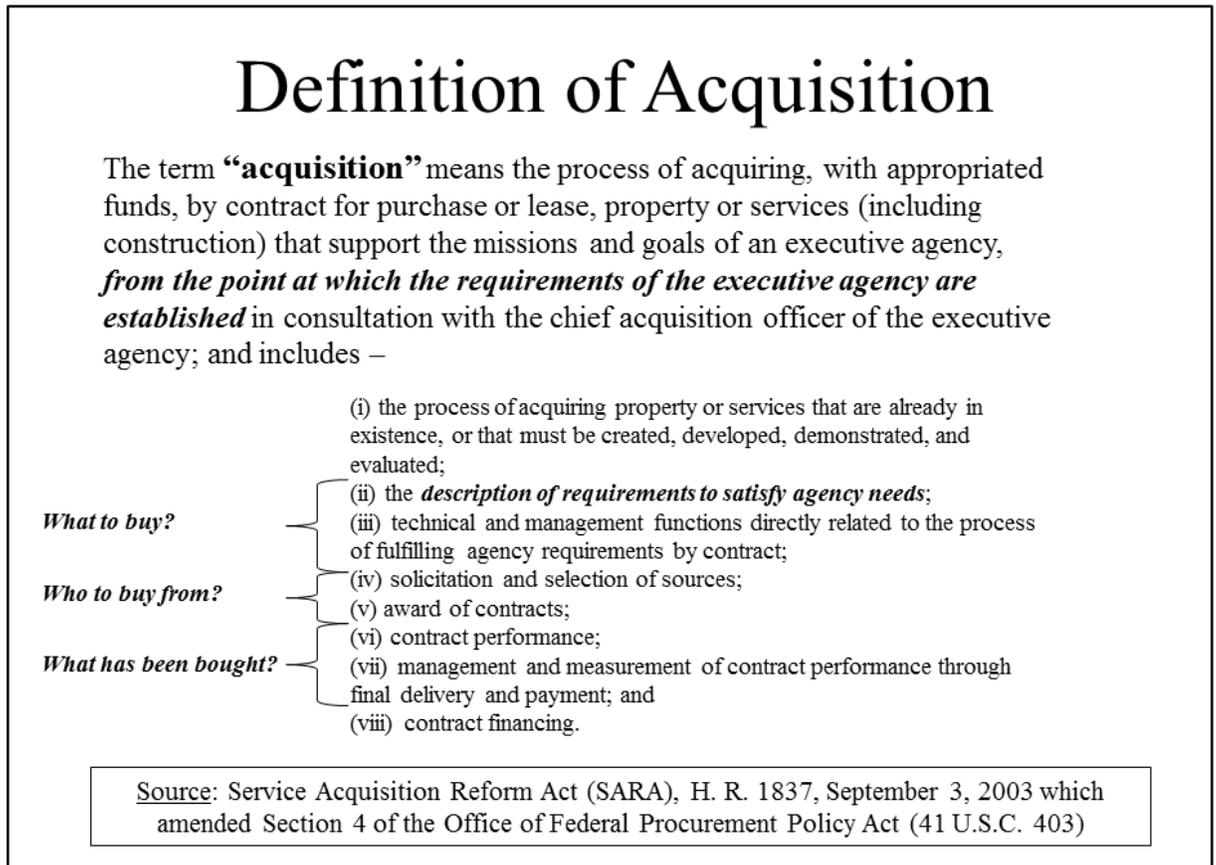
directives, including DOD Directive 5000.1 (The Defense Acquisition System), DOD Instruction 5000.2 (Operation of the Defense Acquisition System), and the Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01H (Joint Capabilities Integration and Development System). Although it is meant as a source of supplementary information for the Defense Department Acquisition Workforce, the DAG offers a helpful array of definitions that are common to all federal agency acquisition and contracting activities. Moreover, Chapter 14 of the DAG is particularly applicable to this study since it focuses specifically on the topic of services acquisition.

## **II. Key Acquisition Fundamentals**

### **a. Acquisition**

Acquisition is the overarching term used to describe the means by which goods and services are acquired by contract with appropriated funds. It is the 'cradle-to-grave' process that encompasses the entire lifecycle of identifying and meeting agency needs. To show the specific association of this research project, Figure 2.1 illustrates how each of Kettl's (1993) smart-buyer questions can be aligned with the corresponding elements and steps of the acquisition process as defined by the Service Acquisition Reform Act (SARA) of 2003.

Figure 2.1: Definition of Acquisition



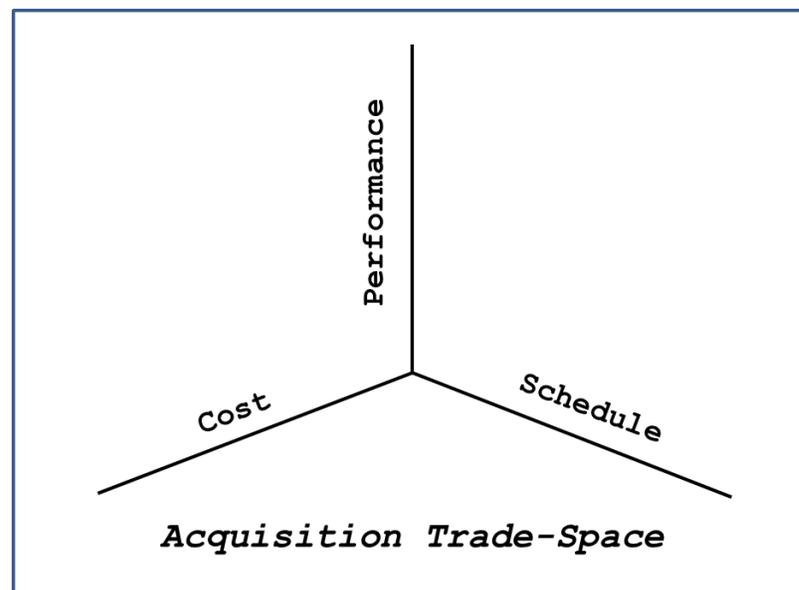
Specifically, acquisition begins at the point when agency needs are established. According to (Rendon, Apte, & Apte, 2012), services acquisition contains requirements management. It includes the description of requirements to satisfy the needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract. Reflecting the all-encompassing nature of acquisition, the DAG (2006) states that the term "acquisition"

refers to the "conceptualization, initiation, design, development, test, contracting, production, deployment, logistics support, modification, and disposal of weapons and other systems, supplies, or services (including construction) to satisfy DOD needs, intended for use in or in support of military missions" (DAG, 2006).

In the same way, the term "procurement" is frequently used in the context of contracting; the FAR definition is simple. It just states - see "acquisition." Snider and Rendon (2012) offer a more detailed characterization of public procurement, but they basically articulate a comparable definition as the one found in the FAR. They state that procurement "includes a variety of means by which public agencies and organizations acquire supplies and services from outside sources" (p. 329). They maintain that their definition is consistent with the one offered by the Journal of Public Procurement (JPP), which states that procurement encompasses acquisition, contracting, buying, renting, leasing, and purchasing, to include functions such as requirements definition an all phases of contract administration. Based on the previous FAR definition of acquisition, this offered JPP definition of procurement appears to be almost identical. However, Snider and Rendon (2012) make a slight distinction in that the term procurement includes acquisition, which leads us to a 'chicken or egg' type argument.

Acquisition trade space encompasses the set of program and system parameters, attributes, and characteristics required to satisfy performance standards (Brantley, McFadden, & Davis, 2002). More specifically in the context of managing an acquisition program, a program manager is responsible for meeting three primary objectives: cost, schedule, and performance. Figure 2.2 depicts the trade space as the area between the three axes of cost, schedule, and performance.

Figure 2.2: Acquisition Trade Space



Fundamentally, these constraints are based on confirmed user requirements, which are explicitly documented in an Acquisition Program Baseline (APB) and approved by the appropriate acquisition decision authority. As requirements are

being developed, trade-off analysis can be used to determine the best balance between cost, schedule, and performance objectives. However, if user requirements or input to one of the parameters changes, an acquisition program may need to be 'rebaselined' and have a revised APB approved by the appropriate decision authority. Frequent rebaselining of programs may be an indicator of poorly defined requirements, or of user requirements expanding beyond their original objective ('requirements creep').

As acquisition trade space applies to military acquisition, the Weapons System Acquisition Reform Act (WSARA) of 2009 stated that "The Secretary of Defense shall ensure that mechanisms are developed and implemented to require consideration of trade-offs among cost, schedule, and performance objectives as part of the process for developing requirements for Department of Defense acquisition programs." (P.L. 111-23, Sec 201)

#### **b. Services Contracting**

It is important to understand that acquiring services differs from acquiring goods and products. For example, goods and products can be specified, developed, tested, and accepted over a period of time. Services, on the other hand, routinely satisfy more immediate needs and the work performed often commences as soon as the contract is signed. Rendon, Apte, and

Apte (2012) observe that the services characteristics differ from those of manufacturing goods in several ways. They list differentiating factors as: intangibility of service output, co-production, simultaneity of production and consumption, the inability to store services, and the complexity in the definition and measurement of services.

Subpart 37.1 of the Federal Acquisition Regulations (FAR) states that the term "Service Contract" means a contract that directly engages the time and effort of a contractor whose primary purpose is to perform an identifiable task rather than to furnish an end item of supply. A service contract may be either a non-personal or personal contract. It can also cover services performed by either professional or nonprofessional personnel whether on an individual or organizational basis.

The House Armed Services Committee Panel on Defense Acquisition Reform final report defines a "service" as "any 'thing', 'class of procurement', that is not manufactured or does not require manufacturing, i.e. a service is not a tangible product, even though the service itself may produce some tangible outcome or output" (House Armed Services Committee Panel on Defense Acquisition Reform, 2010, 11).

Section 37.1 of the FAR lists the various areas in which service contracts are found, including:

- 1) Maintenance, overhaul, repair, servicing, rehabilitation, salvage, modernization, or modification of supplies, systems, or equipment;
- 2) Routine recurring maintenance of real property;
- 3) Housekeeping and base services;
- 4) Advisory and assistance services;
- 5) Operation of Government-owned equipment, real property, and systems;
- 6) Communications services;
- 7) Architect-Engineering;
- 8) Transportation and related services;
- 9) Research and development.

As the list reveals, the types and variety of work constituting services is diverse. Additionally, it is apparent that each service category is broadly stated and there can be a range of work accomplished within each area. Understandably, the capability to specify and evaluate work performed differs both within and between each of the various services areas.

In testimony before the House Panel on Defense Acquisition Reform, the GAO stated that services acquisition presents unique challenges compared to weapons systems acquisition when it comes to defining requirements, since services are less homogenous, more numerous, and harder to measure. Furthermore, the GAO went on to cite the lack of properly defined requirements as a key reason for poor service acquisition outcomes (GAO, 2009c). In addition to requirements being identified as a significant problem, the GAO also stated in the same testimony that the absence of well-defined requirements complicates efforts to hold

both the government and contractors accountable for poor acquisition outcomes.

Similarly, Edwards and Nash (2007) discussed the quality assurance challenges and inspection difficulties encountered particularly in complex long-term services contracts. They claim that relationship management, not contract administration, is the key to services contracting success. Furthermore, they state that "Unlike most supply purchases, long-term service contracts entail close human relationships that enable parties to deal with dynamic complexity and respond to emerging and changing needs and circumstances" (Edwards & Nash, 2007, 356).

The rate of technological change makes government IT services contracting even more challenging. That is, government IT services contract requirements are often written with overly detailed specification which is inconsistent with the pace of technological change and need for rapid delivery of end-user capabilities. Given the level of expertise that IT demands, especially in a continuously changing technological environment, some argue that the government is at a disadvantage when it comes to understanding what it intends to buy (Durant, Girth, & Johnston, 2010). For example, the private sector is typically able to adhere to Moore's Law and deliver IT capabilities on 12-18 month cycles, whereas it generally takes the government 48-60 months to deliver IT capabilities (DAR Final Report, 2010).

The hybrid nature of information technology (IT) was recognized by the 2010 House Armed Services Committee Panel on Defense Acquisition Reform, whereby defense weapons systems have become exponentially dependent on hardware, software, and data communications. As observed by Bretschneider and Ni (2007), IT goods and services typically tend to get bundled together for different contracts, and Amey (2012) warned that bundling of merged requirements into one contract tends to limit competition and favor the larger businesses. Due to the bundling of software, hardware, and telecommunications in many IT contracts for both DOD and non-DOD IT programs, it becomes difficult to dissect what constitutes a service and what is a tangible product. Therefore, many of the IT services contracts analyzed in this study may not be purely services and may also contain hardware, software, and communications as part of the contract.

#### **e. Contract Requirements**

Government contracts, which are based on specific requirements, exist to satisfy agency needs. Contract requirements are the identified agency needs for goods and services that form the foundation upon which successful contracts and acquisition programs are built. Simply stated, requirements are what the government is purchasing (Kelman, 2002). Satisfaction of agency needs is the purpose for

initiating contracts, so it is not surprising that many professionals feel that requirements management is "the name of the game" in establishing successful contracts and managing federal procurements.

The topic of services contract requirements is exceptionally critical to all departments and agencies throughout the entire federal government. In addition to the sheer amount of public funds expended annually on services contracts, they are critically important to virtually all government agencies and enable them to fully execute their missions.

Lacking a thorough understanding of the government's service requirements, a private vendor may not perform the tasks that are expected under the terms and conditions of the contract and thus fail to meet the buyer's expectations in terms of function, performance, and quality. Without a clear understanding of the requirements, a contractor may not be able to perform the functions required to adhere to all of the mandatory regulations, statutes, and policy. Additionally, requirements uncertainty may create incentives to exploit contract ambiguities between the buyer and seller and thus increase the risk of mutually disadvantageous outcomes (Brown, Potoski, & Van Slyke, 2010).

Rendon, Apte, and Apte (2012) state that a contract requirement is the specific service being procured. Similarly, Kelman (2002) maintains in a very direct manner that what the government is purchasing is the meaning of the term - "requirement." He further argues that a requirement may specify the results the government wants or simply specify an overall direction in which the government wants to contractor to go. As Kelman notes, the vagueness of a requirement may be for a couple of reasons. The first involves cutting edge technology where the government may not know the exact results that can be achieved. However, the second reason offered for vague requirements is the lack of willingness to exert the extra effort needed to develop more specificity.

While predominantly applicable to weapons systems acquisition, the Joint Chief of Staff's definition of a requirement is simply stated as "a capability required to meet an organization's roles, functions, and missions in current or future operations" (CJCS Instruction 3170.01H). Additionally, within public law, Title 10 U.S.C. section 2305 requires DOD purchasers to state government specifications in terms of function, performance, and design requirements to allow for full and open competition to the maximum extent possible.

Although the term "well-defined" contract requirement is commonly used, it is rarely defined. There have been several GAO

reports that assert contract problems as a result of a lack of 'well-defined contract requirements,' but do not define what is meant by that term. The only definition with any specificity as to what constitutes a "well-defined" requirement comes from the Defense Acquisition University (DAU). In their Program Manager's e-Toolkit (2012), the DAU states that a well-defined contract requirement consists of the following attributes:

- **Specific, Clear, and Unambiguous** – Contains no vague terms;
- **Understandable** – Stated with sufficient detail in everyday language;
- **Concise** – Contains no unnecessary words;
- **Consistent** – Top-to-bottom consistency with identical usage of terms and conformance to standards;
- **Achievable** – Reflects a need for which a solution is technically feasible at affordable costs;
- **Traceable** – Ultimately traceable back to a higher-level or stakeholder requirement;
- **Verifiable** – Expressed in such a manner so that the requirement can be verified in an objective, preferably quantitative manner;
- **Feasible** – Can achieve, produce, and maintain the requirement.

While the DAU offers this list of requirement attributes, they are quite broadly stated and subject to interpretation as to what each one specifically means in terms of a contract requirement. However, it does provide a basic framework for understanding what is meant by the term "well-defined requirement."

Regarding requirements ownership, Rendon, Apte, and Apte (2012) state that:

The contract management process, and more specifically, the authorities and responsibilities of the Contracting Officer, do not include requirements management activities (such as determining the requirement, modifying the requirement, assessing the effectiveness of the requirement, or terminating the need for the requirement). These requirements management authorities and activities belong to the requirements manager of the organization responsible for the services being procured. Once the requirements organization identifies, develops, and defines the requirement, the contracting organization performs the contracting activities to procure the needed service. (p. 14-15)

Additionally, they note that in general, the practice of having a contracting officer lead the acquisition or own the requirements is "not appropriate, regardless of whether a project-team approach is used." (p. 15)

### **III. Selected Contract Characteristics**

#### **a. Types of Federal Contracts**

The FAR categorizes the major contract types as fixed-price and cost reimbursement. In distinguishing the differences between the two basic contract options, Kelman (2002b) observes that "in fixed-price contracts the agency pays the contractor a specific sum of money for well-defined products or services" (p. 285). Fixed-price contracts are appropriate for well-defined

requirements in situations with low performance risk (Rendon, Apte, and Apte, 2010). On the other hand, Rendon, Apte, and Apte noted, cost-reimbursement contracts are more appropriate for developmental requirements and when performance risk is high. Similarly, Bajari and Tadelis (2001) concluded in their study of the construction industry that cost-plus contracts are preferred over fixed-price contracts for more complex projects.

As outlined in section 16 of the FAR, there can be different varieties of both fixed price and cost reimbursement contracts, frequently depending upon the type of incentive or award structure used. Time-and-materials contracts and labor-hour contracts are another major category of contract types, but are not considered to be fixed-price contracts. The FAR describes a fixed-price contract as:

A firm-fixed-price contract provides for a price that is not subject to any adjustment on the basis of the contractor's cost experience in performing the contract. This contract type places upon the contractor maximum risk and full responsibility for all costs and resulting profit or loss. It provides maximum incentive for the contractor to control costs and perform effectively and imposes a minimum administrative burden upon the contracting parties ... a firm-fixed-price contract is suitable for acquiring commercial items or for acquiring other supplies or services on the basis of reasonably definite functional or detailed when the contracting officer can establish fair and reasonable prices at the outset. (FAR, 2005, section 16.202)

Additionally, Chapter 14 of the DAG states that as a general rule, service contract efforts involving stable requirements would use fixed-price contracts. It further states that a fixed price contract is also the most appropriate type of contract to use when the work requirement can be clearly defined and constant, especially since the contractor bears full responsibility for the performance costs and resulting profit (or loss).

On the other hand, cost type contracts are used when requirements cannot be accurately defined and performance risk is not easily quantified or managed (DAG, chapter 14). Differing from fixed-price contracts, cost contracts place more risk on the government because the contractor bears less responsibility for completing the performance requirement within established cost parameters. It is important to note that there are different types of cost contracts, such as Cost Plus Fixed Fee (CPFF), Cost Plus Award Fee (CPAF), and Cost Plus Incentive Fee (CPIF); however, for purposes of this study, the distinction between the different variations is not made. Rather, all variations of cost contracts are considered as one category: cost contracts.

The final type of contracts included in this study is a Time and Material (T&M) contract, which may have the greatest level of risk for the government since it contains no incentive

for the contractor to control cost. A T&M contract is used when the work requirement cannot be defined in advance, so a level of effort in work hours at a prescribed rate is funded. A variation of a T&M contract is a Labor Hour (LH) hour contract, which may be used if no material is involved. For purposes of this study, T&M and LH contracts are combined into one category of contracts.

Specifically pertaining to contract types and requirements, the 2007 SARA Panel final report stated that the "Government frequently fails to invest in requirements definition. Public sector officials and representatives of government contractors testified that the government is frequently unable to define its requirements sufficiently to allow for fixed-price solutions. Ill-defined requirements also fail to produce meaningful competition for services solutions, relying instead on time-and-materials ("T&M") contracts based on fixed hourly rates. The causes for this failure to define requirements were described by many witnesses, including the Government Accountability Office ("GAO") and agency inspectors general ("IGs")" (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007, 7).

#### **b. Competition in Services Contracting**

Actually, public law (10 U.S.C. 2304 and 41 U.S.C. 253) mandates that except for specific limited exceptions, such as

small disadvantaged businesses, federal government contracting officers are to promote and use full and open competition in awarding government contracts. Furthermore, the Competition in Contracting Act of 1984 established the policy of "full and open competition," and required the bid specification document to specify what the government wanted in terms of minimum needs (Kelman, 2009a).

With respect to a contract action, full and open competition means that all responsible sources are permitted to bid and unless otherwise provided by statute, contracts for services are awarded through sealed bidding (FAR, subpart 37.105). Sealed bidding provides for transparency, since the steps involved include preparation of invitations for bids, publicizing the invitation for bids, submission of bids, evaluation of bids, and contract award. However, in the view of Milward and Provan (2000), contracts should not be rebid frequently, since they contend that frequent bidding only destabilizes the system and does not guarantee better prices.

The transparent nature of the competitive procurement process, which allows both public scrutiny and dialog between government officials and all potential bidders, requires that contract requirements be stated in more well-defined terms than sole source procurements may possibly be. Of particular interest for this study, the SARA Panel final report clearly

stated that requirements definition is key to achieving benefits of competition (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007, 7).

### **c. Performance-Based Acquisition**

Behn and Kant (1999) examined the emergence of performance-based contracting for services and observed that "it is not derived from the principles of scientific management but is based on a contradictor assumption: There is no best way or, certainly, no best way for all times and all circumstances." (p. 473)

According to the DAG Chapter 14, the objectives of a performance-based services acquisition are to maximize performance, maximize competition and innovation, encourage and promote the use of commercial services, shift risk, and achieve savings. Furthermore, to be considered performance-based, at a minimum, a contract should contain a performance work statement (PWS), measurable performance requirements, and a means to monitor and assess contractor performance.

As defined by the FAR, performance-based acquisition (PBA) is an acquisition structured around the results to be achieved rather than the manner by which the work is to be performed. For services, a performance-based contract defines the requirement in terms of desired performance results (*the 'what'*) and allows the contractor latitude to determine how best to meet

the required objectives (*the 'how'*). This means, however, that the government acquisition team must describe the required performance requirements in clearly defined, understandable, and measureable terms.

The Statement of Objectives (SOO) is the portion of a contract that gives a broad description of the government's overall performance objectives (Hagan, 2011). According to the FAR, it is used when the Government wants to provide the maximum flexibility to each potential vendor so they can propose innovative solutions. Similarly, a Statement of Work (SOW) is "that portion of a contract that establishes and defines all nonspecification requirements for contractor's efforts either directly or with the use of specific cited documents" (Hagan, 2011, B-255).

The FAR defines the "Performance Work Statement" (PWS) as a statement of work for performance-based acquisitions which describes the required results in clear, specific and objective terms with measurable outcomes. It is considered the foundation upon which effective and efficient contract performance is built; an accurate one is challenging to write (Friar, 2005a). The DAG claims that the PWS comprises the "heart" of any service acquisition and the success or failure of a contract is greatly dependent on its quality.

There is no mandatory template or outline for a PWS. The FAR only requires that agencies to the maximum extent practicable write it in performance-based terms. Properly written, the PWS should describe all requirements that must be met in clear concise wording, and according to Friar (2005), the contracting officer is ultimately responsible for it.

It is apparent that performance based strategies are becoming increasingly preferred and mandated as the means for attaining services. The Office of Federal Procurement Policy (OFPP) goal has increased over recent years from requiring that 40 percent of all eligible services contracts be performance based in 2003 to the current goal of 50 percent (Burton, 2004, September 7; Denett, 2007, December 5). Additionally, for services, FAR subpart 37.6 specifies an order of precedence for services contracts:

- (1) Use a firm-fixed price performance-based contract;
- (2) Use a performance-based contract that is not firm-fixed price;
- (3) Use a contract that is not performance-based.

#### **d. Integrated Process Teams (IPTs)**

Best practices in project and contract management reflect the use of cross-functional teams, or IPTs, in the management of services projects (Rendon, Apte, & Apte, 2012). The functional

users are the ones responsible for defining the required performance outcomes or results and play an important role in deciding any trade-offs that may need to be made in meeting the agency requirement (DAG, 2011). Therefore, besides the program manager, who leads the team, and a contracting officer, the functional user is normally included as an IPT member. More specifically, the OMB mandates that a business process owner be represented in the IPT for a major investment before the OMB will approve the program budget (OMB Exhibit 300 Guidance, 2011). This is important, since detailed knowledge of the desired requirements is normally conveyed to the IPT by someone representing the user or functional manager.

Since OMB requires that someone familiar with the users' requirements be assigned as a member of an IPT for major IT investments, it is reasonable to expect that investments with an approved IPT in place prior to contract award would have more accurately defined requirements. Additionally, the team membership, guidelines, and objectives are formally documented in an IPT Charter. The charter approval date is a required entry that must be included in required agency submissions (Circular A-11, Exhibit 300) to the Office of Management and Budget.

Cooper (1980) emphasized that government contacts ought to involve a team effort by stating that effective implementation, execution, and accomplishment of a negotiated contracting

program is dependent upon a team approach. Members of the team cited by Cooper consist of "project office and administrative staff, cost advisor, auditor, legal counsel, property administrator, contract negotiator and contracting officer" (p. 464). Notably, however, he made no mention of someone from the user community as being a member of the project team, which is counter to the composition advocated and required by federal policy today.

Differing from Cooper's team composition, the SARA panel concluded that "clearly defining government's needs up-front is not something the procurement community can do alone, but rather program and financial elements within the government must also participate and contribute to clearly define outcomes of an acquisition. Creating high-level business objectives demands multiple stakeholder involvement and a joint and strategic understanding of where the agency wants to be, as well as where industry and technology are going." (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007, 7).

#### **e. Program Manager Qualification**

Formal professional certification is extremely important in federal contracting and program management, since it is a key

factor impacting agency workforce competency and capacity.<sup>4</sup> Fundamentally, human capital is at the core of many acquisition challenges and has direct relevance to the government acting as a "smart-buyer." Acquisition certification programs are designed to establish consistent competencies and standards for those performing acquisition related work and each federal agency has a designated Acquisition Career Manager (ACM) who is responsible for managing the certification requirements of the acquisition workforce members in their particular agency.

There are three different levels of certification (Levels 1, 2, and 3) that are granted based on education, training, and experience. Additionally, certification can be gained in different acquisition career fields, such as program management and contracting. For civilian agencies, the Office of Federal Procurement Policy (OFPP) oversees the federal acquisition certification program and administers it through the Federal

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<sup>4</sup> Federal Acquisition Certification for Program and Project Managers (FAC-P/PM) is based on attaining competencies and having a certain number of years of experience associated with each of three levels. Competency requirements can be satisfied through successful completion of suggested training, completion of comparable education or certification programs, or demonstration of knowledge, skills, and abilities. Appendix B of OMB Administrator memorandum to Chief Acquisition Officers (Dennett, 2007, April 25) provides the essential competencies and proficiencies required for each FAC-P/PM certification level. Each certification level requires specific competencies in seven areas: management processes; systems engineering; test and evaluation; life cycle logistics; contracting; business, cost estimating, and financial management; and leadership/professional.

Acquisition Institute (FAI) (see Denett, 2007, April 25). Along with the OFPP, the Chief Acquisition Officer Council, and the Interagency Acquisition Career Management Council, the FAI works to develop and implement strategies to meet the needs of the acquisition workforce.<sup>5</sup>

Unlike civilian agencies, however, the Department of Defense (DOD) acquisition workforce is governed by the Defense Acquisition Workforce Improvement Act (DAWIA) (P.L. 101-510 of November 5, 1990). It was passed to address concerns related to workforce quality and thus it formally established the acquisition workforce as well as concrete means to increase its professionalism. In developing the legislation, the House Armed Services Committee (HASC) considered the "three distinct elements within DOD's Acquisition System: (1) the policies, procedures, and processes which govern the operation of the acquisition system; (2) the resources of the organization (people, management structure, capital, and facilities) that execute the policies and procedures; and (3) the people within the organization that make the system work" (as cited in the DAR Final Report, 2010).

Similar to the OFPP and FAI certification requirements for civilian agencies, DAWIA also specifies the education, training,

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<sup>5</sup> Additional information can be found at the FAI Website - <http://www.fai.gov>

and work experience required for each level of certification by DOD employees. In addition, as the primary means for providing for the professional education and development of the acquisition workforce, the DAWIA also created the Defense Acquisition University (DAU).

As noted by Rendon, Apte, & Apte(2012), a program manager (PM) is typically the coordinator and integrator of the various functional disciplines involved in the program and has overall responsibility for the program's success. Additionally, the PM frequently represents the service requirement owner and is typically responsible for making any needed changes to the requirement during contract execution. Therefore, a qualified PM is integral to the success of any acquisition program. Unlike the contracting officer, the PM is responsible for requirements. Given the mandated certification attained by a qualified PM, they should be completely familiar with the requirements development process and what constitutes a "well-defined" requirement. Therefore, it is reasonable to expect that fully qualified program managers manage more structured and rigorous requirements generation and documentation processes, and thus realize more accurately defined contract requirements.

Recognizing the importance of professional certification for everyone involved in the acquisition process, section 801 of the John Warner National Defense Authorization Act for fiscal

year 2007 (Public Law 109-364) required the DOD to establish a requirements management certification program. Furthermore, the law stipulated that any DOD employee participating in the requirements generation process for a major defense program after September 30, 2008 must have successfully completed the DAU developed certification training program.

In response to the National Defense Authorization Act of 2007 mandate to provide certification training for requirements management, the Defense Acquisition University (DAU) has been proactive. In addition to deploying two online courses and one resident course, it initiated a requirements management blog, conducted webinars, and formed a Requirements Management Community of Practice (RMCoP). Additionally, the DAU established the Service Acquisition Mall, which contains tools and information specifically applicable to services acquisition.

#### **IV. Conclusion**

In order to better understand the basis for providing this empirical assessment, it was beneficial to first establish an appreciation of key acquisition fundamentals and selected contract characteristics. As will be discussed in Chapter 4 (Research Design), the variables for empirical analysis in this study were selected largely based on the considerations outlined

in this chapter. That is to say, given the stated preference and policy directives to issue services contracts with certain characteristics - namely, firm-fixed price, competed, performance-based, integrated process team, and qualified program manager - it is reasonable to expect that contracts containing those characteristics will correlate positively with successful acquisition program outcomes. We will see if service contracts with the preferences and mandates specified in this chapter do in fact correlate with highly rated investments as evaluated by both the Office of Management and Budget (OMB) and agency Chief Information Officers (CIO's).

However, prior to discussing research design details in depth, it is useful to first turn our attention to underlying literature that is germane to this study. Therefore, the following chapter considers federal contracting literature from historical, theoretical, and contemporary perspectives.

## CHAPTER THREE: HISTORICAL, THEORETICAL, AND CONTEMPORARY PERSPECTIVES

### I. Introduction

O'Toole and Meier (2004) proclaimed that "Government contracting has been one of the most important public management trends in the last generation" (p. 342). However, despite that affirmative declaration, the dollar amount agencies spend annually, and the dependency that virtually all federal agencies have on services contracts, the coverage of this subject in the public management scholarly literature is relatively diminutive. The negligible amount of literature devoted to this 'most important trend' typically addresses services contracting either in the context of social services at the state and local levels (DeHoog & Salamon, 2002; Van Slyke, 2003, 2007; Hefetz & Warner, 2004, 2012; O'Toole & Meier, 2004; Brown & Potoski, 2004; Romzek & Johnston, 2005; Heinrich & Choi, 2007; Amirkhanyan, 2008; Lamothe & Lamothe, 2009 2010; Lamothe, 2011; Levin, & Tadelis, 2010;), or in the context of performance measuring and monitoring (Fernandez, 2007, 2009; Marvel & Marvel, 2007; Amirkhanyan, 2008; Rendon, 2008; Lambright, 2009; Amirkhanyan, Kim & Lambright, 2010). Correspondingly, a number of observers have devoted select attention to the issue of contracting workforce capacity in their scholarly works (Kelman, 2002b;

Cooper, 2003; Schooner, 2004, 2005; Brown, Potoski, & Van Slyke, 2006; Yang, Hsieh, & Li, 2009), which, along with performance measuring and monitoring, does have applicability to the smart-buyer problem as it pertains to federal procurement.

While many public management scholars seem to have a preference for expending the preponderance of their research efforts examining contracting from the perspectives of state and local social services and performance measurement, there are a few who have delved into the world of federal contracting. As will be discussed later in this chapter, this group of scholars, which primarily consists of Kettl, Kelman, Cooper, Schooner, Brown, Potoski, and Van Slyke, have made substantive contributions.

That said, however, public management scholarly literature is nearly devoid of any consequential discussion of contract requirements and how agency needs are translated into accurate and meaningful contractual terms that result in successful acquisition programs. Purchasers of goods and services must correctly state their contract objectives or requirements in order to achieve desired contract results. Although the government has had a problem specifying goals (Kettl, 2002) and clear performance specifications (DeHoog, 1990), well-defined requirements are the basis for effective contracts and successful acquisition programs. Therefore, this research

project contributes to the public management body of knowledge by addressing a neglected topic that is the foundation upon which large expenditures of federal dollars occur and is important to all federal agencies.

While other literature streams, such as economics and business administration, address contracting from those individual viewpoints, they do not include empirical research on contract characteristics pertaining to requirements, which is the focus of this study. Specifically, this chapter outlines a gap in both the scholarly and practitioner literature where negligible attention is given to federal service contract characteristics associated with customer requirements and their correlation to acquisition program success.

## **II. Historical Perspectives**

This section is divided into two parts. First, the historical origins of public contracting in the United States is addressed, as well as some of the background aspects that have influenced current thought and practice. Second, due to its importance as a foundational framework for the smart-buyer problem, New Public Management (NPM) is discussed. In addition, two Presidential initiatives spawned by NPM - Bill Clinton's

National Performance Review (NPR) and George W. Bush's President's Management Agenda (PMA) - are recognized.

#### **a. Origins and Background**

Government contracting has occurred for centuries (Behn & Kant, 1999). The public sector has always depended on the private sector to provide goods and services (Kettl, 1993) and a contract can be considered as the centerpiece of indirect government (Kettl, 2002). On the other hand, direct provision by the government is the most common alternative to contracting, which basically constitutes the make-or-buy (Kelman, 2002) or sourcing decision (Bruel, 2010). Correspondingly, as an alternative to traditional bureaucratic service delivery, service contracting has been cited as one of the most appealing options among various privatization approaches (DeHoog, 1990).

In the United States, the government has relied on the private sector to provide commercial services from the outset of the nation's founding (Moe, 1987). Although considerably different from practices today, government contracts have been used in this country as a means of providing goods and services even since before the American Revolution (Nagle, 1999). Contracts were used in the Revolutionary War largely to supply troops and have become an ever increasing element of military and government operations since then. However, contracts were

not only used in the early days of this nation to provide for military needs, but they were also used by civilian agencies for providing basic services. In fact, some procedures used today originated in the Treasury Department with the first secretary, Alexander Hamilton. Interestingly, as observed by Nagle (1999), some of the same problems in government contracting that plagued us during the Revolutionary period continue to be troublesome today. Kettl (1993) goes on to further state that "waste, fraud, and abuse in American defense contracts began even before the county did" (p. 6).

Nagle (1999) and Cooper (2003) have both thoroughly documented the fact that government contracting has long been an administrative field of practice within the U.S. public sector in each period of the nation's history. Despite the large role that contracting has played in practice, it was largely ignored by the public administration literature until Cooper (1980) accentuated the need to focus on it.

Cooper's 1980 essay in *Public Administration Review*, which called for further research to study the acquisition process, suggested that "the acquisition of goods and services needed by government is an important aspect of public administration that has not been adequately investigated" (Cooper, 1980, 459). Moreover, Cooper offered an integration-operation-separation model, which corresponds roughly to the private sector

contracting phases of agreement, performance, and termination. In his discussion of upfront integration phase, he cited that "the contracting process commences when program personnel decide to acquire services or products by contracts" (p.463).

Additionally, while taking a thorough look at U.S. government contracting, Cooper (2003) recognized the importance of integrated project teams and concluded that the key to understanding public contract management is the recognition that contract managers operate at the intersect of the vertical (authority relationships) and horizontal (contractual relationships based on mutual commitment) models. Despite not directly discussing the issue of defining contract requirements, he did acknowledge the important role played by requirements in the contracting process since the early days of American history. For instance, Cooper stated that the term "change order" originated around the time of the Civil War (Cooper, 1980).

Although Cooper (2003) emphasized the importance and critical role of public sector contracting, one could argue that some of the early observers laid the intellectual foundation for examining this critical function from a scholarly perspective. Most notably, Woodrow Wilson claimed in his 1887 essay - "*The Study of Administration*" - that public administration is "detailed and systematic execution of public law" (p. 212) and that administrative study was to discover how government can

operate with "the utmost efficiency and at the least possible cost of money of energy" (p. 197). Moreover, he argued that the field of administration is a field of business, and that "administration is the province of the technical official." Logically then, in today's terminology, such a technical official could be a program manager or contracting officer.

Although it rarely received empirical examination prior to the 1980s (Salanie, 2003), public sector contracting has long been championed as a way to save costs and improve performance. Fernandez (2009), however, argued that there is no single theoretical approach that governs the understanding of how contractual relationships are effectively managed. Conversely, Brown and Potoski (2004) pointed out that public contracting has deep roots in economic theories of organization. Correspondingly, Johnston and Girth (2012) cite competition as a key catalyst for contracting and chief driver of improved efficiency and effectiveness in government production and service delivery. However, the empirical analysis by Lamothe and Lamothe (2010) on social services contracting found little correlation between competition and vendor performance. Nevertheless, Osborne and Gaebler previously noted that "competition is here to stay, regardless of what our governments do" (Osborne & Gaebler, 1994, 442).

## **b. New Public Management (NPM)**

In many respects, modern contracting practices and procedures have received an increased level of attention in the past couple decades due to the rise of the New Public Management (NPM) movement. Although contracting has been an aspect of government operations since the Revolutionary War, NPM provides a lens for examining and better understanding many of the underlining factors that influence public contracting today. While it did not receive widespread recognition in the United States until the early 1990's, there was a move toward NPM in several Organization for Economic Co-operation and Development (OECD) countries in the 1980's largely due to public sector accounting changes (Hood, 1995).

According to Hood (1991), NPM stems from four administrative "megatrends," namely: attempts to slow down government growth, increased focus on privatization, expanded use of information technology, and a public management agenda that is more internationally focused. Hood further argues that NPM stems from two separate streams of ideas. The first is new institutional economics, which is primarily comprised of public choice, transaction cost theory, and principal-agent theory; the second stream is business-type managerialism stemming from the scientific management movement (Hood, 1991). Slightly different from Hood's two streams, Kaboolian (1998) cited only public

choice, principal-agent theory, and transaction cost economics as having heavily influenced the NPM reforms.

Consistent with Hood's assessment, Kamensky (1996) refers to the New Zealand reform approach as an example and also contends that NPM has commonalities with public choice theory, principal-agent theory, and transaction cost economics. Unlike Hood, however, he makes NPM synonymous with the reinvention movement, and goes so far as to consider it as a new paradigm in public management defined by practitioners rather than by academics. Other observers have taken a significantly different view and consider NPM to have a "fragmented and incoherent framework" (Haque, 2007, 182).

Correspondingly, along with Hood (1991) and Kaboolian (1998), Kamensky's three intellectual cousins of NPM include public choice theory, principal agent theory, and transaction cost analysis (Kamensky, 1996, 251). Rather than terming them as intellectual cousins of NPM, a more appropriate label may be the intellectual foundation of NPM and the smart-buyer problem.

Commentators against the NPM movement expressed concern in the public administration literature, citing the consequences of becoming a "hollow state" (Milward & Provan, 2000) and "running government like a business" (Box, 1999). They argue that governments utilizing private sector practices develop a more distant relationship with their citizens, become less

accountable to the public, and tend to lack public service values. Rosenbloom and Piotrowski (2005), also pointed out that the NPR considered administrative law to be an impediment to effective administration - to achieving results. Moe (1987) suggested that public administrators are marginalized and have become minor players in the sphere of privatization, primarily due to the lack of capacity to draw on their own "theoretical and intellectual roots" (p.453). He further argued that the origins of those intellectual roots are embedded in public law rather than economics of the social sciences.

Despite the negative reaction to NPM by some scholars, public "managerialism" (Hood, 19991; Kettl, 1997) and "steering rather than rowing" (Osborne & Gaebler, 1994) have moved ahead. In fact, it gave much of the basis for the National Performance Review (NPR), which was initiated during the Clinton administration when Bill Clinton declared on January 27, 1996 that "the era of big government is over" (Clinton, 1996). The George W. Bush administration continued reform initiatives by initiating the "President's Management Agenda" (PMA) and included competitive sourcing as one of the top government-wide PMA initiatives (Breul, 2007; Rosenbloom & Piotrowski, 2005). Including that particular initiative as a top priority is consistent with one of the key guiding principles of NPM - the preference for private ownership, contracting out, and

competition in public service provision - outlined by Kamensky (1996).

### **III. Theoretical Perspectives**

Theoretical underpinnings of government contracting - public choice theory, principal-agent theory, transaction cost economics, and contract law - are briefly described in this section. They are considered foundational aspects, since many contracting concepts, policies, and practices can be traced back to these four perspectives.

#### **a. Public Choice Theory**

According to Buchanan and Tullock, public choice theory argues liberal policies that allow market-like solutions to replace central planning and improve the efficiency of the political process (as cited in Hefetz & Warner, 2004). Furthermore, the theory seeks to explain how actors will behave in different institutional settings as a consequence of different incentive structures.

Maintaining that the foundation of the public choice approach originated from the theoretical traditions of public administration previously laid by Wilson, Simon, and Waldo; Vincent and Elinor Ostrom (1971) observe that most political

economists in the public choice tradition begin with the individual as the basic unit of analysis and conceptualize public goods as a type of event associated with the output of public agencies. Moreover, they view the four basic assumptions normally made about individual behavior to include: individuals are assumed to be self-interested, individuals are assumed to be rational, individuals adopt maximizing strategies, and certainty is dependent upon the level of information possessed by individuals (Ostrom & Ostrom, 1971, 205).

In terms of the metaphor of running government like a business, Box argues that public choice suggests "shrinking government by contracting out services or returning them to the private sector on the premise that the private sector is more efficient (in the case of contracting) or the assertion that the private sector is more efficient (in the case of true privatization)" (Box, 1999, 37). Boyne (1998), on the other hand, proposes that replacing monopoly with competition in public service markets is the public choice theorists' solution for problems of bureaucracy. He further states that public choice theory "does not imply that transferring responsibility for a publically funded service to a private organization is sufficient to increase efficiency" (Boyne, 1998, 475). While proposing hypotheses on service contracting that can be derived from public choice arguments on bureaucratic behavior, Boyne (1998, 475)

feels that "it is the competition in market for service production that is important, not whether production is public or private."

### **b. Principal-Agent Theory**

Stephen Ross and Barry Mitnick were the first scholars to explicitly propose agency theory in the early 1970's. Working independently, Ross is responsible for the origin of the economic theory of agency and Mitnick for the institutional theory of agency (Mitnick, 2012). Aligned as a means for analyzing matters pertaining to contracts, Charles Perrow (1986, 224) offered a description of principal-agent theory:

In its simplest form, agency theory assumes that social life is a series of contracts. Conventionally, one member, the 'buyer' of goods or services is designated the 'principal,' and the other, who provides the goods or service is the 'agent' - hence the term 'agency theory.' The principal-agent relationship is governed by a contract specifying what the agent should do and what the principal must do in return. (As cited in Waterman & Meier, 1998, 174)

Similarly, Kettl (2002) observed that a contract is the centerpiece of indirect government relations and asserted that management of indirect tools links with principal-agent theory. Box (1999) argued that principal-agent theory is particularly relevant for analyzing public sector relationships and Lamothe

and Lamothe (2004) empirically demonstrated its applicability for analyzing both contracting-out and contracting-in decisions.

Essentially, the principal-agent problem exists whenever one individual relies on the action of another. The person taking the action is called the agent, and the party dependent on the action is called the principal. The heart of the problem is that agents often have specialized knowledge that their principals lack and infrequent are the circumstances under which principals can perfectly or inexpensively monitor the agents' actions or independently evaluate what agents know (Eisenhardt, 1989; DiIulio, 1994).

Waterman and Meier (1998) maintain that the principal-agent model, as applied in such disciplines as sociology, political science, and public administration, is in essence a theory about contractual relationships between buyers and sellers. The theory considers contractual arrangements between two or more individuals, groups, organizations or other forms of association. One party (the principal) enters into a contractual relationship - implicit or explicit - with another party (the agent) under the expectation that the agent will take actions desired by the principal (Smith & Bertozzi, 1998). However, while examining the collaborative aspects of contract performance measurement, Amirkhanyan's research offered new

evidence suggesting that the view of contracting dyads as merely buyers and sellers is insufficient (Amirkhanyan, 2008).

Epstein and O'Halloran (2002) affirm that a great many articles have been generated over the past two decades on principal-agent theory. Their overall conclusion regarding this theoretical paradigm is that principals can usually diminish conflicts of interest through the careful design of contracts, but can rarely control agents perfectly. Controls only improve a situation; they never completely resolve the basic problem.

### **c. Transaction Cost Economics**

Characterizing the interdisciplinary nature of transaction cost economics (TCE), Oliver Williamson, the founder of modern TCE, emphasized that it joins economics with aspects of organizational theory and has considerable intersection with contract law (Williamson, 1979). According to Mitnick (2012), Williamson's work completely changed the way scholars thought about the nature of firms.

Building upon Ronald Coase's early work concerning the nature of the firm, Williamson identified uncertainty and asset specific investments as the two sources of transaction costs (Kelman, 2009a). Similarly, Williamson singled out "uncertainty, frequency of exchange, and the degree to which investments are

transaction-specific as the principal dimensions for describing transactions” (Williamson, 1979, 261).

Transaction cost analysis assumes individuals are self-interested, but it recognizes the importance of authority relations and takes seriously a range of structural and sociological variables often ignored by economists. TCE relates to antitrust, regulation, and governance law (Williamson, 2008).

In the arena of procurement, the make-or-buy decision is fundamentally a TCE question (Brown & Potoski, 2003, 2005; Melese, Franck, Angelis, & Dillard, 2007; Kelman, 2009a). Simply stated, transaction costs are the management costs incurred in delivering services and they can occur in either government provided or contracted service delivery (Brown & Potoski, 2003, 2005).

Using transaction cost analysis, empirical research conducted by Hefetz and Warner (2012) on local level contracting decisions found that market and management characteristics are particularly important in explaining sourcing decisions. Conducting research at the federal level, Johnston and Girth (2012) concluded that managing the market entails real costs and that it is an important element of the transaction costs associated with outsourcing of public goods and services. The costs cited by Johnston and Girth (2012) consist of public

resources used to create, enhance, and sustain competition in thin markets where the government procures goods and services.

Unsurprisingly, when surveying 75 local government officials regarding 64 common services, Brown and Potoski (2005) found that successful service delivery is challenging when contracting for services that are asset specific or difficult to measure.

Incomplete contracts are unavoidable (Williamson, 2002) and a subsequent study with Van Slyke, Brown and Potoski found that incomplete contracts, especially when it comes to complex products, are a fundamental source of contracting failure (Brown, Potoski, & Van Slyke, 2010).

#### **d. Contract Law**

A contract is a mutually binding legal relationship obligating the seller to furnish supplies or services and the buyer to pay for them. More specifically in the context of government procurement, Kelman (2002, 282) defines contracting as "a business arrangement between a government agency and a private entity in which the private entity promises, in exchange for money, to deliver certain products or services to the government agency or to others on the government's behalf." Entering into contracts begins with the authority given to the federal government by the Constitution of the United States.

As outlined by Cooper (2003, 18), the enumerated powers of Congress listed in Article 1, Section 8 of the U.S. Constitution establishes that the federal government has the capacity to participate in the national economy as a purchaser of goods and services. Specifically, the first clause of Article 1, Section 8 gave Congress the "Power To lay and collect Taxes, Duties, Imposts and Excises, to pay the Debts and provide for the common Defence and general Welfare of the United States." Other enumerated powers listed in Article 1, Section 8 gave Congress the power to borrow and coin money, regulate commerce, fix standards of weight and measurement, raise and support Armies, and provide and maintain a Navy. Of particular importance for public contracting was the necessary and proper clause, Article 1, Section 8, Clause 18, that authorized Congress: "To make all Laws which shall be necessary and proper for carrying into Execution the foregoing Powers, and all other Powers vested by this Constitution in the Government of the United States, or in any Department or Officer thereof."

Article 1, Section 9, generally referred to as the audits and accounts clause (Cooper, 2003, 21), mandated appropriations for the withdrawal of funds from the U.S. Treasury by stating: "No money shall be drawn from the Treasury, but in Consequence of Appropriations made by Law; and a regular Statement and Account of the Receipts and Expenditures of all public Money

shall be published from time to time." Article 1, Section 10 also addressed contracts by putting constraints on states by stating: "No State shall ... pass any Law impairing the Obligation of Contracts." Finally, Article VI acknowledged public contracts by stating: "All Debts contracted and Engagements entered into, before the Adoption of this Constitution, shall be valid against the United States under this Constitution, as under the Confederation."

Accordingly, federal procurements can be traced to legislative authorization and appropriation. To contain all of the procurement rules imposed by Congress<sup>6</sup>, the Federal Acquisition Regulations (FAR) was established in 1984. The FAR defines processes, provides guidance, implements preference programs, and includes the specific language for many of the clauses found in a federal contract. According to the FAR, contracting means obtaining supplies or services from nonfederal sources; it includes description (but not determination) of supplies and services required, selection and solicitation of

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<sup>6</sup> Applicable federal acquisition laws include: Antideficiency Act (originally enacted in 1884); Armed Services Procurement Act of 1947; Federal Property and Administrative Services Act of 1949; Contract Disputes Act of 1978; Competition in Contracting Act of 1984; Federal Acquisition Streamlining Act of 1994; Federal Acquisition Reform Act of 1995; Information Technology Management Reform Act of 1996; and the Service Acquisition Reform Act of 2003.

sources, preparation and award of contracts, and all phases of contract administration.

According to Schwartz and Scott (2003), contract law has more rules regulating different aspects of the contracting relationship than are needed just to perform its enforcement and interpretation purposes. They further state that the current state of contract law scholarship suffers from the absence of a successful theory of contract. Specifically, Schwartz and Scott claim that:

Contract law has neither a complete descriptive theory, explaining what the law is, nor a complete normative theory, explaining what the law should be. These gaps are unsurprising given the traditional definition of contract as embracing all promises that the law will enforce. Even a theory of contract law that focuses only on the enforcement of bargains must still consider the entire continuum from standard form contracts between firms and consumers to commercial contracts among businesses. No descriptive theory has yet explained a law of contract that comprehends such a broad domain. Normative theories that are grounded in a single norm—such as autonomy or efficiency—also have foundered over the heterogeneity of contractual contexts to which the theory is to apply. (p. 543)

This difficulty identified by Schwartz and Scott is especially pronounced in the context of government services contracts, since encompassing the full range of heterogeneous services and stakeholder interests with single norms is unachievable. It could be argued, however, that certain contract characteristics reflect normative interests in a broad

sense. For example, besides being based on economic market dynamics, the contract characteristic 'Extent Competed' is also rooted in norms such as fairness and transparency. Moreover, enhancing advantages for small and disadvantaged companies through the competitive contracting process can be viewed as a means for accomplishing normative societal goals of increased opportunity and equity. Also, good faith and trust are implicit in 'Firm-fixed Price' contracts where both parties reach an agreement that should be based on an accurate statement and understanding of contract requirements and price. Despite these examples relevant to contract characteristics, normative theories grounded in single norms will continue to break down in the diverse and highly complex federal services contracting environment.

White (2009) contends that government procurement and contracting are "fundamentally matters of hermeneutic<sup>7</sup> interpretation as parties to a pending or existing contract attempt to come to some mutual agreement about the meaning of a contract and the circumstances surrounding it" (p. 303). He

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<sup>7</sup> According to White (2009, 302), hermeneutics is the "art or science of interpreting the meaning of something." It is the process of coming to an understanding of the meaning of something by a group of interested persons. Government contracts consist of written text, so hermeneutics comes into play as parties to a contract try to interpret and understand the meaning or their obligations as set forth in the contract wording.

argues that anticipatory hermeneutics becomes a factor in requirements determination stage, before a contract is written. Furthermore, he maintains that anticipatory hermeneutics comes into play as each party to a potential contract tries to understand what the other wants and what the other can provide, thereby searching for better insights of a possible future contractual relationship (White, 2009).

According to Schooner (2005), federal procurement statutes and regulations assume a pattern in which agencies rely upon warranted contracting professionals to procure needed supplies and services. This procedure splits programmatic and procurement authorities such that program managers (PMs) rely upon contracting officers (COs) to fulfill their requirements. This procurement system then assumes that COs are familiar with, understand, and follow congressional mandates and accomplish the government's procurement objectives. Contracting officers are expected to meet the PM's needs, but within the established constraints of the federal procurement system.

Similarly, Cooper (1980) observed that, in accordance with the FAR, contracting officer's (CO) responsibilities include securing bids, selecting a contractor by awarding a contract, maintain the necessary agreements, monitoring the progress of the contractor, and accepting the completed product or service on behalf of the government. Nowhere in the job description

offered by Cooper does it state that the CO is responsible to for the identification, definition, or management of contract requirements. He does observe, however, that contracting authority is fragmented and that the program manager (PM) is responsible for the program, while the CO is the legal representative of the government and is responsible for the legality and propriety of the contract.

Moving beyond workforce issues, Steven Schooner (2002), identified three overarching principles of government procurement systems: competition, transparency, and integrity. In the United States, he observed, our system encourages participation by the widest possible pools of potential competitors; it establishes that competitors will be impartially considered for contract awards and it treats all contractors in a manner that balances appropriate risks with incentives and rewards. Citing the Competition in Contract Act of 1984 (CICA), Schooner further stated that by maximizing the effective use of competition, the government receives its best value in terms of price, quality, and contract terms and conditions. The next of his overarching principals, integrity, entails rules of conduct for procurement personnel in the government and private industry. As such, Schooner (2002) specified that bribery, favoritism, and unethical behavior have no place in a successful procurement system. Finally, the

principal of transparency employs procedures by which buyers and contractors ensure that government business is conducted in an impartial and open manner. In order to achieve transparency, Schooner noted that the government publishes all of the statutes, regulations, and rules that define the federal procurement process.<sup>8</sup>

Although each theoretical perspective described in this section - public choice theory, principal-agent theory, transaction cost economics, and contract law - is a foundational aspect of government contracting, the perspective most germane to this study is principal-agent theory. It is especially relevant since the unit of analysis in principal-agent theory is the contract and determining the optimal contract between principal and agent is the focus (Jensen & Meckling, 1976; Eisenhardt, 1989). Furthermore, goals, as articulated by clear contract requirements, are "the keystone of a contract" and most important to the principal-agent relationship (Kettl, 1993, 25).

Concerning the challenge of clearly defining contract requirements, Kettl (1993, 26) stated:

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<sup>8</sup> The following websites provide federal statutes, regulations, and related procurement information: GPO Access site - [http://www.access.gpo.gov/su\\_docs/index.html](http://www.access.gpo.gov/su_docs/index.html); the Federal Acquisition Regulation - <http://www.arnet.gov/far/>; and, the Commerce Business Daily - <http://cbdnet.gpo.gov>.

In a contracting relationship, however, goals must be specified far more clearly, in advance, and reduced to legally enforceable language. For the government principal, the job is difficult because public goals rarely stand still long enough to allow precise formulation. For the government contractor, such fuzzy and shifting goals make it hard to know what the government expects. And without legally enforceable goals specified clearly in the contract, there are no clear standards against which to measure contractor's performance. Defining goals is thus at once the most important and most elusive element of the principal-agent relationship.

While Kettl considers the smart buyer question - what has been bought - to be "the core of principal-agent theory" (Kettl, 1993, 181), the statement above expresses the central importance of defining requirements (the "what to buy" question) to the principal-agent relationship. Moreover, judging the quality of what has been bought is only achievable if the first smart buyer question - what to buy - is accurately stated and understood. Therefore, conducting this study in the context of the smart-buyer problem and considering requirements definition as a formative component in the contracting process provides a contribution towards better understanding principal-agent relationships.

#### **IV. Contemporary Perspectives**

Divided into two parts, this section offers a review of scholarly public management literature pertaining to contracting,

followed by a discussion of contracting practice literature, reports, and studies.

#### **a. Public Service Contracting**

Government contracts are here to stay, since they have become imbedded in many key government functions and are now a vital aspect of successful government operations. As stated by Brown, Potoski, and Van Slyke (2006, 323), "Contracting is and will continue to be a major task facing public managers." Some observers even argue that the propensity in the United States to seek market-based solutions, such as contracting, for government problems is rooted in American exceptionalist values (Durant, Girth, & Johnston, 2010). Moreover, White (2009) asserts that "Contracts are becoming the basis for the legitimacy of public action as agencies at all three levels of government are turning to partnerships with for-profit and not-for-profit organizations to provide goods and services to the public and services to government that were once the sole domain of governmental agencies" (White, 2009, 303).

In the context of this study, the term "Contracting" refers to a business arrangement between a government agency and a private entity, which can be either for-profit or non-profit, in which the private entity promises to deliver certain products or services to the government agency (or to others on the

government's behalf) in exchange for money (Kelman, 2002b). Additionally, direct provision by the government is the most common alternative to contracting, which basically constitutes the make-or-buy (Kelman, 2002b) or sourcing decision (Bruel, 2010). Regardless of terminology used, principal-agent theory provides much of the foundational basis upon which the decision is made and when it comes to monitoring contractual relationships, following the money trail is the most reliable guide of who is actually doing different actions (Kettl, 2002).

Steven Kelman, the former director of the Office of Federal Procurement Policy and current Weatherhead Professor of Public Management at Harvard University, is an experienced senior procurement professional and contract management scholar. As stated by Johnston and Girth (2012), he has "been an intellectual leader on federal contracting for several goods and services and was instrumental in instituting critical reforms that have enhanced the effectiveness of federal contracting and contract management" (p. 5).

Bridging scholarship and practice, Kelman, along with Donald Kettl, has been instrumental in connecting public management and federal procurement. Both as an academic and featured *Federal Computer Week* columnist, he has covered an array of issues impacting federal contracting. Focused on workforce policy challenges, Kelman (2011) asserted that

providing more contracting officers and program managers is the key to improving service contract management. Regarding contract types and requirements, Kelman (2009) offered a straightforward view when he stated that "A second kind of problem is where government isn't, or can't be, specific about what it wants. In such situations, a fixed-price contract is meaningless, because it is unclear what the customer will get for the price. A poorly specified requirement will produce a poorly delivered service." (p. 1) With regard to workforce capacity, he further stated that "The administration and Congress need to understand that more fixed-price contracting requires more acquisition professionals to develop requirements" (Kelman, 2009, 2).

Of particular importance to contracting scholarship, Donald Kettl identified the "*Smart-Buyer Problem*" as a fundamental means to better understand government procurement challenges. In his book *Sharing Power* (1993), a widely regarded work in the public management literature that is largely based on principal-agent theory, Kettl advanced what he called the *competition prescription*. The competition prescription, which substitutes market for government control, assumes a competitive market.

However, due to the nature of many of the goods and services bought by the government, demand-side or supply-side market imperfections frequently exist. The primary argument of

Kettl's book is that "the higher the level of imperfections in the markets in which it buys, the greater the burden on the government to behave as a smart buyer" (Kettl, 1993, 17).

Furthermore, in order to act as a smart buyer, the government must know how to answer three basic questions: what to buy, who to buy from, and what has been bought.

Topping the list of demand-side market imperfections cited by Kettl is what could be termed as the challenge of requirements definition. Specifically, he states:

A market cannot be competitive unless the buyer can define what it wants to buy. The federal government must have the capacity to define products ranging from the purchase of office supplies out of a catalog to projects beyond the bounds of existing technology. In some cases the government cannot define precisely what it wants in advance. No one knows with certainty, for example, what toxic wastes a cleanup might uncover or, in some cases, how best to treat them. In these and other contracts, the final product often is not so much a market response to the buyer's demands as it is a cooperative alliance between the government and its suppliers. This sort of collaborative venture destroys the arm's length relationship between buyer and seller that makes for a competitive market (Kettl, 1993, 34).

As previously noted, this study contributes to public management by addressing the question of Kettl's *Smart-Buyer Problem* that receives little attention and tends to be overlooked in the literature - "what to buy." This lack of scholarly attention is rather noteworthy, since according to Kelman (2009a), the "what to buy question" is the business

strategy part of contracting, which should receive the personal attention of agency senior leadership.

Originating from the smart-buyer problem, Brown, Potoski, and Van Slyke (2005; 2006) advocate the federal buying process in three phases: (1) deciding whether to make-or-buy the services, (2) vendor selection, and (3) using monitoring tools to oversee contract execution. In their view, the first question is essentially the make-or-buy decision - whether conditions are suitable for contracting. This phase does not directly address the requirements determination (what to buy) question but rather that is seen as part of the second phase after deciding to contract, according to Brown, Potoski, and Van Slyke (2006). They see specifying tasks, as well as the other factors regarding the terms and conditions of the contract leading up to contract award, as a second phase.

Kettl (1993; 2002) asserted that, while accepting the market-based potential of contracting, governments have failed to develop the capacity to cope with the most basic contracting questions. Specifically, Kettl (2002) argues that managing an indirect tool, such as a contract, is fundamentally a people problem and that it requires extremely strong public management to make indirect tools work. He further states, regarding goal setting, that "All government managers need to understand the goals of the programs they run. In indirect programs, this is

even more important." (p. 500). Related to the issue of a collaborative alliance between buyer and seller cited by Kettl, collaborative performance measurement of state and local government contracts was a topic examined in detail by Amirkhanyan (2008). Of note, she found that high service measurability, long-term contracts, and highly dynamic markets reduce the likelihood of collaboration and joint decision marking.

Kettl's first question - what to buy - essentially consists of determining the need and articulating basic requirements of the contract: the government must know what it wants to buy. It establishes the need upon which the entire acquisition procurement process flows, since it provides the fundamental reasoning as to why a contract is generated, awarded, executed, and monitored. It is that aspect of the smart-buyer problem that is the primary focus of this research effort. The question of "what to buy" is arguably the most important area of smart-buyer inquiry since the other two questions are contingent upon it being answered correctly.

While some include sustaining and managing markets as a key element (Johnston & Girth, 2012; Kettl, 2002), deciding "who to buy from" is largely governed by law and procurement regulations, such as the Federal Acquisition Regulations (FAR), which contracting officers are mandated to follow. Besides, as

outlined in Chapter 2, individuals discharging the actual procurement function are warranted contracting officers who undergo specific training and meet certification requirements.

Although it may be prescribed by regulations and instruction guides, Kim and Brown (2012) maintain that contract design is an underexamined area of public management. Looking at contract type, length, and value in three federal agencies, Kim and Brown found that short-term fixed-price contracts were used for the majority of purchases, although in many cases frequent contract modifications to the initial contract were needed. Moreover, their analysis revealed that short-term fixed-price contracts frequently tend to be modified without the benefit of full and open competition, which exposes the government to higher costs and greater risk.

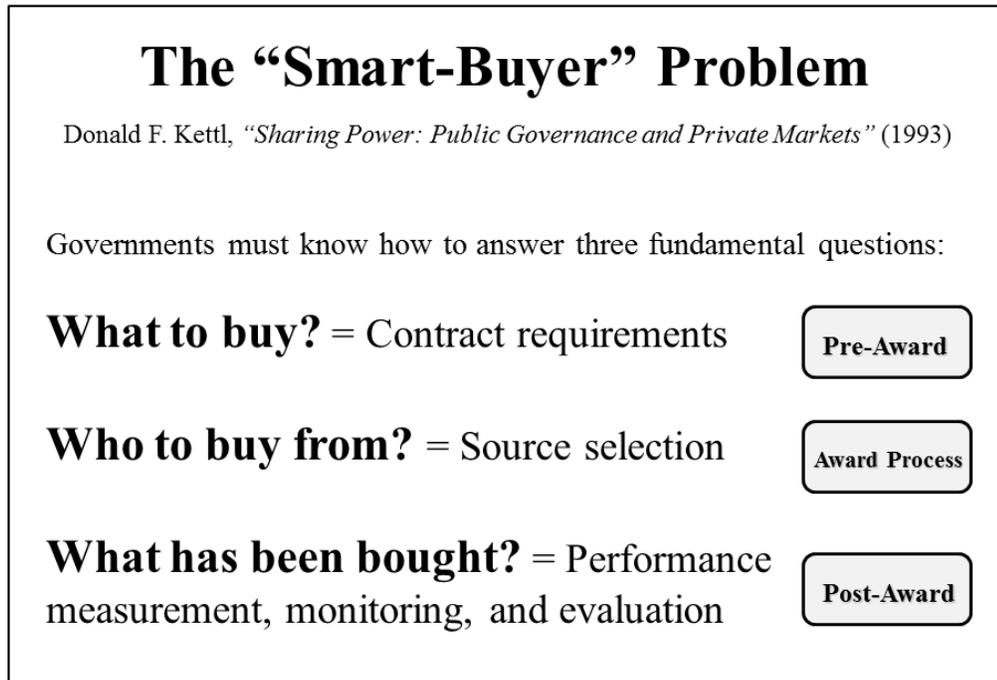
The question of "what has been bought" is directly related to performance measurement and contractor monitoring, which is similarly governed by regulations and has associated training and professional certification requirements. Additionally, as remarked at the onset of this chapter, the question of "what has been bought" has been well documented in public management literature; there has been a wide body of literature written concerning contract performance measurement and evaluation (Fernandez, 2007, 2009; Brown and Potoski, 2006; Brown, Potoski, & Van Slyke, 2006; Marvel & Marvel, 2007; Amirkhanyan, 2008;

Rendon, 2008; Lambright, 2009; Amirkhanyan, Kim & Lambright, 2010).

Regarding contract requirements, DeHoog (1990, 328) observed that "Because the contract does not clearly specify performance standards, and technologies may be poorly understood, complex, or rapidly changing, the government may need to devote more effort and resources to overseeing suppliers' actions and their outcomes." Therefore, the quality of contract requirements has direct bearing on the ability to accurately assess "what has been bought" and determine whether the government did actually receive what was needed.

As depicted in Figure 3.1, the three smart-buyer problem questions can be directly linked to contracting aspects discussed and stages in the procurement process.

Figure 3.1: The Smart-Buyer Problem



#### **b. Contracting Practice, Reports, and Studies**

Similar to what Vann (2011) previously discovered, contracting practitioner literature reviewed for this study was dominated by articles that told of best practices and success stories. They, too, were found to be based on professional opinions or subjective evidence and generally lacked empirical analysis to support claims made. Moreover, much of the material published seemed to be written by individuals with specific interests in outcomes or policy consequences. Besides representing government organizations, unlike the scholarly literature contributors, many of these individuals are

associated with consulting firms, private companies, advocacy groups, or think tanks.

Indicative of much of the practice literature, Garrett (2007) offered a brief article in *Contract Management* which outlines the basic definition and components of performance-based contracting. He observed that it is a "strategic method to manage business arrangements by promoting flexibility and innovation and focusing on outcomes, while using performance standards, metrics, and incentive to motivate superior performance" (Garrett, 2007, 56). He stated that performance-based contracting is a subset of performance-based acquisition (PBA) since PBA involves improving all aspects of buying and selling - people, processes, performance measures, metrics, incentives, and pricing. However, firm-fixed price and performance-based contracts should not be considered as a one size fits all solution for every type of service acquisition (Prentice, 2010). Interestingly, poor requirements definition is not listed by Garrett as one of the possible reasons for not obtaining desired results when using performance-based contracts (Garrett, 2007).

Similarly, Livingstone (2010) gave a list of factors and barriers regarding performance-based acquisition. While focused on performance-based services, his article largely discussed success stories and gave what he considered to be keys to

successfully using a performance-based approach. He reiterated much of what the Office of Federal Procurement Policy (OFPP) chronicled as the seven steps to performance-based acquisition. While not mentioning requirements determination directly, one of the listed barriers to successful performance-based acquisition was the lack of meaningful/effective performance objectives (Livingstone, 2010). Additionally, he offered a "new approach" to performance-based acquisition that called for a greater level of socialization in the initial phase of the acquisition. Similarly, as an advocate for performance-based contracting for services, Kelman (2010) has voiced concern on the slow rate of progress that federal agencies have made adopting that approach and meaningful metrics.

While advocating a cradle-to-grave approach to performance-based service acquisition, Cavadias (2005) focused on the contract administration aspects of the process. Unfortunately, he did not address the underlining requirements determination process needed accurately formulate the performance objectives and metrics needed for sound contract administration. Rather, the argument was made to simply devote more attention and resources to post-award contract administration.

In their 2007 article, Edwards and Nash claim that the term "performance-based contracting" has been replaced by the term "performance-based service acquisition. Regardless of the label

used, it is the federal government's preferred approach to services contracting. Using this approach, results must be specified rather than the method and/or process that contractors must follow. Edwards and Nash claim that there are two types of services and that a performance-based approach is only applicable to the common, routine, and simple services. In their opinion, although it encompasses the greatest amount of taxpayer money, complex services - such as information technology services - are not conducive to a performance-based approach (Edwards & Nash, 2007). Offering no empirical evidence, they go on to state that it is unrealistic to ask agencies to state in clear, specific, objective, and measurable terms future needs that are not fully understood. They further claim that "the PBSA (*performance-based services acquisition*) requirement for beforehand specification and objective and measurable standards ignores the nature of long-term and complex service relationships" (Edwards & Nash, 2007, 356).

A relational approach to performance-based service acquisition is advocated by Edwards and Nash, which will allow the government and its contractor to engage in ad hoc specification and adjustment of expectations throughout the life of the contract (Edwards & Nash, 2007, 358). They specifically cite ad hoc specification of requirements during performance as a key feature of relational PBSA. This approach is somewhat

similar to the one advocated by Balter (2011) for information technology (IT) investments, where he calls for an "agile", or "define as you go," approach for software development rather than a more rigid waterfall development process. However, unlike Edwards and Nash, Balter acknowledges that current procurement regulations and practices do not allow for the utilization of such free flowing and open methods for government contracting. However, it should be noted that using an ad hoc or agile requirements process was specifically cited as a major weakness of the services contracting requirements process by the House Armed Services Committee Panel on Defense Acquisition Reform (Andrews, Conaway, et al., 2010).

As identified over three decades ago, there is a lack of interaction between military administration and public administration (Jefferies, 1977). Furthermore, despite the volume and level of expenditures involved with Department of Defense (DOD) acquisition, the attention given to military administration in the public management literature tends to be devoid of meaningful discussion of service contracts and service contract requirements. However, Friar (2005b) suggested that proper oversight of services contracts is even more critical since there is often no end product that can be pointed to after the expenditure of funds.

Accounting for nearly 60 percent of the total federal expenditures on services contracts from 2007 to 2010, the Defense Department was the dominant consumer of services in the federal government (CSIS, 2011). Nevertheless, acquisition topics addressed in defense oriented practitioner publications are typically focused on the procurement of weapon systems (aircraft, ships, tanks, etc.). Despite accounting for over 50 percent of the DOD acquisition expenditures, services contracts receive relatively little discussion. Major weapon systems procurements tend to capture headlines, which in turn results in the disproportionate amount of coverage in the practitioner literature.

On June 28, 2010, Ashton Carter, the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)), issued a memorandum to the Department of Defense acquisition workforce announcing the framework to improve efficiency in the acquisition business. Recognizing the strong likelihood of reduced defense budgets in the future and the corresponding need to preserve adequate funds for force structure and modernization, he issued the memorandum titled "*Better Buying Power: Mandate for Restoring Affordability and Productivity in Defense Spending.*" Secretary Carter subsequently issued more detailed implementation guidance on September 14, 2010 and November 3, 2010 to execute the mandate that he issued on June 28, 2010. With the goal of

achieving a \$100 billion redirection of defense budget dollars, the Better Buying Power (BBP) initiative calls for the DOD acquisition workforce to "do more without more."

The BBP guidelines gave heightened importance to services acquisition. In the more detailed guidance issued in September and November 2010 by Secretary Carter, improving the tradecraft of services acquisition was identified as one of BBP's main objectives. Specifically related to this study, the guidance pertaining to services acquisition called for improving requirements definition and preventing requirements creep, requiring greater competition, limiting the use of time and materials and award fee contracts for services, and using firm fixed price contracts to the maximum extent possible when competition exists (Carter, 2010, September 14, 11; Carter, 2010, November 3, 5).

Frank Kendall succeeded Ashton Carter in the Pentagon as the USD(AT&L) when Dr. Carter was elevated to the Deputy Secretary of Defense position. Secretary Kendall continued the BBP initiative and issued a memorandum to the DOD acquisition workforce on November 13, 2012 titled "*Better buying power 2.0: Continuing the pursuit for greater efficiency and productivity in defense spending.*" His BBP 2.0 guidance preserves improving the tradecraft in services acquisition as one of the primary focus areas. Additionally, his guidance continues and expands the

initiatives that were started by Secretary Carter. Moreover, contracting for services is considered as one of the areas with the greatest potential for cost reduction and improved efficiencies (Kendall, 2012, November 13).

Largely in support of the DOD's Better Business Initiative goal to "Improve the Tradecraft in Services Acquisition," Beers (2011) discussed the material that the Department of Defense uses in its Defense Acquisition University (DAU) curriculum and tools available to everyone involved in the acquisition of services. Beginning with an identified mission requirement, the services acquisition process - according to Beers - consists of three phases: planning, development, and execution. In greater specificity, he lays out the seven steps advocated by DAU, where requirements definition is the fourth step in the entire process and a function of the entire project team. Moreover, he identifies sources of information, workshops, and courses available for those involved in services acquisition.

Reports from the Government Accountability Office (GAO) are considered influential in professional contracting circles and tend to have an impact on practice, so they are recognized here as an important element of contracting literature. GAO reports use empirical data and accepted audit methodology, Making them particularly valuable.

Between 2001 and 2009, the GAO issued 16 reports pertaining to trends, challenges and deficiencies in contracting for services (Rendon, Apte, & Apte, 2012). If a broader view is taken to include other aspects related to services contracting, such as contract types, requirements management, and workforce capacity, the number of GAO reports issued in this period is closer to 40. Due to the large number of GAO reports issued, each one is not individually discussed in this literature review. Instead, a detailed list of the pertinent reports issued during the 11 year period from 2001 - 2012 is included in the references section of this study.<sup>9</sup>

As an examination of the reports list reveals, the DOD has tended to be a favorite audit target of the GAO. Although other federal agencies receive varying degrees of GAO attention, the scrutiny devoted to DOD acquisition is understandable given the relative magnitude of procurement conducted by that particular department. Although the GAO does not specifically define the term "well-defined requirement" in any of their reports, they refer to it regularly and a few of the reports did highlight

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<sup>9</sup> See References, section II(a), U.S. Government Accountability Office (GAO) Reports - Federal acquisition (2003, 2007a, 2007g, 2008a, 2008b, 2009d, 2010d, 2011c); Services contracting (2001, 2002a, 2002b, 2002c, 2007f, 2008c, 2008d, 2009b, 2011e, 2012a); Data Quality (2004, 2005b, 2009a, 2009e, 2012b, 2012d); and Defense Department services contracting (2005a, 2006, 2007b, 2007c, 2007d, 2007e, 2009c, 2010a, 2010b, 2010c, 2011a, 2011b, 2011d, 2011f, 2012c).

instances of diminished contract outcomes due to a lack of sufficiently defined service requirements (GAO, 2002, 2007b, 2009d).

Beyond GAO reports, one of the findings by the interagency SARA Panel was that clear requirements definition was a best practice by commercial buyers of services (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007). The Panel singled out defining requirements as a key finding and noted that in the private sector effective services competition depends upon a strong requirements development process. They recommended that agencies place greater emphasis on defining requirements and that no acquisition should take place without a review and sign-off from both the program manager and contracting officer. Of particular significance to this study, the Panel found that the use of fixed price contracts was facilitated by well-defined performance-based requirements.

For acquiring activities, the Panel found "detailed statements of work communicating specific contract requirements and expected levels of service quality are essential to a successful relationship with vendors" (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007, 88). This statement is fundamentally opposed to the ad hoc relational approach advocated by Edwards and Nash (2007) and the agile approach advocated by Balter (2011). However, the SARA Panel's finding is consistent

with the House Armed Services Committee Panel on Defense Acquisition Reform finding that a structured requirements process for services contracting is warranted (Andrews, Conaway, et al., 2010).

In a similar vein, as cited in a Congressional Research Service report, the Special Inspector General for Iraq Reconstruction testified before the Senate Armed Service Committee (SASC) that the inability to properly define and prepare requirements was a significant oversight challenge in the contracting process (Grasso, 2007, CRS-11). Additionally, the testimony revealed that some of the contracts bypassed the requirements development process by using undefinitized (*sic.*) contract actions, which do not require the contracting officers to write complete performance work statements before the contract work is complete. Ultimately, this gave certain contractors cost advantages, which was not in the best interest of the government.

Even President Obama weighed in on the nexus between contract type and requirements by mandating via Presidential Memorandum on March 4, 2009 that there shall be a preference for fixed-price contracts. Moreover, he stated that "Cost-reimbursement contracts shall be used only when circumstances do not allow the agencies to define its requirements sufficiently to allow for a fixed-price type contract" (Obama, 2009, March 4, ¶ 9). Similarly, regarding competition, President Obama proclaimed

in the same memorandum that full and open competition ought to be used by all federal agencies to the maximum extent possible.

As a result, specific guidance regarding competition and contract types was issued in a memorandum to the heads of departments and agencies on July 29, 2009 by Peter Orszag, the Director of the Office of Management and Budget. In the memorandum, he stated that "noncompetitive contracting, cost-reimbursement contracts, and time-and-materials and labor-hour (T&M/LH) contracts pose special risks to overspending" and called for a 10 percent reduction of dollars obligated via contracts with those characteristics (Orszag, 2009, 2). As a means to achieve savings through more effective acquisition practices, Orszag suggested that agencies enhance upfront planning to align with program requirements and acquisitions and to "make sure that acquisition requirements are clearly stated" (Orszag, 2009, July 29, attachment 1). Likewise, he explicitly called for the "migration of work from a cost-type to a fixed-price contract as requirements become better defined" (Orszag, 2009, July 29, attachment 2). Similarly, in a letter sent to Senator Lieberman on March 18, 2009, Director Orszag stated the "Cost-reimbursement contracts play a role in circumstances where an agency is not able to define its requirements sufficiently to allow for a fixed-price contract" (Orszag, 2009, March 18, paragraph 2).

The official documents issued by both President Obama and OMB Director Orszag illustrate the commonly accepted nexus between contract type and level of requirements definition, which supports a hypothesis that fixed-price contracts correlate positively with well-defined requirements. Their stated preference for full and open competition, which require better defined contract requirement due to the heightened level of transparency, supports the hypothesis that competitively awarded contracts positively correlate to well-defined requirements as evidenced by better acquisition outcomes.

## **V. Literature Review Summary**

Contracting as a recognized means of governance is not going away (Kelman 2002a, 2002b; Cooper, 2003; Brown, Potowski, & Van Slyke, 2006). Disconcertingly, despite its importance, federal contracting has received limited coverage in the public management scholarly literature; rather than addressing federal contracting, public management scholars tend to focus on social services contracting at the state and local levels (Van Slyke, 2003, 2007; Hefetz & Warner, 2004, 2012; O'Tool & Meier, 2004; Brown & Potoski, 2004; Romzek & Johnston, 2005; Heinrich & Choi, 2007; Amirkhanyan, 2008; Lamothe & Lamothe, 2009 2010; Lamothe, 2011; Levin, & Tadelis, 2010;), as well as performance measuring

and monitoring (Fernandez, 2007, 2009; Marvel & Marvel, 2007; Amirkhanyan, 2008; Rendon, 2008; Lambright, 2009; Amirkhanyan, Kim & Lambright, 2010). On the other hand, Kelman, Kettl, Cooper, Schooner, Brown, and Potowski, have also made noteworthy scholarly contributions to the public management contracting literature in additional areas.

Despite increased levels of interest in recent years, a number of observers have expressed the need for more scholarly and empirical research in government contracting. This conclusion was confirmed during the course of reviewing literature for this study, since it became quite apparent that across both of the public management scholarly literature and contracting practice literature the demand for more empirical research still exists.

More disturbing than the limited focus of most observers and lack of empirical research, with the possible exception of selected GAO reports and studies, the literature is very silent on the entire issue of contract requirements in general and the relationship to between requirements and acquisition program outcomes in particular. This study is a step towards filling that void by empirically examining the underexplored dimension of the smart-buyer problem. Providing such illumination is valuable to both scholars and practitioners.

In summary, the literature reveals three key elements that form the origin of this study. First, the historical and theoretical perspectives provide the foundation upon which federal contracting is conducted. Not only does the literature establish the long history of government contracting in the United States, but also that it is founded on public choice theory, principal-agent theory, transaction cost economics, and contract law. Many of the federal contracting policies and practices employed today can be traced to these historical and theoretical roots. Second, a gap in the scholarly literature was identified. As documented in this literature review, there has been great deal of focus on state and local contracting, as well as on performance measurement and monitoring. However, there is a lack of empirical research on federal government contracts and virtually no scholarly research on contract requirements (the "what to buy" question). Finally, the literature offers a solid basis for selecting each of the specific contract characteristics for investigation in this study. As such, the selected contract characteristics are all grounded in the literature and represent a consensus on what should constitute the attributes of successful contracts.

## CHAPTER FOUR: RESEARCH DESIGN

### I. Introduction

While the importance of contract requirements is undeniable, there is little empirical research related to federal service contract requirements. As identified in the previous chapter, except for a few exceptions, the dialogue that has occurred tends to be focused on state and local contracting and performance measurement and monitoring. As such, it appears as if most scholars prefer to consider those topics disproportionately and treat contract requirements as being accurately identified. Rather than taking a step back and questioning contract requirements, the issue of "what to buy" is not examined or simply passed off as the "make-or-buy" question by those few scholars who consider it in the context of the smart-buyer problem.

Therefore, this study makes a contribution towards filling that gap for both scholarship and practice. Analyzing contract characteristics is important since current acquisition policy advocates particular characteristics, such as firm-fixed price, performance-based, and competitively awarded contracts, as the preferred methods of procurement. Additionally, the use of integrated process teams and qualified program managers are

based in policy and widely accepted as best practices. The study strives to gain an empirical comprehension of service contract characteristics associated with requirements and their correlation to acquisition program success.

In terms of organization, this chapter begins by restating the research question that forms the basis of the study. In addition, the corresponding hypotheses studied in Chapter 5 are delineated, as well as their linkage to the substance and gaps previously discussed in both Chapter 2 (Background Information) and Chapter 3 (Historical, Theoretical, and Contemporary Perspectives). Next, the approach and elements of the quantitative analysis are discussed. In this section, topics such as sources of data, variable selection, sampling methodology, and statistical tools are covered. After taking into account the quantitative approach, the qualitative component of this study is briefly defined. While not as extensive as the quantitative component, the qualitative discussion looks at participant selection criteria and questions used for the semi-structured interviews with subject matter experts. Finally, this chapter concludes with a summary of the results that were expected prior to conducting the qualitative analysis and subject matter expert interviews.

### **a. Research Question**

As initially introduced in Chapter 1, the research question of this study is:

**Is there significant correlation between selected services contract characteristics\* related to contract requirements and information technology (IT) investment ratings?**

\* - The five contract characteristics selected for analysis are: Contract Type, Extent Competed, Performance-Based Acquisition, Integrated Process Team, and Program Manager Qualification.

### **b. Articulation of the Hypotheses**

With the aim of establishing a means for answering the research question, the null hypothesis is defined as:

**$H_0$ :** There is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings.

In order to reject the null hypothesis, each of the following individual alternate hypotheses are examined to see if they can be answered affirmatively.

*H<sub>1</sub>*: There is statistically significant correlation between firm-fixed price (FFP) service contracts and investment ratings.

*H<sub>2</sub>*: There is statistically significant correlation between competitively awarded service contracts and investment ratings.

*H<sub>3</sub>*: There is statistically significant correlation between performance-based service contracts (PBSCs) and investment ratings.

*H<sub>4</sub>*: There is statistically significant correlation between service contracts with a chartered Integrated Process Team (IPT) in place prior to contract award and investment ratings.

*H<sub>5</sub>*: There is statistically significant correlation between programs with fully qualified Program Managers and investment ratings.

As can be seen, there is a nexus between each of the contract characteristics examined in the individual alternate hypotheses and the material previously discussed in Chapters 2 and 3. More specifically, each of the characteristics selected for examination has a relationship to contract requirements. For example, besides being specified in the Federal Acquisition Regulations, it was repeatedly stated in both the public management and practice literature that firm-fixed price contracts are preferable in cases where requirements can be well-defined (Bajari & Tadelis, 2001; Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007; Rendon, Apte, and Apte,

2010). In a similar fashion, the policy and preference for performance-based contracts was thoroughly documented. Given that performance-based contracts mandate measurable outcome based requirements, the argument can be made that requirements for those contracts are required to be more accurately defined and thus result in favorable acquisition results. Likewise, the connection between each of the independent variables stated in the individual alternate hypotheses and contract requirements can be established.

## **II. Mixed Methods Research Approach**

Mixed methods research can be defined as “the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study” (Johnson & Onwuegbuzie, 2004, 17). Using this approach, the researcher needs to make two primary decisions. The first decision is whether to operate largely within one dominant paradigm or not; the second decision is whether to conduct the phases concurrently or sequentially (Johnson, Onwuegbuzie, & Turner, 2007).

This study used both quantitative and qualitative research methods. However, as an empirical research effort, it was not equally balanced between the two methods. Rather, a

quantitative dominant mixed method research approach was applied; therefore, quantitative methodology constitutes the core component. As a result, the study was weighted more towards statistical analysis that examined in detail the correlation between service contract characteristics related to requirements and information technology (IT) investment ratings. The supplementary component research method was qualitative and consisted of interviews with senior subject matter experts who provided reactions and insights to aid in better understanding that informed the quantitative findings.

Besides being quantitative dominant, this research study used a sequential design (Creswell, 2009) that consists of two phases. In particular, the initial phase was the quantitative core component and the second phase was the qualitative supplementary component. Since enhancement is a primary rationale for selecting a mixed methods approach (Johnson, Onwuegbuzie, & Turner, 2007), the supplementary qualitative phase was conducted to inform a quantitative phase. Moreover, this approach was particularly well suited for this study, since employing an explanatory sequential strategy as a means to enhance explanation of the findings is especially useful when unexpected or unusual findings are generated from the quantitative analysis (Creswell, 2009; Doyle, Brady, & Byrne, 2009).

### **III. Quantitative Component**

In this section, the sources of data are identified and explained, as well as the other key elements of the quantitative methodology. Each of the variables, both dependent and independent, are defined and the rationale for using them is summarized. Additionally, the sampling methodology and statistical techniques that were used are described.

#### **a. Sources of Data**

As stated earlier, the quantitative analysis for this study was based on publically available data. This was most fitting, since open data sources allow for subsequent replication and independent peer review. Additionally, using authoritative government data sources in the public domain was considered preferable to data collected by other means, such as sample surveys.

Collecting survey data was disregarded since it can have a tendency to be based more on opinions and attitudes than actual results (Kerlinger, 1986), thereby increasing the probability of gaining more biased and subjective data regarding program outcomes and their relationship to contract requirements. Additionally, due to the sensitive and proprietary nature of specific

acquisition program and contract information, individual program managers and contracting officers could be reluctant to admit substandard acquisition outcomes and divulge actual reasons for poor contract results.

Rather than collecting potentially biased data or subjective opinions, the decision was made to use authoritative open government data sources for the quantitative portion of this study. The sources used consist of data submitted to the Office of Management and Budget (OMB), the General Accountability Office (GAO), and other higher level organizations. As a result, the data is reviewed and approved by senior level public managers as official agency submissions.

Since the data used in this study was derived from official agency submissions, it is important to note that the GAO has raised concerns regarding data accuracy and timeliness in some of their reports (GAO, 2004, 2005b, 2009e, 2011b, 2012b, 2012d). Therefore, while acknowledging these concerns regarding data quality, a fundamental assumption was nevertheless made in this study that the sources utilized provide the most reliable public data available.

Accordingly, although discrepancies and shortfalls have been observed, the following authoritative government sources of investment, program, and contract data were used for this research

effort:

- *Office of Management and Budget (OMB) Federal IT Dashboard* (<http://www.itdashboard.gov>)

Provides data for a total of 27 federal agencies (listed in Appendix B) and is used as the primary source of acquisition program investment data. Agency Chief Information Officers (CIO) are responsible for evaluating and updating select data on a regular basis, which includes their evaluation of programs and assignment of investment ratings.

- *OMB Exhibit 300 for selected Capital IT Investments*

This mandatory *OMB Circular A-11* exhibit provides detailed planning, budgeting, acquisition, and management information pertaining to major information technology (IT) capital investments. Individual program submissions are obtained through the Federal IT dashboard, and the Exhibit 300 data fields displayed on the IT Dashboard are shown in Appendix C. Besides the data shown on the dashboard, additional information is acquired, such as actual service contracts

exercised, Integrated Process Team charter date, and Program Manager qualification by examining the individual Exhibit 300 submissions for each program.

- *Federal Procurement Data System - New Generation*

(FPDS-NG) (<https://www.fpds.gov>)

Based in law (41 U.S.C. 401) and as stated in the FAR (subpart 4.6), the Office of Federal Procurement Policy (OFPP) is responsible for establishing a computer-based data system for collecting, developing and disseminating procurement data to Congress, the Executive branch, and private sector. Accordingly, FPDS was developed as the single authoritative repository for federal post-award procurement data. A comprehensive source of procurement data, the individual elements collected for each contract are shown in Appendix A.

- *Federal Agency Service Contract Inventories*

The Consolidated Appropriations Act of 2010 required executive agencies, except the Department of Defense (DOD), covered by the

Federal Activities Inventory Reform (FAIR) Act of 1998 (Public Law 105-270), to submit information annually in support of the agency-level inventories for service contracts. As a result, individual agency service contract inventory information is obtained for this study via the OMB service contract website<sup>10</sup>. The Department of Defense (DOD) has been required to submit service contract inventories since prior to the 2010 Act, and information on DOD service contracts is obtained directly from the Defense Procurement and Acquisition Policy website<sup>11</sup>. Therefore, both the OMB and DOD websites are used as authoritative sources for service contract information in order to verify whether contracts listed in the Federal IT Dashboard are in fact services contracts. The specific agencies submitting service contract inventories can be seen in Appendix D.

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<sup>10</sup> The OMB service contract website address is - <http://www.whitehouse.gov/omb/procurement-service-contract-inventories>

<sup>11</sup> The DOD service contract website address is - [http://www.acq.osd.mil/dpap/cpic/cp/acquisition\\_of\\_services\\_policy.html](http://www.acq.osd.mil/dpap/cpic/cp/acquisition_of_services_policy.html)

In order to navigate the various data repositories and construct a unique, consolidated database for this study, two primary data elements were employed: the Unique Investment Identifier (UII) and the Procurement Instrument Identifier (PIID). The UII was used for identifying individual investments in the Federal IT Dashboard and their corresponding OMB Exhibit 300 submissions, which listed the PIIDs for each investment. Obtaining PIIDs, which are commonly referred to as contract numbers, provided a means for obtaining detailed FPDS-NG and service contract inventory information.

**b. Dependent Variable - Investment Ratings**

Major federal information technology (IT) acquisition program investment ratings, as recorded in the Federal IT Dashboard, were used as the dependent variable in this study. To enhance completeness, this analysis considered both the OMB overall ratings and the individual agency CIO evaluation ratings.

The OMB overall ratings, computed on a 10 point scale, were only assigned during a two year period from June 2009 to September 2011. The equally weighted factors comprising the OMB overall rating were cost variance, schedule variance, and agency CIO evaluation. The OMB discontinued providing overall investment ratings, but since their discontinuance has relied on

individual agency CIO evaluations as the primary measures of investment health and program performance.

To allow for more current data and an added means of exploration, this study also considered individual CIO evaluation ratings as a dependent variable. That rating, on a 5 point scale as shown in Appendix E, considers six factors: Risk Management, Requirements Management, Contractor Oversight, Historical Performance, Human Capital, and Other. Of particular significance for this study was the requirements management factor, which calls for agency Chief Information Officers to assess the completeness and clarity of investment requirements, as well as stakeholder involvement in the requirements development process. Since requirements management is included as a primary factor in the agency CIO evaluation rating, it is reasonable to assume that the rating provides a good indicator for the quality of the service contract requirements for each investment. Appendix E also shows cost and schedule variance guidelines listed on the Federal IT Dashboard for assigning CIO evaluation ratings.

The information displayed in Appendix E is the only OMB guidance provided for assigning agency CIO evaluation ratings. Although this minimal level of computational guidance and potential limitations regarding the use of investment ratings as an accurate gauge of program performance was recognized from the

beginning, the use of investment rating was judged the best available yardstick for this study. Additionally, as later confirmed during interviews with subject matter experts, several senior officials conceded that their internal data sources could not provide more accurate program performance information. Their concerns regarding the use of investment ratings as a dependent variable will be more fully discussed in Chapter 5.

Additionally, an assumption made in this study was that program investment rating (dependent variable) is an accurate indicator of contract performance. The logic behind this assumption rests on the view that acquisition programs are only able to achieve high ratings if they have high quality underlying contracts. By the same token, proper contracts are only achieved through accurate and well defined requirements. Therefore, well defined requirements contribute positively to high quality contracts which result in highly rated acquisition programs and investments. The logic of this assumption was also confirmed during interviews with senior subject matter experts; all concurred that it is rational.

### **c. Independent Variables - Selected Contract Characteristics**

Based on the literature reviewed and policies outlined in Chapters 2 and 3, the independent variables selected for examination in this study were well established. Each one of

these independent variables has a connection to service contract requirements, so they were thought to provide a creditable means of better understanding the nexus between contract requirements and acquisition program outcomes. Specifically, the selected contract characteristics consisted of:

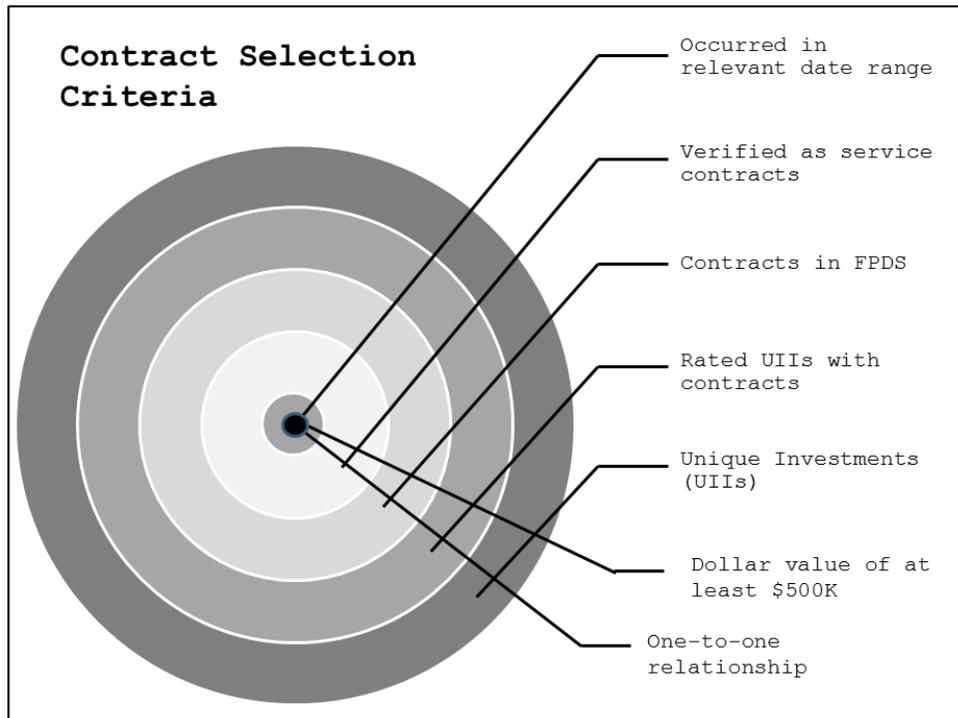
- 1) Contract Type;
- 2) Extent Competed;
- 3) Performance Based Acquisition;
- 4) Integrated Process Team (IPT);
- 5) Program Manager Qualification.

The coding key for the assessment of each independent variable is provided in Appendix F.

#### **d. Sampling Methodology**

To ensure optimal exploration of the data, two different sampling methods were used as the basis for detailed analysis. The first sampling method, used in conjunction with the OMB 10-point overall ratings, was a deliberate selection of contracts based on strict criteria and a unitary relationship with individual investments. More specifically, in order to isolate the effect of individual contracts on investment outcomes, only contracts meeting the criteria displayed in Figure 4.1 were selected within OMB overall investment ranking categories:

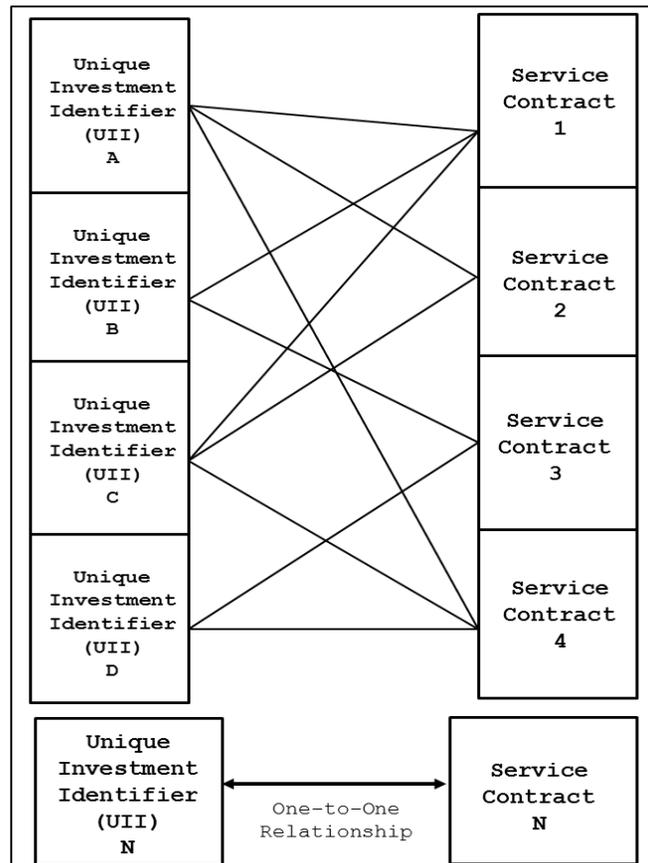
Figure 4.1: Contract Selection Criteria



1. Rated investments with Unique Investment Identifiers (UII);
2. UIIs with identifiable contracts;
3. Contracts with information included in the Federal Procurement Data System - New Generation (FPDS-NG) database;
4. Contracts that can be verified as Service Contracts per FY 2010 Agency Service Contract Inventories;
5. Service Contracts that occurred in the relevant UII Date Range (June 30, 2009 - September 4, 2011);
6. Service Contracts with a dollar value of at least \$500K.
7. Service Contracts that are used for only one investment (UII);
8. Investments that have only one Service Contract listed.

Particularly significant for this sample were criteria 7 and 8, which called for a unitary relationship between the individual contract and individual investment. As depicted in Figure 4.2, it is possible and normal for individual service contracts are used for multiple investments. The converse case is also frequently true, whereby individual investments are composed of multiple contracts. Therefore, to obtain as pure of a view as possible between investment and contract, sixty (60) contracts are selected that have a unitary 'one-to-one' relationship with sixty (60) individual investments.

Figure 4.2: Display of UII and Service Contract Relationships



Further elaborating sampling based on the unitary one-to-one relationships, the Table 4.1 presents details regarding the number of contracts and investments considered for this method.

Table 4.1: Breakdown of UII and Service Contract Matches

Agency Name	Number of UII's with overall ratings (4 Sep 2011)	Number of rated UII's with ITDB Contract Actions	Number of ITDB Contract Actions	Total Number of Service Contract Actions (FY 10 Inventory)	ITDB Contract Actions positively identified as Service Contracts	Rated UII's with Service Contract matches
Department of Agriculture	39	35	143	10,601	28	12
Department of Commerce	41	32	234	5,053	48	18
Department of Defense	72	69	689	212,901	358	54
Department of Health and Human Services	70	70	418	17,042	131	42
Department of the Interior	48	37	117	12,360	31	18
Department of Justice	15	15	72	1,409	4	3
Department of Labor	31	29	109	2,829	40	19
Department of State	7	0	0	--	--	--
Department of the Treasury	31	17	76	4,491	33	9
Social Security Administration	13	13	406	2,028	18	12
Department of Education	21	18	28	1,235	14	14
Department of Energy	19	19	45	4,306	23	14
Environmental Protection Agency	10	9	35	6,604	11	6
Department of Transportation	42	41	247	2,025	12	14
General Services Administration	21	19	40	5,490	15	7
Department of Homeland Security	77	76	629	12,105	144	55
Department of Housing and Urban Development	10	10	29	36	1	1
National Aeronautics and Space Administration	12	12	63	2,552	1	3
Office of Personnel Management	9	7	55	3,082	9	3
Small Business Administration	8	8	41	325	10	4
Department of Veterans Affairs	25	24	295	27,810	94	22
U.S. Agency for International Development	4	3	11	17	0	0
National Archives and Records Administration	5	5	16	160	0	0
National Science Foundation	0	0	17	--	--	--
Nuclear Regulatory Commission	7	7	43	795	8	4
TOTAL =	637	575	3,858	335,256	1,033	334

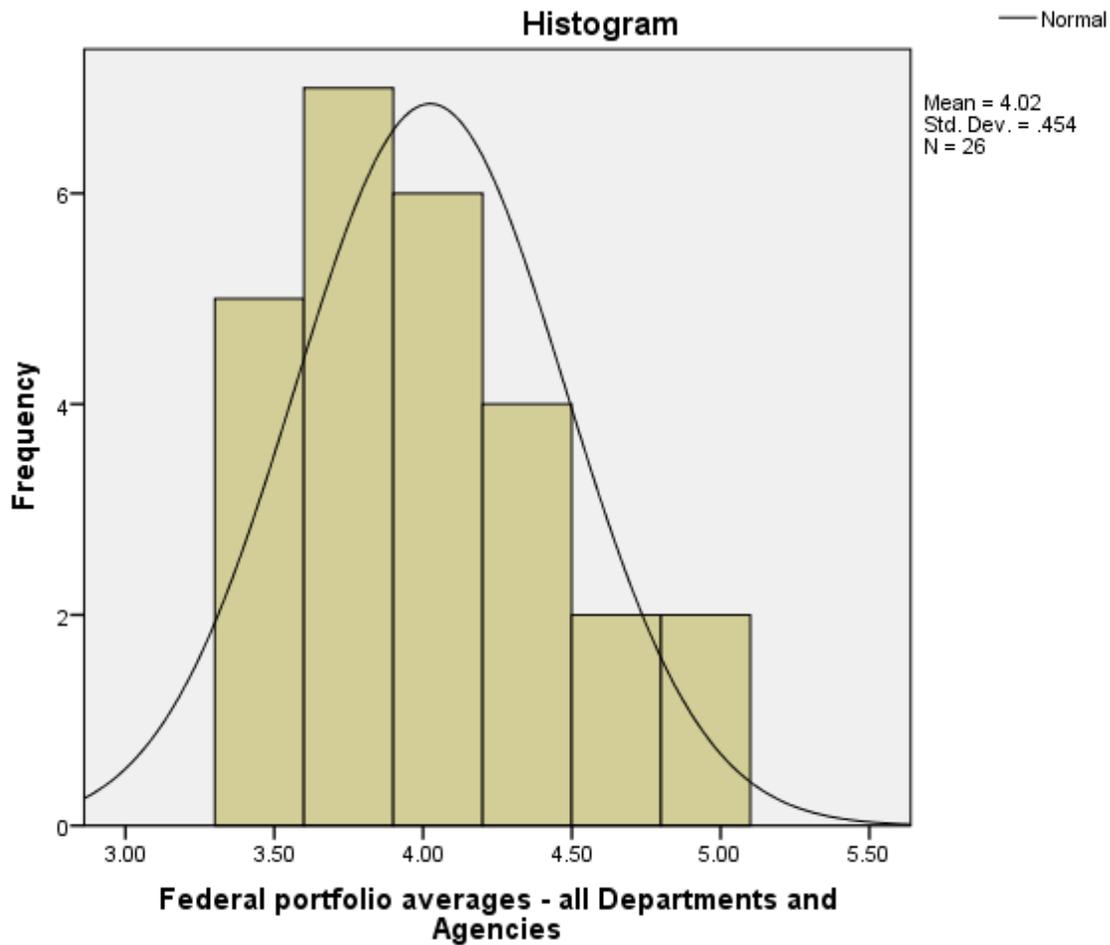
As can be seen, of the 637 investments with OMB overall ratings on September 4, 2011, which was the last date that overall OMB ratings were assigned, only 334 investments have

matching service contracts. Accordingly, a sample of 60 was selected from that pool that met the criteria specified above.

The second sampling method used for this study was considerably more random and used in conjunction with agency CIO 5-point ratings. Again, to ensure more comprehensive exploration and better substantiate results, adding an additional method of sample selection and corresponding analysis was considered beneficial. Using a second view of investment ratings as the dependent variable provided a means for an increased level of rigor and scrutiny. Therefore, agency Chief Information Officer (CIO) evaluation ratings were used as the dependent variable, and an additional sample of sixty (60) investments was selected on a random basis within rating levels.

Similarly to the case with OMB overall ratings, skewed CIO ratings were the reason that samples were made within specified categories (or levels) of investment rating scores. As shown in Graph 4.1, although the investment ratings are made on a 5 point scale, the average CIO investment rating for all agencies is 4.02. A complete list of individual agency CIO portfolio averages can be seen in Appendix G. The investments selected for initial analysis using the CIO investment ratings as the dependent variable were split into three separate groups: ratings below 4, ratings of 4, and ratings above 4.

Graph 4.1: Federal Portfolio Averages



Of the entire population of over 700 investments, a total of 60 investments, consisting of twenty investments from each rating category (<4, 4, >4), were selected using a random number generator. By selecting 20 investments from each rating category, it was assumed that a reasonable spread of ratings would be achieved. Otherwise, there was a high likelihood that investments at either extreme could be underrepresented and not allow for a more comprehensive assessment of the independent variable influences.

Between the two variants of the dependent variable (OMB overall rating and CIO rating), a total of 120 investments were analyzed. Moreover, since the second sample of investments (CIO ratings) did not adhere to the unitary one-to-one criterion, a total of 213 service contracts were examined. That is to say, for investments with OMB overall ratings, 60 service contracts were studied with 60 corresponding investments meeting the criteria and one-to-one relationship previously outlined. On the other hand, since there is no unitary relationship stipulated for the 60 investments randomly selected with CIO rating as the dependent variable, there were a total of 153 contracts evaluated for those investments. The combined sample size of 120 investments resulted in a 95 percent confidence level with an eight percent margin of error.

#### **e. Statistical Analysis**

Two separate methods of statistical analysis were employed for this study: point-biserial correlation coefficients and independent sample t-tests for difference of means. Additionally, scatterplots were created for each set of variables analyzed. The statistical methods of analysis were applied to each alternate hypothesis and separately evaluated so as to investigate whether they permit rejection of the null hypothesis. Additionally, the analysis was conducted on both

variants of the dependent variable (OMB overall rating and agency CIO rating) for each independent variable. By looking at each hypothesis and its corresponding independent variables in a systematic manner that includes different sampling methods and dependent variable configurations, a more exhaustive examination was conducted for determining whether or not the null hypothesis ( $H_0$ ) could be rejected.

Initially, a scatter plot was produced for each independent variable in relation to the dependent variable, since correlations without scatterplots can be misleading (Myers, Well, & Lorch, 2010). This graphical representation allowed for an overall understanding of the distribution and how the two variables related to one another and is considered as perhaps one of the best ways to determine whether there is a relationship between two variables (Myers, Well, & Lorch, 2010). In particular, viewing the scatterplot provided a means to determine whether a linear or nonlinear (curvilinear) relationship exists between the two variables. Understanding the nature of the relationship helps to more accurately interpret the Pearson correlation coefficient ( $r$ ) and independent sample t-test results.

A point-biserial correlation coefficient was generated, along with a scatterplot and independent sample t-test of difference between means, for each analysis conducted. A point-

biserial correlation coefficient results when the Pearson r formula is applied to a data set when one variable is continuous and the other variable takes on values of 0 and 1 (Myers, Well, & Lorch, 2010, 483). Since each of the selected contract characteristics was coded as a dichotomous independent variable (see Appendix F) and the investment ratings were continuous variables, the point-biserial correlation coefficient was computed as a Pearson product-moment correlation coefficient (r).

Correlation between the two variables was analyzed as an index of the strength of relationship and significance. The formula used for computing a Pearson product-moment correlation coefficient between two variables x and y was:

$$r_{pb} = \frac{\sum_{i=1}^N (x_i - \bar{x})(y_i - \bar{y})}{(N - 1)s_x s_y}$$

where,  $r_{pb}$  is the point-biserial correlation coefficient, N is the number of observations,  $s_x$  is the standard deviation of the first variable, and  $s_y$  is the standard deviation of the second variable (Field, 2009, 170).

According to Myers, Well, & Lorch (2010), there are many expressions for the correlation coefficient (i.e., Kendall's tau ( $\tau$ ) or Spearman's rho ( $\rho$ )), but they are all essentially

equivalent to this equation and give the same result within rounding error. Also, a measure of a linear relationship between two variables is determined by where the Pearson's correlation coefficient ( $r$ ) falls between -1 and +1. A value of -1 represents a perfect negative relationship and an  $r$  value of +1 corresponds to a perfect positive relationship. The closer the correlation coefficient ( $r$ ) comes to zero (0), the greater the reduction in the strength relationship between the two variables. Although there are no firm rules regarding classifying the strength of a relationship between two variables, for this study the following guidelines were used:

$0 <  r  < .1$	None or very weak correlation
$.1 <  r  < .3$	Weak correlation
$.3 <  r  < .5$	Moderate correlation
$.5 <  r  < .7$	Strong correlation
$ r  > 0.7$	Very strong correlation

When analyzing the correlation results, the p-value for each bivariate correlation was used to determine whether a statistically significant relationship exists. As such, using a generally accepted significance level of  $\alpha = .05$ , the correlation was considered statistically significant if  $p \leq .05$  (Myers, Well, & Lorch, 2010). Therefore, in order to allow for rejection of the null hypothesis ( $H_0$ ), the p-value must be less than .05 for each alternate hypothesis.

The second method of statistical analysis used in this study was the independent sample t-test for difference between means. This test was used to determine whether there was a statistically significant difference of means between two categories of each independent variable. In this test, which was especially appropriate since the independent variables were dichotomous, the null hypothesis was termed as  $H_0: \mu_1 - \mu_2 = 0$  and the alternate hypothesis as  $H_x: \mu_1 - \mu_2 \neq 0$ , where x = alternate hypotheses 1, 2, 3, 4 and 5. For example, the Contract Type independent variable has two dichotomous conditions - either a firm-fixed price contract or not (other contract type). The t-test determines whether or not the mean ratings for firm-fixed price contracts are statistically different or the same as other contract types. It was useful to conduct this test as an additional means to see if contract characteristics related to requirements resulted in higher average ratings or if there was no difference between the different means for each dichotomous category of the service contract characteristics investigated. The independent t-test equation for equal sample sizes is:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{s_p^2}{N_1} + \frac{s_p^2}{N_2}\right)}}$$

Similarly, the independent t-test equation for unequal sample sizes is:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}\right)}}$$

where, the pooled variance estimate is:

$$s_p^2 = \frac{((n_1 - 1)s_1^2 + (n_2 - 1)s_2^2)}{n_1 + n_2 - 2}$$

(Myers, Well, & Lorch, 2010, 131; Field, 335). Since each of the independent variables has a different number of observations for each of the dichotomous conditions, the equation for unequal sample sizes was predominately used in this study.

#### **IV. Qualitative Component**

Since this was a quantitative dominant mixed method research effort, the qualitative portion was a supplementary component. The purpose of conducting interviews was the key criterion (Aberbach & Rockman, 2002), and as such, a number of interviews were conducted with senior acquisition and information technology executives in order to help better understand and inform the

quantitative findings. To describe the qualitative approach, both the interview participant selection criteria and corresponding interview questions are briefly outlined.

#### **a. Participant Selection Criteria**

The primary target population for interviews was senior level experienced professionals in both the acquisition and information technology communities. As stated by Lilleker (2003, 207), "Elites can be loosely defined as those with close proximity to power or policymaking; the category would include all elected representatives, executive officers of organizations and senior state employees." Therefore, given this broad definition offered by Lilleker, the interview participants for this study were considered 'elites.' No elected representatives were interviewed, but rather elites of Lilleker's second and third type (executive officers of organizations and senior state employees) were included.

Among the acquisition community participants, the goal was to have a mix of individuals with significant program management and contracting experience. All interview participants had recent experience with service contracts and were familiar with their individual agency's requirements determination processes and policies. Similarly, since the focus of analysis for this study was information technology investments and their

corresponding services contracts, it was valuable to include insights from experienced information technology professionals. In particular, all were familiar with the means by which their agency assigns CIO investment ratings and the extent to which requirements management was considered. Additionally, the IT community representatives were knowledgeable of user requirements and challenges that may have prevented the attainment of favorable acquisition outcomes.

To facilitate reaching the interview target audience, an invitation was sent to federal agency Chief Information Officers (CIO), Chief Acquisition Officers (CAO), and Senior Procurement Executives (SPE) requesting participation. As noted by Aberbach and Rockman (2002), gaining access is frequently a problem with elite interviews because these officials are typically very senior executives and so in some cases were not able to personally participate within the designated interview timeframe for this study. However, most that were unable to participate delegated the interview to an appropriately qualified person in their organization who also meets Lilleker's (2003) elite definition. That is to say, all were senior federal government officials serving in positions of authority involving agency acquisition programs and policy. While gaining elite access may sometimes be difficult, Aberbach and Rockman (2002, 673) also observed that "bureaucratic elites are little studied by

political scientists," so an assumption was made that agencies would be responsive and inclined to arrange for participation by their principal official, if time permitted, or designate an appropriate alternate.

For this study, that assumption proved correct since 16 interviews were conducted with a total of 22 senior executives; four agencies had more than one person participate in the interview. In all cases, interview participants were fully qualified and knowledgeable about service contracts, contract requirements, and information technology services acquisition.

#### **b. Interview Questions**

Following a technique often used in elite interviewing, the style used for this study was semi-structured interviews with open ended questions (Leech, 2002). The questions and ensuing discussion were used to gain participants' views of the findings, and to acquire their insights in order to better inform the quantitative results. While recognizing that variability in actual exchanges can frequently occur in semi-structured interviews, the following open ended questions were used to the maximum extent possible:

1. Please explain the extent of your experience with service contracts.

2. Do you have any comments regarding the quantitative analysis and findings? Do any of the findings surprise you? If so, please explain.
3. In your experience, have you observed disconnects between the requirements generator (user), contracting officer, and/or program manager? If so, how would you characterize the primary reason(s) and nature of disconnects? Are disconnects generally the exception or the rule when it comes to service contracts? Do you agree that the service contract requirements process is 'ad hoc' compared to requirements processes for supplies and systems (i.e, weapons systems)? If not, then why not?
4. Do you agree that the Program Manager (PM) is responsible for ensuring that the requirements are accurately stated prior to awarding a service contract? If not the PM, then who do you believe is responsible for accurate contract requirements? What impact do you think certification or quality of workforce play on the quality of service contract requirements? Is skill level emphasized? Does it make a difference?
5. Can you offer any further comments on how you believe requirements relate to successful service contracts and acquisition programs?
6. Can you suggest anyone that I could benefit from interviewing?

Additionally, for IT professionals, questions were also asked about the assignment of investment ratings and the degree to

which requirements management is considered in their investment evaluations.

**V. Expected Results**

Expected results for each of the alternate hypotheses were developed prior to conducting the quantitative analysis and subsequent subject matter expert interviews. They are largely based upon acquisition policy, contracting literature, and personal experience. They are summarized for each of the independent variables as follows:

Alternate Hypothesis - $H_1$	Independent Variable
There is statistically significant correlation between firm-fixed price (FFP) service contracts and investment ratings.	<p style="text-align: center;"><b>Contract Type</b></p> <p style="text-align: center;">(0 = Other contract type, 1 = Firm-fixed price contract)</p>

The variable 'Contract Type' considered firm-fixed price contracts, cost contracts, time and material contracts, and labor hour contracts. Since fixed price contracts are more suited for contracts with well-defined requirements, the assumption was made that firm-fixed price contracts ought to correlate more favorably with highly rated investments. It was expected that there would be a strong and statistically significant positive correlation between firm-fixed price (FFP)

service contracts and above average investment ratings. Additionally, it was expected that the independent sample t-test would show that firm-fixed price contracts had a significantly higher investment rating mean than other contract types, since requirements for firm-fixed price contract ought to be better defined.

<b>Alternate Hypothesis - <math>H_2</math></b>	<b>Independent Variable</b>
There is statistically significant correlation between competitively awarded service contracts and investment ratings.	<p style="text-align: center;"><b>Extent Competed</b></p> <p style="text-align: center;">(0 = Not Competed, 1 = Competitively Awarded)</p>

Given that competed contracts have more transparency and are open to greater public scrutiny and comment by potential bidders, it was reasonable to assume that the contract requirements would be more clearly defined. Therefore, the variable 'Extent Competed' considered whether or not full and open competition was exercised and in cases when it was, the variable ought to correlate favorably with high investment ratings. It was expected that there would be a moderate and statistically significant positive correlation between competitively awarded service contracts and above average investment ratings. The reason that it was expected to have moderate correlation, rather than strong correlations, was due

to agencies meeting federal mandates for achieving set-aside contract goals, which frequently have limited competition. Similarly, it was expected that the independent sample t-test would show a higher investment rating mean for competitively awarded contracts.

<b>Alternate Hypothesis - <math>H_3</math></b>	<b>Independent Variable</b>
There is statistically significant correlation between performance-based service contracts (PBSCs) and investment ratings.	<p align="center"><b>Performance-Based Acquisition</b></p> <p>(0 = Not Performance-Based, 1 = Performance-Based Contract)</p>

The policy regarding performance-based acquisition is clear and since the OFPP requires at least 50% of agency contracts to be awarded in such a manner, it follows that they ought to produce better results. Therefore, the variable 'Performance-Based Acquisition' looked at whether or not a performance-based service contract was used. Since the requirements for a true performance-based contract need to specify desired outcomes with measureable results, it was assumed that the corresponding contract requirements would be more comprehensively developed, better defined, and result in more favorable outcomes. Therefore, it was expected that the quantitative analysis would show a strong and statistically significant positive correlation between performance-based service contracts (PBSCs) and

investment ratings. In addition, since performance-based acquisition has been such a widely acclaimed and recommended method of procurement, it was fully expected that the independent sample t-tests would show that performance-based contracts have significantly higher investment rating mean than contracts that are not performance-based.

Alternate Hypothesis - $H_4$	Independent Variable
There is statistically significant correlation between service contracts with a chartered Integrated Process Team (IPT) in place prior to contract award and investment ratings.	<p><b>Integrated Process Team (IPT)</b></p> <p>(0 = IPT after contract award, 1 = IPT prior to award)</p>

In light of the fact that user involvement is key to developing well-defined contract requirements, and Integrated Process Teams (IPTs) are supposed to include representation from the actual users, it would make sense that contracts with functioning IPTs possess higher quality requirements. Therefore, the variable 'Integrated Process Team (IPT)' considers the charter date and determines whether or not an IPT was in place prior to the actual contract award date. The assumption was made that if an IPT is functioning prior to contract award, there would be a higher probability of user involvement in the requirements development process, which

should result in better defined contract requirements as reflected in higher investment ratings. Therefore, the expected result was that the quantitative analysis would show strong and statistically significant positive correlation between service contracts with a chartered Integrated Process Team (IPT) in place prior to contract award and investment ratings. Likewise, due to greater user involvement, the independent sample t-test was expected to show that contracts with an IPT chartered prior to the award date would have a higher mean investment rating than contracts with an IPT chartered after award.

<b>Alternate Hypothesis - <math>H_5</math></b>	<b>Independent Variable (contract characteristic)</b>
There is statistically significant positive correlation between programs with fully qualified Program Managers and investment ratings.	<b>Program Manager Qualification</b>  (0 = Not qualified/validated, 1 = fully qualified)

Much emphasis and resources have been devoted to increasing Program Manager (PM) competencies and qualifications, seeing as it is widely believed that better qualified PM's produce more favorable acquisition results. Since the PM is the solely responsible individual for the entire acquisition program, which includes requirements development and approval, having a fully qualified PM at the helm should enforce greater discipline and adherence to a more systematic and rigorous requirements

development process. They should be better trained and experienced than a non-qualified PM, so it was reasonable to assume that contract requirements for those programs with fully qualified PM's in charge ought to be accurately defined and result in more positive investment ratings. Accordingly, the variable 'Program Manager Qualification' considered whether or not the designated PM was fully qualified. The expected result was that statistical analysis would show a strong and statistically significant positive correlation between programs with fully qualified Program Managers and investment ratings. Similarly, it was expected that the independent sample t-test would show statistically higher investment rating means for contracts with fully qualified program managers as opposed to contracts without a qualified program manager.

As can be seen, the expected results closely parallel what has been cited in literature and policy. Moreover, the net expected result was that the null hypothesis would be rejected, since it was predicted that each of the individual alternate hypotheses would be positively verified through empirical analysis. Therefore, assuming that the empirical analysis would indeed allow for rejection of the null hypothesis, a resulting conclusion could be made that a statistically significant correlation exists between service contract characteristics related to contract requirements and investment ratings. In

doing so, an empirical basis would be established for supporting the claim that service contract requirements do in fact have a major influence on acquisition program outcomes.

## **VI. Conclusion**

This chapter provided details regarding the research design and methodology for this study. As such, it articulated the research questions, underlying hypotheses, and the mixed research method approach. As a quantitative dominant sequential mixed methods research project, more discussion was devoted to sources of data, variable selection, sampling methodology, and statistical tools. The qualitative portion of this study was a supplementary component and was conducted to better inform and understand the quantitative findings. Therefore, in this chapter's qualitative discussion, particular attention was paid to participant selection criteria and open ended questions were used during semi-structured interviews. Finally, the results that were expected prior to conducting the quantitative analysis were discussed.

## CHAPTER 5: ANALYSIS AND FINDINGS

### I. Introduction

The null hypothesis is defined as:

$H_0$ : There is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings.

Prior to investigating each alternative hypotheses in order to see if the null can be rejected, a few comments are offered regarding the manner in which the analysis was conducted and statistical test assumptions satisfied. The results of two tests conducted for each alternative hypothesis are summarized in this chapter and more detailed results of each point-biserial correlation analysis and independent sample t-test for difference of means are contained in:

- Appendix H: Statistical Details of Contract Type ( $H_1$ )
- Appendix I: Statistical Details of Extent Competed ( $H_2$ )
- Appendix J: Statistical Details of Performance-Based ( $H_3$ )
- Appendix K: Statistical Details of Integrated Process Team  
( $H_4$ )
- Appendix L: Statistical Details of Program Manager  
Qualification ( $H_5$ )

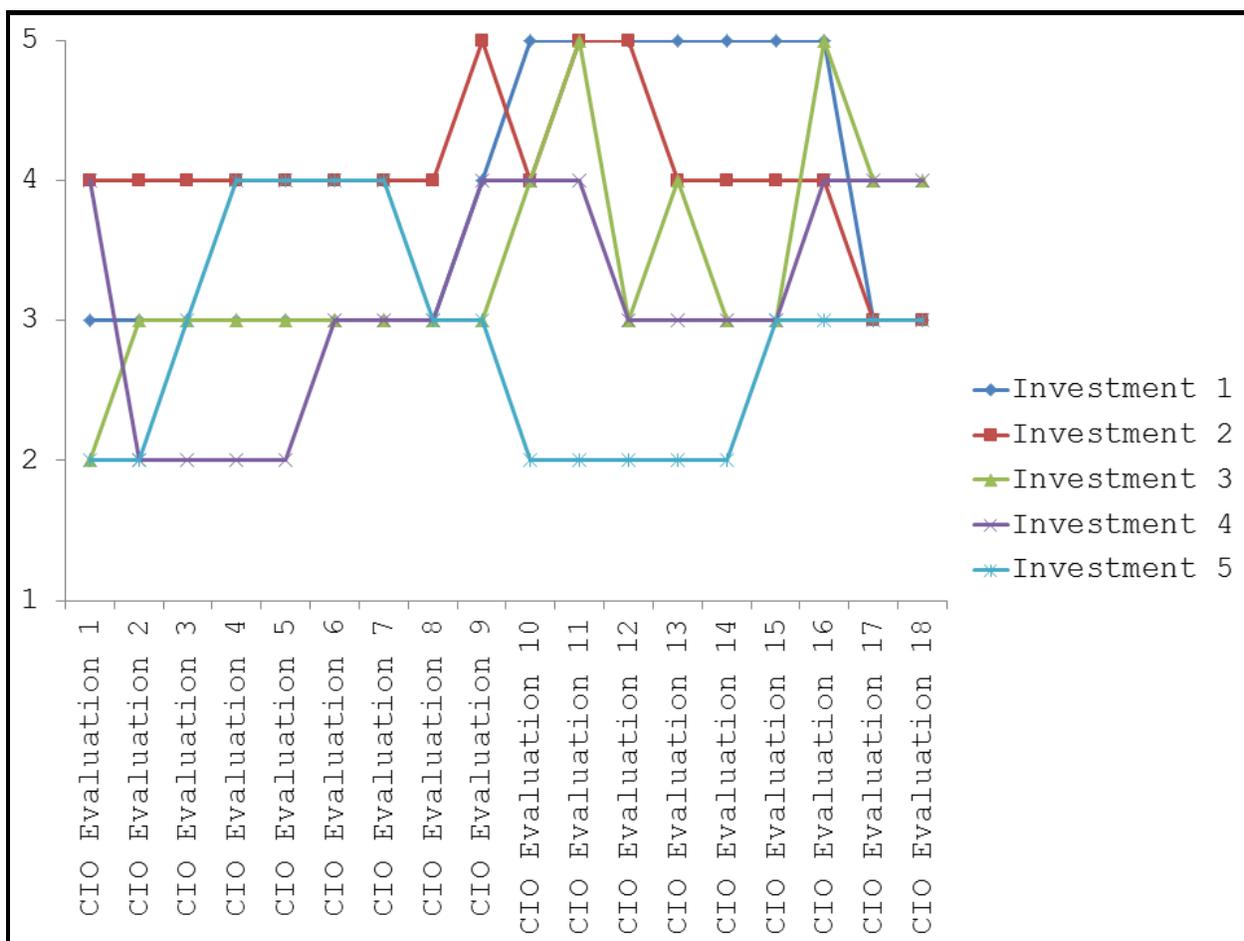
Consolidated scatterplots are shown in the applicable appendices for each of the four dependent variable variants used to evaluate each alternate hypothesis. Similarly, boxplots for each independent variable can be found in the corresponding appendix. Those plots are useful for better understanding the distribution of data, since they show the median of each independent variable, the interquartile range, and outliers.

The analysis consisted of two different samples. The first sample included 60 programs and 60 contracts. A unitary relationship existed between those programs and contracts. That is, each program only has one contract and each contract supports only one program. The second sample was a more randomly selected group of programs, some of which have several contracts. In that sample, there were 60 programs and 153 contracts, which resulted in a total of 213 contracts between the two samples. Since a total of 120 programs out of a population size of 637 were sampled, the study has a 95 percent confidence level with an eight percent margin of error.

Two variations of the dependent variable were used for each sample of 60 programs. The first group was based on the OMB 10-point scale rating, which was configured by both the latest snapshot rating (September 4, 2011) and a 27 month average rating (June 30, 2009 to September 4, 2011). Likewise, the dependent variable for the second sample of 60 programs was

configured by the latest CIO 5-point rating as of August 30, 2012 and a 38 month average rating (June 30, 2009 to August 30, 2012). As illustrated in figure 5.1, using OMB and CIO average ratings, rather than solely the latest or snapshot ratings, was intended compensate for possibly misleading investment ratings due to recent changes to acquisition program baselines, which usually entail modifying cost and schedule parameters.

Figure 5.1: Example of CIO Evaluation Rating Fluctuations



Since two tests (point-biserial correlation and independent sample t-test) were conducted using four variants of the dependent variable for each of the five independent variables, a total of 40 tests were conducted in order to accurately determine if the null hypothesis could be rejected.

#### **a. Dependent Variable Correlation**

There was strong and significant correlation between the dependent variables for both samples. A Pearson product-moment correlation coefficient was computed to assess the relationship between the OMB snapshot and average ratings. There was a very strong and significant positive correlation between the two variables,  $r = 0.790$ ,  $n = 60$ ,  $p = 0.000$ . Similarly, a Pearson product-moment correlation coefficient was computed to assess the relationship between the latest and average CIO ratings. There was a very strong and significant positive correlation between the two variables,  $r = 0.818$ ,  $n = 153$ ,  $p = 0.000$ . Table 5.1 and 5.2 provide details regarding the correlations.

Table 5.1: Correlation of OMB Ratings

		Average OMB Rating (6/30/2009 - 9/4/2011)	Snapshot OMB Rating (9/4/2011)
Average OMB Rating (6/30/2009 - 9/4/2011)	Pearson Correlation	1	.790**
	Sig. (2-tailed)		.000
	N	60	60
Snapshot OMB Rating (9/4/2011)	Pearson Correlation	.790**	1
	Sig. (2-tailed)	.000	
	N	60	60

\*\* Correlation is significant at the 0.01 level (2-tailed).

Table 5.2: Correlation of CIO Ratings

		Latest CIO Rating (8/30/2012)	Average CIO Rating (6/30/2009-8/30/2012)
Latest CIO Rating (8/30/2012)	Pearson Correlation	1	.818**
	Sig. (2-tailed)		.000
	N	153	153
Average CIO Rating (6/30/2009-8/30/2012)	Pearson Correlation	.818**	1
	Sig. (2-tailed)	.000	
	N	153	153

\*\* Correlation is significant at the 0.01 level (2-tailed).

As previously noted in Chapter 4, there are no firm rules regarding classifying the strength of a relationship between two variables; for this study the following guidelines were used:

Table 5.3: Correlation Guidelines

$0 <  r  < .1$	None or very weak correlation
$.1 <  r  < .3$	Weak correlation
$.3 <  r  < .5$	Moderate correlation
$.5 <  r  < .7$	Strong correlation
$ r  > 0.7$	Very strong correlation

Therefore, in the case of investment ratings, there was very strong correlation between the snapshot and average OMB ratings, as well as a very strong correlation between the latest and average CIO ratings.

#### **b. Assumptions for Statistical Tests**

Three assumptions need to be satisfied in order to conduct the statistical analysis for each of the alternative hypothesis: Independence, Normal Distribution, and Homogeneity of Variance (Myers, Well, & Lorch, 2010, 134; Field, 2009, 133). The following discussion briefly demonstrates how each of the required assumptions was satisfied.

##### **1) Independence**

The scores in each group of ratings are independently distributed. That is, the OMB or CIO rating score of each investment is given independently of the rating score for any

other investment. Also, each independent variable can only take one dichotomous value, either 0 or 1.

Table 5.4: Independent Variable Coding

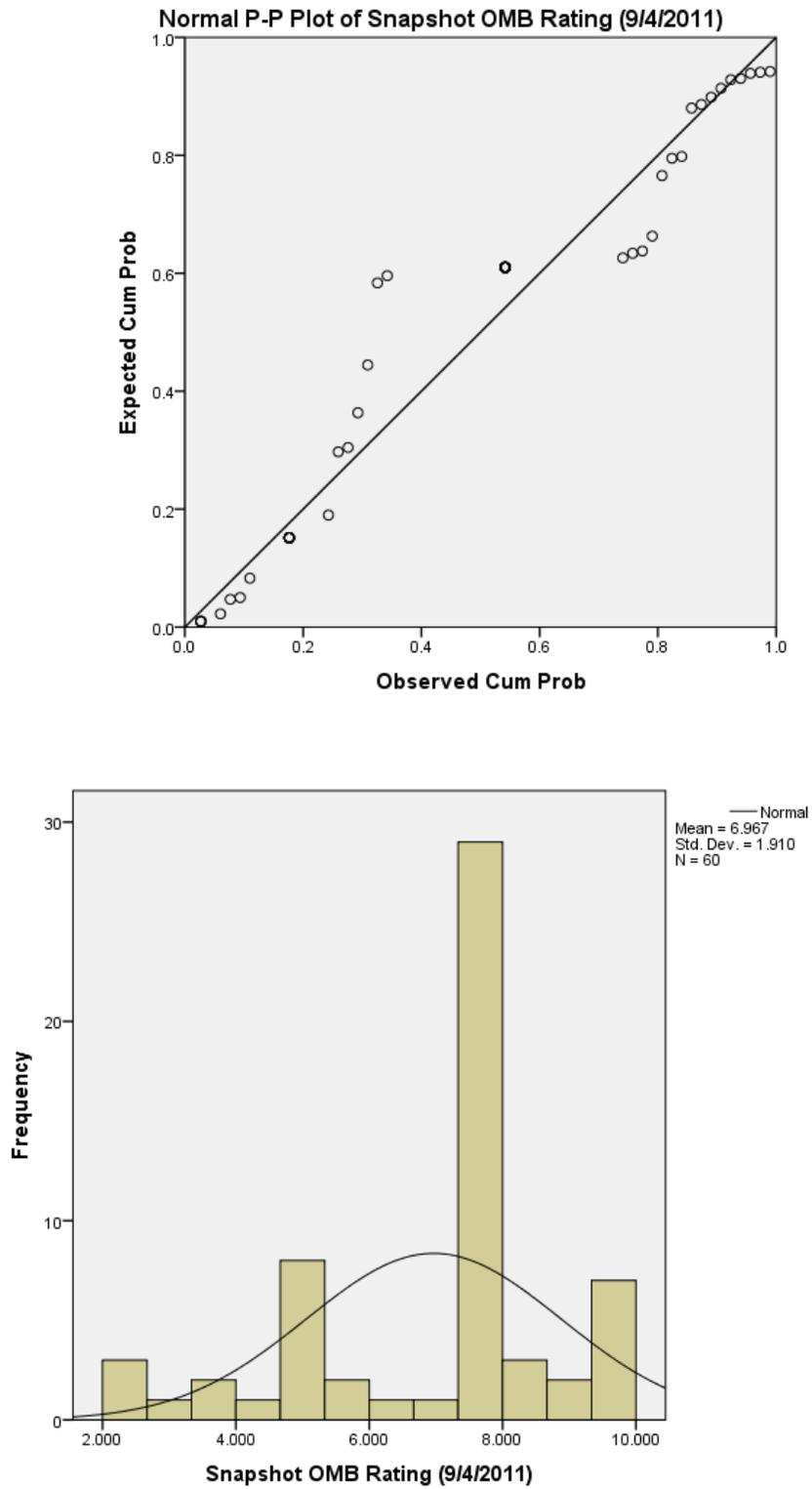
Contract type:	0 = Other contract type (cost, T&M/LH) 1 = Firm-fixed price contract
Extent Competed:	0 = Not competed 1 = Competitively awarded
Performance-Based:	0 = Not Performance-based 1 = Performance-based contract
Integrated Process Team:	0 = IPT after contract award 1 = IPT prior to contract award
Program Manager:	0 = Not qualified or validated 1 = Fully qualified Program Manager

## 2) Normal Distribution

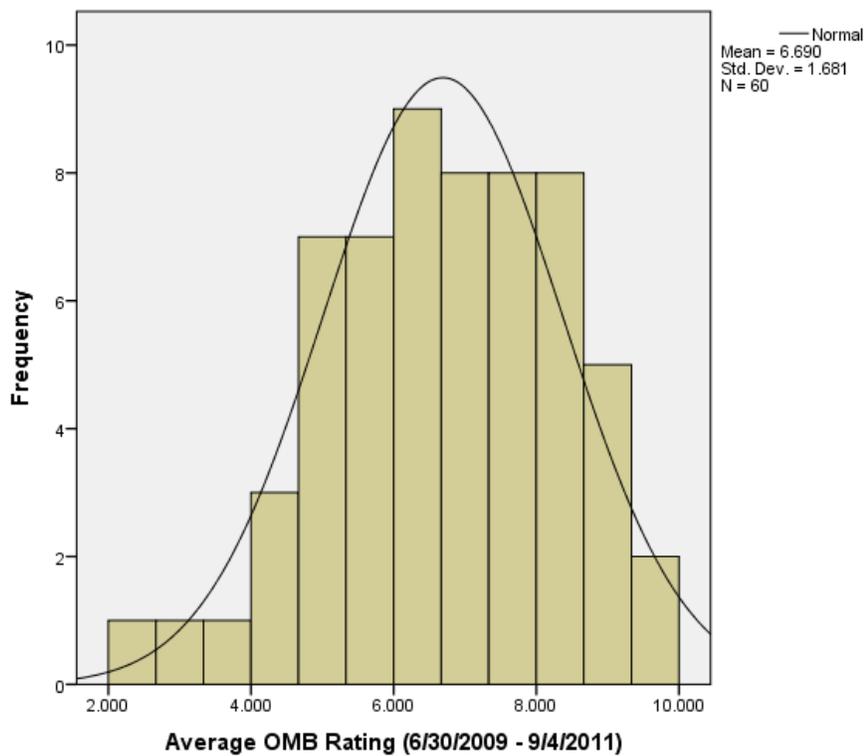
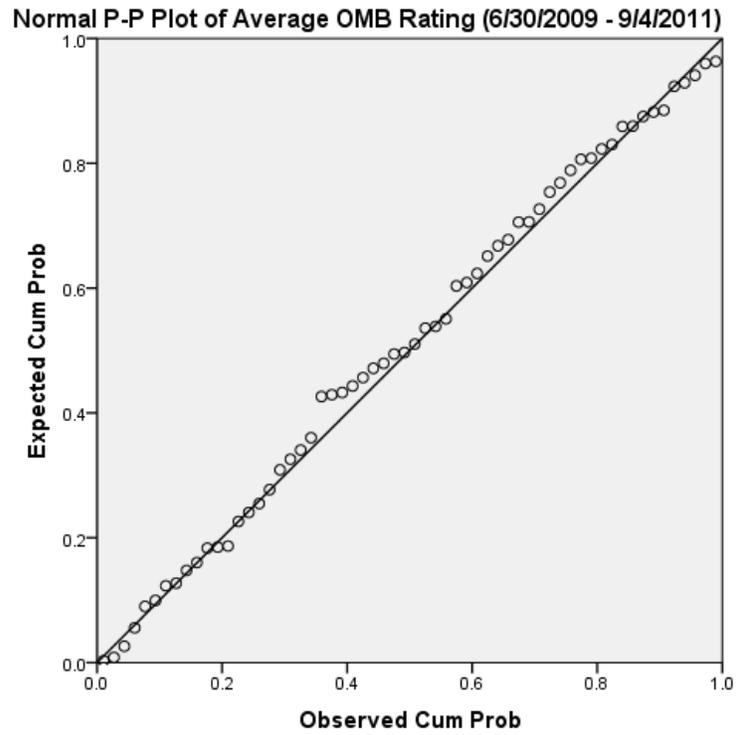
The following charts provide the output of dependent variable verification of normal distribution. A probability-probability (P-P) plot and histogram with a fitted normal distribution curve is provided for each of the four configurations of the dependent variables (OMB snapshot rating, OMB average rating, CIO latest rating, and CIO average rating). The plots and histograms are shown below as graphs 5.1 through 5.4.

The P-P plot graphically shows the cumulative probability of each dependent variable against the cumulative probability of a normal distribution. Since the values for both the average OMB and average CIO ratings fall quite close to the diagonal line, they have normal distributions. While not as fitted to the diagonal line as the average ratings, the values for the point estimates (OMB snapshot and CIO latest) generally fall on the diagonal line of the P-P plot, so those dependent variables can also be considered to have normal distributions.

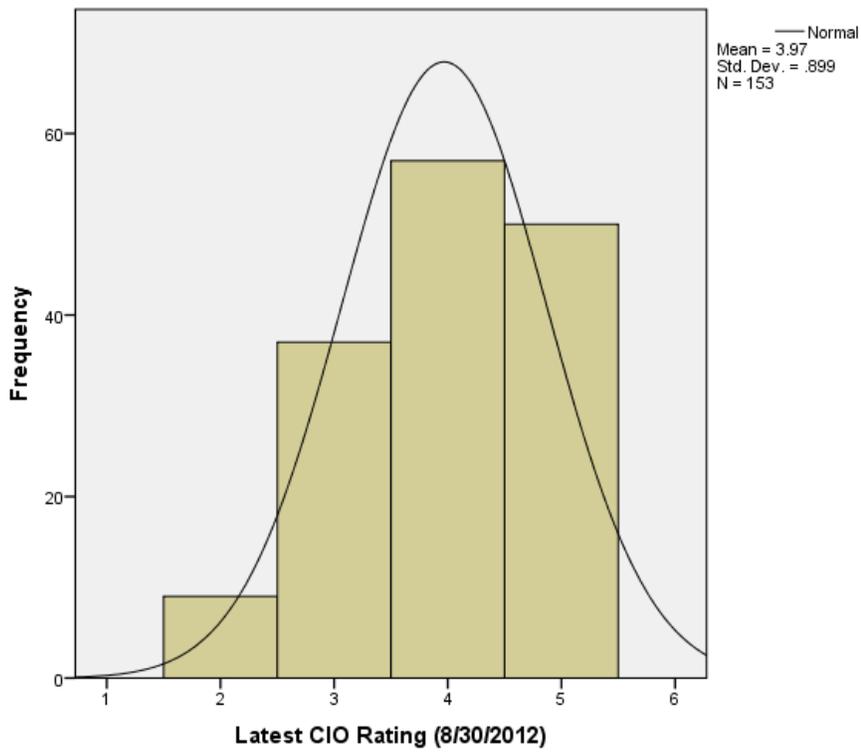
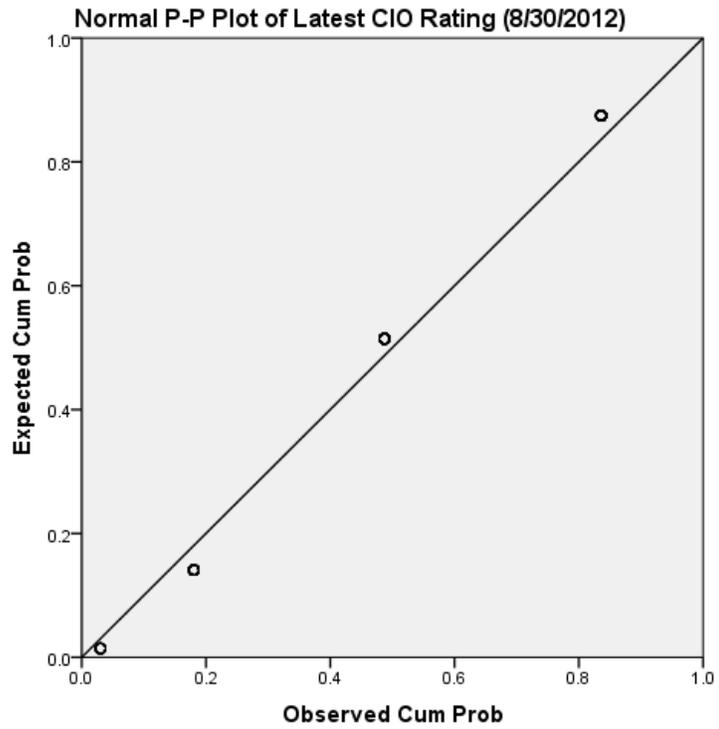
Graph 5.1: P-P Plot and Distribution of Snapshot OMB Rating



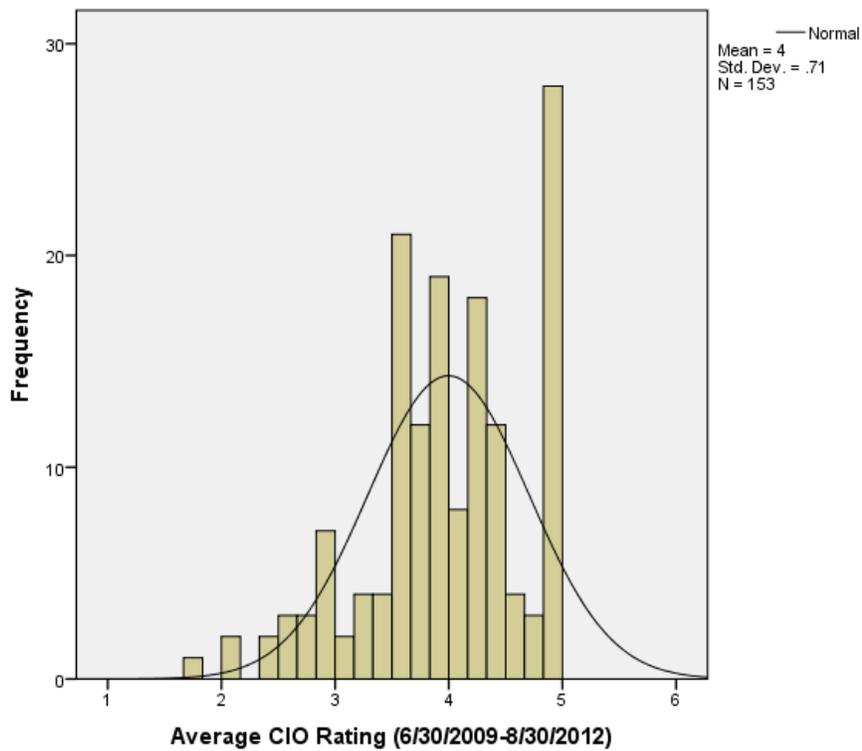
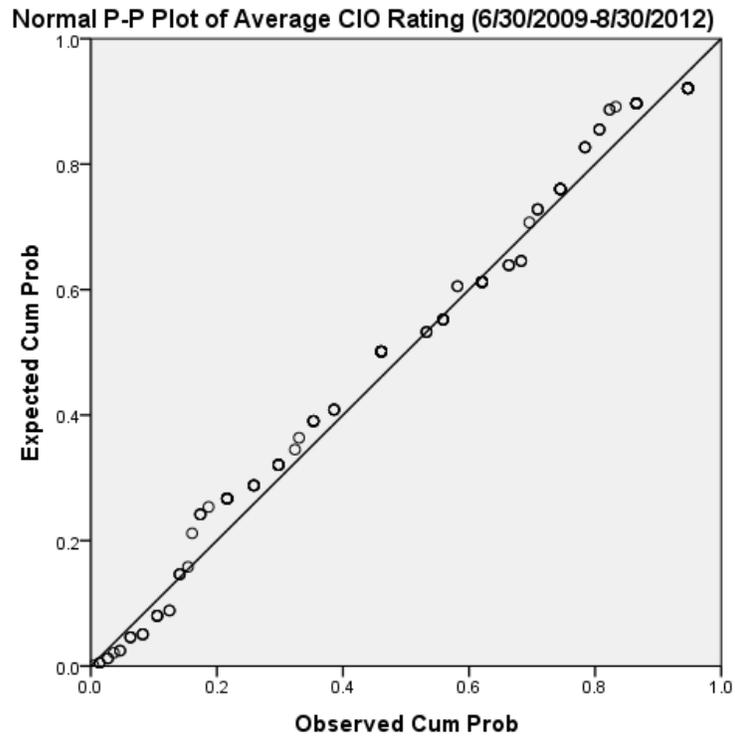
Graph 5.2: P-P Plot and Distribution of Average OMB Rating



Graph 5.3: P-P Plot and Distribution of Latest CIO Rating



Graph 5.4: P-P Plot and Distribution of Average CIO Rating



### 3) Homogeneity of Variance

Levene's test was used to determine the equality of variances. This test conducts a one-way ANOVA on the deviation of scores by testing an average absolute deviation of ratings about each group mean and the difference between the two averages ((Field, 2009, 150; Myers, Well, and Lorch, 2010, 139). Table 5.5 summarizes the results of the Levene's test for each selected service contract characteristic in both samples (n=60 and n=153).

Table 5.5: Levene's Test Results for Independent Variables

	Snapshot OMB Rating	Average OMB Rating
Contract Type	.330	.265
Extent Competed	.989	.702
Performance-Based	.039	.671
Integrated Process Team	.120	.932
Program Manager Qualification	.066	.056
	Latest CIO Rating	Average CIO Rating
Contract Type	.959	.879
Extent Competed	.144	.049
Performance-Based	.039	.936
Integrated Process Team	.135	.053
Program Manager Qualification	.599	.372

The Levene's test is significant at  $p \leq .05$ , in which case the variances are considered significantly different. However,

the Levene's test is non-significant if  $p > .05$ , so the variances are considered roughly equal and the homogeneity assumption is satisfied (Field, 2009). As the results of Levene's test shows, except for three cases all of the contract characteristics satisfied the homogeneity of variance assumption. The three instances when the Levene's test revealed significantly different variances are circled on Table 5.5 - performance-based acquisition (snapshot OMB rating and latest CIO rating) and extent competed (average CIO rating). Fortunately, the statistical software used for this study, SPSS, automatically computes an adjusted t-test ( $t'$ ) that corrects for a significant Levene's test of  $p \leq .05$  and thus equal variances not assumed. The correctly adjusted t-test results were included in the following analysis of each alternative hypothesis.

The next section discusses the quantitative analysis for each alternate hypothesis. It presents the results of both the point-biserial correlation analysis and the independent sample t-test for each variant of the dependent variable, as well as the scatterplots for each case. Once the results of the alternative hypotheses are presented, a summary of the quantitative findings is offered. In order to verify whether combining the individual correlation p-values into a single statistic would allow for rejection of the null hypothesis, the summary includes a meta-analysis using Fisher's combined p-value

method (Borrór, 2012; DeMeeûs, Guégan, & Teriokhin, 2009). Following the quantitative analysis, the qualitative component of this study is discussed. In this section, interview observations are presented that help better understand and inform the quantitative findings. Finally, a summary of both the quantitative and qualitative analysis is provided.

## **II. Quantitative Analysis and Findings**

In order to reject the null hypothesis, each individual alternate hypothesis is examined to see it can be answered affirmatively.

### **a. Alternative Hypothesis $H_1$ : Contract Type**

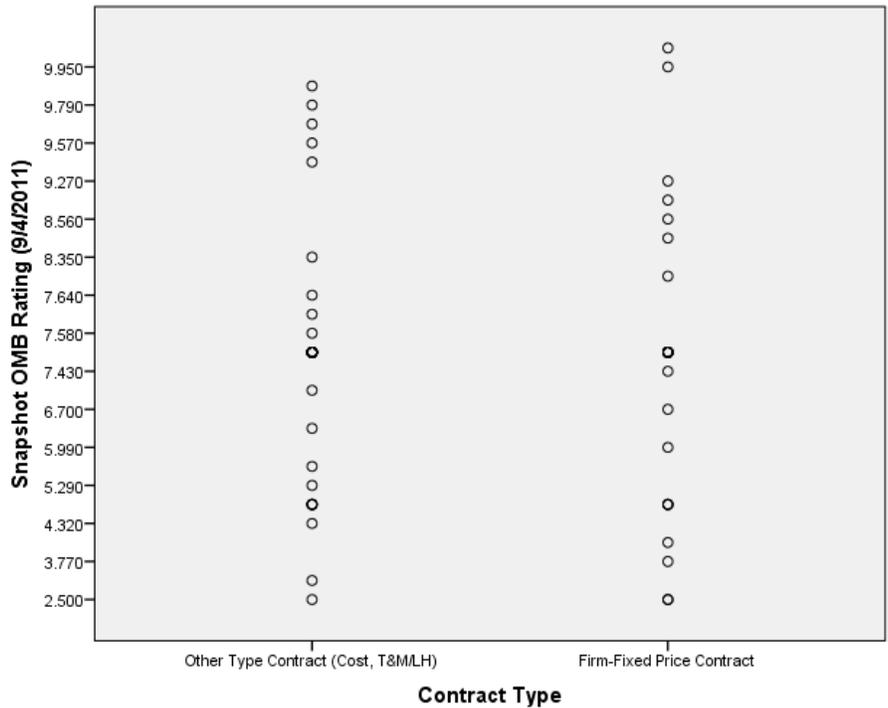
$H_1$ : There is statistically significant correlation between firm-fixed price (FFP) service contracts and investment ratings.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the snapshot OMB ratings and contract type. There was a very weak, insignificant correlation between the two variables,  $r = -.047$ ,  $n = 60$ ,  $p = .722$ .

Additionally, in an independent sample t-test, firm-fixed price (FFP) contracts ( $M = 6.87$ ,  $SD = 2.09$ ) and other contract types ( $M = 7.04$ ,  $SD = 1.79$ ) did not differ significantly on snapshot

OMB ratings,  $t(58) = .357$ ,  $p = .722$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between snapshot OMB ratings and contract type. Graph 5.5 summarizes the results.

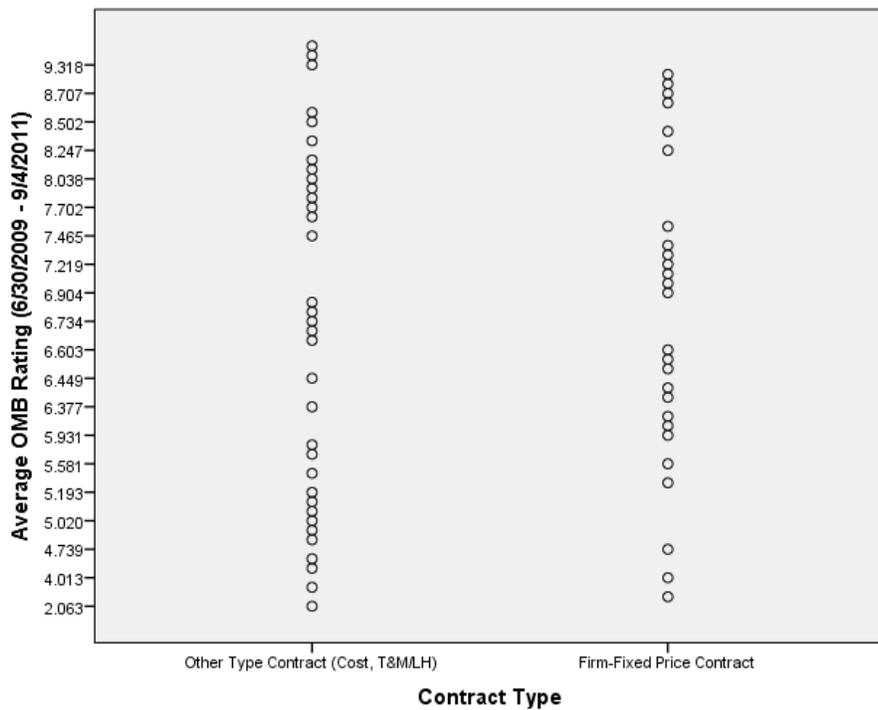
Graph 5.5: Scatterplot of Snapshot OMB Ratings and Contract Type



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average OMB rating and contract type. There was a very weak, insignificant correlation between the variables,  $r = .043$ ,  $n = 60$ ,  $p = .744$ . Additionally, in an independent sample t-test, firm-fixed price (FFP) contracts ( $M = 6.77$ ,  $SD = 1.54$ ) and other contract types

(M = 6.63, SD = 1.80) did not differ significantly on average OMB ratings,  $t(58) = -.328$ ,  $p = .744$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average OMB ratings and contract type. Graph 5.6 summarizes the results.

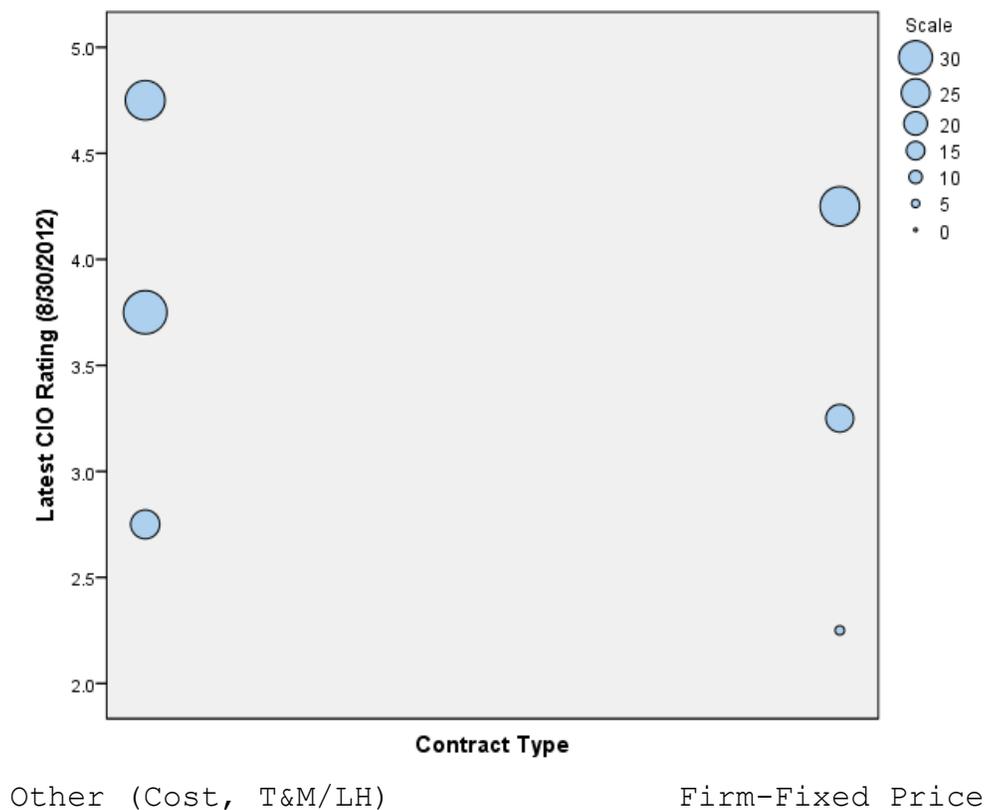
Graph 5.6: Scatterplot of Average OMB Ratings and Contract Type



A Pearson product-moment correlation coefficient was computed to assess the relationship between the latest CIO ratings and contract type. There was a very weak, insignificant correlation between the two variables,  $r = -.009$ ,  $n = 153$ ,  $p = .908$ . Additionally, in an independent sample t-test, firm-fixed price (FFP) contracts (M = 3.96, SD = .895) and other contract types

( $M = 3.98$ ,  $SD = .908$ ) did not differ significantly on latest CIO ratings,  $t(151) = .116$ ,  $p = .908$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between latest CIO ratings and contract type. Graph 5.7 summarizes the results.

Graph 5.7: Scatterplot of Latest CIO Ratings and Contract Type



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average CIO ratings and contract type. There was a very weak, insignificant correlation between the two variables,  $r = .003$ ,  $n = 153$ ,  $p = .975$ .

Additionally, in an independent sample t-test, firm-fixed price

(FFP) contracts (M = 4.00, SD = .738) and other contract types (M = 4.00, SD = .690) did not differ significantly on average CIO ratings,  $t(151) = -.031, p = .975$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average CIO ratings and contract type. Graph 5.8 summarizes the results.

Graph 5.8: Scatterplot of Average CIO Ratings and Contract Type

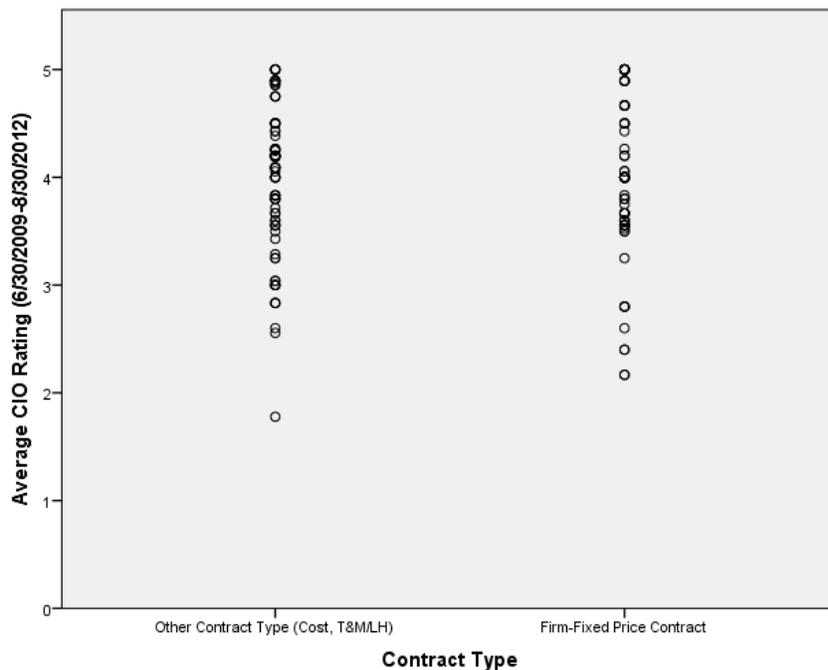


Table 5.6 summarizes the quantitative results for both samples and dependent variable variants. Based on empirical evidence, alternative hypothesis  $H_1$  (Contract Type) cannot be accepted.

Table 5.6: Quantitative Results for Alternative Hypothesis  $H_1$ :  
Contract Type

		<b>Snapshot OMB Rating</b>	<b>Average OMB Rating</b>
60 Contracts	Point-biserial Correlation	$r = -.047$ $p = .722$	$r = .043$ $p = .744$
	Independent Sample t-Test	$t(58) = .357$ $p = .722$	$t(58) = -.328$ $p = .744$
		<b>Latest CIO Rating</b>	<b>Average CIO Rating</b>
153 Contracts	Point-biserial Correlation	$r = -.009$ $p = .908$	$r = .003$ $p = .975$
	Independent Sample t-Test	$t(151) = .116$ $p = .908$	$t(151) = -.031$ $p = .975$

**b. Alternative Hypothesis  $H_2$ : Extent Competed**

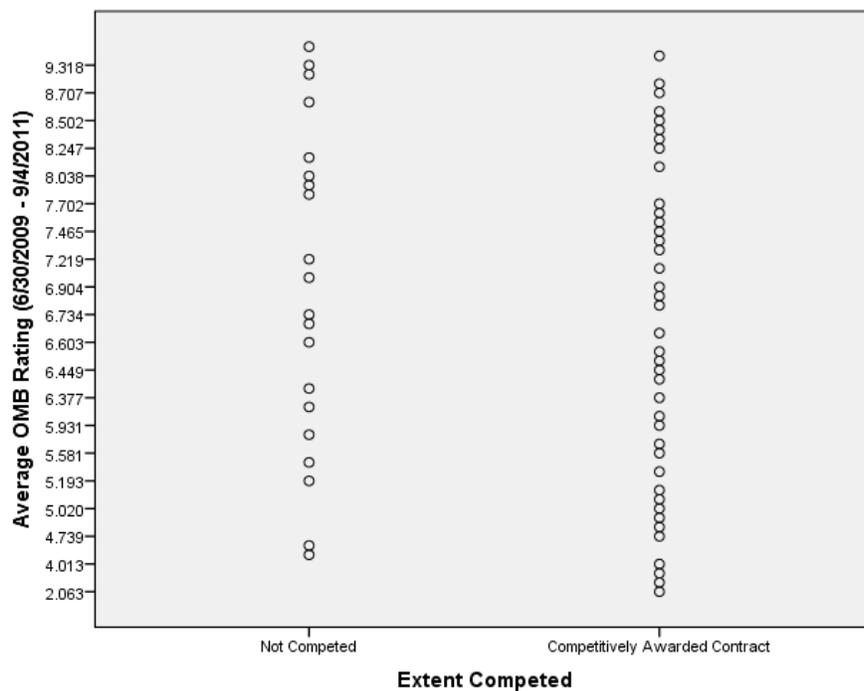
$H_2$ : There is statistically significant correlation between competitively awarded service contracts and investment ratings.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the snapshot OMB ratings and extent competed. There was weak, insignificant correlation between the two variables,  $r = -.128$ ,  $n = 60$ ,  $p = .331$ . Additionally, in an independent sample t-test, contracts competitively awarded ( $M = 6.80$ ,  $SD = 1.91$ ) and contracts not competed ( $M = 7.31$ ,  $SD = 1.92$ ) did not differ significantly on snapshot OMB ratings,  $t(58) = .981$ ,  $p = .331$ . Based on both



average OMB ratings,  $t(58) = 1.206$ ,  $p = .233$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average OMB ratings and extent competed. Graph 5.10 summarizes the results.

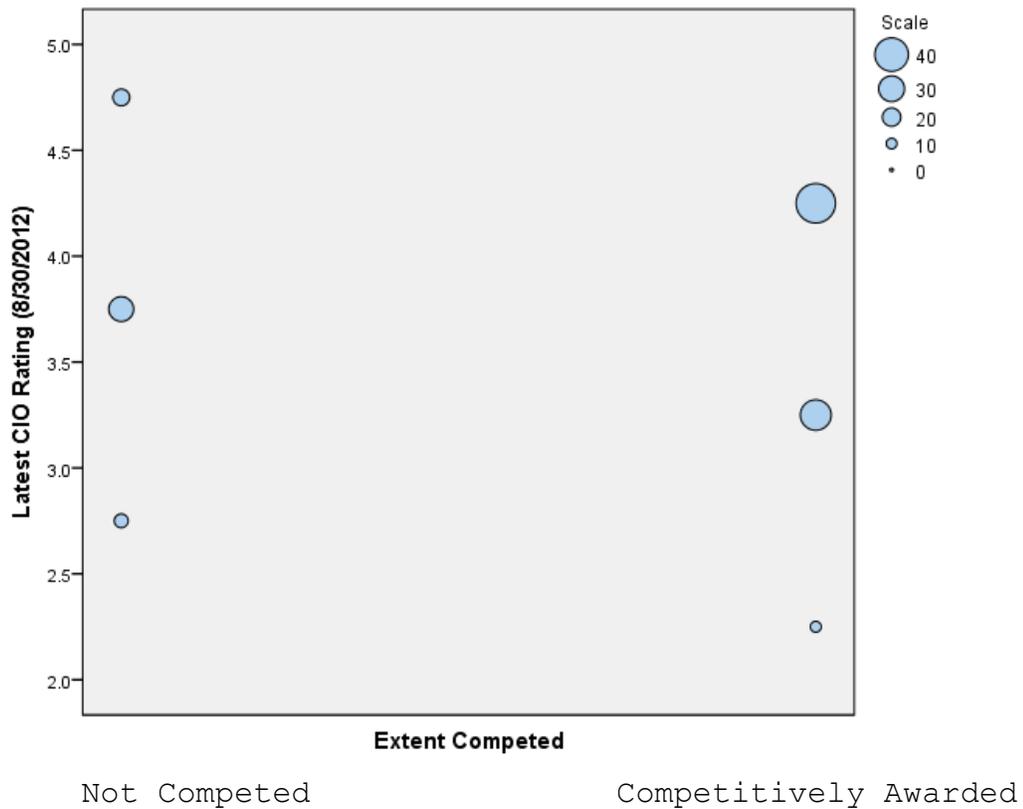
Graph 5.10: Scatterplot of Average OMB Ratings and Extent Competed



A Pearson product-moment correlation coefficient was computed to assess the relationship between the latest CIO ratings and extent competed. There was a very weak, insignificant correlation between the two variables,  $r = -.008$ ,  $n = 153$ ,  $p = .922$ . Additionally, in an independent sample t-test, contracts competitively awarded ( $M = 3.96$ ,  $SD = .931$ ) and contracts not competed ( $M = 3.98$ ,  $SD = .830$ ) did not differ significantly on

latest CIO ratings,  $t(151) = .098$ ,  $p = .922$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between latest CIO ratings and extent competed. Graph 5.11 summarizes the results.

Graph 5.11: Scatterplot of Latest CIO Ratings and Extent Competed



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average CIO ratings and extent competed. There was weak, insignificant correlation between the two variables,  $r = -.138$ ,  $n = 153$ ,  $p = .089$ . Additionally, in an independent sample t-test, contracts

competitively awarded ( $M = 3.93$ ,  $SD = .734$ ) and contracts not competed ( $M = 4.15$ ,  $SD = .636$ ) did not differ significantly on average CIO ratings,  $t(151) = 1.812$ ,  $p = .073$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average CIO ratings and extent competed. Graph 5.12 summarizes the results.

Graph 5.12: Scatterplot of Average CIO Ratings and Extent Competed

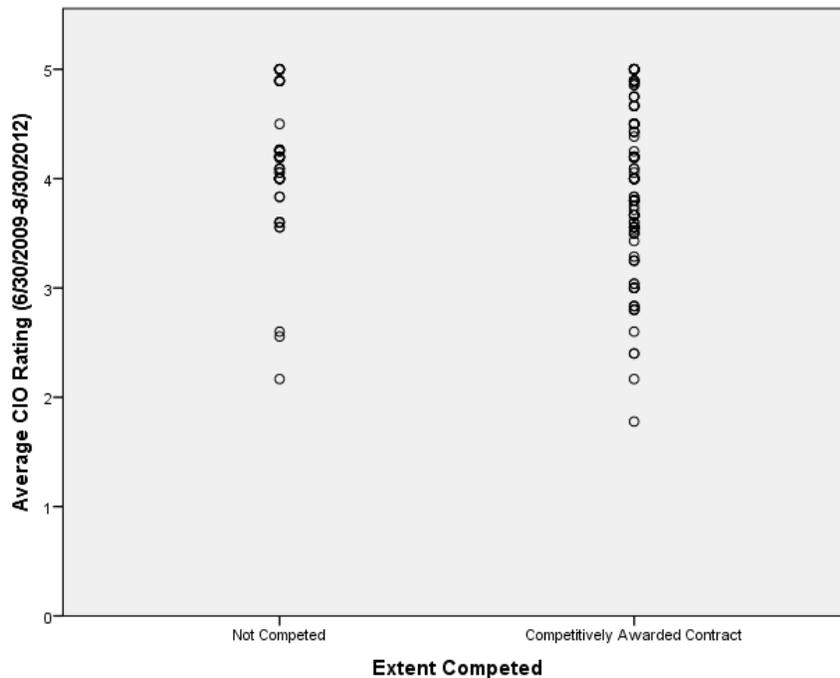


Table 5.7 summarizes the quantitative results for both samples and dependent variable variants. Based on empirical evidence, alternative hypothesis  $H_2$  (Extent Competed) cannot be accepted.

Table 5.7: Quantitative Results for Alternative Hypothesis  $H_2$ :  
Extent Competed

		Snapshot OMB Rating	Average OMB Rating
60 Contracts	Point-biserial Correlation	$r = -.128$ $p = .331$	$r = -.156$ $p = .233$
	Independent Sample t-Test	$t(58) = .981$ $p = .331$	$t(58) = 1.206$ $p = .233$
		Latest CIO Rating	Average CIO Rating
153 Contracts	Point-biserial Correlation	$r = -.008$ $p = .922$	$r = -.138$ $p = .089$
	Independent Sample t-Test	$t(151) = .098$ $p = .922$	$t(151) = 1.812$ $p = .073$

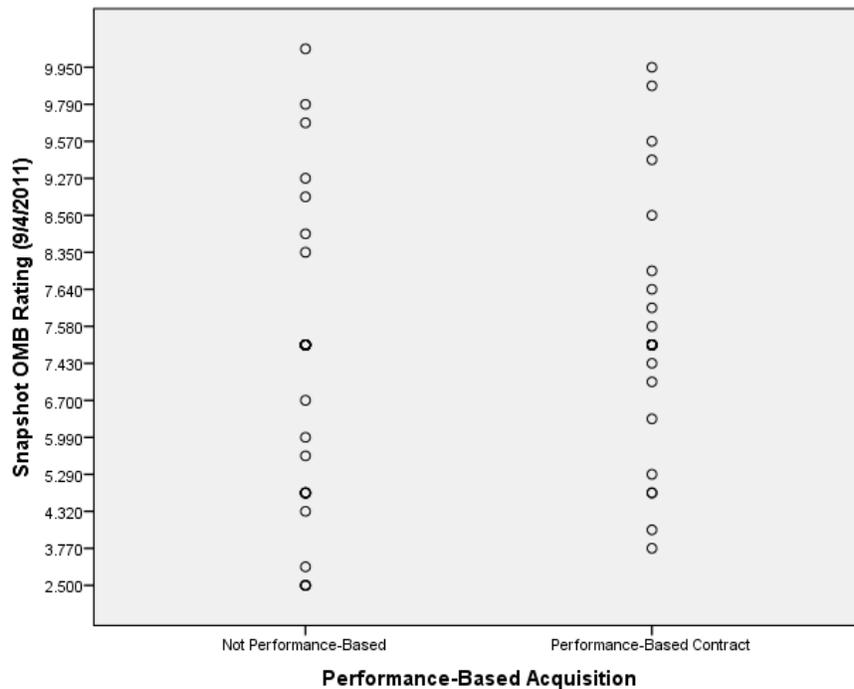
**c. Alternative Hypothesis  $H_3$ : Performance-Based Acquisition**

$H_3$ : There is statistically significant correlation between performance-based service contracts (PBSCs) and above average investment ratings.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the snapshot OMB ratings and performance-based acquisition. There was weak, insignificant correlation between the two variables,  $r = .158$ ,  $n = 60$ ,  $p = .229$ . Additionally, in an independent sample t-test, performance-based service contracts ( $M = 7.30$ ,  $SD = 1.59$ ) and contracts that were not performance-based ( $M = 6.70$ ,  $SD = 2.12$ ) did not differ significantly on snapshot OMB ratings,  $t(58) = -1.250$ ,  $p = .216$ . Based on both statistical tests, empirical

evidence shows that there was not significant correlation between snapshot OMB ratings and performance-based service contracts. Graph 5.13 summarizes the results.

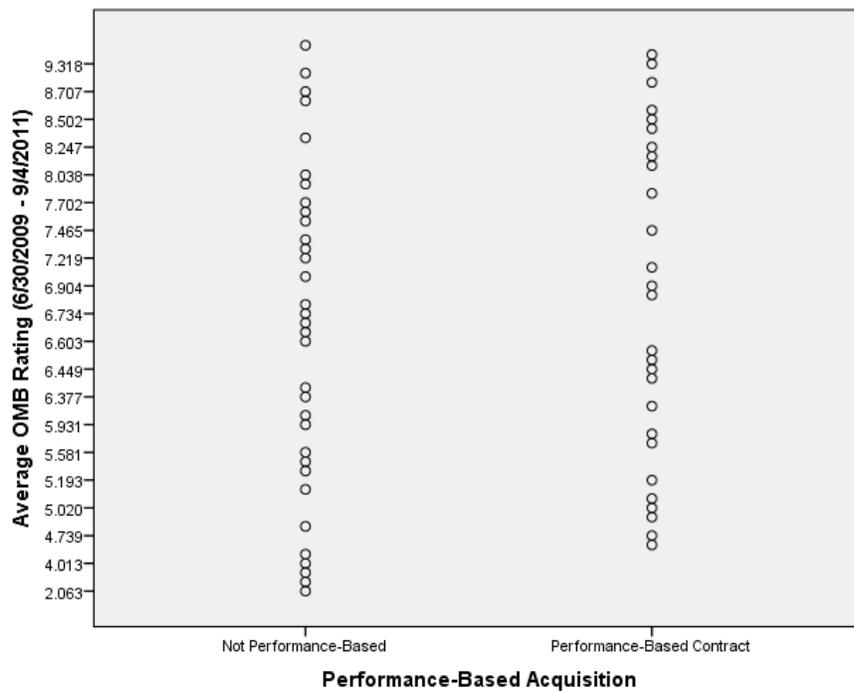
Graph 5.13: Scatterplot of Snapshot OMB Ratings and Performance-Based Service Contracts



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average OMB ratings and performance-based acquisition. There was weak, insignificant correlation between the two variables,  $r = .140$ ,  $n = 60$ ,  $p = .287$ . Additionally, in an independent sample t-test, performance-based service contracts ( $M = 6.95$ ,  $SD = 1.52$ ) and contracts that were not performance-based ( $M = 6.48$ ,  $SD = 1.80$ )

did not differ significantly on average OMB ratings,  $t(58) = -1.075$ ,  $p = .287$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average OMB ratings and performance-based service contracts. Graph 5.14 summarizes the results.

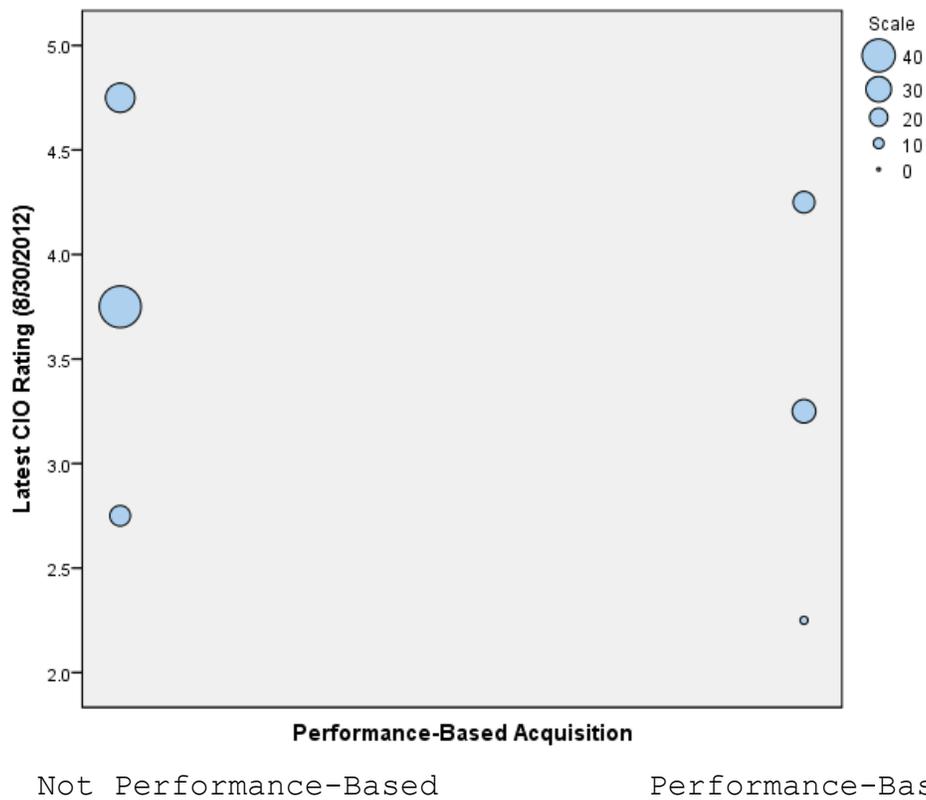
Graph 5.14: Scatterplot of Average OMB Ratings and Performance-Based Service Contracts



A Pearson product-moment correlation coefficient was computed to assess the relationship between the latest CIO ratings and performance-based acquisition. There was very weak, insignificant correlation between the two variables,  $r = -.027$ ,  $n = 153$ ,  $p = .739$ . Additionally, in an independent sample t-

test, performance-based service contracts (M = 3.94, SD = .959) and contracts that were not performance-based (M = 3.99, SD = .856) did not differ significantly on latest CIO ratings,  $t(151) = .329$ ,  $p = .743$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between latest CIO ratings and performance-based service contracts. Graph 5.15 summarizes the results.

Graph 5.15: Scatterplot of Latest CIO Ratings and Performance-Based Service Contracts



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average CIO ratings and

performance-based acquisition. There was weak, insignificant correlation between the two variables,  $r = -.121$ ,  $n = 153$ ,  $p = .137$ . Additionally, in an independent sample t-test, performance-based service contracts ( $M = 3.90$ ,  $SD = .696$ ) and contracts that were not performance-based ( $M = 4.07$ ,  $SD = .716$ ) did not differ significantly on average CIO ratings,  $t(151) = 1.497$ ,  $p = .137$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average CIO ratings and performance-based service contracts. Graph 5.16 summarizes the results.

Graph 5.16: Scatterplot of Average CIO Ratings and Performance-Based Service Contracts

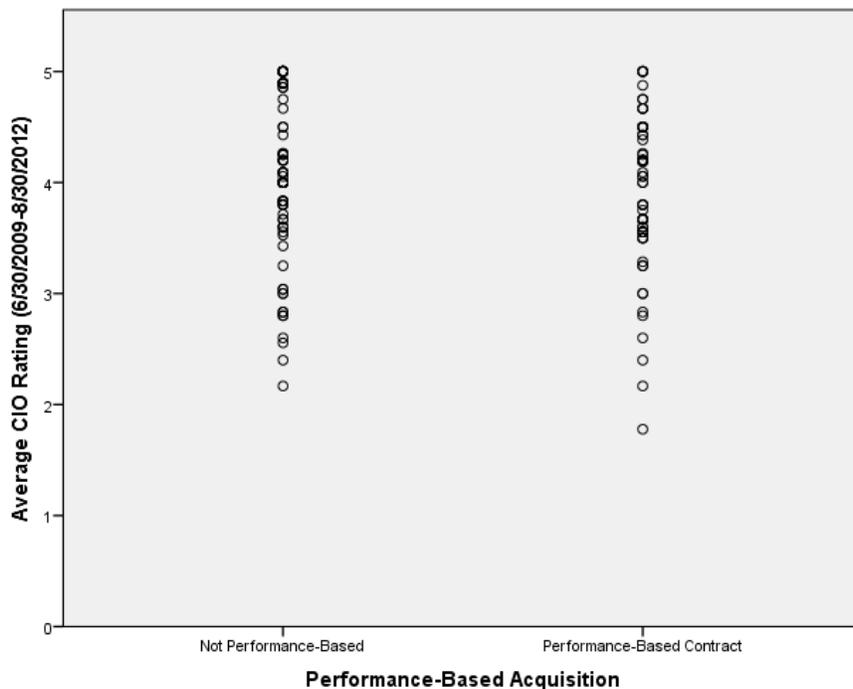


Table 5.8 summarizes the quantitative results for both samples and dependent variable variants. Based on empirical evidence, alternative hypothesis  $H_3$  (Performance-Based) cannot be accepted.

Table 5.8: Quantitative Results for Alternative Hypothesis  $H_3$ : Performance-Based Acquisition

		<b>Snapshot OMB Rating</b>	<b>Average OMB Rating</b>
60 Contracts	Point-biserial Correlation	r = .158 p = .229	r = .140 p = .287
	Independent Sample t-Test	t(58) = -1.250 p = .216	t(58) = -1.075 p = .287
		<b>Latest CIO Rating</b>	<b>Average CIO Rating</b>
153 Contracts	Point-biserial Correlation	r = -.027 p = .739	r = -.121 p = .137
	Independent Sample t-Test	t(151) = .329 p = .743	t(151) = 1.497 p = .137

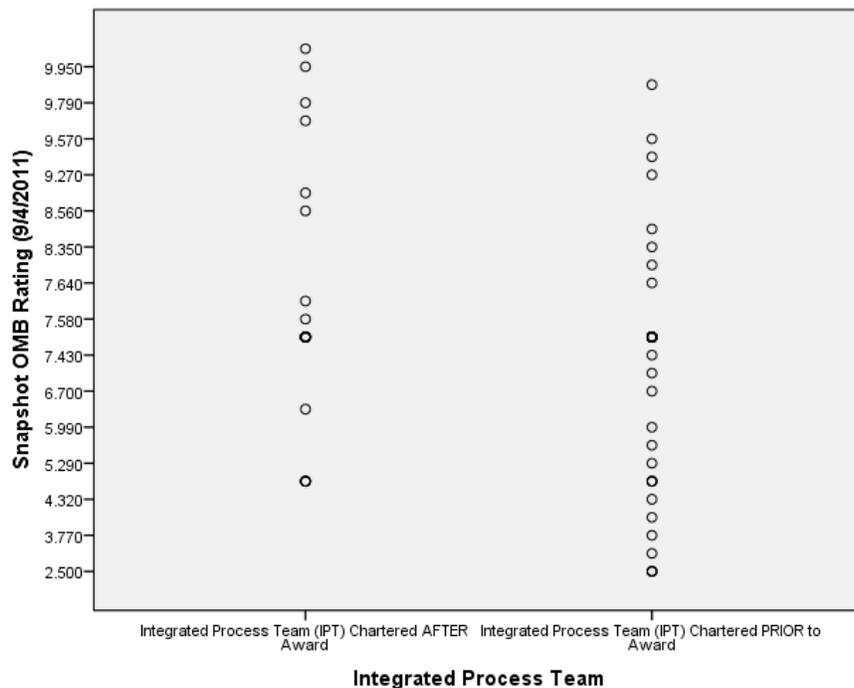
**d. Alternative Hypothesis  $H_4$ : Integrated Process Team**

$H_4$ : There is statistically significant correlation between service contracts with a chartered Integrated Process Team (IPT) in place prior to contract award and investment ratings.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the snapshot OMB ratings and integrated process team (IPT). There was weak, insignificant correlation between the two variables,  $r = -.230$ ,  $n = 60$ ,  $p =$

.078. Additionally, in an independent sample t-test, contracts with a chartered IPT prior to award (M = 6.65, SD = 1.993) and contracts with a chartered IPT after award (M = 7.56, SD = 1.626) did not differ significantly on snapshot OMB ratings,  $t(58) = 1.797, p = .078$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between snapshot OMB ratings and integrated process teams. Graph 5.17 summarizes the results.

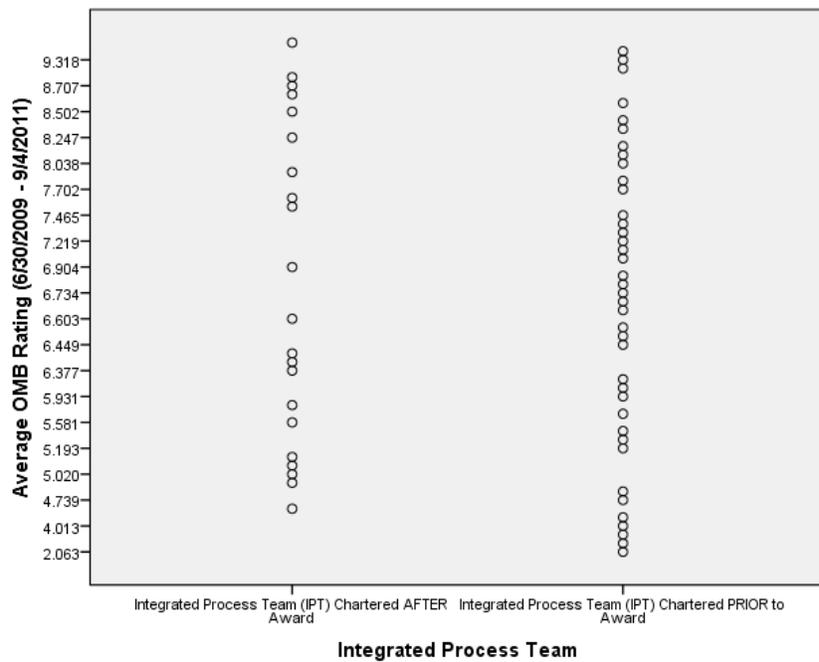
Graph 5.17: Scatterplot of Snapshot OMB Ratings and Integrated Process Teams



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average OMB ratings and

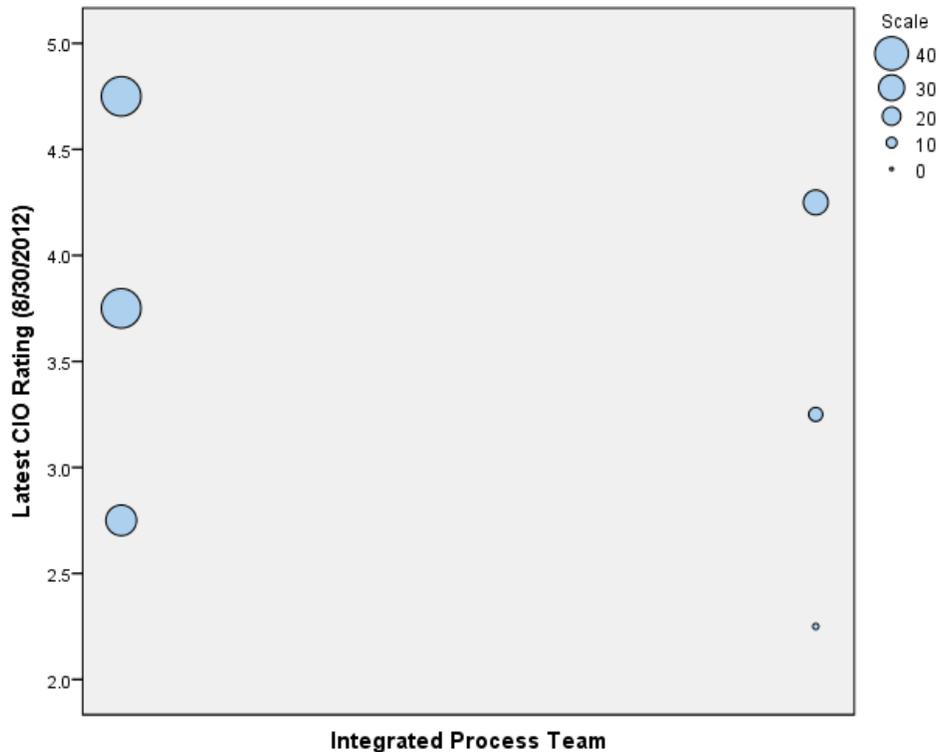
integrated process team (IPT). There was very weak, insignificant correlation between the two variables,  $r = -.095$ ,  $n = 60$ ,  $p = .472$ . Additionally, in an independent sample t-test, contracts with a chartered IPT prior to award ( $M = 6.757$ ,  $SD = 1.756$ ) and contracts with a chartered IPT after award ( $M = 6.904$ ,  $SD = 1.552$ ) did not differ significantly on average OMB ratings,  $t(58) = .724$ ,  $p = .472$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average OMB ratings and integrated process teams. Graph 5.18 summarizes the results.

Graph 5.18: Scatterplot of Average OMB Ratings and Integrated Process Teams



A Pearson product-moment correlation coefficient was computed to assess the relationship between the latest CIO ratings and integrated process team (IPT). There was very weak, insignificant correlation between the two variables,  $r = .024$ ,  $n = 153$ ,  $p = .766$ . Additionally, in an independent sample t-test, contracts with a chartered IPT prior to award ( $M = 4.00$ ,  $SD = .834$ ) and contracts with a chartered IPT after award ( $M = 3.95$ ,  $SD = .930$ ) did not differ significantly on latest CIO ratings,  $t(151) = -.299$ ,  $p = .766$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between latest CIO ratings and integrated process teams. Graph 5.19 summarizes the results.

Graph 5.19: Scatterplot of Latest CIO Ratings and Integrated Process Teams



Chartered AFTER Award

Chartered PRIOR to Award

A Pearson product-moment correlation coefficient was computed to assess the relationship between the average CIO ratings and integrated process team (IPT). There was very weak, insignificant correlation between the two variables,  $r = .097$ ,  $n = 153$ ,  $p = .235$ . Additionally, in an independent sample t-test, contracts with a chartered IPT prior to award ( $M = 4.10$ ,  $SD = .604$ ) and contracts with a chartered IPT after award ( $M = 3.95$ ,  $SD = .751$ ) did not differ significantly on average CIO ratings,  $t(151) = -1.191$ ,  $p = .235$ . Based on both statistical tests, empirical evidence shows that there was not significant

correlation between average CIO ratings and integrated process teams. Graph 5.20 summarizes the results.

Graph 5.20: Scatterplot of Average CIO Ratings and Integrated Process Teams

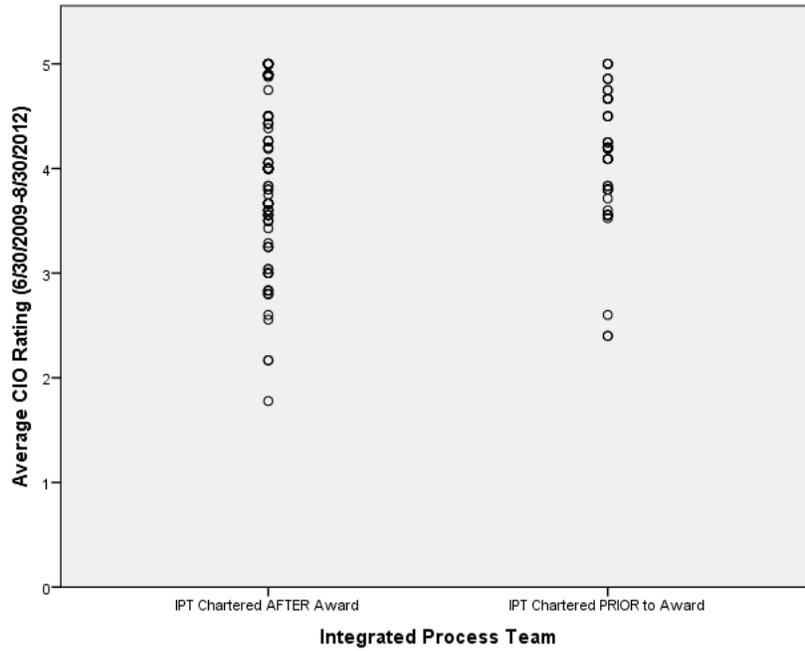


Table 5.9 summarizes the quantitative results for both samples and dependent variable variants. Based on empirical evidence, alternative hypothesis  $H_4$  (Integrated Process Team) cannot be accepted.

Table 5.9: Quantitative Results for Alternative Hypothesis  $H_4$ :  
Integrated Process Team (IPT)

		<b>Snapshot OMB Rating</b>	<b>Average OMB Rating</b>
60 Contracts	Point-biserial Correlation	r = -.230 p = .078	r = -.095 p = .472
	Independent Sample t-Test	t(58) = 1.797 p = .078	t(58) = .724 p = .472
		<b>Latest CIO Rating</b>	<b>Average CIO Rating</b>
153 Contracts	Point-biserial Correlation	r = .024 p = .766	r = .097 p = .235
	Independent Sample t-Test	t(151) = -.299 p = .766	t(151) = -1.191 p = .235

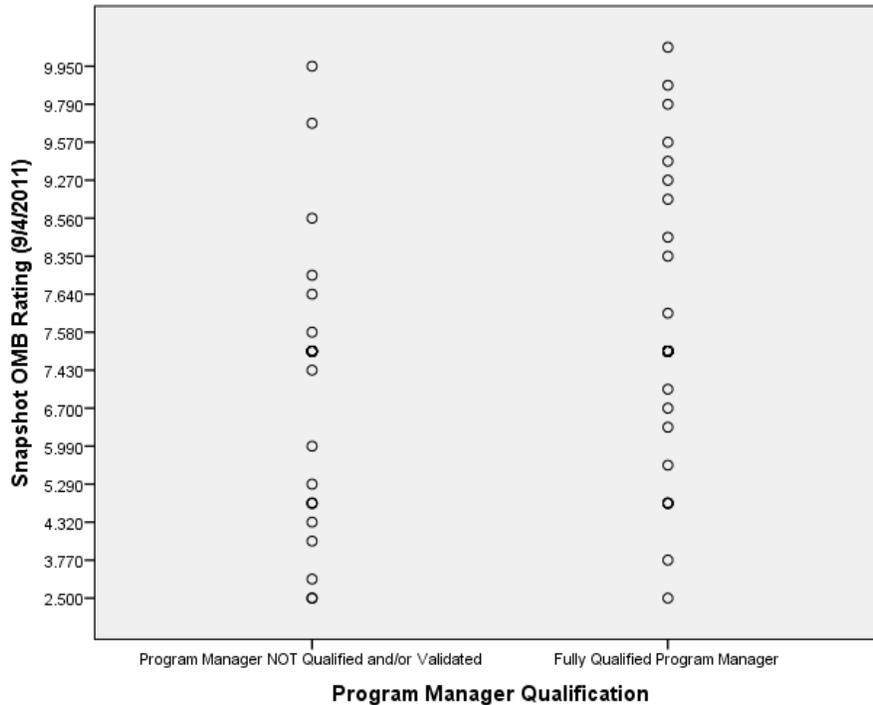
**e. Alternative Hypothesis  $H_5$ : Program Manager Qualification**

$H_5$ : There is statistically significant correlation between programs with fully qualified Program Managers and investment ratings.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the snapshot OMB ratings and program manager qualification. There was weak, insignificant correlation between the two variables,  $r = .230$ ,  $n = 60$ ,  $p = .077$ . Additionally, in an independent sample t-test, contracts with a fully qualified program manager ( $M = 7.33$ ,  $SD = 1.72$ ) and contracts with an unqualified or verified program manager ( $M = 6.45$ ,  $SD = 2.07$ ) did not differ significantly on snapshot OMB ratings,  $t(58) = -1.803$ ,  $p = .077$ . Based on both statistical

tests, empirical evidence shows that there was not significant correlation between snapshot OMB ratings and program manager qualification. Graph 5.21 summarizes the results.

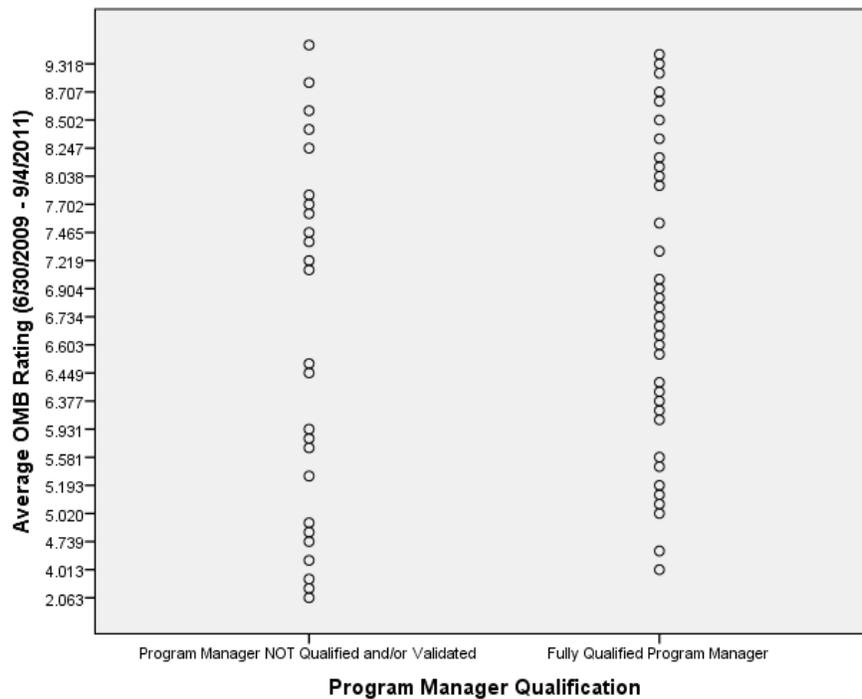
Graph 5.21: Scatterplot of Snapshot OMB Ratings and Program Manager Qualification



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average OMB ratings and program manager qualification. There was weak, insignificant correlation between the two variables,  $r = .158$ ,  $n = 60$ ,  $p = .228$ . Additionally, in an independent sample t-test, contracts with a fully qualified program manager ( $M = 6.91$ ,  $SD = 1.42$ ) and contracts with an unqualified or verified program manager ( $M =$

6.38, SD = 1.98) did not differ significantly on average OMB ratings,  $t(58) = -1.218$ ,  $p = .228$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average OMB ratings and program manager qualification. Graph 5.22 summarizes the results.

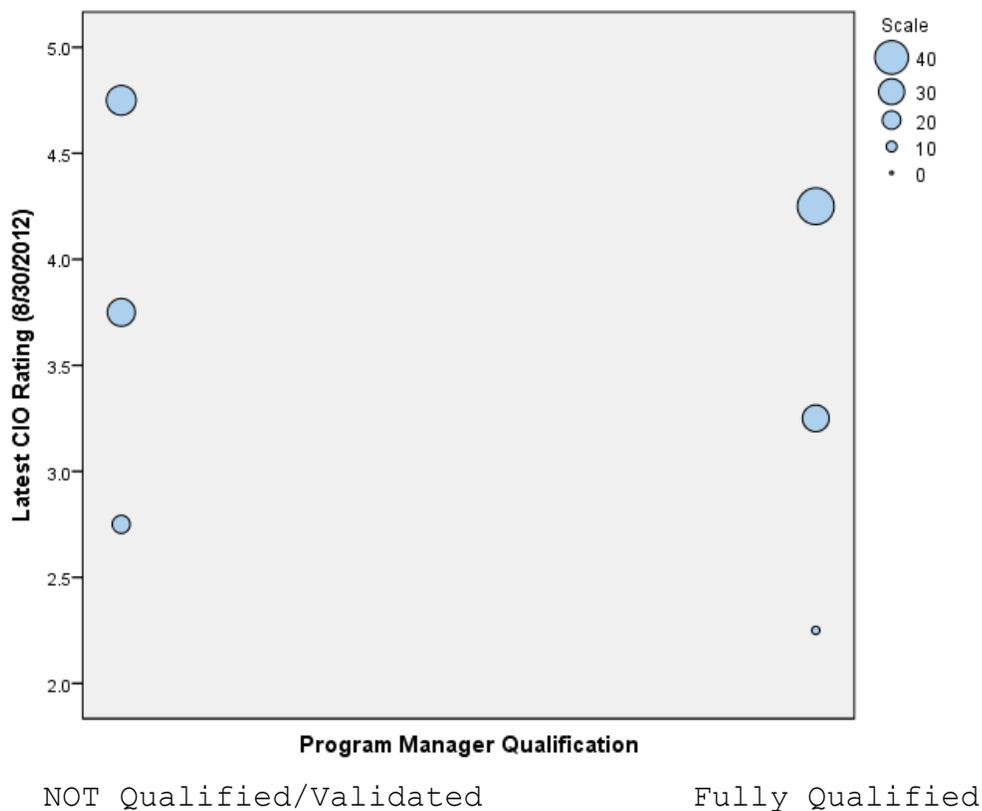
Graph 5.22: Scatterplot of Average OMB Ratings and Program Manager Qualification



A Pearson product-moment correlation coefficient was computed to assess the relationship between the latest CIO ratings and program manager qualification. There was very weak, insignificant correlation between the two variables,  $r = -.062$ ,  $n = 153$ ,  $p = .444$ . Additionally, in an independent sample t-test, contracts with a fully qualified program manager ( $M =$

3.92, SD = .867) and contracts with an unqualified or verified program manager (M = 4.03, SD = .939) did not differ significantly on latest CIO ratings,  $t(151) = -.768, p = .444$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between latest CIO ratings and program manager qualification. Graph 5.23 summarizes the results.

Graph 5.23: Scatterplot of Latest CIO Ratings and Program Manager Qualification



A Pearson product-moment correlation coefficient was computed to assess the relationship between the average CIO ratings and program manager qualification. There was very weak,

insignificant correlation between the two variables,  $r = .083$ ,  $n = 153$ ,  $p = .305$ . Additionally, in an independent sample t-test, contracts with a fully qualified program manager ( $M = 4.05$ ,  $SD = .667$ ) and contracts with an unqualified or verified program manager ( $M = 3.93$ ,  $SD = .759$ ) did not differ significantly on average CIO ratings,  $t(151) = -1.028$ ,  $p = .305$ . Based on both statistical tests, empirical evidence shows that there was not significant correlation between average CIO ratings and program manager qualification. Graph 5.24 summarizes the results.

Graph 5.24: Scatterplot of Average CIO Ratings and Program Manager Qualification

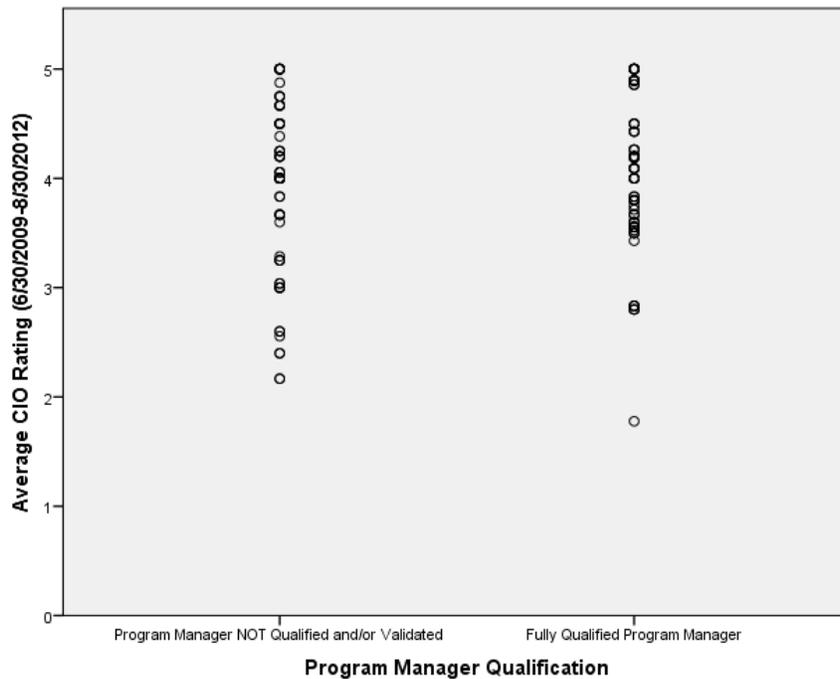


Table 5.10 summarizes the quantitative results for both samples and dependent variable variants. Based on empirical evidence,

alternative hypothesis  $H_5$  (Program Manager Qualification) cannot be accepted.

Table 5.10: Quantitative Results for Alternative Hypothesis  $H_5$ : Program Manager Qualification

		<b>Snapshot OMB Rating</b>	<b>Average OMB Rating</b>
60 Contracts	Point-biserial Correlation	r = .230 p = .077	r = .158 p = .228
	Independent Sample t-Test	t(58) = -1.803 p = .077	t(58) = -1.218 p = .228
		<b>Latest CIO Rating</b>	<b>Average CIO Rating</b>
153 Contracts	Point-biserial Correlation	r = -.062 p = .444	r = .083 p = .305
	Independent Sample t-Test	t(151) = .768 p = .444	t(151) = -1.028 p = .305

#### **f. Summary of Quantitative Findings**

Eight statistical tests were conducted to evaluate each of the five alternate hypotheses in order to confirm whether empirical evidence would allow rejection of the null hypothesis. The lowest p-value of all 40 tests was .073, which was still above the critical significance level ( $\alpha$ ) of .05. Since all resulting p-values were  $> .05$ , they were not significant and thus did not allow for rejection of the null hypothesis.

Table 5.11 summarizes the results of the quantitative findings for each selected contract characteristic evaluated. The predominant result of all eight tests conducted for each independent variable is listed as the quantitative finding. In the cases where there was an even split between tests, both results are annotated (e.g., Program Manager Qualification showed both very weak and weak correlation).

Table 5.11: Summary of Quantitative Findings

<b>Null Hypothesis:</b> There is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings.	
<b>Contract Characteristic</b>	<b>Quantitative Finding</b>
Contract Type	Very weak correlation, not significant. No significant difference of means.
Extent Competed	Weak correlation, not significant. No significant difference of means.
Performance-Based Acquisition	Weak correlation, not significant. No significant difference of means.
Integrated Process Team	Very weak correlation, not significant. No significant difference of means.
Program Manager Qualification	Very weak / weak correlation, not significant. No significant difference of means.

In addition to determining that all of the individual correlation p-values did not allow for rejection of the null hypothesis, Fisher's combined p-value method was considered as a means of meta-analysis to verify whether combining the individual correlation p-values into a single statistic would allow for rejection of the null hypothesis (Borrór, 2012; DeMeeûs, Guégan, & Teriokhin, 2009).

The following formula was used to compute a combined p-value:

$$X_{2m}^2 \sim -2 \sum_{i=1}^m \ln(p_i)$$

where,  $p_i$  is individual p-values and  $m$  is the number of p-values to be combined. By converting the p-value for each individual point-biserial correlation into one test statistic ( $\chi^2$ ) having a chi-square distribution with  $2m$  degrees of freedom, the combined p-value for  $\chi^2$  can be interpolated from a chi-square table. The same criterion applies as with individual tests; thus  $H_0$  can be rejected if the combine p-value is lower than the critical significance level ( $\alpha$ ). Using the Fisher combined p-value method for all 20 point-biserial correlations, which included both OMB and CIO rating samples (n=60 contracts and n=153 contracts), the combined p-value was .315. Likewise, a combined p-value was computed for each of the two samples separately and

the corresponding combined p-values were  $p_{n=60} = .150$  and  $p_{n=153} = .636$ . Therefore, using the Fisher combined p-value method for both separate and aggregated samples resulted in p-values  $> .05$ , which was not significant and thus does not allow for rejection of the null hypothesis.

Therefore, the quantitative analysis indicates that on both an individual and combined basis none of the alternate hypotheses can be accepted and thus, empirical evidence does not support rejection of the null hypothesis ( $H_0$ ) that there is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings. By failing to reject the null hypothesis, a conclusion can be made that service contract requirements are not better defined in cases when they ought to be given the selected contract characteristics.

Likewise, since all of the correlations were evaluated as weak or very weak with no statistical significance and all lacked any statistically significant difference between means, the inference can be made that defining requirements for service contracts is problematic for federal agencies. For example, firm-fixed price contracts showed no significant correlation with investment ratings and the mean ratings of firm-fixed price contracts were not significantly different from the rating means of other contract types (i.e., cost or time and material).

Based on contracting literature and policy guidance, firm-fixed price contracts ought to have more accurately defined contract requirements. Since no correlation or difference of means was detected, the empirical results showed that firm-fixed prices do not perform measurably better than other contract types. A similar outcome was seen for all the other selected contract characteristics. Since none of the contract characteristics showed even a moderate level of correlation, but they all have an established connection to containing well-defined contract requirements, the cumulative effect suggests that writing well-defined contract requirements must be a challenge for many federal government agencies. Therefore, based on the empirical analysis of this study, it appears as though concern and criticism regarding the quality of service contract requirements is valid.

### **III. Insights and Explanations obtained from Interviews**

To help inform and better understand the quantitative findings, 16 interviews were conducted with senior executives representing 11 different federal departments and industry. Of the 16 interviews, nine were conducted with acquisition professionals and seven were conducted with information technology professionals. Additionally, more than one person

attended four of the 16 interviews conducted, so a total of 22 individuals participated in the interview discussions. All of the interview participants were highly qualified subject matter experts with significant senior level experience in areas relevant for this study, including services contracting, program management, requirements management, and information technology acquisition. Moreover, several had a wide range and depth of experience and knowledge that encompassed all relevant subject areas. Eleven interviews were conducted in-person and five were conducted via telephone; all were conducted during the time period February 1-15, 2013. Table 5.12 provides the number of interview participants by position title.

Table 5.12: Number of Interview Participants by Title

<u>Title</u>	<u>Number</u>
Chief Acquisition Officer	2
Senior Procurement Executive	4
Other Senior Acquisition Professional	5
Chief Information Officer	4
Deputy Chief Information Officer	3
Other Senior IT Professional	2
Industry (President or Chief Executive Officer)	<u>2</u>
<b>Total =</b>	<b>22</b>

In accordance with the approved Institutional Review Board (IRB) protocol (Appendix M), all of the interviews were conducted in a strictly anonymous manner. Therefore, to

maintain interviewee confidentiality, interview comments and views are not attributed to specific individuals, federal departments, acquisition programs, or service contracts.

**a. The Importance of Service Contract Requirements to Acquisition Program Success**

All of the interview participants stressed the importance of contract requirements, and stated that there is a direct connection between well-defined contract requirements and program success. Illustrative of the importance placed on contracts requirements in the acquisition process, the following sample of interviewee quotes is provided:

- "The probability of success is minimal, if you don't get the requirements right."
- "Requirements definition is THE issue when it comes to acquisition program success."
- "All problems with IT programs can be traced to problems with the requirements."
- "Requirements are everything."
- "You are staring at a failed system if the requirements are not correct."
- "The requirements phase is the 'bread and butter' of acquisition."
- "Requirements are absolutely key to every contract."
- "Poorly performing programs can be traced back to poorly defined requirements or a bad acquisition strategy."

While the importance of contract requirements was recognized by all, they overwhelmingly noted that significant problems are common. Several stated that there is no requirements process for IT services while other interviewees said that the requirements process for services is ad hoc and more of an art than a science. A few interviewees were more critical and asserted that developing contract requirements is a huge problem and a "completely broken system."

A few of the executives interviewed cited writing an accurate Statement of Work (SOW) as the single key to a successful services contract. One subject matter expert specifically noted that the SOW strategy drives everything, but requirements analysis and SOW writing is "terrible." That person also remarked that while being an absolutely important element for a successful procurement, there is no measure of SOW quality and how well the requirement is described. Similarly, another senior executive stated that the attributes of success need to be clearly defined, understood, and measured. That particular individual went on to state that it is important for the government to understand "How do you know what you want and then how do you measure success?".

All interview participants were asked about responsibility for contract requirements definition. By a significant margin, the program manager was the most frequently cited person

responsible for requirements generation, definition, and management. It was commonly felt that the program manager is accountable for working with customers and the acquisition community to develop accurate requirements. Moreover, several interviewees stressed that in order to be effective, a program manager needs to be proficient at translating user needs into requirements that can be understood by industry. None of the respondents felt that the contracting officer was responsible for contract requirements. While recognizing that a knowledgeable and technically proficient contracting officer could provide extremely valuable assistance to a program manager, the vast majority of respondents reiterated that the contracting officer was not considered to have responsibility for requirements definition.

It should be noted, however, that during the course of conducting the interviews it was discovered that the definition of a program manager differs by federal agency. Specifically, in many of the civilian (non-DOD) agencies, the person called the program manager is actually the business or mission area manager: they are not actual program managers in an acquisition lifecycle context. Therefore, some agencies may have actually meant the business owner or functional area sponsor is responsible for requirements development. Additionally, in a few cases, the resource sponsor was cited as being the

responsible party for contract requirements, which translates more clearly to the business or functional mission area owner. Nevertheless, in no case was the contracting officer considered as being responsible for contract requirements definition and management.

While all the subject matter experts interviewed clearly felt that the contracting officer is not responsible for requirements development and management, a few did state that misunderstandings tend to exist. In particular, it was pointed out that Congressional oversight committee staff members often misunderstand who is responsible for contract requirements and often turn to contracting officers regarding problems with them rather than to program managers.

Interview participants were also asked if they thought disconnects exist between users, contracting officers, and program managers when it comes to defining contract requirements. That question was repeatedly answered in the affirmative. Most subject matter experts felt that disconnects tend to occur between the different parties, but acquisition and information technology professionals generally cited each other as the reason for disconnects when it comes to IT services contracts. One person simply observed that program managers and contracting officers "just throw rocks at each other." Information technology professionals felt that disconnects

occurred between buying and technology and that contracting officers always want more details and specifications. Similarly, there was a strong feeling that contracting officers are taught to be risk averse and try to drive risk to zero, rather than managing it as needed in a rapidly evolving advanced technology environment. In a similar fashion, acquisition professionals felt the assumption that IT professionals know what is best is false.

Besides stating that there is a lack of internal government collaboration between the IT workforce and acquisition workforce, a few interviewees stated that there is also a lack of external collaboration between government and industry. One executive went on to state that collaboration is currently at the lowest level they have seen in the past 15 years. Inadequate communications was cited as the reason for the reduced level of collaboration and barriers to more effective government-industry communications include funding uncertainties, perception concerns, fear of bid protests, rate of technological change, and the risk-averse federal contracting culture.

Calling for increased pessimism regarding information systems (IS)<sup>12</sup> development efforts, Goldfinch (2007, 917)

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<sup>12</sup> Goldfinch considers information systems (IS) to be "a computer system combined with the organization and personnel to produce

observed that the majority of IS projects, especially complex ones, are unsuccessful. He stated that research suggests failure may be the norm, and cited a survey showing the U.S. government to have an 82 percent failure rate. Among other factors, Goldfinch claimed that public sector IS developments are a potent mix of unclear aims and technical specifications, and that overblown and unrealistic expectations are the chief reason for the dismal failure rates (Goldfinch, 2007). These observations by Goldfinch correspondingly suggest that accurately defining requirements is problematic, and a major element impacting program success. Without a clear statement of requirements, the probability of information system project failure increases significantly (Standish, 1995; Charette, 2005). As a result, requirements analysis is considered by some to be the most important stage of information system development (Castro, Kolp, & Mylopoulos, 2002).

Offering a slightly different view, the key reason that software projects fail, according to Sessions (2009), is complexity. In his view, schedule delays, cost overruns and information systems failing to meet user needs are predominately the result of increased complexity. Also citing program

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useful outcomes, as opposed to information technology (IT), which is a general term for the computers, networking, and software used in an information system." (Goldfinch, 2007, 926, note 1).

complexity, Bretschneider (1990, 542) revealed empirical evidence that services contracts generate the longest differential in procurement between public and private IT projects. The main reason given for the differential was procedural delay and the increased amount of 'red tape' involved with public sector procurement decisions and execution.

#### **b. Explanations of the Quantitative Findings**

No interview participant disputed the quantitative findings. Moreover, participants in 11 out of the 16 interviews, which equates to nearly 70 percent of the subject matter experts interviewed for this study, stated that they were not surprised by the inability to reject the null hypothesis. A breakdown of these numbers shows that 67 percent of the acquisition professionals and 71 percent of the information technology professionals were not surprised by the results. Of the five subject matter experts that voiced some level of surprise by the quantitative findings, only three said that they would have expected all of the selected contract characteristics to have shown a stronger correlation with investment ratings. Two out of the five interviewees expressing some surprise stated they were surprised by just one or two of the correlations. One of those individuals expected that integrated process teams would have shown more correlation, but the other individual

expected the opposite. That particular person stated that the IPT finding was not unusual, but that the lack of correlation shown by program manager qualification was a surprise. There was widespread concurrence that the minimal correlation between the selected contract characteristics and investment ratings is an indication that the federal agencies have difficulty accurately defining contract requirements. Moreover, the subject matter expert reactions to the quantitative findings suggest that the inability to accurately define contract requirements is well known by both the federal acquisition and information technology communities.

Participants in all 16 interviews agreed that the rationale for choosing the selected contract characteristics was realistic. They all concurred that each of the selected contract characteristics had a relationship to contract requirements as previously specified and that the alternative hypotheses made logical sense. Although they agreed with the contract characteristic selection and logic of the alternate hypotheses, the interviewees did offer comments regarding the dependent and each independent variable that help explain possible reasons for the null finding that selected contract characteristics and investment ratings do not correlate. Accordingly, comments regarding the dependent variable (investment ratings) are discussed first, then followed by each

of the independent variables (selected contract characteristics).

### **1) Dependent Variable - Investment Ratings**

There were four issues pertaining to the dependent variable (investment ratings) that were identified during interviews: lack of OMB guidance, program rebaselining, data accuracy and quality, and agency reluctance to self-report adverse results. These issues help explain the null finding, since they raise the matter of dependent variable correctness as a measure of program performance. Doubt was expressed regarding the employment of investment ratings as an indicator of true acquisition program performance, which may explain the lack of correlation with selected contract characteristics. Each issue is individually discussed in the following paragraphs.

A large number of comments regarding the dependent variable revolved around the lack of OMB guidance given for the assignment of CIO investment ratings. Many information technology professionals cited that there is no specific guidance given, so each federal agency uses its own standards and criteria for assigning rating scores. The IT professionals stated that factors given weight on the rating score are not standardized and tend to differ by agency. The variance in agency CIO ratings can be seen in Appendix G, which illustrates

the point made by several interview participants. Furthermore, one interviewee stated that "we populate the federal IT dashboard because we have to, not because we use it."

Data accuracy and quality was cited as a concern by several interviewees, although none of the 22 individuals participating in interviews knew of any better sources of contract and program performance data. Instead, a significant number of the subject matter experts stated that their internal sources would not provide more accurate data. Some even stated that the federal IT dashboard data was the best data source available, since federal agencies are strongly incentivized to ensure data accuracy as OMB uses it for making programmatic budget decisions.

Conversely, two information technology professionals felt that submitting OMB Exhibit 300 data has historically involved nothing more than "checking the box." Reflecting a similar sentiment, another interviewee expressed specific concern regarding contract data in the FPDS-NG database. That particular acquisition professional felt that collectively the data was accurate, but due to the large volume it is questionable on an individual basis for specific transactions and contract records. Several interviewees noted that inflated investment rating scores may be misleading since program rebaselining could have occurred, which would give the

impression that an acquisition program is on track when it really would be out of cost and/or schedule variances if no rebaselining had occurred.

More than a few interview participants noted that political pressure can influence the rating scores shown on the federal IT dashboard. Stating that agencies do not want undue attention from oversight and audit bodies, they identified the possibility of intentionally marking programs higher than truly deserved as a reason to be skeptical about the accuracy of CIO evaluations. One person stated that unless it is a major failure, a program may not be accurately reflected on the federal IT dashboard. Another interviewee suggested that it would be beneficial to look at programs that have undergone audits by oversight agencies, such as the GAO, and see if their rating scores tend to be lower than investments that have not been subject to outside scrutiny.

The concerns raised regarding the accuracy of investment ratings as an accurate indicator of true program performance merits consideration. Although most interview participants stated that the data sources used for this study were the best available and none offered any better sources, accuracy of the dependent variable data may be a reasonable explanation for the null finding since the correlation analysis was based on the assumption that it is correct.

## **2) Independent Variables - Selected Contract Characteristics**

There was widespread agreement among the interviewees that the contract characteristics selected as independent variables for this study were accurate and the basis for expecting a relationship between the characteristics and contract requirements was affirmatively recognized. That said, several observations were offered regarding the different contract characteristics that help explain why the null hypothesis could not be rejected. Building on Table 5.11, Table 5.13 shows the predominant explanation given that helps explain the reason for a lack of contract characteristic correlation with investment ratings. Each selected service contract characteristic and reason offered by subject matter experts for not being able to reject the null hypothesis are more fully described in subsequent paragraphs.

Table 5.13: Summary of Qualitative Explanation

<b>Null Hypothesis:</b> There is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings.		
<b>Contract Characteristic</b>	<b>Quantitative Finding</b>	<b>Qualitative Explanation</b>
Contract Type	Very weak correlation, not significant. No significant difference of means.	Not using the correct contract type.
Extent Competed	Very weak correlation, not significant. No significant difference of means.	Small value contracts being less visible. Reduced capabilities of set-aside vendors.
Performance-Based Acquisition	Very weak correlation, not significant. No significant difference of means.	Not issuing true performance-based contracts.
Integrated Process Team	Very weak correlation, not significant. No significant difference of means.	IPT usage not being mature and widely institutionalized.
Program Manager Qualification	Very weak correlation, not significant. No significant difference of means.	Definition of PM and qualifications differ among agencies.

**a) Contract Type**

Many of the interviewees stated that using the correct contract type was a key factor for attaining successful acquisition program results. They noted that in many cases, contracts are issued as firm-fixed price, but really should be another type of contract. Most frequently cited was the OMB

memorandum to heads of departments and agencies declaring that any contract type other than firm-fixed price is considered high-risk (Orszag, 2009, July 29). That particular memorandum also called for agencies to reduce cost, time and material, and labor hour contracts by at least 10 percent. Therefore, in order to comply with the OMB mandate, many interviewees stated that contracts are being issued as firm-fixed price that really ought to be other contract types (cost, time and material, or labor hour). By complying with the OMB guidance, but using an incorrect type of contract, requirements for contracts issued as firm-fixed price may not be as well-defined as would be expected for situations when a firm-fixed price contract is truly warranted.

More than a few interviewees felt very strongly about this issue and stated that the policy needs to be reversed, since considering everything other than firm-fixed price as high-risk causes problems and that risk to the government may actually be lower if another contract type is used. A large number indicated that this is especially true for IT acquisition, since firm-fixed price contracts tend not to work well with advanced technology acquisitions. Furthermore, several of the subject matter experts pointed out that the problem of contract type is compounded for commercial items, which is how many IT investments are classified. Specifically, FAR dictates that

only firm-fixed price contracts can be used for commercial items by stating that the "use of any other contract type to acquire commercial items is prohibited" (FAR Part 12, paragraph 12.207).

As a result, the assumption that firm-fixed price contracts have better defined contract requirements would not hold, and thus produce weak correlations.

**b) Extent Competed**

Except for one, all interviewees agreed that contracts involving competition normally have better defined requirements than contracts without competition. They stated that competitive awards are more transparent and allow for clarification questions before the procurement, which may lead to revisions of the requirements documents and thus result in better understood user needs. It was noted, however, that large dollar value contract awards tend to get more attention and scrutiny, whereas small value contracts may not get as much. Therefore, contract size was suggested as a factor influencing extent competed and contract requirements.

In a similar vein, several interviewees felt that requirements may be better defined for sole source contracts than for contracts with limited competition such as mandated set-aside contracts. The reason cited for this difference was that the government and contractors tend to work closer together

on sole source competitions. Additionally, in the case of contract renewals, the incumbent vendor usually better understands user needs and is able to respond accordingly. That said, however, it was reiterated that sole source contracts are more likely to have less defined requirements than competitively awarded contracts.

Regarding mandatory set-aside contracts, it was pointed out by several subject matter experts that those contracts may be listed as competitive, but in reality only a few select vendors meeting the specified socio-economic criteria qualify to submit bids. Several interviewees raised this as a concern, especially since they felt that vendors receiving mandatory set-aside contract awards are frequently less capable and unable to adequately perform the contracted work and fulfill needed requirements.

The predominant null finding explanation for the 'extent competed' contract characteristic not correlating with investment rating was that contract dollar value and set-aside contracts were not factored into the analysis. Small dollar value contracts do not receive the visibility and scrutiny that larger value contracts may receive; therefore, the data could be skewed if a large number of small dollar value contracts are included in the sample. In a similar manner, if there are a large number of mandatory set-aside contracts included as

competitively awarded contracts, they may adversely impact investment ratings since many of the vendors receiving mandatory set-aside contracts may be less qualified and not able to deliver required results.

### **c) Performance-Based Acquisition**

Virtually everyone interviewed had a strong opinion about performance-based acquisition and all agreed that it is a meaningful contract characteristic for this study. They concurred that if done correctly, performance-based contracts ought to have better defined contract requirements. However, interviewees very consistently stated that most services contracts are performance-based in name only and that few are truly performance-based contracts. Many of the subject matter experts stated that contracts are simply labeled as performance-based in order to meet the OMB mandate for at least 50 percent of an agency's services contracts being performance-based (see Denett, 2007, December 5). Many interview participants stated that writing a true performance-based contract is difficult and a few interviewees further stated that even vendors do not understand how to write and manage them. It was observed that being forced to make contracts performance-based when it is not a good fit actually adds to program complexity and can produce negative secondary effects.

As previously noted by Behn and Kant (1999), there is no best way for implementing a performance-based solution. At a minimum, however, a performance-based contract ought to contain a performance work statement (PWS), measurable performance requirements, and a means to monitor and assess contractor performance. If contracts are simply being labeled as performance-based, they are most likely missing those traits and not meeting the designated performance objectives.

Moreover, it is apparent that contracts incorrectly labeled as performance-based suffer from less well defined performance criteria and means of measurement. They may not be outcome based and may be void of any significant means of contractor performance monitoring. Therefore, in terms of the null finding, incorrectly labeling contracts as performance-based may lead to contracts with requirements no more accurately specified than non-performance based contracts. With respect to the null hypothesis, this is problematic since it does not allow for true identification and differentiation between contract types.

#### **d) Integrated Process Team (IPT)**

While having user involvement in the contract requirements development process was repeatedly identified as essential, many stated that IPTs are rarely used for services contracts. It was noted that since there is no federal policy directive requiring

the use of an IPT other than for IT programs submitting an OMB exhibit 300, it is simply considered by most agencies as an optional best practice. At least one person even remarked that "civilian agencies do not even know what an IPT is." Others said that using an IPT is a relatively new practice, which has not yet been institutionalized in many agencies.

As stated by the SARA panel, "clearly defining government's needs up-front is not something the procurement community can do alone, but rather program and financial elements within the government must also participate and contribute to clearly define outcomes of an acquisition. Creating high-level business objectives demands multiple stakeholder involvement and a joint and strategic understanding of where the agency wants to be, as well as where industry and technology are going." (Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007, 7).

Several attributes were cited by interview participants for developing better contract requirements through IPTs. One included making contractors part of the team and getting industry involved early in the process. Another called for having a truly integrated multifunctional team with well qualified representation from all stakeholders. A third attribute noted that a lifecycle approach was needed for developing and managing contract requirements, which calls for having an IPT involved on a continual basis before and after

contract award. One interviewee also stated that ad hoc groups, which are not necessarily chartered IPTs, can be just as effective for developing and managing contract requirements.

While those are all noteworthy recommendations, in terms of explaining the null finding, the seemingly sporadic use and optional view of IPTs throughout many federal agencies appears to be the key factor. It is not a widely institutionalized concept, and the predominant view appears to be that IPTs are simply suggested best practices that only apply to programs required to submit an OMB Exhibit 300. Further exasperating the situation, the listed IPT charter date used to determine whether or not an IPT was in place before contract award date is suspect. Not only does it not specify the actual IPT membership and level of user involvement, but in many cases the entered charter may be only a 'check the box' entry on the Exhibit 300.

#### **e) Program Manager Qualification**

Similar to the other selected service contract characteristics, interview participants agreed with the logic that acquisitions with qualified program managers ought to have better defined contract requirements. However, there were many strong opinions on the topics of program managers and qualifications.

As previously noted, the actual definition of program manager differs between agencies. The title of program manager has a more distinct meaning in the Department of Defense (DOD), whereas many people with a program manager title in civilian agencies are actually mission or business area managers; basically a customer or user rather than what would be considered as an acquisition program manager. In fact, one senior civilian agency executive claimed that the organization was in a "state of chaos" since there were no actual acquisition program managers.

Since there is not a clear definition of program manager across all agencies, some of the interviewees stated that their organizations do not have an understanding of what program manager qualification really means. It was noted that outside of information technology (IT) programs, there is no requirement for certification of program managers for service contracts.

A number of the subject matter experts explained that the notion of program manager qualification is not mature across the federal government and that it tends to be nothing more than a drill focused on submitting the required paperwork rather than fulfilling the true intent of certification. It was further noted that in many cases employees self-identify themselves as being qualified as a program manager, despite little or no acquisition knowledge or experience. One senior executive

interviewed estimated that no more than 4 out of 10 designated program managers were actually qualified. Conversely, another interview participant remarked that some of the best acquisition program managers were not actually certified. That person stated that both technical and management experience were needed, and "not just a piece of paper stating that you are certified."

Therefore, the null finding for this variable may be explained by the lack of a consistent federal definition of what constitutes an acquisition program manager and the requisite qualification. It is apparent that this inconsistency could have contributed towards agencies entering a variety of responses to the OMB Exhibit 300 data field for program manager qualification.

#### **IV. Conclusion and Implications**

Empirical evidence failed to reject the null hypothesis that there is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings. By analyzing five selected contract characteristics using two separate statistical tests and four variants of the dependent variable, the quantitative

results consistently showed that the null hypothesis could not be rejected.

Besides all independent variables showing weak or very weak correlation with investment ratings, the lowest p-value of all 40 tests was .073, which was above the critical significance level ( $\alpha$ ) of .05. Since all resulting p-values were  $> .05$ , they were not considered significant and did not allow for rejection of the null hypothesis. Similarly, using the Fisher combined p-value method, the resulting p-values were greater than .05 and did not allow for rejection of the null hypothesis. By failing to reject the null hypothesis through multiple tests, the conclusion was reached that service contract requirements are not better defined in cases when they should be based on selected contract characteristics. Therefore, concern and criticism regarding the quality of service contract requirements appears to be valid.

In order to better inform and understand the quantitative findings, 16 interviews were conducted with 22 senior executives representing 11 different federal departments and industry. Of the 16 interviews, 9 were conducted with acquisition professionals and 7 were conducted with information technology professionals. None of the subject matter experts interviewed disputed the quantitative finding that empirical evidence failed to reject the null hypothesis.

Participants in all 16 interviews thought that the rationale for choosing the selected contract characteristics was realistic. They all agreed that each of the selected contract characteristics had a relationship to contract requirements, and that the alternative hypotheses were logical. Moreover, participants in 11 out of the 16 interviews stated that they were not surprised by the quantitative findings. That number equates to nearly 70 percent of the subject matter experts not being surprised that the selected service contract characteristics did not correlate with investment ratings. Besides providing their views of the empirical findings regarding the lack of correlation between selected service contract characteristics and investment ratings, the senior executives revealed a number of major issues and challenges concerning federal acquisition and contract requirements.

The lack of correlation between selected contract characteristics related to requirements and investment ratings highlights that service contract requirements definition is a significant problem for federal agencies. That conclusion was confirmed by interviews with senior acquisition and information technology subject matter experts who consistently stated that accurately defining and managing service contract requirements is a genuine obstruction facing the federal government today. They also reinforced the importance of service contract

requirements to the government acting as a smart-buyer and that the other smart-buyer questions ("who to buy from?" and "what has been bought?") all rely upon getting the "what to buy?" correct.

Table 5.14, which is shown on the following page, builds on Table 5.13 and provides a summary of the implications regarding each contract characteristic finding. Each implication shown on Table 5.14 is based on the preceding qualitative explanations of possible reasons for the null finding, and discussed in more detail in subsequent paragraphs.

Table 5.14: Summary of Implications

<b>Null Hypothesis:</b> There is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings.			
<b>Contract Characteristic</b>	<b>Quantitative Finding</b>	<b>Qualitative Explanation</b>	<b>Implications</b>
Contract Type	Very weak correlation, not significant. No significant difference of means.	Not using the correct contract type.	Provides less flexibility for high tech acquisitions, and in many cases results in greater risk to the government.
Extent Competed	Very weak correlation, not significant. No significant difference of means.	Small value contracts being less visible. Reduced capabilities of set-aside vendors.	Less qualified vendors are selected to perform work, which may result in inferior results and additional costs to the government.
Performance-Based Acquisition	Very weak correlation, not significant. No significant difference of means.	Not issuing true performance-based contracts.	Acquisition programs do not benefit from actual performance-based contracts with specified performance objectives and measurable outcomes.
Integrated Process Team	Very weak correlation, not significant. No significant difference of means.	IPT usage is not mature and widely institutionalized	Diminishes the quality of contract requirements due to less user involvement.
Program Manager Qualification	Very weak correlation, not significant. No significant difference of means.	Definition of Program Manager and qualifications differ among agencies.	Creates uncertainty regarding program responsibilities. Increases the possibility of unqualified managers leading major acquisition programs.

As Table 5.14 shows, there are several significant implications resulting from the quantitative findings and null explanations.

Classifying all contracts other than firm-fixed price as 'high-risk' can result in making incorrect awards. Based on interviews, this appears to be especially true since many contracting officers are unwilling to discount the guidance and issue other types of contracts. Using the wrong contract type can increase risk, particularly for high tech investments. Given the pace of emerging technology and innovation, flexibility needs to be built into contracts to allow for rapid change. Firm-fixed price contracts tend to lock the government into set constraints, so the reduced flexibility may increase the level of risk to the government by diminishing its capability to respond to and take advantage of emerging technologies.

Although valid for socio-economic reasons, from a contracting standpoint small value and mandatory set-aside contracts may not provide optimal acquisition results. The small dollar value contracts do not typically receive the same level of visibility and scrutiny as larger contracts, so the requirements definition and level of competition may be diminished. Additionally, smaller contracts may not be able to gain the same economies of scale advantages that larger contracts enjoy, so their overhead cost structure could be more expensive on a per unit basis.

Vendor capability is a concern regarding mandatory set-aside contracts that are awarded with limited competition to traditionally disadvantaged businesses. Cases were mentioned during more than a few interviews where set-aside vendors simply could not perform the work and had to be replaced for lack of performance. This is not always the case, but when it does happen, additional expense and program delays inevitably result.

Mislabeled contracts as performance-based is certainly deceiving and skews any real understanding of the impact and effectiveness of performance-based contracts. The DAG Chapter 14 states that the objectives of performance-based services acquisition is to maximize performance, maximize competition and innovation, encourage and promote the use of commercial services, shift risk, and achieve savings. Therefore, even more important than mislabeling contracts, not actually writing performance-based contracts prevents the government from taking advantage of the benefits derived from them.

It became apparent during the interviews with several subject matter experts that integrated process teams (IPTs) are not widely used throughout the federal government. This is especially true for acquisitions that are not for information technology products and services. The lack of institutionalizing IPTs results in less user involvement in a formalized manner throughout the acquisition lifecycle. While

user involvement was repeatedly mentioned as a critical component needed for developing well-defined contract requirements, the absence of their involvement is increased without using established IPTs that are multifunctional with representation from all stakeholders. This absence results in not fully understanding user needs and erroneously defining contract requirements, which produces adverse second and third order effects.

Finally, having different agency definitions of program managers and qualification standards may result in people being assigned to positions without the proper skills and experience. This can be a real concern for major acquisition programs involving millions of dollars. Within the Department of Defense, the role of a program manager is well defined. However, different definitions exist among the non-DOD agencies, where the term 'program manager' seems to be more typically assigned to business or mission area managers. The inconsistent definitions leads to confusion regarding program accountability and responsibilities, especially since there may be no designated acquisition program manager assigned. The manner in which agencies designate and certify program managers is a concern, since agencies differ in their implementation and management of certification programs. While the DOD adheres to the Defense Acquisition Workforce Improvement Act (DAWIA) of

1991 for acquisition training and certification, civilian agencies typically use the Federal Acquisition Institute (FAI) standards for certification (FAC-P/PM and FAC-C). However, the manner in which agencies verify and ensure that individuals really have the needed training and experience prior to certification and assignment to a program manager position widely differs. In some case, it was stated during interviews that individuals simply fill out the needed paperwork and self-certify themselves as fully qualified. Therefore, the risk exists for federal employees to be assigned as major program managers without the necessary skills, experience, and knowledge for the job.

## CHAPTER SIX: SUMMARY AND FUTURE RESEARCH

### I. Summary

Services contracts have been integral enablers of successful public management since the United States' earliest days and are now indispensable for effective and efficient government operations. Growing over the past several years, service contracts currently account for 80 percent of all contract money obligated by civilian agencies (GAO, 2011) and over 50 percent of the total DOD acquisition budget (Andrews, Conaway, et. al., 2010). In dollar terms, that equates to over \$335 billion spent in fiscal year 2010 for services (GAO, 2011; Kaminski, 2011).

Despite the prevalence and scope of federal services contracting, Donald Kettl (1993) asserted that, while accepting the market-based potential of contracting, governments have failed to develop the capacity to cope with the most basic contracting questions such as *what to buy, who to buy from, and what has been bought*. It is the decision of "what to buy" that forms the basis upon which the other two questions can be determined, since "what to buy" is the key question that largely establishes how the other stages in the acquisition process will be conducted in order to meet identified user needs. However,

the determination of service contract requirements is an underexplored aspect of government contracting in both practice and scholarship.

Contract requirements are formulated based upon identified needs during the pre-solicitation phase of acquisition planning and are a particularly important aspect of the entire procurement process. Contracting officers procure services on behalf of a user for a particular purpose; therefore, the user needs establish the basis upon which contracts are written, awarded, executed, and evaluated. Without clear and complete contract requirements, contracting officers are not able to write and award accurate contracts. Similarly, contract requirements form the basis upon which vendor performance and contract fulfillment is monitored and measured.

The importance of requirements definition ("what to buy?") to successful competition and performance of services contracts has been widely recognized, but the lack of well-defined contract requirements has been declared as a prime factor preventing the achievement of better acquisition program results (Kelman, 2007; Madsen, Addeo, Anderson, Burman, DeMaio, Doke, et al., 2007; Andrews, Conaway, et al., 2010; Amey, 2012). Therefore, the element of Kettl's smart-buyer problem that was the focus of this study is the question of "what to buy?," which translates to the matter of contract requirements determination.

In spite of their critical importance to contracting and acquisition processes, services contract requirements have not received critical examination as a subject of inquiry by public management scholars up to this point. Therefore, this research study makes a contribution to the literature by using an empirical approach to look at this underexplored, but critical, aspect of the federal government acquisition and contracting process.

This study serves both research and practical purposes. For most scholars, contract requirements are usually assumed to be correct and are not challenged. However, accurately identifying services to be performed is the foundation upon which the entire contracting process is executed. Additionally, for the public manager, the study findings provide a basis for a better response to recent criticism that the requirements process for the acquisition of services is a weakness. Furthermore, the findings provide a means for acquisition professionals to better understand the linkage and correlation between selected services contract characteristics and acquisition program success.

Therefore, this study empirically examined the question of whether significant correlation exists between selected services contract characteristics related to contract requirements and information technology (IT) investment ratings. While there are

many contract characteristics that could be studied, the five that were selected for this research effort were: Contract Type, Extent Competed, Performance-Based Acquisition, Integrated Process Team, and Program Manager Qualification. Those five contract characteristics were chosen due to their connection to policy, best practices, and contract requirements. Analyzing those five contract characteristics was especially important since current acquisition policy advocates particular contract characteristics as the preferred methods of procurement, such as firm-fixed price, performance-based, and competitively awarded contracts. Additionally, the use of integrated process teams and qualified program managers are based in policy and widely accepted as best practices.

To answer the research question, this study utilized a quantitative dominant sequential mixed-methods research design, which had two phases. The primary phase was quantitative, which looked in detail at contract characteristics and information technology (IT) investment ratings as documented in the Office of Management and Budget (OMB) federal IT dashboard. To enhance completeness, this analysis considered both the OMB overall ratings and the individual agency CIO evaluation ratings; an assumption made in this study was that investment rating (dependent variable) is an accurate indicator of contract performance. The secondary phase was qualitative and consisted

of conducting semi-structured interviews with senior acquisition and information technology professionals to garner their reactions and insights to better understand the quantitative findings.

In order to reject the null hypothesis, each alternate hypothesis, based on the five selected contract characteristics, was examined to see if it could be answered affirmatively. Each independent variable had a connection to service contract requirements, so they were thought to provide a creditable means of understanding the nexus between contract requirements and acquisition program outcomes.

To ensure optimal exploration of the data, two different sampling methods were used as the basis of empirical analysis. The first sampling method, used in conjunction with the OMB 10-point overall ratings, was a deliberate selection of contracts based on strict criteria and a unitary relationship with individual investments. The second sampling method was considerably more random and consisted of using agency CIO 5-point ratings. Again, to ensure more comprehensive exploration and better substantiate results, adding an additional method of sample selection and corresponding analysis was considered beneficial. Between the two variants of the dependent variable (OMB overall rating and CIO rating), a total of 120 investments were analyzed. Additionally, since the second sample of

investments (CIO ratings) did not adhere to the unitary one-to-one criterion, a total of 213 service contracts were examined. The combined sample size of 120 investments resulted in a 95 percent confidence level with an eight percent margin of error.

After verifying that the required underlying statistical assumptions were satisfied, two separate methods of examination were employed for this study: point-biserial correlation coefficients and independent sample t-tests for difference of means. Both statistical methods were applied to each alternate hypothesis and separately analyzed so as to investigate whether they permit rejection of the null hypothesis. Additionally, the analysis was conducted on both variants of the dependent variable (OMB overall rating and agency CIO rating) for each independent variable using the latest and average investment ratings. By looking at each hypothesis and their corresponding independent variables in a systematic manner that included different sampling methods and dependent variable configurations, a more exhaustive examination was conducted for determining whether or not the null hypothesis ( $H_0$ ) could be rejected.

When analyzing the correlation results the p-value for each bivariate correlation was used to determine whether a statistically significant relationship existed. As such, using a generally accepted significance level of  $\alpha = .05$ , the

correlation was considered statistically significant if  $p \leq .05$  (Myers, Well, & Lorch, 2010). Similarly, the guideline used to measure the relationship strength between variables was:

$0 <  r  < .1$	None or very weak correlation
$.1 <  r  < .3$	Weak correlation
$.3 <  r  < .5$	Moderate correlation
$.5 <  r  < .7$	Strong correlation
$ r  > 0.7$	Very strong correlation

The second method of statistical analysis used in this study was the independent sample t-test for difference between means. This test was used to determine whether there was a statistically significant difference of means between two categories of each independent variable.

Accordingly, eight statistical tests were conducted to evaluate each of the five alternate hypotheses in order to confirm whether empirical evidence would allow rejection of the null hypothesis. Besides all independent variables showing weak or very weak correlation with investment ratings, the lowest p-value of all 40 tests was .073, which was still above the critical significance level ( $\alpha$ ) of .05. Since all resulting p-values were  $> .05$ , they were not significant and thus did not allow for rejection of the null hypothesis. In addition to determining that all of the individual correlation p-values did not allow for rejection of the null hypothesis, Fisher's combined p-value method was considered as a means of meta-

analysis to verify whether combining the individual correlation p-values into a single statistic would allow for rejection of the null hypothesis (Borrór, 2012; DeMeeûs, Guégan, & Teriokhin, 2009). Using the Fisher combined p-value method for all 20 point-biserial correlations, which includes both OMB and CIO rating samples (n=60 contracts and n=153 contracts), the combined p-value = .315. Likewise, a combined p-value was computed for each of the two samples separately, and the corresponding combined p-values were  $p_{n=60} = .150$  and  $p_{n=153} = .636$ . Therefore, using the Fisher combined p-value method for both separate and aggregated samples resulted in p-values > .05, which was not significant and thus does not allow for rejection of the null hypothesis.

Therefore, the quantitative analysis indicated that on both an individual and combined basis none of the alternate hypotheses could be accepted; thus, empirical evidence did not support rejection of the null hypothesis ( $H_0$ ) that there is no statistically significant correlation between selected service contract characteristics related to contract requirements and investment ratings. By failing to reject the null hypothesis, a conclusion was made that service contract requirements are not better defined in cases when they ought to be, given the selected contract characteristics. Therefore, based on the empirical analysis of this study, it appears as though concern

and criticism regarding the quality of service contract requirements is valid.

In order to better understand the quantitative findings, 16 interviews were conducted with a total of 22 senior executives representing 11 different federal departments and industry. Of the 16 interviews, 9 were conducted with acquisition professionals and 7 were conducted with information technology professionals. None of the interview participants disputed the quantitative finding that the null hypothesis could not be rejected.

All of the interview participants stressed the importance of contract requirements and stated that there is a direct connection between well-defined contract requirements and program success. No interviewee voiced disagreement with the logic that highly rated acquisition programs are based on high-quality contracts and that high-quality contracts are created by having well-defined requirements. Therefore, the linkage between investment ratings and contract requirements was confirmed by subject matter experts.

While the importance of contract requirements was recognized by all, they noted that significant problems do commonly exist. Some stated that there is no requirements process for IT services. Others said that the requirements process for services is ad hoc, and is more of an art than a

science. Additional interviewees were more critical and asserted that developing contract requirements is a huge problem and that it is a "completely broken system."

Participants in 11 out of the 16 interviews stated that they were not surprised by the findings, which translates to nearly 70 percent of the subject matter experts not being surprised that the selected service contract characteristics did not correlate with investment ratings. A breakdown of the results shows that 67 percent of the acquisition professionals and 71 percent of the information technology professionals were not surprised by the results. Overall, it was stated that the lack correlation between the selected contract characteristics and investment ratings is an indication that the federal government has a significant problem accurately defining contract requirements.

Finally, this study's findings are consistent with the results of the Professional Services Council (PSC) 2012 survey of federal acquisition executives, titled "The Balancing Act: Acquisition in an Unabated Crisis." Like this study, the PSC survey identified a number of issues pertaining to requirements definition and contracting. Similar issues found include: the importance of selecting the appropriate contract type, identifying requirements correctly at the front-end of an acquisition program, changing federal workforce demographics and

skills gaps, the adverse impact of budget instability and reduced funding, countering the zero-risk mentality, and the need for better collaboration with industry partners.

**a. Other Factors to Consider**

Donald Kettl correctly observed that the federal government has difficulty acting as a smart-buyer, since it has trouble answering the question of "what to buy?". The lack of statistical correlation between selected contract characteristics related to requirements and information technology investment ratings highlights that service contract requirements definition is a significant challenge facing federal agencies. That conclusion was confirmed by interviews with senior subject matter experts who consistently stated that accurately defining and managing service contract requirements is a genuine concern. Some noted that it is indicative of a broad system failure in federal acquisition beyond just requirements determination and that there is a dire need to look at the entire system holistically.

Since the null finding was clear and not disputed by subject matter experts, it can be concluded that other factors must influence acquisition program performance and investment ratings more than selected contract characteristics. The question then becomes: if selected contract characteristics do

not show any correlation with program performance and investment ratings, then what factors do correlate better? As such, based on the elite interviews conducted for this study, six predominant factors emerged that may have greater influence on program performance and more strongly correlate with investment ratings.

### **1) Internal Processes and Agency Governance**

Most federal departments do not have defined acquisition processes and guidance that is followed throughout the entire organization. Many of the acquisition professionals interviewed voiced frustration with their efforts to implement better acquisition discipline and processes, citing that improvement initiatives are often met with opposition from the business or mission area managers. Several commented that every office and organizational component essentially "does their own thing," and that acquisition improvement initiatives were viewed by functional business owners as attempts to encroach on their missions and workloads. More than a few interviewees stated that internal politics get in the way, impeding business based decisions. Aggravating the situation even more, a fair number of the interview participants stated that there is no external federal pressure to implement better acquisition structure and processes, so functional stakeholders tend to be resistant to

internal acquisition improvement initiatives. Among the federal departments, the DOD seems to have the most mature guidance and processes with the DOD 5000 series directives, but a few interviewees pointed out that even that guidance is more focused on acquiring hardware systems rather than services.

Similar to the lack of guidance and processes, several interviewees commented on the state of their internal governance structures. A number of the federal departments do not have an established review board, which examines proposed investments prior to program initiation and integrates requirements, acquisition, and budget processes. Rather, it was stated that acquisition is fragmented and every office or departmental component approaches it in their own manner. Moreover, it was pointed out by a few subject matter experts that most civilian agencies equate acquisition to procurement and do not view acquisition as an integrated lifecycle process encompassing requirements, procurement, and budget. They stated that it would be beneficial for agencies to focus more on implementing an integrated lifecycle approach.

## **2) Federal Acquisition and Information Technology Workforces**

Human capital was a top concern of every senior executive interviewed for this study. In order to be able to a smart-

buyer, the government needs a technically skilled and experienced workforce. Overall, interviewees stated that there is a significant skills gap and lack of capacity in both the government acquisition and information technology workforces. While recognizing that the government needs sufficient expertise to develop contract requirements, evaluate vendor proposals, and manage acquisition programs, it was frequently stated that no strategic federal approach has been implemented for developing future talent. Problems cited include certification and training, technical knowledge and experience, and changing workforce demographics.

Connected to generating better contract requirements, the need to improve government workforce technical capabilities and minimize the impact of changing workforce demographics was highlighted as needing senior level strategic attention. This is equally true for both the acquisition and information technology workforces. In order to write accurate contract requirements and evaluate vendor proposals, a technically competent and qualified workforce is needed. As was pointed out on several occasions, qualification needs be more than just having the correct acquisition certification paperwork. Rather, especially in the information technology environment, qualification needs to be based on real experience and knowledge of advanced technologies. In the acquisition arena, the loss of

workforce capacity is magnified due to the proportion of retirement eligible federal workers and their years of experience. This problem will become increasingly prevalent due to reduced manning levels and the length of time needed to develop truly qualified acquisition professionals; therefore, program managers may increasingly be assigned to manage major acquisitions and oversee the requirements development process without having the requisite experience and knowledge.

Several interview participants stated that contracting officers and program managers simply go through the certification courses and get promoted too quickly without having the requisite experience and knowledge. Some interviewees felt that certification is frequently based on self-evaluation and submission of the required paperwork. Moreover, the move to online courses by some training organizations was viewed as detrimental to effective learning. It was also explained that much of the acquisition training that does exist is focused on hardware systems and that training is not adequately institutionalized for developing services acquisition expertise. Tighter federal budgets were also listed as a concern, since interviewees believe that lower funding levels will make training and workforce professional development even more difficult in the future.

Additionally, alarm was frequently expressed regarding the skills gap and technical proficiency of government IT workers. One senior executive stated that there is a loss of government capacity to evaluate and understand the current technology and federal workers can't go technically "toe-to-toe" with industry. As a result, the executive stated there is an overreliance on industry to inform the government about correct IT solutions. Several subject matter experts pointed out that not only is having sufficiently qualified government workers a necessity for writing accurate contract requirements, but sufficiently qualified source selection panel members are needed as well. They stated that "in order to make correct contract awards, you need technically capable people to evaluate proposals."

Changing demographics of both the acquisition and IT workforces was a major issue expressed by many senior executives. Some interviewees observed that the declining workforce size and increasing proportion of retirement eligible acquisition professionals was a growing concern; replacing retirees is particularly difficult since it takes years of experience to become fully proficient and training budgets are becoming increasingly limited. The aging federal workforce was also cited as a concern for the IT community, since older workers tend to be less familiar with current advanced

technologies and thus have diminished abilities to define technical requirements and evaluate contract proposals.

### **3) Fiscal Environment and Federal Budget Cycle**

Not only was the austere fiscal environment and funding instability mentioned as an acquisition program management challenge, but the budget cycle was also specified as factor inhibiting better requirements definition. A number of interviewees stated that an acquisition program may initially have well defined requirements, but as the budget changes so do the requirements. Contract requirements tend to be modified in order to fit within the current budget, rather than to reflect what was originally specified as the need.

Similarly, a senior information technology professional stated that budgeting years in advance for technical service requirements presents a problem; since technology is rapidly evolving, even though the requirement may be correctly defined, the budget previously submitted is aged and no longer supports what was initially needed given current market prices. Therefore, service requirements tend to be modified in order to fit within the original budget constraint.

One interviewee noted that a reduced funding environment forces firm-fixed price contracts, which may not be the best contract type. It was stated that there is a tendency to want

greater certainty regarding contract costs in a more severe financial environment, since agencies need more firm cost information for stringent budgeting and do not have the capacity to cover unforeseen contract cost overruns. Therefore, it was also observed that affordability and fiscal constraints are becoming increasingly important for services contracts.

Several subject matter experts stated that the federal budget cycle imposes an urgency to award contracts and obligate money, since appropriated funds expire and Chief Financial Officers are evaluated on their financial obligation and expense rates. Therefore, since appropriated funds expire at the end of the government fiscal year, it was observed that contracts are frequently awarded without spending sufficient time developing requirements. It was also revealed during an interview that industry has found a correlation between time spent on requirements definition and the ultimate cost of an acquisition program.

#### **4) Rate of Technological Change**

It was observed by a large number of interview participants that the federal acquisition and budget processes cannot keep pace with the rate of technological change. Since technology is rapidly evolving, it was mentioned during several interviews that functional users intentionally try to keep contract

requirements less defined so that contracts will have sufficient flexibility to allow for change in a fast moving technological environment. This tendency was also cited for less technical service contracts, where flexibility was desired for potential contingencies and emergencies. Interviewees stated that users view the time required for developing and issuing a new contract as too lengthy, so they frequently try to write service contract requirements broadly in order to stay within scope and not have to re-compete contracts.

Risk management was brought up as an issue by some of the information technology professionals interviewed. Given the rate of technological change, they advocated considering risk along a continuum that balanced risk and performance. In particular, the criticism was that contracting officers need to understand risk management better, not simply understand risk avoidance. Interviewees believed that contracting officers are not taught to manage risk but rather taught to avoid it altogether. By doing so, the IT professionals felt that contracting officers tend to require over-specification of contract requirements. They also cited cases where contracting officers changed what customer activities initially requested in order to minimize risk. Over-specification of requirements is problematic in the area of IT procurement, since it can produce adverse consequences. Besides being counter to performance-

based acquisition, it can reduce competition, limit the use of commercially available solutions, and require significant modifications to commercial products in order to fit within specified constraints. Moreover, over-specifying IT requirements reduces the government's ability to take advantage of newer technologies that may emerge and lead to better program outcomes.

#### **5) Industry Partners and Collaboration**

Industry is obviously indispensable for successful acquisition programs. The need to build strategic partnerships and trust was frequently emphasized by interview participants, although it was noted that building those relationships is challenging given the many federal government contracting constraints. Teaming with industry was cited as a critical component in the requirements development process, since industry must be able to deliver the desired capabilities. In particular, it was mentioned that building trust based relationships between government and vendors is beneficial since long-term vendors tend to better understand users' needs; therefore, habitually re-competing contracts frequently results in less program stability and more poorly defined contract requirements. Additionally, an interview participant stated that writing contract requirements from the vendors' perspective

rather than from the government's perspective - which is normally the case - results in better outcomes.

While the value of reliable industry partners was widely acknowledged, interview participants did have some concerns related to contract requirements. It was repeatedly stated that given the current competitive environment and limited government funds, vendors will bid on anything, even if the contract requirements are not fully understood. It is a matter of survival for some companies, so they will take the chance and bid on unclear contract solicitations. In other cases, it was noted that poorly written contract requirements have a tendency to push off the best companies, since they cannot afford the risk. Therefore, the government only receives proposals from less qualified vendors who need the business to stay afloat.

This can be labeled as the 'shell company predicament.' It goes beyond the concept of a 'hollow corporation,' introduced in 1986, which inspired Milward and Provan to use the term 'hollow state' as a metaphor to describe public sector reliance on contracting for the delivery of goods and services (Milward & Provan, 2000, 362). Instead of having a 'hollow company,' which replaces internal production with a network of subcontractors, a 'shell company' only gives the façade of capacity when it comes to contract performance and program delivery.

The shell company predicament was alluded to during interviews with seven different individuals, where senior executives voiced frustration with vendors revealing their lack of capability to deliver services only after contracts were awarded. They stated that in nearly all instances, winning vendors received mandated preferential treatment in accordance with federal contracting regulations. Several senior executives offered the view that less capable shell companies strive to win contracts only to become attractive buy-out targets for larger, more qualified companies. However, it was stated that in the information technology services arena there are only a limited number of large companies; therefore, contract workers tend to migrate to the winning company in a competitive bid scenario.

This shell company phenomenon is particularly important for services contracting, since one senior executive noted that "services have now become the hunting territory for vendors." It was further noted that this move to services is especially true for those companies that have traditionally been hardware providers. One interview participant stated that small businesses in particular frequently do not understand the scale of federal IT projects; they bid on sophisticated projects without a clear understanding of the requirements and get in over their heads in terms of size and complexity.

## **6) Senior Leadership Involvement**

The final factor that may have significant influence on program performance is the level of senior leadership involvement. It was repeatedly stated during interviews that having senior leaders involved throughout the acquisition lifecycle was key to the requirements process and successful services contracts. In particular, several subject matter experts stated that decisions need to be made at higher levels when business cases make sense, since lower level managers are resistant to change and fearful of losing their mission area workload. Additionally, it was stated that vendors are more responsive and engaged when they know that senior leaders are actively involved and asking hard questions. Lastly, interviewees observed that engaged and active senior leaders can better institutionalize trust based relationships among internal and external stakeholders, as well as facilitate a better understanding of what constitutes success in a particular service contract and acquisition program.

As stated by one senior government official, well-defined acquisition program and contract requirements have a bearing on national security. Without well-defined requirements, acquisition programs often fail to deliver needed capabilities

within designated budget and schedule constraints. This can have significant adverse effects on organizations, such as the Departments of Defense and Homeland Security, meeting their national security missions. Given the limited amount of federal funds available to some agencies, the criticality of properly identifying requirements and keeping acquisition programs on target is even more important. Therefore, senior leadership involvement is essential throughout the entire acquisition lifecycle, including the requirements development and management processes.

## **II. Future Research**

There are a number of opportunities for further research, since all of the six factors outlined above that may influence program performance and investment ratings more than the previously selected contract characteristics warrant further consideration. In addition, factors such as scale, complexity, stakeholders, and the federal environment may be the true culprits leading to poor IT acquisition outcomes, rather than poorly defined contract requirements. While conventional wisdom suggests that contract requirements matter, the interaction and multiplicity of factors and interests make accurate contract requirements determination nearly impossible at the early stages

of a major acquisition program. Rather than trying to describe exact contract and funding requirements for complex programs with rapidly evolving technologies, which frequently lead to a continuous need to explain baseline variances to oversight bodies and higher authorities, less precision may be advantageous early in the program lifecycle. This presents a 'requirements conundrum' worthy of further study since it goes against current federal acquisition and budgeting mindsets, where precise requirements definitions and budget forecasts are typically demanded years in advance of actual program initiation and development.

Several other research opportunities related to variable selection also exist. The variables selected for this study were chosen based on their relationship to policy, best practices, and contract requirements. However, it may be useful to examine variables such as the range of vendor bids or contract modifications. Bids may be a good indicator of how well the contract requirements are defined and understood by industry, since a narrow range would indicate different vendors have the same understanding of the requirements while a wide range would indicate different understandings. Similarly, contract modifications, especially change orders within scope, may provide insight regarding how well the contract requirements are defined.

Since there is a considerable amount of variance among agency CIO investment ratings, it would be useful to study whether or not ratings of acquisition programs that have undergone external audits differ significantly from programs that have not. A case study approach, which looks more in-depth at a limited number of individual CIO rating histories, service contracts, and requirements documents could be used. That research may provide some useful insights regarding the extent to which CIO evaluation ratings accurately reflect true program performance.

Finally, this study focused on service contract requirements as they relate to information technology (IT) investments. Since a large number of government functions use services contracts in addition to IT, it would be valuable to see if similar results are found with other types of functions and services.

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## APPENDIX A

### Display of Federal Procurement Data System - New Generation (FPDS-NG) Contract Data Fields

#### Contract Identification Information

Procurement Instrument Identifier  
Modification Number  
Referenced PIID  
Agency Identifier  
Referenced IDV Modification Number  
Referenced IDV Agency Identifier

#### Dates

Date Signed  
Effective Date  
Current Completion Date  
Ultimate Completion Date  
Fiscal Year

#### Dollar Values

Base and All Options Value  
Base and Exercised Options Value  
Action Obligation  
Non-Government Dollars

#### Purchaser Information

Contracting Agency Code  
Contracting Office Code  
Program/Funding Agency - Code  
Program/Funding Office - Code

#### Contract Information

Description of Requirement  
Performance-Based Service Contract  
Treasury Account Symbol Agency Identifier  
Account Codes

#### Product or Service Information

Product or Service Code  
Product Service Code Description

#### Contractor Data

DUNS Number  
Principal Place of Performance  
Congressional District - Contractor  
Congressional District - Place of Performance  
Zip Code - Place of Performance

#### Competition Information

Extent Competed  
Solicitation Procedures

Nontraditional Government Contractor Participation  
Type of Agreement

**Transaction Information**

IDV Type  
Award Type  
Reason for Modification

**Contractor Data**

Vendor Name  
Vendor Doing As Business Name  
Vendor Address

**Type of Set Aside**

Small Business  
8A Firm  
Hist. Underutilized Business Zone (HUBZone) Firm  
Small Disadvantaged Business  
Sheltered Workshop (JWOD Provider)  
Historically Black College or University  
Educational Institution  
Woman Owned Business  
Veteran Owned Business  
Service Disabled Veteran Owned Firm  
Local Government  
Minority Institution  
American Indian Owned Business  
State Government  
Federal Government  
Minority Owned Business  
Asian-Pacific American Owned Business  
Tribal Government  
Black American Owned Business  
Native American Owned Business  
Subcontinent Asian (Asian-Indian) American Owned  
Business  
Nonprofit Organization  
Hispanic American Owned Business  
Emerging Small Business

## APPENDIX B

### Federal Information Technology (IT) Dashboard Agencies

The following 27 agencies have data available on the Federal IT Dashboard (<http://www.itdashboard.gov>):

- Department of Agriculture
- Department of Commerce
- Department of Defense
- 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 State
- Department of Transportation
- Department of Treasury
- Department of Veteran's Affairs
- U.S. Agency for International Development (USAID)
- U.S. Army Corps of Engineers
- Environmental Protection Agency
- General Services Administration
- National Aeronautics and Space Administration
- National Archives and Records Administration
- National Science Foundation
- Nuclear Regulatory Commission
- Office of Personnel Management
- Small Business Administration
- Smithsonian Institution
- Social Security Administration

## APPENDIX C

### OMB Exhibit 300 Data Fields

Unique Investment Identifier  
Business Case ID  
Agency Code  
Agency Name  
Bureau Code  
Bureau Name  
Investment Title (Exhibit 53)  
Investment Title (Exhibit 300)  
Brief Summary  
Summary of Performance Gap  
Accomplishments PY  
Accomplishments CY BY  
IPT Charter Date  
Funding PY1 and Prior (\$ M)  
Funding PY (\$ M)  
Funding CY (\$ M)  
Funding BY (\$ M)  
Summary of Funding Start Year  
Summary of Funding End Year  
Explanation of Change to PY or CY Funding  
No EVM Explanation  
Evaluation (by Agency CIO)  
CIO Evaluation Comments  
CIO Evaluation Color  
Date of Last Update to CIO Evaluation  
Date of Last Change to CIO Evaluation  
Number of changes to Baseline  
Date of Last Baseline  
Date of Last Change to Activities  
Date of Last Update to Activities  
Data Freshness  
Date of Last Change to Contracts  
Date of Last Change to Performance Metrics  
Date of Last Tech Stat  
Budget Year  
Date Investment First Submitted  
Date of Last Investment Detail Update

**APPENDIX D**

**List of Federal Agencies submitting FY 2010**

**Service Contract Inventories**

Department of Agriculture  
Agency for International Development  
Department of Commerce  
Department of Defense  
Department of Education  
Department of Energy  
Environmental Protection Agency  
General Services Administration  
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  
National Aeronautical and Space Administration  
National Science Foundation  
Nuclear Regulatory Commission  
Office of Personnel Management  
Small Business Administration

**APPENDIX E**

**Agency CIO Evaluation Factors and Guidelines**

<b>Evaluation Factor</b>	<b>Supporting Examples</b>
Risk Management	<ul style="list-style-type: none"> <li>• Risk Management Strategy Exists</li> <li>• Risks are well understood by senior leadership</li> <li>• Risk log is current and complete</li> <li>• Risks are clearly prioritized</li> <li>• Mitigation plans are in place to address risks</li> </ul>
<b>Requirements Management</b>	<ul style="list-style-type: none"> <li>• <b>Investment objectives are clear and scope is controlled</b></li> <li>• <b>Requirements are complete, clear and validated</b></li> <li>• <b>Appropriate stakeholders are involved in requirements definition</b></li> </ul>
Contractor Oversight	<ul style="list-style-type: none"> <li>• Acquisition strategy is defined and managed via an Integrated Program Team</li> <li>• Agency receives key reports, such as earned value reports, current status, and risk logs</li> <li>• Agency is providing appropriate management of contractors such that the government is monitoring, controlling, and mitigating the impact of any adverse contract performance</li> </ul>
Historical Performance	<ul style="list-style-type: none"> <li>• No significant deviations from planned cost and schedule</li> <li>• Lessons learned and best practices are incorporated and adopted</li> </ul>
Human Capital	<ul style="list-style-type: none"> <li>• Qualified management and execution team for the IT investments and/or contracts supporting the investment</li> <li>• Low turnover rate</li> </ul>

<u>Cost and Schedule Variance Rating</u>	<u>Agency CIO Evaluation</u>
≥ 30%	1 or 2
≥ 10% and < 30%	3
< 10%	4 or 5

**The percent cost variance is calculated as follows:**

Cost Variance =  
 Projected or Actual Total Cost - Planned Total Costs

Cost Variance (Percentage) =  
 (Cost Variance / Planned Total Cost) x 100

**The percent schedule variance is calculated as follows:**

Schedule Variance =  
 Planned Completion Date - Actual or Projected Completion Date

Schedule Variance (Percentage) =  
 (Schedule Variance/Total Duration) x 100

## APPENDIX F

### Independent Variables - Coding Key

#### Type of Contract:

- 0 = Other contract type  
(Cost, time and material, or labor hour)
- 1 = Firm-fixed price contract

#### Extent Competed:

- 0 = Not competed
- 1 = Fully competed contract

#### Performance Based Acquisition:

- 0 = Not performance-based
- 1 = Performance-based contract

#### Integrated Process Team (IPT):

- 0 = Charter signed after contract award date
- 1 = Charter signed prior to contract award

#### Program Manager Qualification:

- 0 = Not qualified or validated
- 1 = Fully qualified Program Manager

**APPENDIX G**  
**Agency Chief Information Officer (CIO) Investment Rating**  
**Averages**

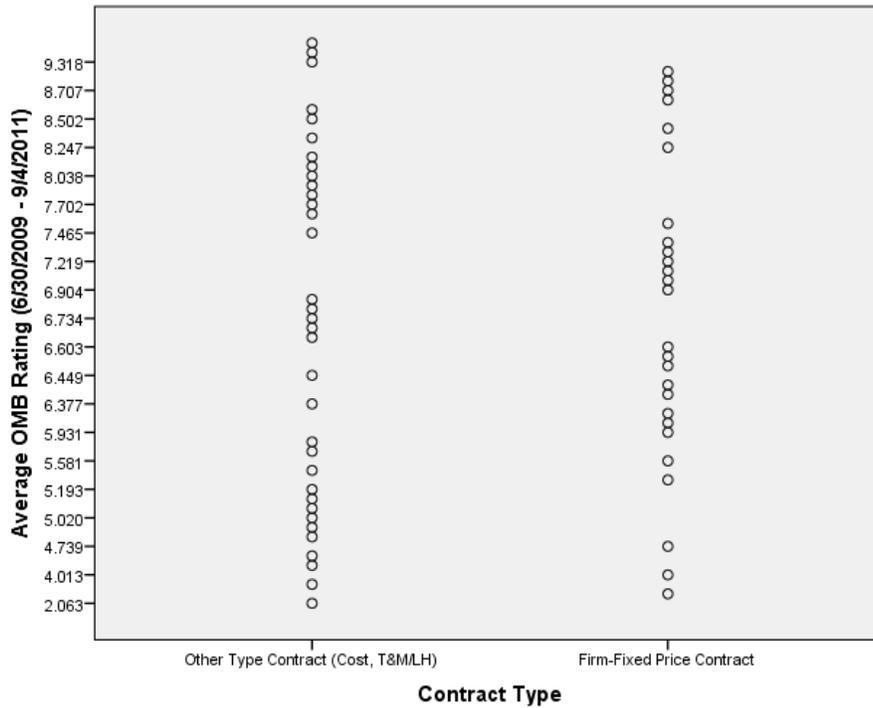
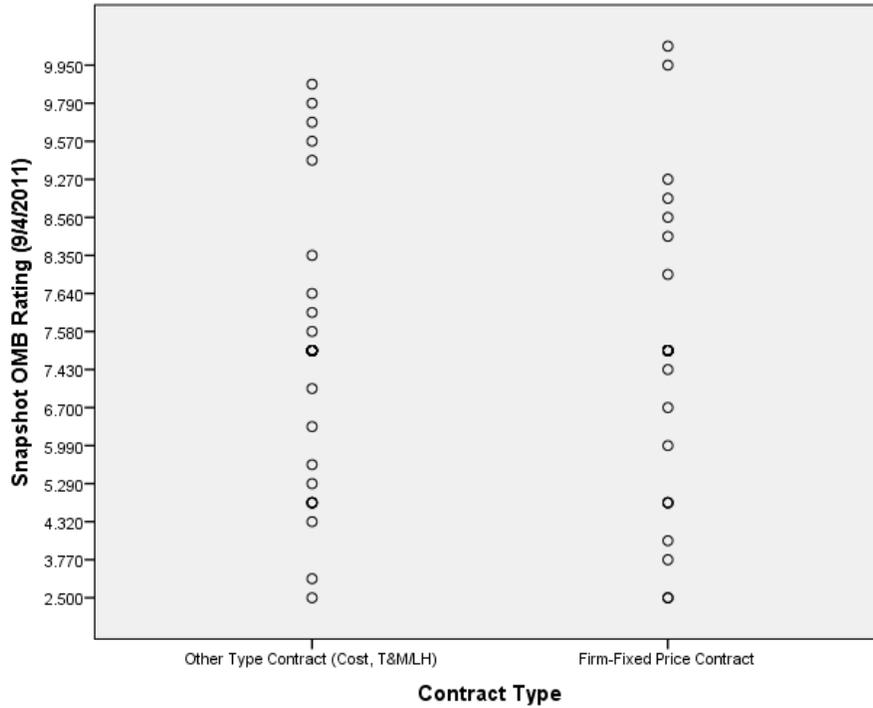
	Mean	N	Std. Deviation	Variance
US Department of Agriculture	3.50	40	.906	.821
US Department of Commerce	3.39	41	.862	.744
US Department of Defense	4.43	87	.757	.573
US Department of Education	3.40	25	.707	.500
US Department of Energy	4.85	20	.489	.239
US Department of Health and Human Services	3.81	81	.691	.478
US Department of Homeland Security	3.75	83	.763	.582
US Department of Housing and Urban Development	3.60	10	.843	.711
US Department of Justice	3.84	19	.375	.140
US Department of Labor	4.12	33	.740	.547
US Department of State	3.47	15	.516	.267
US Department of Interior	3.85	48	.967	.936
US Department of Treasury	4.04	48	.544	.296
US Department of Transportation	3.89	44	.443	.196
US Department of Veterans Affairs	3.84	25	1.143	1.307
Environmental Protection Agency	4.10	10	.316	.100
General Services Administration	4.46	24	.658	.433
National Aeronautics and Space Administration	4.67	12	.778	.606
National Archives and Records Administration	3.33	6	.516	.267
National Science Foundation	4.20	5	.447	.200
Nuclear Regulatory Commission	4.00	9	.707	.500

Office of Personnel Management	4.11	9	1.453	2.111
Small Business Administration	4.50	10	.707	.500
Social Security Administration	4.47	15	.640	.410
US Agency for International Development	5.00	4	.000	.000
US Army Corps of Engineers	4.00	13	.707	.500

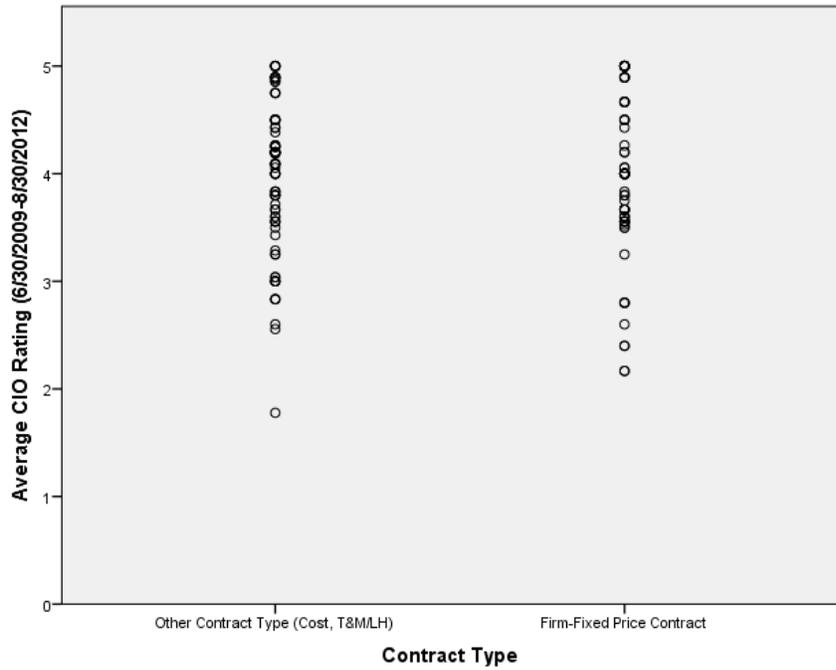
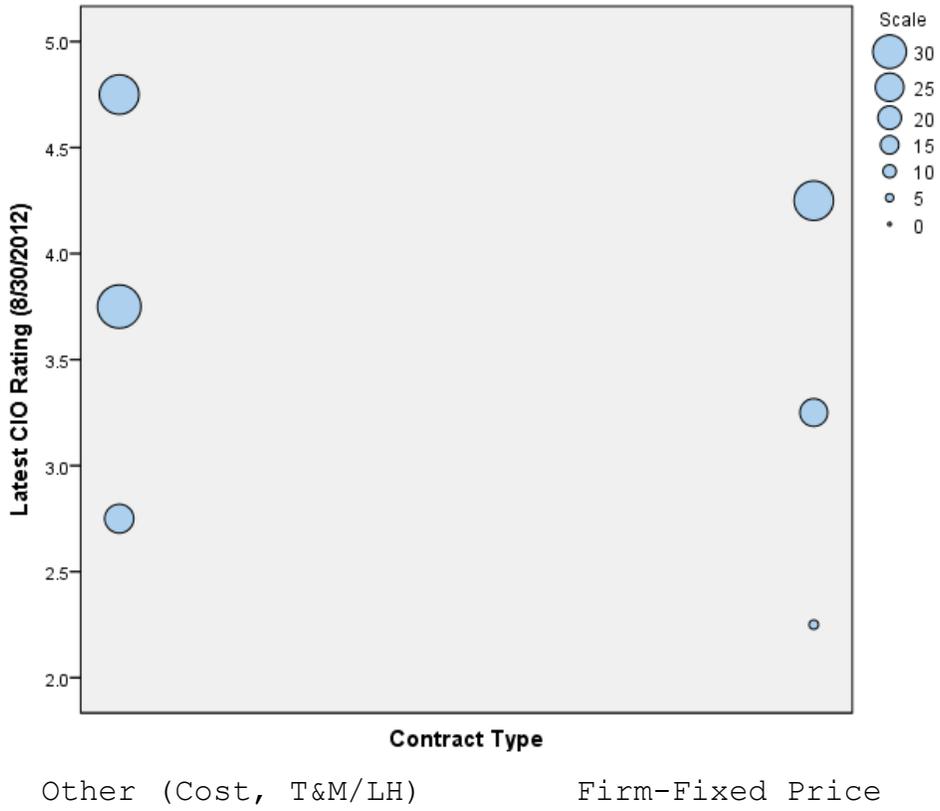
# APPENDIX H

## Statistical Details of H1: Contract Type

### Contract Type - Scatterplot (N = 60)



**Contract Type - Scatterplots (N = 153)**



**Contract Type - OMB Ratings**

**Point-Biserial Correlation (N = 60)**

<b>Correlations</b>			
		Snapshot OMB Rating (9/4/2011)	Contract Type
Snapshot OMB Rating (9/4/2011)	Pearson Correlation	1	-.047
	Sig. (2-tailed)		.722
	N	60	60
		Average OMB Rating (6/30/2009 - 9/4/2011)	Contract Type
Average OMB Rating (6/30/2009 - 9/4/2011)	Pearson Correlation	1	.043
	Sig. (2-tailed)		.744
	N	60	60

**Contract Type - CIO Ratings**

**Point-Biserial Correlation (N = 153)**

<b>Correlations</b>			
		Latest CIO Rating (8/30/2012)	Contract Type
Latest CIO Rating (8/30/2012)	Pearson Correlation	1	-.009
	Sig. (2-tailed)		.908
	N	153	153
		Average CIO Rating (6/30/2009-8/30/2012)	Contract Type
Average CIO Rating (6/30/2009-8/30/2012)	Pearson Correlation	1	.003
	Sig. (2-tailed)		.975
	N	153	153

**Contract Type - Independent t-Test (OMB Snapshot Rating)**  
**(N = 60)**

**Group Statistics**

Contract Type		N	Mean	Std. Deviation
Snapshot OMB Rating (9/4/2011)	Other Type Contract (Cost, T&M/LH)	34	7.04412	1.789407
	Firm-Fixed Price Contract	26	6.86500	2.088171

Contract Type		Std. Error Mean
Snapshot OMB Rating (9/4/2011)	Other Type Contract (Cost, T&M/LH)	.306881
	Firm-Fixed Price Contract	.409524

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.967	.330	.357
	Equal variances not assumed			.350

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	58	.722	.179118
	Equal variances not assumed	49.206	.728	.179118

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.501219	-.824182	1.182417
	Equal variances not assumed	.511748	-.849169	1.207404

**Contract Type - Independent t-Test (OMB Average Rating)**

(N = 60)

**Group Statistics**

Contract Type		N	Mean	Std. Deviation
Average OMB Rating	Other Type Contract (Cost, T&M/LH)	34	6.62681	1.800204
(6/30/2009 - 9/4/2011)	Firm-Fixed Price Contract	26	6.77179	1.543401

Contract Type		Std. Error Mean
Average OMB Rating (6/30/2009 - 9/4/2011)	Other Type Contract (Cost, T&M/LH)	.308732
	Firm-Fixed Price Contract	.302686

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average OMB Rating	Equal variances assumed	1.269	.265	-.328
(6/30/2009 - 9/4/2011)	Equal variances not assumed			-.335

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average OMB Rating	Equal variances assumed	58	.744	-.144981
(6/30/2009 - 9/4/2011)	Equal variances not assumed	57.186	.739	-.144981

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average OMB Rating	Equal variances assumed	.441406	-1.028550	.738589
(6/30/2009 - 9/4/2011)	Equal variances not assumed	.432359	-1.010704	.720742

**Contract Type - Independent t-Test (Latest CIO Rating) (N = 153)**

**Group Statistics**

Contract Type		N	Mean	Std. Deviation
Latest CIO Rating (8/30/2012)	Other Contract Type (Cost, T&M/LH)	81	3.98	.908
	Firm-Fixed Price Contract	72	3.96	.895

Contract Type		Std. Error Mean
Latest CIO Rating (8/30/2012)	Other Contract Type (Cost, T&M/LH)	.101
	Firm-Fixed Price Contract	.105

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Latest CIO Rating (8/30/2012)	Equal variances assumed	.003	.959	.116
	Equal variances not assumed			.116

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Latest CIO Rating (8/30/2012)	Equal variances assumed	151	.908	.017
	Equal variances not assumed	149.375	.908	.017

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Latest CIO Rating (8/30/2012)	Equal variances assumed	.146	-.272	.306
	Equal variances not assumed	.146	-.271	.305

**Contract Type - Independent t-Test (Average CIO Rating) (N = 153)**

**Group Statistics**

Contract Type		N	Mean	Std. Deviation
Average CIO Rating (6/30/2009-8/30/2012)	Other Contract Type (Cost, T&M/LH)	81	4.00	.690
	Firm-Fixed Price Contract	72	4.00	.738

Contract Type		Std. Error Mean
Average CIO Rating (6/30/2009-8/30/2012)	Other Contract Type (Cost, T&M/LH)	.077
	Firm-Fixed Price Contract	.087

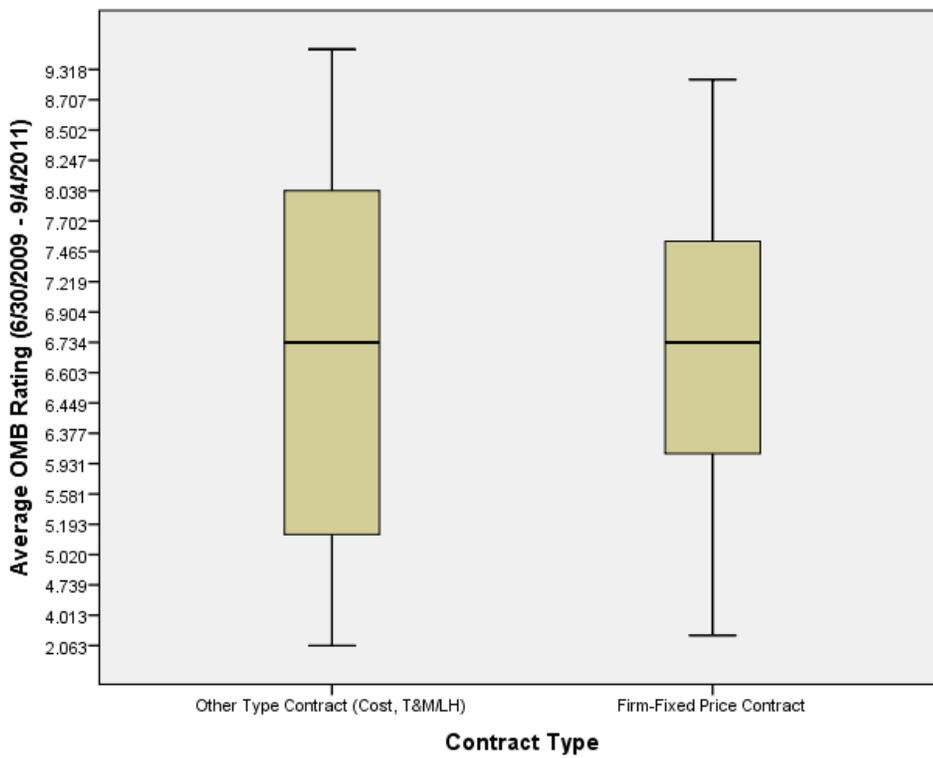
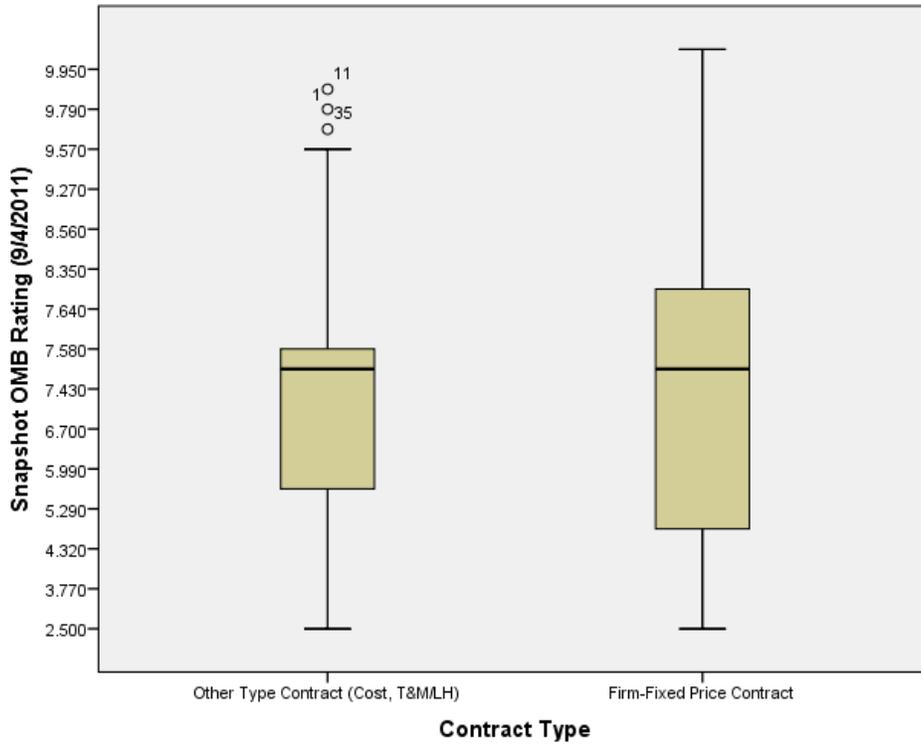
**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	.023	.879	.031
	Equal variances not assumed			-.031

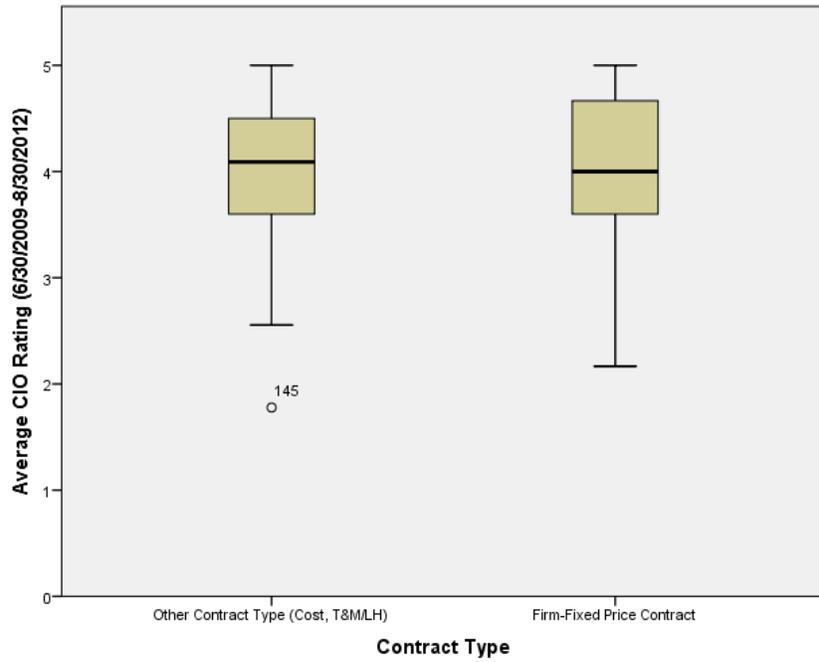
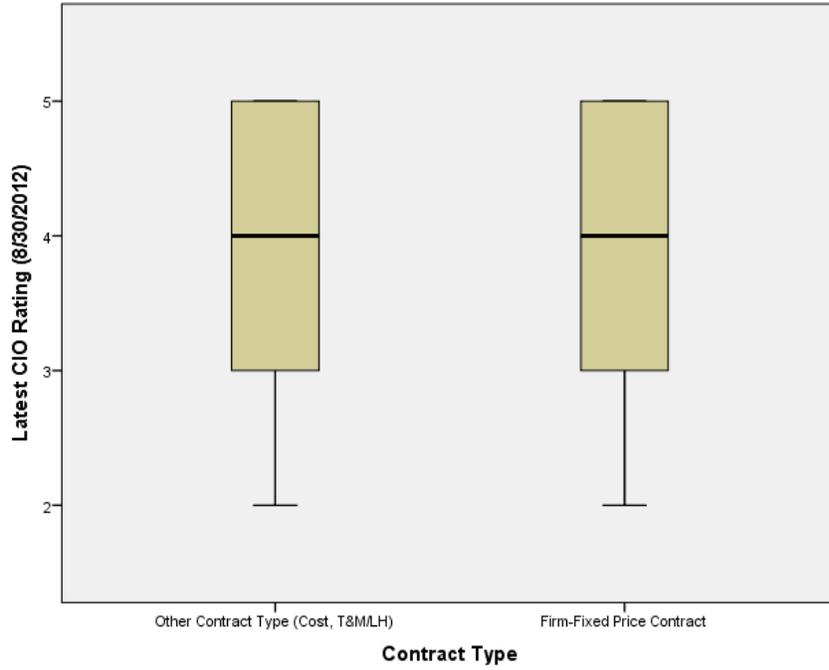
		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	151	.975	-.004
	Equal variances not assumed	145.947	.975	-.004

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	.115	-.232	.224
	Equal variances not assumed	.116	-.233	.225

**Contract Type - Boxplot (N = 60)**

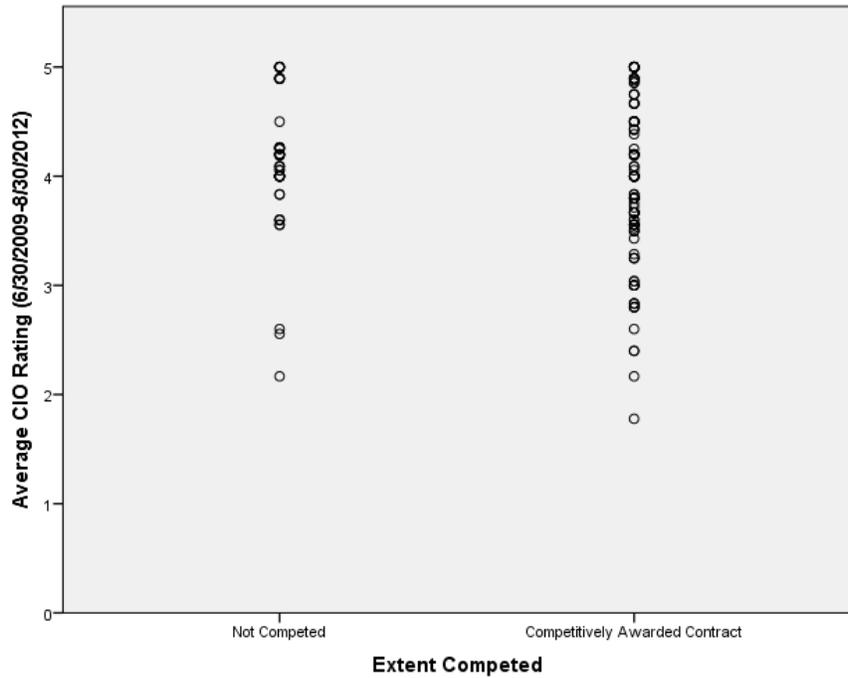
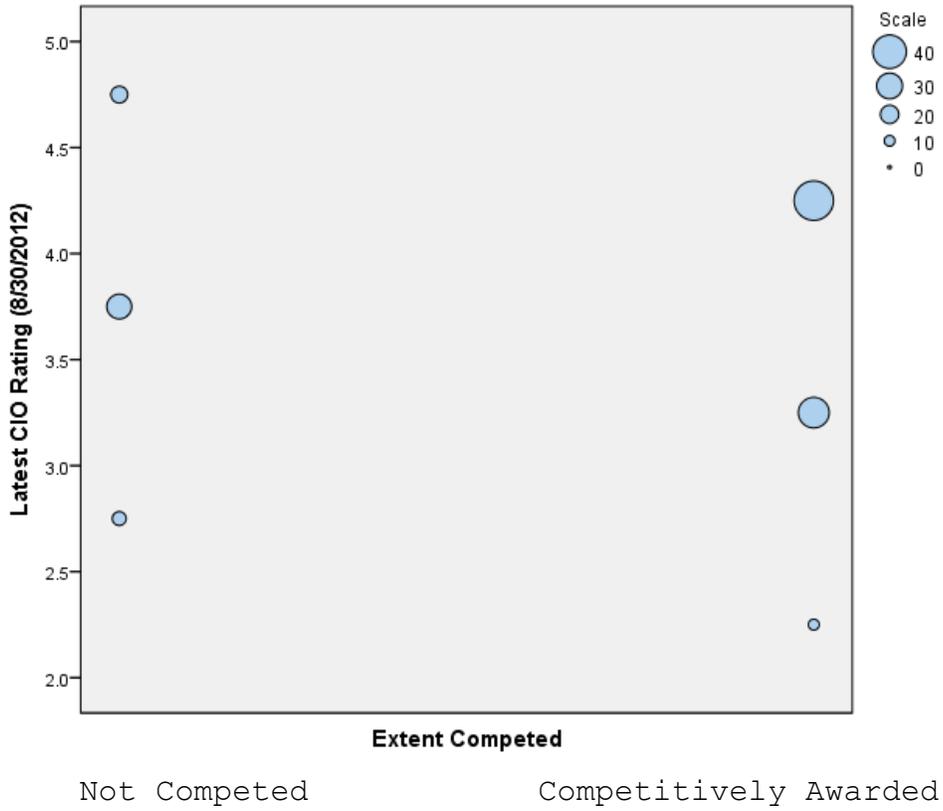


**Contract Type - Boxplots (N = 153)**





**Extent Competed - Scatterplots (N = 153)**



**Extent Competed - OMB Ratings**

**Point-Biserial Correlation (N = 60)**

<b>Correlations</b>			
		Snapshot OMB Rating (9/4/2011)	Extent Competed
Snapshot OMB Rating (9/4/2011)	Pearson Correlation	1	-0.128
	Sig. (2-tailed)		.331
	N	60	60
		Average OMB Rating (6/30/2009 - 9/4/2011)	Extent Competed
Average OMB Rating (6/30/2009 - 9/4/2011)	Pearson Correlation	1	-0.156
	Sig. (2-tailed)		.233
	N	60	60

**Extent Competed - CIO Ratings**

**Point-Biserial Correlation (N = 153)**

<b>Correlations</b>			
		Latest CIO Rating (8/30/2012)	Extent Competed
Latest CIO Rating (8/30/2012)	Pearson Correlation	1	-0.008
	Sig. (2-tailed)		.922
	N	153	153
		Average CIO Rating (6/30/2009- 8/30/2012)	Extent Competed
Average CIO Rating (6/30/2009-8/30/2012)	Pearson Correlation	1	-0.138
	Sig. (2-tailed)		.089
	N	153	153

**Extent Competed - Independent t-Test (OMB Snapshot Rating)**

(N = 60)

**Group Statistics**

Extent Competed		N	Mean	Std. Deviation
Snapshot OMB Rating (9/4/2011)	Not Completed	20	7.30850	1.915200
	Competitively Awarded Contract	40	6.79550	1.907802

Extent Competed		Std. Error Mean
Snapshot OMB Rating (9/4/2011)	Not Completed	.428252
	Competitively Awarded Contract	.301650

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.000	.989	.981
	Equal variances not assumed			.979

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	58	.331	.513000
	Equal variances not assumed	37.976	.334	.513000

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.523138	-.534174	1.560174
	Equal variances not assumed	.523825	-.547449	1.573449

**Extent Competed - Independent t-Test (OMB Average Rating)**

(N = 60)

**Group Statistics**

Extent Competed		N	Mean	Std. Deviation
Average OMB Rating	Not Competed	20	7.05848	1.541355
(6/30/2009 - 9/4/2011)	Competitively Awarded Contract	40	6.50522	1.736375

Extent Competed		Std. Error Mean
Average OMB Rating (6/30/2009 - 9/4/2011)	Not Competed	.344658
	Competitively Awarded Contract	.274545

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average OMB Rating	Equal variances assumed	.148	.702	1.206
(6/30/2009 - 9/4/2011)	Equal variances not assumed			1.256

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average OMB Rating	Equal variances assumed	58	.233	.553266
(6/30/2009 - 9/4/2011)	Equal variances not assumed	42.438	.216	.553266

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average OMB Rating	Equal variances assumed	.458715	-.364953	1.471484
(6/30/2009 - 9/4/2011)	Equal variances not assumed	.440640	-.335711	1.442242

**Extent Competed - Independent t-Test (Latest CIO Rating) (N = 153)**

**Group Statistics**

Extent Competed		N	Mean	Std. Deviation
Latest CIO Rating (8/30/2012)	Not Competed	46	3.98	.830
	Competitively Awarded Contract	107	3.96	.931

Extent Competed		Std. Error Mean
Latest CIO Rating (8/30/2012)	Not Competed	.122
	Competitively Awarded Contract	.090

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Latest CIO Rating (8/30/2012)	Equal variances assumed	2.162	.144	.098
	Equal variances not assumed			.103

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Latest CIO Rating (8/30/2012)	Equal variances assumed	151	.922	.016
	Equal variances not assumed	95.062	.918	.016

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Latest CIO Rating (8/30/2012)	Equal variances assumed	.159	-.299	.330
	Equal variances not assumed	.152	-.286	.317

**Extent Competed - Independent t-Test (Average CIO Rating) (N = 153)**

**Group Statistics**

Extent Competed		N	Mean	Std. Deviation
Average CIO Rating	Not Competed	46	4.15	.636
(6/30/2009-8/30/2012)	Competitively Awarded Contract	107	3.93	.734

Extent Competed		Std. Error Mean
Average CIO Rating (6/30/2009-8/30/2012)	Not Competed	.094
	Competitively Awarded Contract	.071

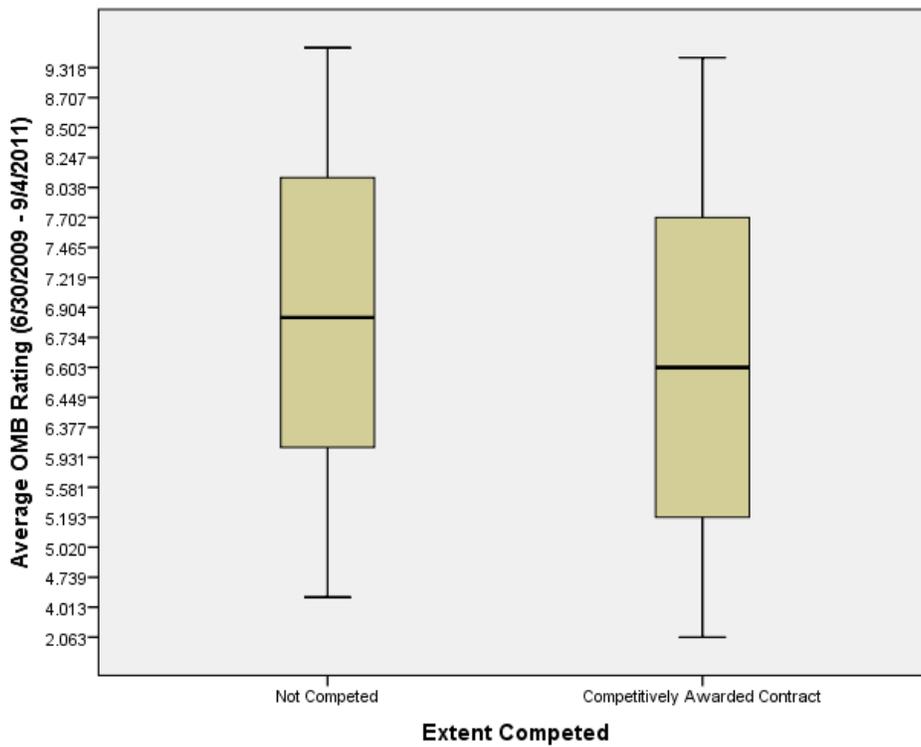
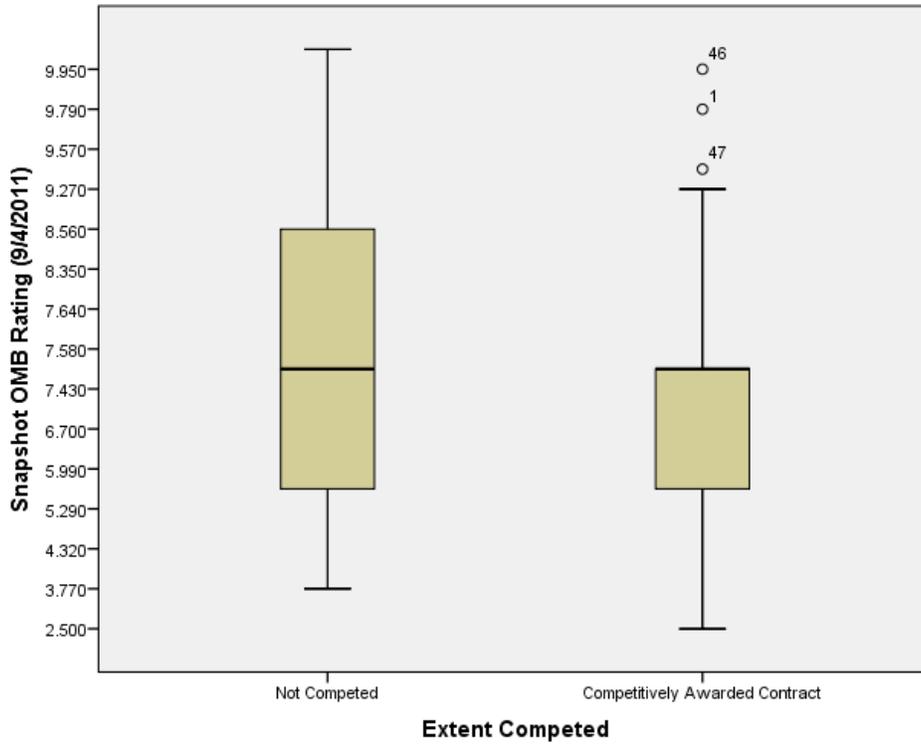
**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average CIO Rating	Equal variances assumed	3.948	.049	1.711
(6/30/2009-8/30/2012)	Equal variances not assumed			1.812

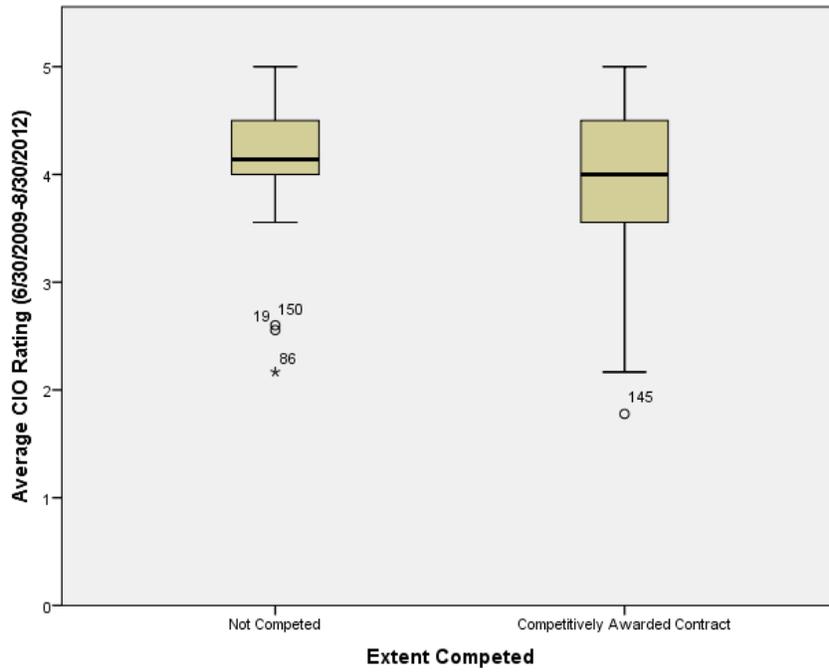
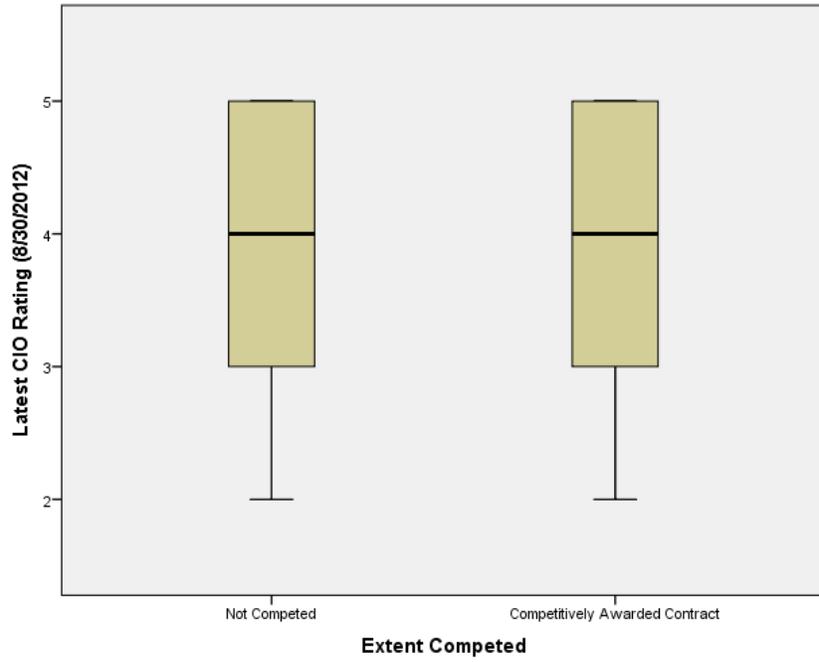
		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average CIO Rating	Equal variances assumed	151	.089	.213
(6/30/2009-8/30/2012)	Equal variances not assumed	97.636	.073	.213

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average CIO Rating	Equal variances assumed	.124	-.033	.459
(6/30/2009-8/30/2012)	Equal variances not assumed	.118	-.020	.446

**Extent Competed - Boxplot (N = 60)**



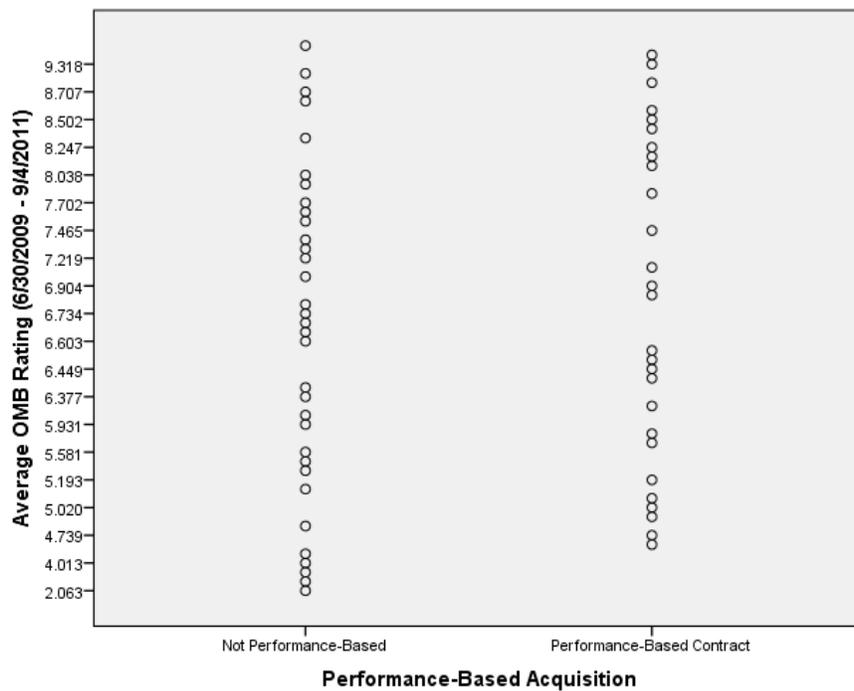
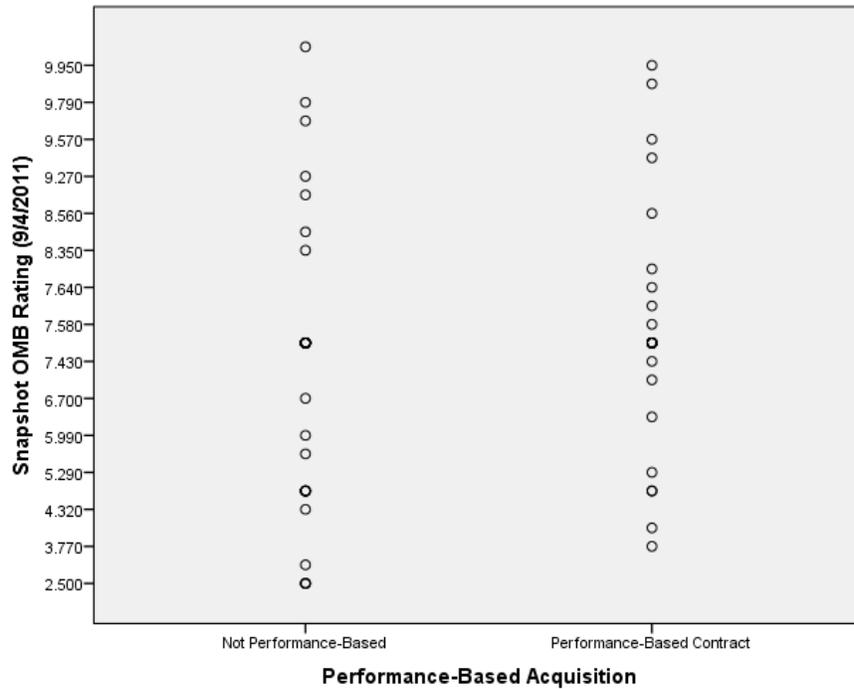
**Extent Competed - Boxplots (N = 153)**



## APPENDIX J

### Statistical Details of H3: Performance-Based Acquisition

#### Performance-Based Acquisition - Scatterplot (N = 60)





**Performance-Based Acquisition - OMB Ratings**

**Point-Biserial Correlation (N = 60)**

Correlations			Snapshot OMB Rating (9/4/2011)	Performance-Based Acquisition
Snapshot OMB Rating (9/4/2011)	Pearson Correlation		1	.158
	Sig. (2-tailed)			.229
	N		60	60
Correlations			Average OMB Rating (6/30/2009 - 9/4/2011)	Performance-Based Acquisition
Average OMB Rating (6/30/2009 - 9/4/2011)	Pearson Correlation		1	.140
	Sig. (2-tailed)			.287
	N		60	60

**Performance-Based Acquisition - CIO Ratings**

**Point-Biserial Correlation (N = 153)**

Correlations			Latest CIO Rating (8/30/2012)	Performance-Based Acquisition
Latest CIO Rating (8/30/2012)	Pearson Correlation		1	-.027
	Sig. (2-tailed)			.739
	N		153	153
Correlations			Average CIO Rating (6/30/2009-8/30/2012)	Performance-Based Acquisition
Average CIO Rating (6/30/2009-8/30/2012)	Pearson Correlation		1	-.121
	Sig. (2-tailed)			.137
	N		153	153

**Performance-Based - Independent t-Test (OMB Snapshot Rating) (N = 60)**

**Group Statistics**

	Performance-Based Acquisition	N	Mean	Std. Deviation
Snapshot OMB Rating (9/4/2011)	Not Performance-Based	33	6.69667	2.119197
	Performance-Based Contract	27	7.29630	1.594438

	Performance-Based Acquisition	Std. Error Mean
Snapshot OMB Rating (9/4/2011)	Not Performance-Based	.368905
	Performance-Based Contract	.306850

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	4.463	.039	-1.215
	Equal variances not assumed			-1.250

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	58	.229	-.599630
	Equal variances not assumed	57.639	.216	-.599630

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.493555	-1.587588	.388329
	Equal variances not assumed	.479841	-1.560264	.361005

**Performance-Based - Independent t-Test (OMB Average Rating)**  
**(N = 60)**

**Group Statistics**

		Performance-Based Acquisition	N	Mean	Std. Deviation
Average OMB Rating (6/30/2009 - 9/4/2011)	Not Performance-Based		33	6.47879	1.799914
	Performance-Based Contract		27	6.94734	1.517536

		Performance-Based Acquisition	Std. Error Mean
Average OMB Rating (6/30/2009 - 9/4/2011)	Not Performance-Based		.313325
	Performance-Based Contract		.292050

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average OMB Rating (6/30/2009 - 9/4/2011)	Equal variances assumed	.182	.671	-1.075
	Equal variances not assumed			-1.094

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average OMB Rating (6/30/2009 - 9/4/2011)	Equal variances assumed	58	.287	-.468551
	Equal variances not assumed	57.935	.279	-.468551

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average OMB Rating (6/30/2009 - 9/4/2011)	Equal variances assumed	.435755	-1.340810	.403708
	Equal variances not assumed	.428329	-1.325965	.388863

**Performance-Based - Independent t-Test (Latest CIO Rating) (N = 153)**

**Group Statistics**

	Performance-Based Acquisition	N	Mean	Std. Deviation
Latest CIO Rating (8/30/2012)	Not Performance-Based	87	3.99	.856
	Performance-Based Contract	66	3.94	.959

	Performance-Based Acquisition	Std. Error Mean
Latest CIO Rating (8/30/2012)	Not Performance-Based	.092
	Performance-Based Contract	.118

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Latest CIO Rating (8/30/2012)	Equal variances assumed	4.318	.039	.334
	Equal variances not assumed			.329

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Latest CIO Rating (8/30/2012)	Equal variances assumed	151	.739	.049
	Equal variances not assumed	131.114	.743	.049

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Latest CIO Rating (8/30/2012)	Equal variances assumed	.147	-.242	.340
	Equal variances not assumed	.149	-.247	.345

**Performance-Based - Independent t-Test (Average CIO Rating) (N = 153)**

**Group Statistics**

	Performance-Based Acquisition	N	Mean	Std. Deviation
Average CIO Rating (6/30/2009-8/30/2012)	Not Performance-Based	87	4.07	.716
	Performance-Based Contract	66	3.90	.696

	Performance-Based Acquisition	Std. Error Mean
Average CIO Rating (6/30/2009-8/30/2012)	Not Performance-Based	.077
	Performance-Based Contract	.086

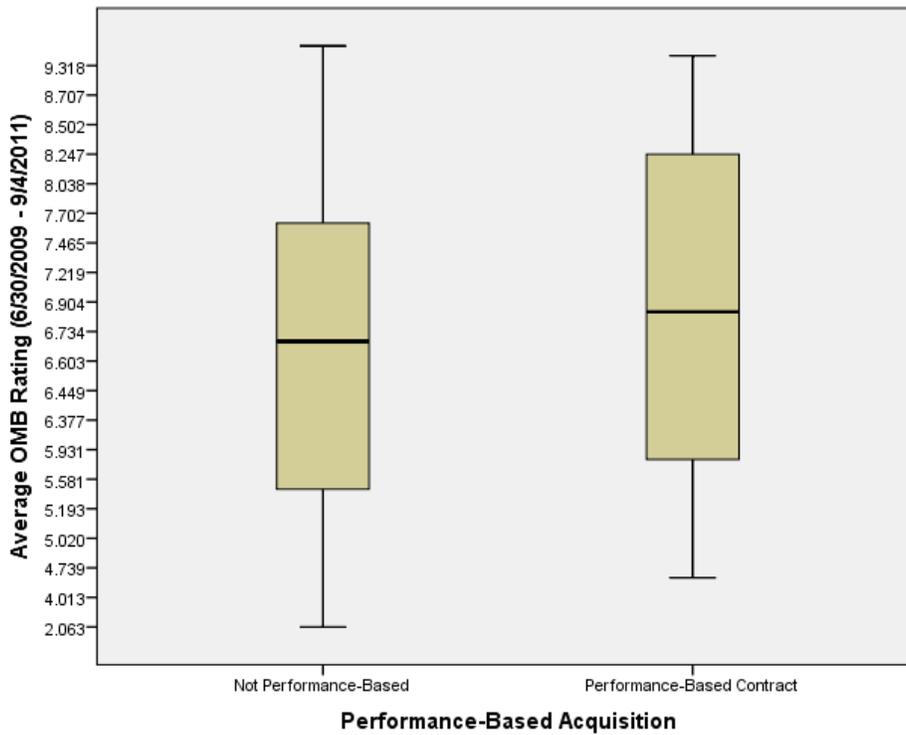
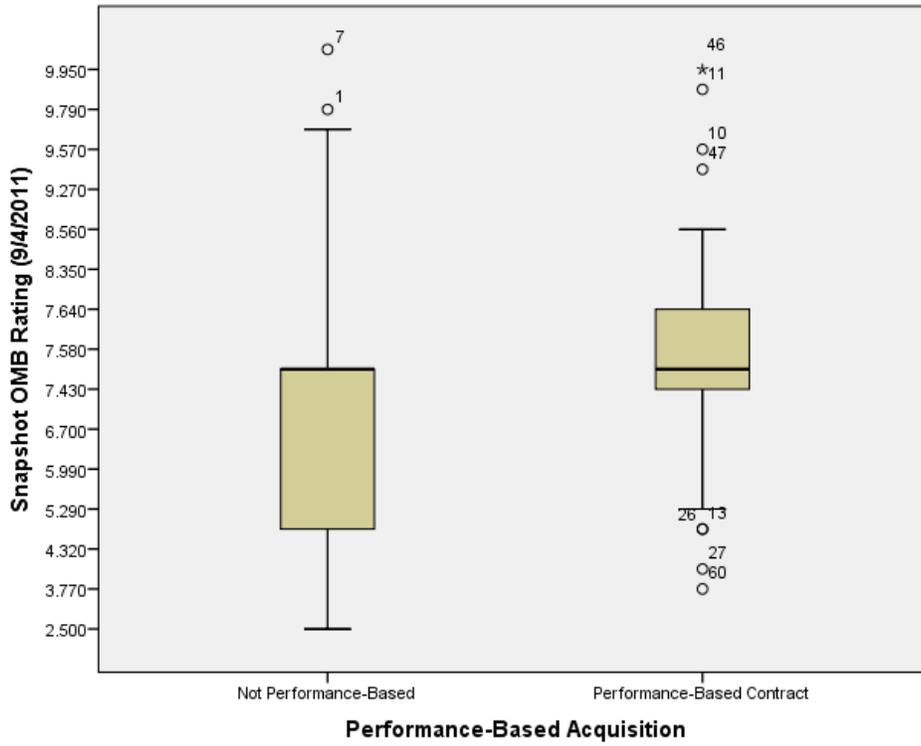
**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	.006	.936	1.497
	Equal variances not assumed			1.503

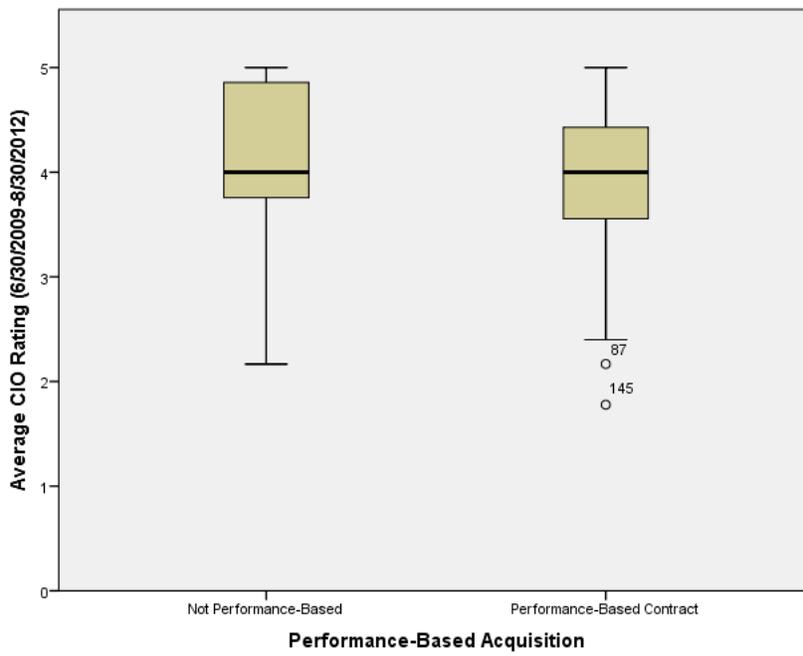
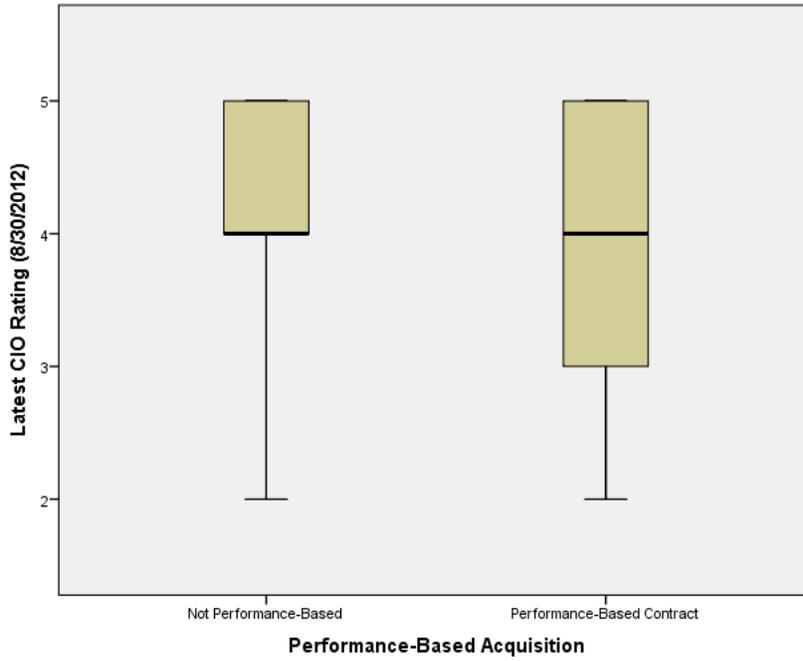
		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	151	.137	.173
	Equal variances not assumed	142.100	.135	.173

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	.115	-.055	.401
	Equal variances not assumed	.115	-.055	.400

**Performance-Based Acquisition - Boxplot (N = 60)**

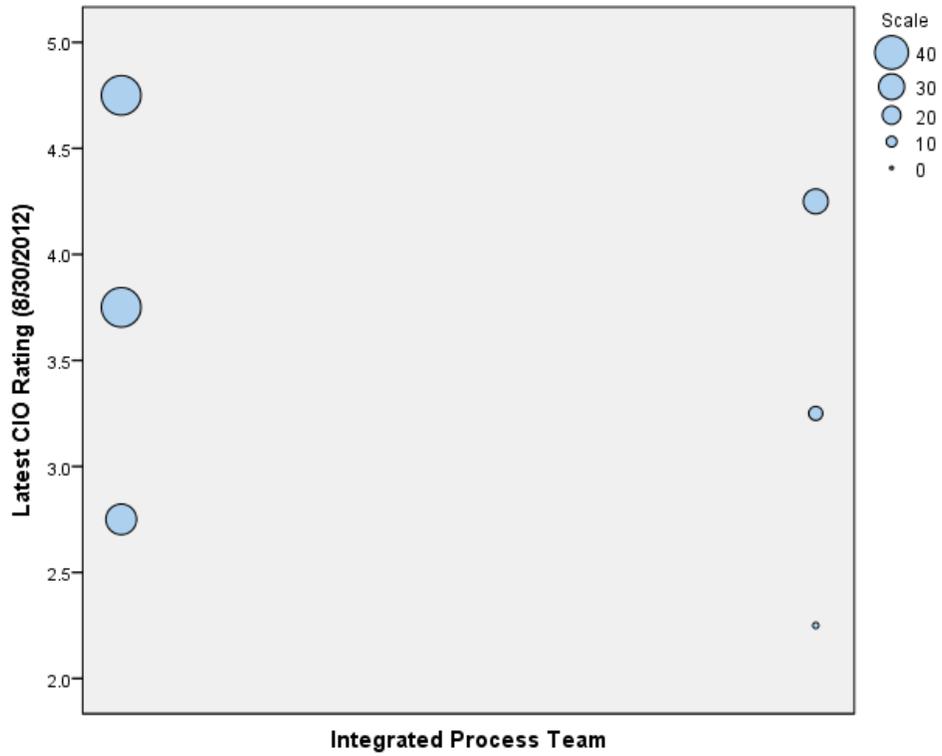


Performance-Based Acquisition - Boxplots (N = 153)

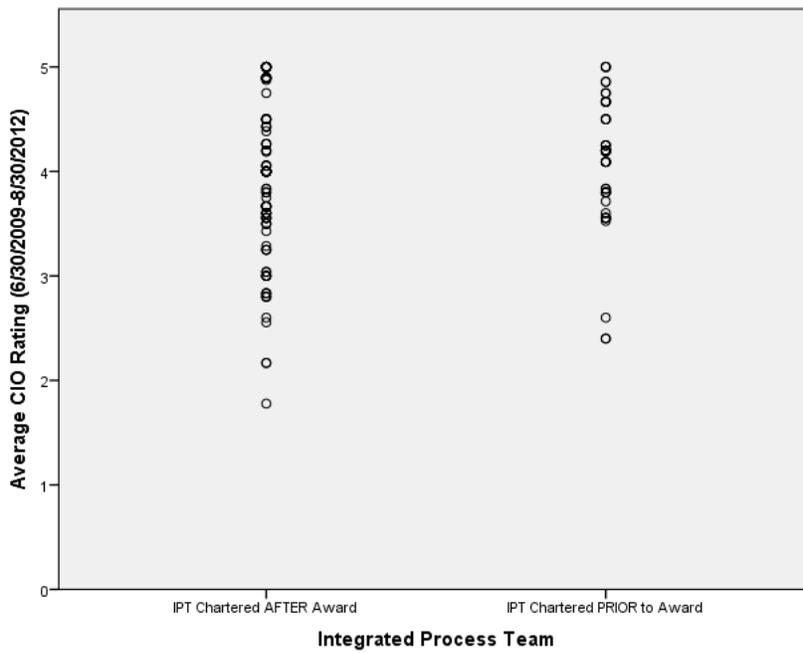




**Integrated Process Team - Scatterplots (N = 153)**



Chartered AFTER Award      Chartered PRIOR to Award



**Integrated Process Team - OMB Ratings**

Point-Biserial Correlation (N = 60)

Correlations			
		Snapshot OMB Rating (9/4/2011)	Integrated Process Team
Snapshot OMB Rating (9/4/2011)	Pearson Correlation	1	-.230
	Sig. (2-tailed)		.078
	N	60	60
		Average OMB Rating (6/30/2009 - 9/4/2011)	Integrated Process Team
Average OMB Rating (6/30/2009 - 9/4/2011)	Pearson Correlation	1	-.095
	Sig. (2-tailed)		.472
	N	60	60

**Integrated Process Team - CIO Ratings**

Point-Biserial Correlation (N = 153)

Correlations			
		Latest CIO Rating (8/30/2012)	Integrated Process Team
Latest CIO Rating (8/30/2012)	Pearson Correlation	1	.024
	Sig. (2-tailed)		.766
	N	153	153
		Average CIO Rating (6/30/2009-8/30/2012)	Integrated Process Team
Average CIO Rating (6/30/2009-8/30/2012)	Pearson Correlation	1	.097
	Sig. (2-tailed)		.235
	N	153	153

**Integrated Process Team - Independent t-Test (OMB Snapshot Rating) (N = 60)**

**Group Statistics**

Integrated Process Team		N	Mean	Std. Deviation
Snapshot OMB Rating (9/4/2011)	IPT Chartered AFTER Award	21	7.55905	1.626198
	IPT Chartered PRIOR to Award	39	6.64744	1.992851

Integrated Process Team		Std. Error Mean
Snapshot OMB Rating (9/4/2011)	IPT Chartered AFTER Award	.354865
	IPT Chartered PRIOR to Award	.319112

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	2.489	.120	1.797
	Equal variances not assumed			1.910

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	58	.078	.911612
	Equal variances not assumed	48.673	.062	.911612

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.507374	-.104007	1.927230
	Equal variances not assumed	.477244	-.047609	1.870832

**Integrated Process Team - Independent t-Test (OMB Average Rating) (N = 60)**

**Group Statistics**

Integrated Process Team		N	Mean	Std. Deviation
Average OMB Rating	IPT Chartered AFTER Award	21	6.90454	1.551500
(6/30/2009 - 9/4/2011)	IPT Chartered PRIOR to Award	39	6.57392	1.755974

Integrated Process Team		Std. Error Mean
Average OMB Rating (6/30/2009 - 9/4/2011)	IPT Chartered AFTER Award	.338565
	IPT Chartered PRIOR to Award	.281181

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average OMB Rating	Equal variances assumed	.007	.932	.724
(6/30/2009 - 9/4/2011)	Equal variances not assumed			.751

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average OMB Rating	Equal variances assumed	58	.472	.330615
(6/30/2009 - 9/4/2011)	Equal variances not assumed	45.669	.456	.330615

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average OMB Rating	Equal variances assumed	.456956	-.584082	1.245312
(6/30/2009 - 9/4/2011)	Equal variances not assumed	.440101	-.555436	1.216666

**Integrated Process Team - Independent t-Test (Latest CIO Rating)**

(N = 153)

**Group Statistics**

Integrated Process Team		N	Mean	Std. Deviation
Latest CIO Rating (8/30/2012)	IPT Chartered AFTER Award	106	3.95	.930
	IPT Chartered PRIOR to Award	47	4.00	.834

**Group Statistics**

Integrated Process Team		Std. Error Mean
Latest CIO Rating (8/30/2012)	IPT Chartered AFTER Award	.090
	IPT Chartered PRIOR to Award	.122

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Latest CIO Rating (8/30/2012)	Equal variances assumed	2.254	.135	-.299
	Equal variances not assumed			-.311

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Latest CIO Rating (8/30/2012)	Equal variances assumed	151	.766	-.047
	Equal variances not assumed	97.664	.756	-.047

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Latest CIO Rating (8/30/2012)	Equal variances assumed	.158	-.359	.265
	Equal variances not assumed	.152	-.348	.254

**Integrated Process Team - Independent t-Test (Average CIO Rating) (N = 153)**

**Group Statistics**

Integrated Process Team		N	Mean	Std. Deviation
Average CIO Rating	IPT Chartered AFTER Award	106	3.95	.751
(6/30/2009-8/30/2012)	IPT Chartered PRIOR to Award	47	4.10	.604

**Group Statistics**

Integrated Process Team		Std. Error Mean
Average CIO Rating (6/30/2009-8/30/2012)	IPT Chartered AFTER Award	.073
	IPT Chartered PRIOR to Award	.088

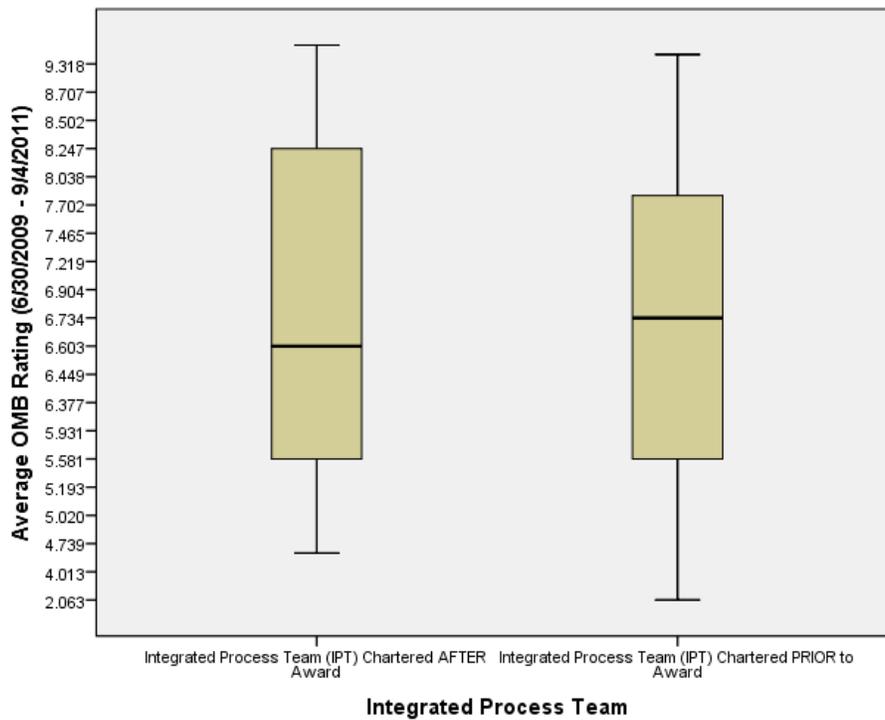
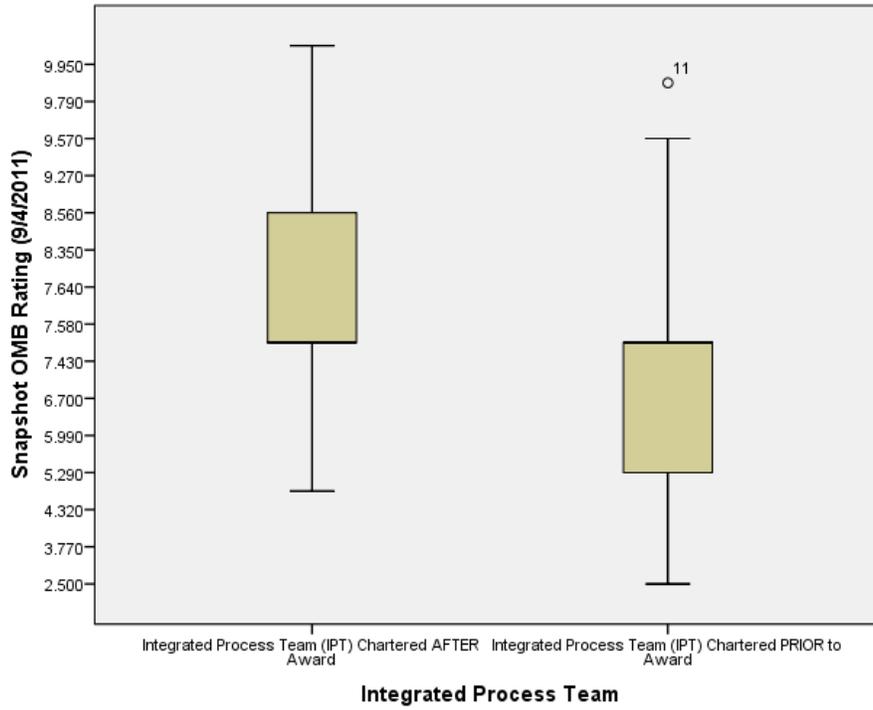
**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average CIO Rating	Equal variances assumed	3.797	.053	-1.191
(6/30/2009-8/30/2012)	Equal variances not assumed			-1.295

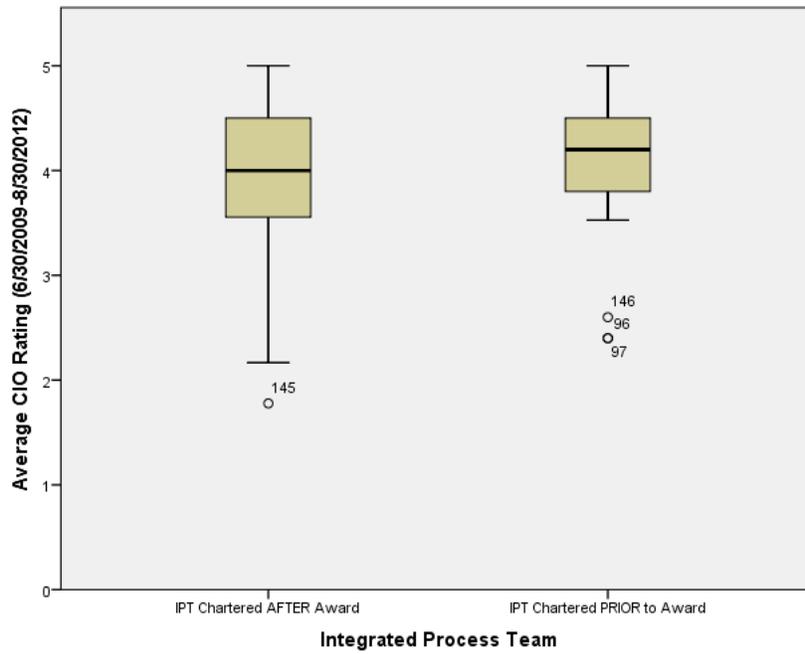
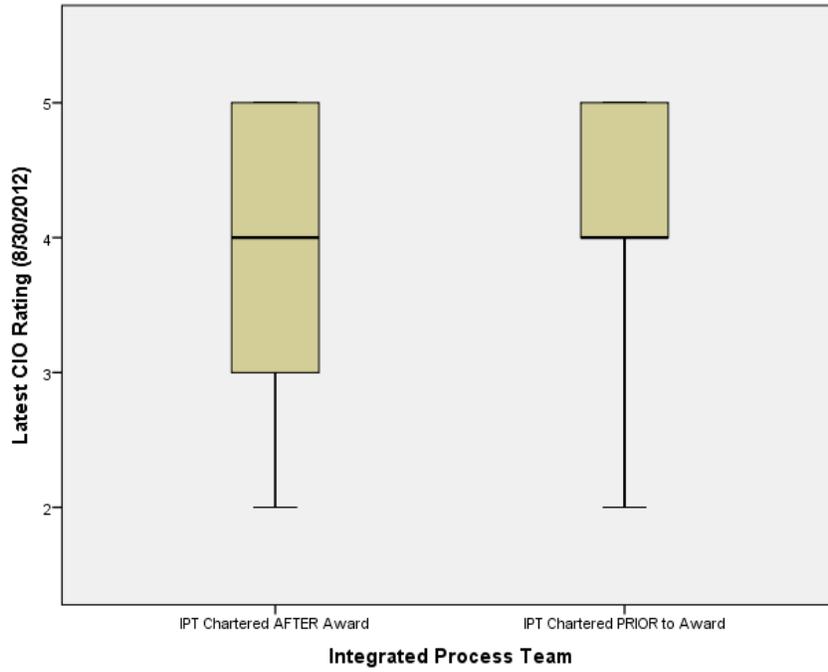
		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average CIO Rating	Equal variances assumed	151	.235	-.148
(6/30/2009-8/30/2012)	Equal variances not assumed	108.343	.198	-.148

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average CIO Rating	Equal variances assumed	.124	-.394	.098
(6/30/2009-8/30/2012)	Equal variances not assumed	.114	-.375	.079

**Integrated Process Team - Boxplot (N = 60)**

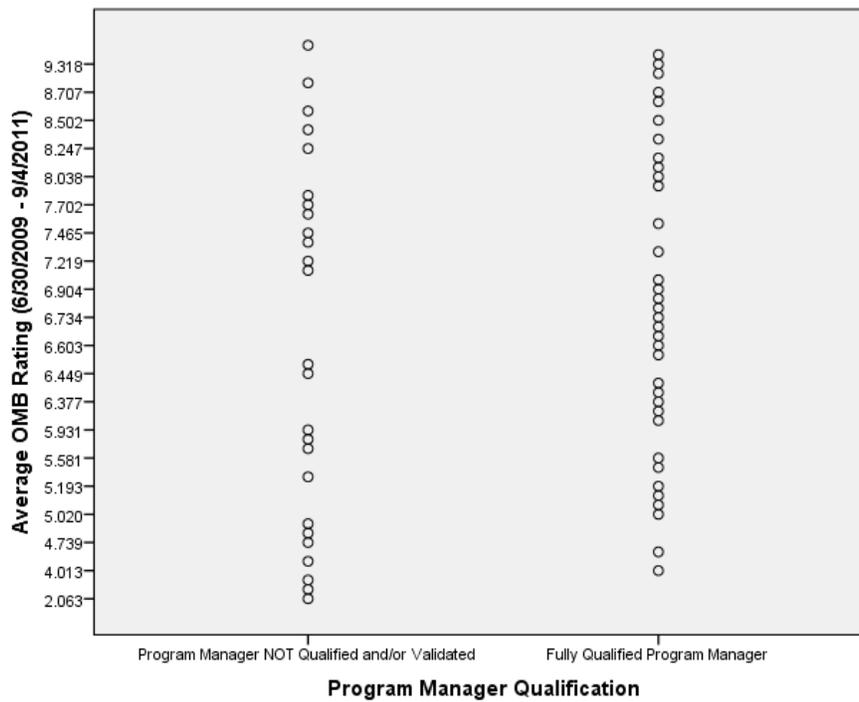
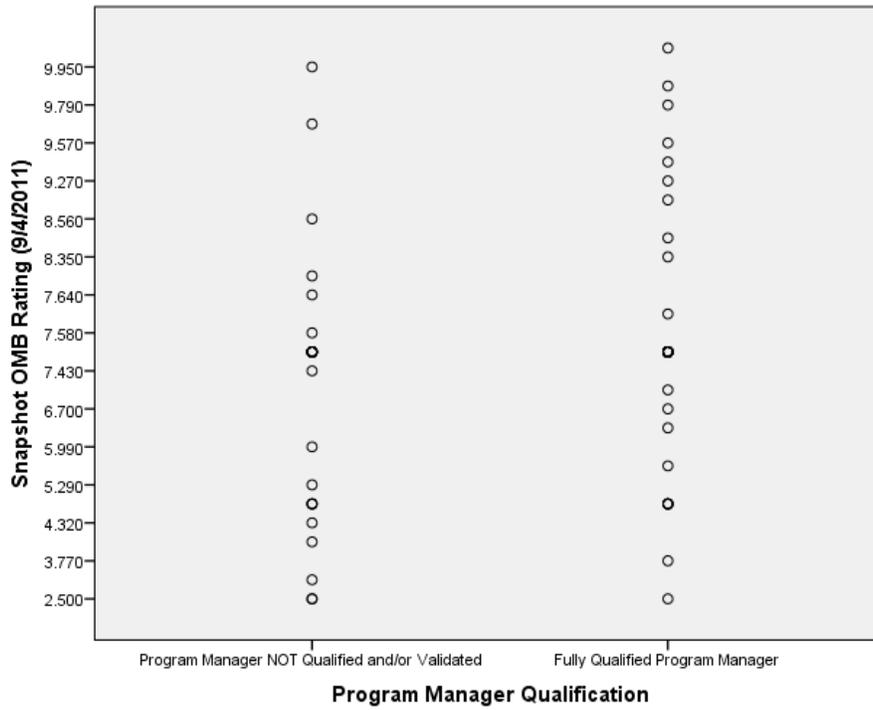


**Integrated Process Team - Boxplots (N = 153)**



**APPENDIX L**  
**Statistical Details of H5: Program Manager Qualification**

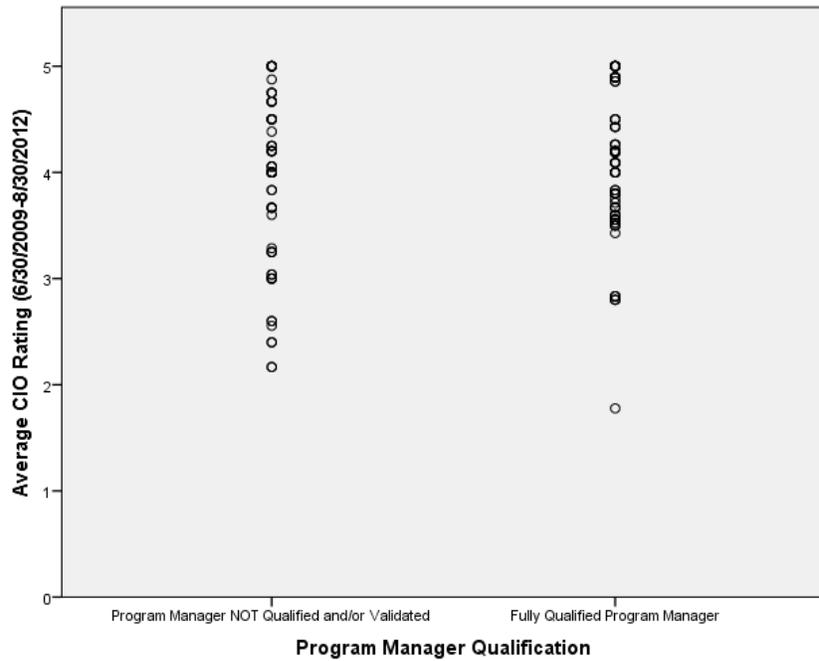
**Program Manager Qualification - Scatterplot (N = 60)**



Program Manager Qualification - Scatterplots (N = 153)



NOT Qualified/Validated                      Fully Qualified



**Program Manager Qualification - OMB Ratings**

**Point-Biserial Correlation (N = 60)**

Correlations			
		Snapshot OMB Rating (9/4/2011)	Program Manager Qualification
Snapshot OMB Rating (9/4/2011)	Pearson Correlation	1	.230
	Sig. (2-tailed)		.077
	N	60	60
		Average OMB Rating (6/30/2009 - 9/4/2011)	Program Manager Qualification
Average OMB Rating (6/30/2009 - 9/4/2011)	Pearson Correlation	1	.158
	Sig. (2-tailed)		.228
	N	60	60

**Program Manager Qualification - CIO Ratings**

**Point-Biserial Correlation (N = 153)**

Correlations			
		Latest CIO Rating (8/30/2012)	Program Manager Qualification
Latest CIO Rating (8/30/2012)	Pearson Correlation	1	-.062
	Sig. (2-tailed)		.444
	N	153	153
		Average CIO Rating (6/30/2009-8/30/2012)	Program Manager Qualification
Average CIO Rating (6/30/2009-8/30/2012)	Pearson Correlation	1	.083
	Sig. (2-tailed)		.305
	N	153	153

**Program Manager Qual. - Independent t-Test (OMB Snapshot Rating) (N = 60)**

**Group Statistics**

Program Manager Qualification		N	Mean	Std. Deviation
Snapshot OMB Rating (9/4/2011)	Program Manager NOT Qualified and/or Validated	25	6.45040	2.074660
	Fully Qualified Program Manager	35	7.33514	1.718694

Program Manager Qualification		Std. Error Mean
Snapshot OMB Rating (9/4/2011)	Program Manager NOT Qualified and/or Validated	.414932
	Fully Qualified Program Manager	.290512

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	3.508	.066	-1.803
	Equal variances not assumed			-1.747

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	58	.077	-.884743
	Equal variances not assumed	45.568	.087	-.884743

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Snapshot OMB Rating (9/4/2011)	Equal variances assumed	.490783	-1.867151	.097666
	Equal variances not assumed	.506523	-1.904583	.135097

**Program Manager Qual. - Independent t-Test (OMB Average Rating) (N = 60)**

**Group Statistics**

Program Manager Qualification		N	Mean	Std. Deviation
Average OMB Rating (6/30/2009 - 9/4/2011)	Program Manager NOT Qualified and/or Validated	25	6.37811	1.984189
	Fully Qualified Program Manager	35	6.91216	1.415862

Program Manager Qualification		Std. Error Mean
Average OMB Rating (6/30/2009 - 9/4/2011)	Program Manager NOT Qualified and/or Validated	.396838
	Fully Qualified Program Manager	.239324

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average OMB Rating (6/30/2009 - 9/4/2011)	Equal variances assumed	3.788	.056	-1.218
	Equal variances not assumed			-1.152

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average OMB Rating (6/30/2009 - 9/4/2011)	Equal variances assumed	58	.228	-.534047
	Equal variances not assumed	40.821	.256	-.534047

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average OMB Rating (6/30/2009 - 9/4/2011)	Equal variances assumed	.438511	-1.411822	.343728
	Equal variances not assumed	.463418	-1.470064	.401970

**Program Manager Qual. - Independent t-Test (Latest CIO Rating)**

(N = 153)

**Group Statistics**

Program Manager Qualification		N	Mean	Std. Deviation
Latest CIO Rating (8/30/2012)	Program Manager NOT Qualified and/or Validated	69	4.03	.939
	Fully Qualified Program Manager	84	3.92	.867

Program Manager Qualification		Std. Error Mean
Latest CIO Rating (8/30/2012)	Program Manager NOT Qualified and/or Validated	.113
	Fully Qualified Program Manager	.095

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Latest CIO Rating (8/30/2012)	Equal variances assumed	.277	.599	.768
	Equal variances not assumed			.762

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Latest CIO Rating (8/30/2012)	Equal variances assumed	151	.444	.112
	Equal variances not assumed	140.265	.447	.112

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Latest CIO Rating (8/30/2012)	Equal variances assumed	.146	-.177	.401
	Equal variances not assumed	.147	-.179	.404

**Program Manager Qual. - Independent t-Test (Average CIO Rating)**

(N = 153)

**Group Statistics**

Program Manager Qualification		N	Mean	Std. Deviation
Average CIO Rating (6/30/2009-8/30/2012)	Program Manager NOT Qualified and/or Validated	69	3.93	.759
	Fully Qualified Program Manager	84	4.05	.667

Program Manager Qualification		Std. Error Mean
Average CIO Rating (6/30/2009-8/30/2012)	Program Manager NOT Qualified and/or Validated	.091
	Fully Qualified Program Manager	.073

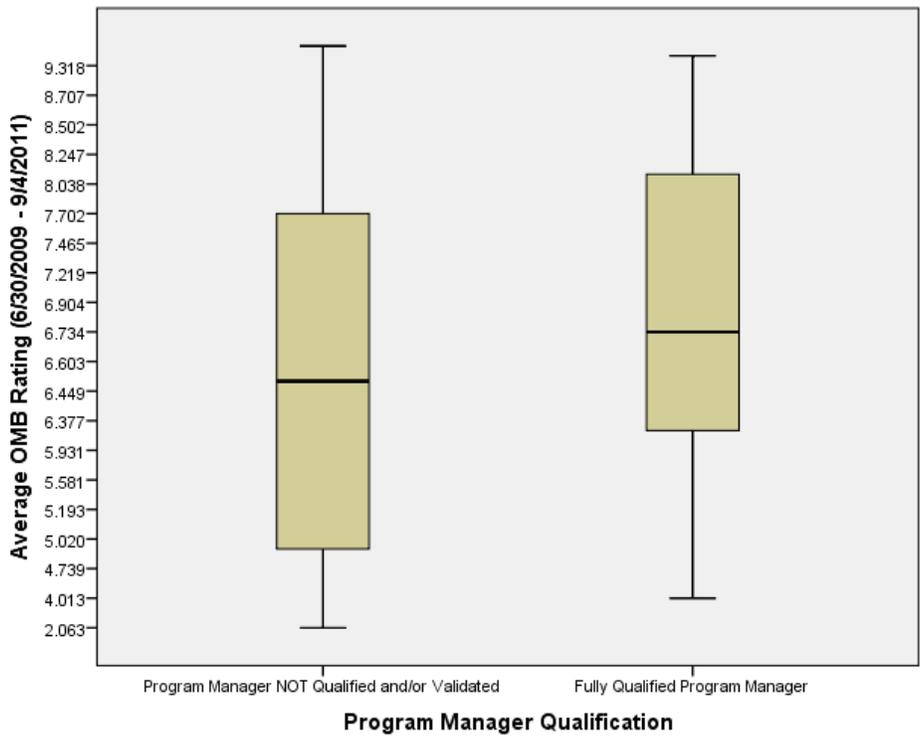
**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	.802	.372	-1.028
	Equal variances not assumed			-1.015

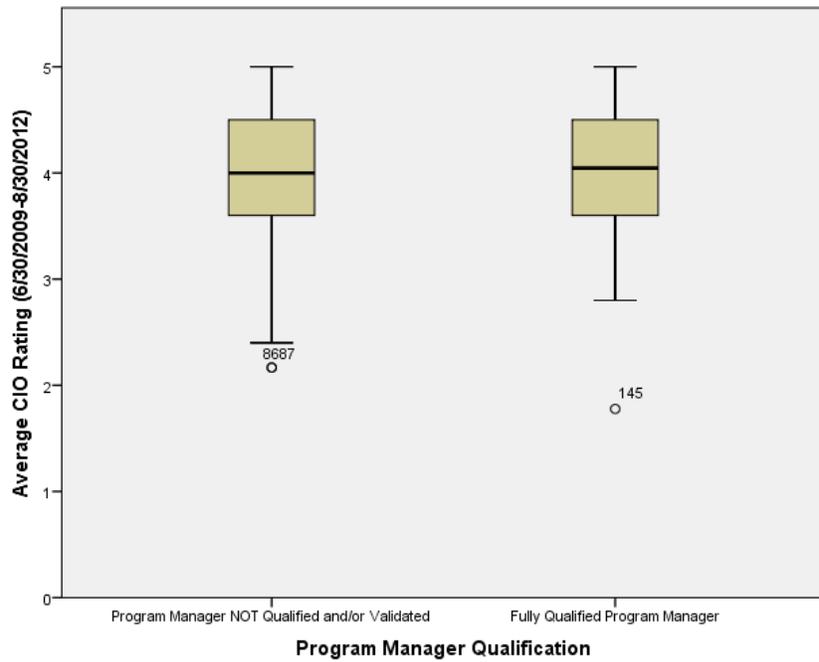
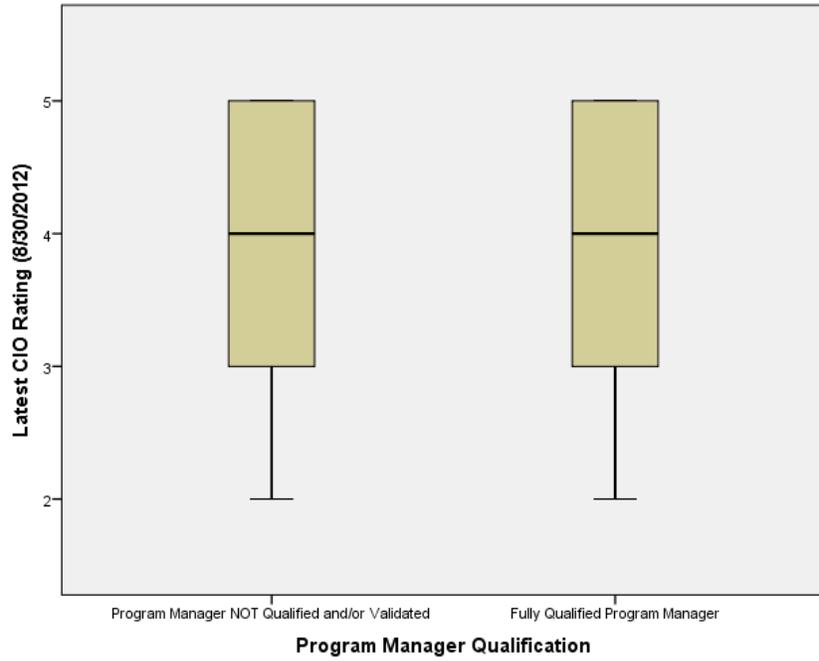
		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	151	.305	-.119
	Equal variances not assumed	136.579	.312	-.119

		t-test for Equality of Means		
		Std. Error Difference	95% Confidence Interval of the Difference	
			Lower	Upper
Average CIO Rating (6/30/2009-8/30/2012)	Equal variances assumed	.115	-.347	.109
	Equal variances not assumed	.117	-.350	.112

**Program Manager Qualification - Boxplot (N = 60)**



Program Manager Qualification - Boxplots (N = 153)



**APPENDIX M**  
**Institutional Review Board (IRB) Approval Letter**



Office of Research Compliance  
Institutional Review Board  
2000 Kraft Drive, Suite 2000 (J497)  
Blacksburg, VA 24060  
540/231-4606 Fax: 540/231-0969  
email: [irb@ut.edu](mailto:irb@ut.edu)  
website: <http://www.irb.ut.edu>

**MEMORANDUM**

**DATE:** January 30, 2013  
**TO:** James F Wolf, James LeVoy Lapse  
**FROM:** Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)  
**PROTOCOL TITLE:** What to Buy?: The Under Explored Dimension of the Smart-Buyer Problem  
**IRB NUMBER:** 12-835

Effective January 29, 2013, the Virginia Tech Institutional Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

<http://www.irb.vt.edu/pages/responsibilities.htm>

(Please review responsibilities before the commencement of your research.)

**PROTOCOL INFORMATION:**

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**  
Protocol Approval Date: **September 25, 2012**  
Protocol Expiration Date: **September 24, 2013**  
Continuing Review Due Date\*: **September 10, 2013**

\*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

**FEDERALLY FUNDED RESEARCH REQUIREMENTS:**

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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